Asia Pacific Journal *of* Health Management

Volume 17 Issue 1 2022

The Journal of ACHSM & SHAPE

ACHSM
shape
Asia-Pacific Journal
of Health Management

Contents

Vol 17(1), 2022

ACHSM Asia-Pacific Journal of Health Management

WELCOME TO THE INAUGURAL ISSUE FOR OUR NEW CHIEF EDITOR

Dr. Neale Fong FCHSM

President of Australasian College of Health Service Management

Welcome to the inaugural issue of the College's flagship journal with our new Editor-in-Chief, Dr Mark Avery. On behalf of all members, contributors and readers we wish him and the editorial team all the best.

Firstly, I would like to thank all members and all those health professionals across our regions for your dedicated service, commitment and support of the community in the past two years during the COVID-19 Pandemic. In Australia we have also seen natural disasters add to workloads and from time to time it really is important to take a moment to acknowledge the fantastic job being done managing through these crises. Thank you.

We now have some wonderful analysis from the vast number of College members who have completed the self-assessment against the ACHSM Master Health Service Competency Framework. This report was generated in October last year with 864 overall completions, 732 of those from Australia. Thanks to *The* Screening Lab who provide the platform for this self-assessment survey and have generated this report from your feedback.

Respondents came from across the health leader and manager spectrum with 10% identifying as emerging leaders and the remainder evenly spread across middle and executive leadership.

It appears education matters, with 66% of respondents citing having a Masters as their highest qualification, 11% with PhDs and 20% with Bachelor qualifications. This commitment to education has carried through to our Certification Program with our credentialled members committing to a program of lifelong learning.

The final page of the report lists the fifteen competencies that had the lowest rankings in the self-assessment data, and this will assist the College in informing professional development programs to support our current and future leaders. It is worth noting that some of these competencies are quite discrete and it may be that "manages supply chain" for example, is a specialty skill that is not inherently necessary for all health leaders and might be better expressed for most as "understands supply chain issues." Others, however, such as "creates and controls budgets" are more important to the success of senior leaders.

I encourage you to consider this report and if you are a College member, to use your own personal report from this free self-assessment service to generate a plan for your individual development. This report will be available shortly on the College website under the Resources tab. The College Board believes this aggregated data should be a freely available resource for the health sector and your participation supports the future of leadership. Better leadership. Healthier Communities. It is also an opportunity to conduct research into leadership development and be published in this journal.

It was also particularly good to see over 180 people attend in person our first face-to-face conference for two years, in Melbourne on March 18th. Themed as "The Health of our

Nations," the calibre and scope of speakers and panelists was outstanding. I look forward to seeing so many of you in Perth at the Annual Congress 21-23 September this year. Plan now to come!!

Domain 3 – Business Skills	Q9.1 Manages supply chain
Domain 3 – Business Skills	Q7.4 Understands insurance management
Domain 4 – Comms & Relationships	Q2.5 Applies marketing tools and principles
Domain 3 – Business Skills	Q9.3 Manages supply contracts
Domain 3 – Business Skills	Q9.4 Manages facilities
Domain 2 – Health & Healthcare Environment	Q3.3 Promotes the preferences of population groups
Domain 2 – Health & Healthcare Environment	Q4.2 Uses data to control threats to health
Domain 3 – Business Skills	Q2.3 Creates and controls budgets
Domain 3 – Business Skills	Q3.1 Promotes cultural safety and Indigenous rights
Domain 3 – Business Skills	Q5.4 Plans for business continuity
Domain 3 – Business Skills	Q2.2 Uses financial principles
Domain 2 – Health & Healthcare Environment	Q3.4 Responds to diverse health needs
Domain 3 – Business Skills	Q6.4 Promotes digital literacy
Domain 4 – Comms & Relationships	Q2.4 Demonstrates effective public relations skills
Domain 5 – Professional & Social Responsibility	Q1.1 Demonstrate commitment to policy advocacy and capacity

To access the full report please click here

ACHSM Asia-Pacific Journal of Health Management

EDITORIAL

KNOWLEDGE, REFLECTION AND STRATEGY

Dr Mark Avery

Editor-in-Chief, Asian Pacific Journal of Health Management

This first issue of the journal for 2022 brings a comprehensive range of contributions from a number of authors.

Reflection is a critically important process and opportunity that contributes to the development of strategy. Creating future opportunity stems from reflection on the past and engagement with issues of the current time. Research provides granular understanding for this.

The World Economic Forum's (International Organisation for Public–Private Corporation) recent global risks report [1] examines risk tensions relevant to health, aged and social care. Climate, social cohesion, livelihoods and infectious diseases present as some current and emerging serious issues. The current pandemic in itself, highlights these problems, as well as for mental health, migration and social security issues.

Papers presented in this issue work to contribute to this continuum of learning, reflection and future strategy. Researchers and authors here are offering new knowledge and perspectives. From this range of work that we publish, some examples of these knowledge contributions may be identified.

The engagement and development opportunities for health professionals is an ongoing responsibility. Balasubramanian and Flood report on the importance of engaging clinicians in an inclusive research culture where research and innovation structures enable opportunity. Martins et al. present and discuss skills and competencies for health managers, particularly at the opportunity of postgraduate education.

Access and understanding by patient and client stakeholders are assessed and presented. Liu et al. present findings and opportunities in relation to service access for people with disabilities. Andriani et al. have studied access and opportunities for those needing and requiring antenatal care. Clements et al. provide research results regarding patient perceptions and their engagement in relation to the use of artificial intelligence (AI) in diagnostic imaging.

Evaluation approaches and methods are examined through the practical examination of temperature monitoring of refrigerated pharmaceutical products by Zamani and Wembridge.

A series of papers presented by researchers and authors in relation to the COVID-19 disease and pandemic across several countries and communities highlights critical learning about population awareness, understanding and sense making; care and support delivery in response preparations; prehospital emergency care; tele-medicine and the potential for re-purposing of drugs.

Recognition and Thanks – Dr. David Briggs AM

In February Dr. David Briggs completed his long and distinguished association with our journal as Editor-in-Chief. David provided strong knowledge, experience and leadership from health care academia, delivery and system management.

A critical part of a profession is having a body of knowledge from which members may operate. The College enables this knowledge through its commitment to this journal that provides for expansion, development, debate and translation to practice of healthcare management knowledge. David Briggs has been a critical part of this

process and has worked to expand contributions and the impact of the journal both nationally and internationally.

In starting my time in this role with the journal, I look forward to contributions from researchers and practitioners as well as ideas and suggestions towards the sustained growth and development of this publication. I am particularly grateful to Mrs Yaping Liu who undertakes both roles as Managing Editor for the journal and ACHSM Librarian. Yaping has great skills on journal operations and direction and is an enormous support to the journal, College members and the health management profession.

Dr. Mark Avery
Editor-in-Chief

References

1. World Economic Forum. The Global Risks Report 2022. Geneva, Switzerland; 2022. ISBN: 978-2-940631-09-4. Accessed February 2022 https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2022.pdf

ACHSM Asia-Pacific Journal of Health Management

COMMENTARY

REPURPOSING OF POLIO VACCINE IN PREVENTION OF COVID-19: THINKING TOWARDS MORE OPTIONS

Sunil Kumar[1], Dharmendra Pandey[1], Awanish Kumar[2]*

1. Faculty of Biosciences, Institute of Biosciences and Technology, Shri Ramswaroop Memorial University, Barabanki, Uttar Pradesh, India
2. Department of Biotechnology, National Institute of Technology, Raipur, Chhattisgarh, India

Correspondence: drawanishkr@gmail.com

ABSTRACT

COVID-19 has created an unprecedented crisis worldwide in every sector. There currently is no approved drug available against this disease. The development of a vaccine is also a complex and long process that is often completed in 10-15 years. Recently, several vaccines for COVID-19 have received emergency approval for use but few experts deem that currently approved COVID-19 vaccines might provide a temporary boost to the immune system, but they are dubious for their long-term effect and safety. This article sheds light on polio vaccine as a possibility on COVID-19 prophylaxis because this vaccine was developed through a rigorous process of the various phases of development. The polio vaccine could provide another option to combat COVID-19 and if we have more options, we can fight more effectively against the pandemic. The polio vaccine is utilized globally with a highly satisfactory retort and very good immune responses. By seeing a satisfactory cross-protective immune response, the polio vaccination could be repurposed and offered against COVID-19 for an effective immuno-prophylaxis and protection. This article focusses on the repurposing of vaccines/drugs for COVID-19 and discusses the scientific rationale behind the suggestive use of the polio vaccine against COVID-19 because the polio vaccine is FDA-approved less expensive, readily available, easy to administer, and highly safe.

KEYWORDS

COVID-19; Vaccine repurposing; Polio vaccine; Immuno-prophylaxis against SARS-CoV-2; More prophylactic option

INTRODUCTION

The COVID-19 (coronavirus disease-2019) pandemic has impacted all aspects of our life for the past two years. The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is an etiologic agent of COVID-19 that has infected millions of people globally and put unprecedented strain on healthcare systems [1–4]. Co-infections are a common consequence [3, 5], especially with longer hospital stays [6]. This coronavirus illness is worldwide disseminated and has predisposed a relatively high proportion of individuals to acute respiratory distress syndrome. While the world waits for a fully verified vaccine of COVID-19, some experts believe that current vaccinations might provide a much-needed temporary boost to the immune system in order to prevent infection. It is still unclear if such an approach would work, and some authorities are skeptical. Others, including Israeli, Dutch, and Australian researchers, are

investigating that a TB vaccine may help jump-start the immune system and make COVID-19 less dangerous, however, the WHO strongly recommends against using it until it has been shown effective against the COVID-19 disease.

COVID-19 has created a global healthcare emergency, particularly for poor countries like India, which have inadequate healthcare resources and a patchwork healthcare infrastructure. Given that we are in a pandemic, it is critical to investigate the potential of repurposing existing vaccinations. A recent epidemiological study reported that live-attenuated vaccinations (LAV) such as the Bacillus Calmette-Guérin (BCG) measles vaccine and oral polio vaccine (OPV) may induce non-specific immune responses after single or double doses and may protect against different viruses [7-13]. Furthermore, Mayo Clinic retrospective research found that those who have had previous OPV immunizations over a 1-, 2-, or 5-year period have a reduced incidence of SARS-CoV-2 infection than for people who have not been vaccinated yet [14].

The return of COVID-19 in India and in some other countries has resulted in an upsurge in the number of pediatric COVID-19 patient hospitalizations [15]. It may be claimed that because the majority of these individuals were vaccinated with OPV and BCG as part of the National Immunization Schedule, the predicted cross-protection from OPV against SARS-CoV-2 may not occur. However, anecdotal data suggests that the relative COVID-19 severity in pediatric instances is lower than in adult cases, even in the second wave, and it's possible that innate immune system activation plays a role in partial immunity to severe COVID-19 in pediatric cases. The possible reason behind this is there was extensive Polio vaccination done in children globally that could have resulted in innate immune responses [activated natural killer (NK) cells and induction of interferons (IFNs)] which offer a natural immunity against SARS-CoV-2 in children. So if the Polio vaccine is offered to the adult population, it will surely confer cross-protection in adults against SARS-CoV-2.

After entering its third phase, which includes all people over the age of 18, the world is presently experiencing severe shortages in order to carry out an ambitious universal COVID-19 immunization push. In such cases, innate immune system reactivation with a LAV like OPV could hypothetically act as partial immunity against COVID-19 until available vaccines become widely available and can boost the immune response subsequently with a combination of OPV, or inactivated vaccine category of the three COVID-19 vaccine candidates that OPV, LAV, and an adenovirus vector-based. We attempt to spotlight discussion on some available data and scientific reasons for the potential use of Polio vaccination against COVID-19 in this paper.

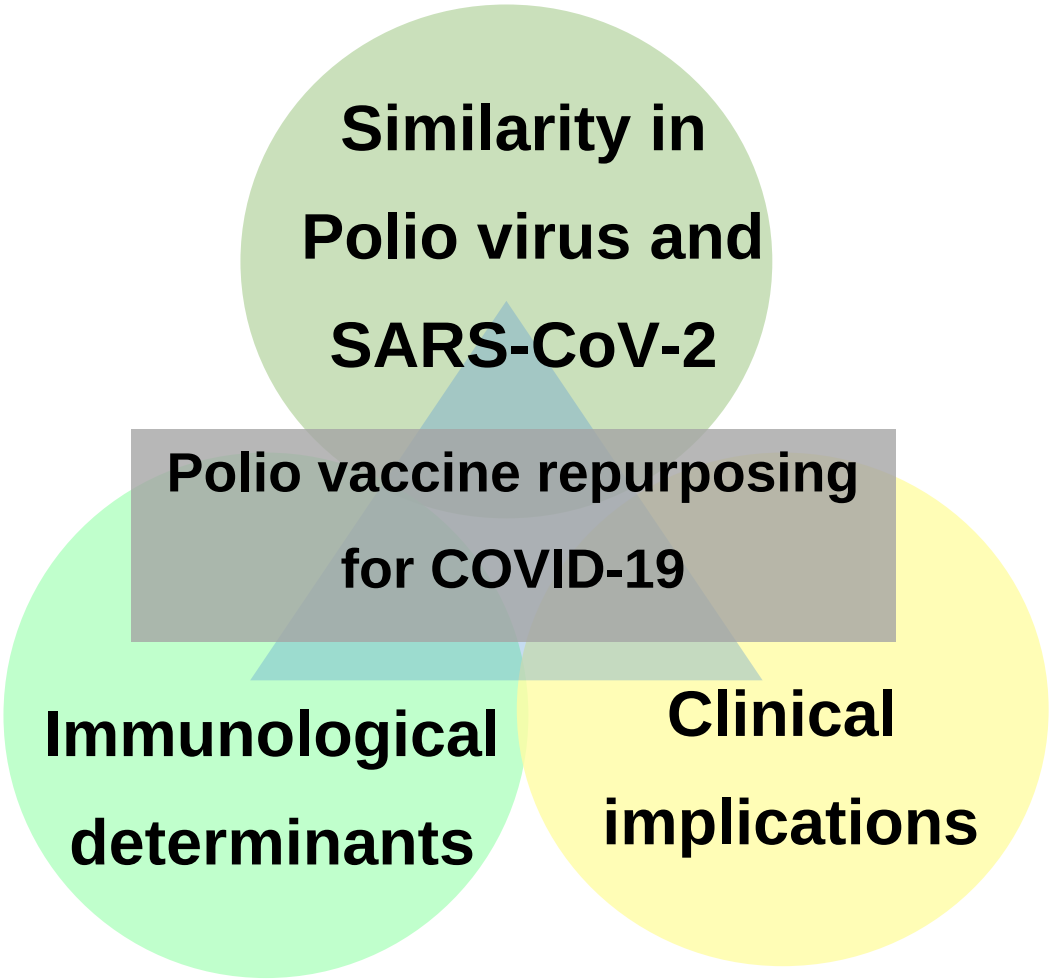
CURRENT THERAPEUTIC STATUS AND REPURPOSING OF VACCINE/DRUG FOR COVID-19: IN BRIEF

Currently, there is no dedicated drug available for COVID-19 treatment. The current research and development (R&D) of drugs and their production timelines are not conducive to give any quick responses to COVID-19 pandemic threats. Anti-COVID-19 drugs are in the development phase and may take a few years to come into the global market [16]. Since the process of research and working on new content is time-consuming, expensive, and needs regulatory approvals, therefore repurposing could shorten the time and reduce the cost of the vaccine and drug discovery [17]. Repurposing of vaccines and drugs may give relief for the current pandemic because repurposing of vaccines/drugs, represents an effective strategy to use existing vaccines/drugs to combat the unknown threat. Opinions of researchers have demonstrated that some existing vaccines (like Polio and BCG) may protect against other viral infections of the respiratory tract. A Phase 3 randomized double-blind trial of oral polio vaccine was completed, and its efficacy and safety studies were also performed for COVID-19 [18]. The trial of the BCG vaccine to check its efficacy against COVID-19 has begun with the collaboration of four countries Australia, Germany Netherlands, and United Kingdom [19]. These steps could be useful because in the present situation active research seeks to hasten and strengthen vaccine development for COVID-19. After all, significant vaccination is needed in society to achieve herd immunity against COVID-19. Some vaccines for COVID-19 received emergency approval and some are under a development phase. Polio and BCG vaccines may offer a new potential tool in dealinf with COVID-19 because they are safe and approved already.

Repurposing drugs would be another potent strategy to treat common and rare diseases like COVID-19. Repurposing of drugs is strongly advocated because it offers the use of risk-addressed compounds that can be developed in shorter timelines with lower costs.

Hydroxychloroquine (an analog of chloroquine) is a popular and approved antimalarial drug which was found to be efficient on nCOV and reported to be effective on COVID-19 patients in China, USA, and other countries [20]. In the direction of repurposing, a recent powerful network-based study was performed with some repurposed drugs (e.g., sirolimus, mercaptopurine, and melatonin) for rapid identification of a potential drug against COVID-19 [21]. A trial of the antiviral drug Lopinavir–Ritonavir was undertaken in adult hospitalized patients in China, but no significant result was observed in severe COVID-19 patients [22]. However, repurposing/testing of some other antiviral agents like Favipiravir, Remdesivir, and other classes of drugs is warranted in the future to anticipate some good results. Repurposing of the polio vaccine would meet the immediate challenge of COVID-19. The next section of this paper discusses some scientific rationale behind the suggested use of the polio vaccine against COVID-19 (Figure 1).

FIGURE 1: SCIENTIFIC RATIONALE BEHIND THE SUGGESTIVE USE OF POLIO VACCINE AGAINST COVID-19



RATIONALE BEHIND THE SUGGESTED USE OF POLIO VACCINE AGAINST COVID-19

The similarity between Polio and SARS-CoV-2 virus: Both the SARS-CoV-2 and Poliovirus contain single-stranded positive-sense RNA (+ssRNA) as their genetic material. The Poliovirus consists of four coat proteins VP1, VP2, VP3, and VP4. There are sixty copies of each of these proteins that make the icosahedral protein shell of the Poliovirus. The genetic material of the Poliovirus is approximately 7500 nucleotides long having single-stranded positive-sense RNA (+ssRNA), encapsulated inside the icosahedral protein shell and makes a fully functional Poliovirus [23]. Similarly, SARS-CoV-2 is also made up of primarily four structural proteins namely, membrane glycoprotein (M), envelop protein (E), nucleo-capsid protein (N), and the spike protein (S) [24]. Both the viruses are invisible and unknown to the public, mostly asymptomatic but lethal too. The mode of transmission and spread of viruses is due to human to human contact; Poliovirus transmits through water contaminated with the fecal matter of infected person,

while transmission of SARS-CoV-2 is thought to be primarily by droplets [25].

Immunological determinants: A prompt and coordinated innate and adaptive immune response works as a first line of defense in SARS-CoV-2 infection. However, the excessive and uncontrolled immune response of the host immune system, such as cytokine storm, may be deleterious to the COVID-19 patient. The severity of COVID-19 pathology can be signified by a substantial surge in serum levels of pro-inflammatory cytokines (e.g., IL-1β, IL-2, IL-6, IL-8, IL-17, G-CSF, GM-CSF, IP-10, MCP-1, CCL3, and TNFa) as well as an absolute decline of circulating CD4+, CD8+, B cells and natural killer cells along with decreased levels of basophils, eosinophils, and monocytes [26]. In the case of Poliovirus infection, extraneural organ activation of IFNa/β in the CD155 transgenic mice model has been observed. Additionally, augmentation of cytokines and antigen presentation, as well as inhibition of NF-κB, has also been observed in post-poliovirus infection [27].

Several case studies at autopsy of the lung from people who died due to COVID-19, shows infiltration in alveolar immune cells. A post-mortem outcome from 38 patients who died due to COVID-19 showed plenty of CD68 positive macrophages present in the alveolar lumen and a few CD45 positive lymphocytes were seen in the interstitial space [26]. Another case study of histology of lung autopsy of a COVID-19 patinets indicated a low amount of polymorphonuclear neutrophils (PMN) and the moderate number of macrophages was present in the alveolar exudate, whereas infiltration of monocytes and T cells, but not B cells, was seen in interstitial compartment [28].

Clinical implications: Recent studies show Poliovirus vaccine can show cross-reactivity and thereby induce adaptive immunity and prevent the infection from SARS-CoV-2. Administration of Poliovirus vaccine generates antibodies against RdRP (RNA dependent RNA polymerases) protein, binds to RdRP of both Poliovirus as well as SARS-CoV-2 [14]. Another study that explored the effect of other available vaccines and their role in preventing SARS-CoV-2 infection shows that people administered with Polio vaccine show a lower rate of SARS-CoV-2 infection [29]. However, several vaccines have been developed for COVID-19, alternative therapeutical approaches, in addition to the repurposing of old drugs (as explained above), are needed to develop the potential drug against SARS-CoV-2 to contain the viral infection.

Most recent COVID-19 vaccination has the strongest nonspecific effects, therefore, we hypothesize that, even though SARS-CoV-2 suppresses TLR signaling, the prophylactic use of OPV or other LAV could activate innate immunity before COVID-19 infection via TLRs, priming the immune response/system for adaptive immunity if SARS-CoV-2 infection occurs later. Despite the UNICEF and WHO's efforts to phase down OPV a year after wild Poliovirus eradication, the potential advantages of OPV for COVID-19 need prospective research to determine the impact of OPV on COVID-19 illness and death globally. High rates of morbidity and death associated with COVID-19 have already seen globally [30], therefore, it is critical to do these trials as soon as possible.

CONCLUDING REMARKS

Significant vaccination is needed in society to achieve herd immunity against COVID-19. Some vaccines for COVID-19 have recieved emergency approval for use and some are under the development phase in different countries of the world. There is a large overall population of the world is to be vaccinated but many are hesitant with the currently used COVID-19 vaccines. The use of FDA approved Polio vaccine against COVID-19 is tested and safe, therefore, it could be thought of as one more option. Some common points are also associated between Polioviruse and SARS-CoV viz, their primary replication and possible cross-protective innate immunity offered by Polio vaccine further suggested it's repurposing for immune-prophylaxis and prevention of COVID-19. It will surely save time, resources, and lives of billions of people worldwide and protect society which is currently facing the COVID-19 pandemic.

DECLARATIONS

Ethics approval and consent to participate:

This article does not contain any studies involving human participants or animals performed by any of the authors.

Consent for publication:

Not applicable

Availability of data and material:

Not applicable

Competing interests:

None

Funding:

The authors have no financing to disclose.

Acknowledgements:

Authors are grateful to the National Institute of Technology, Raipur (CG), India and Shri Ramswaroop Memorial University (SRMU), Barabanki (UP), India for providing the facility and space for this work.

All authors have read and approved the manuscript

References

1. Soltani S, Zakeri A, Zandi M, Kesheh MM, Tabibzadeh A, Dastranj M, Faramarzi S, Didehdar M, Hafezi H, Hosseini P. The role of bacterial and fungal human respiratory microbiota in COVID-19 patients. BioMed Research Intl. 2021; https://doi.org/10.1155/2021/6670798
2. Talento AF, Hoenigl M. Fungal infections complicating COVID-19: with the rain comes the spores. J. Fungi. 2020; 6:279.
3. Chowdhary A, Sharma A. Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect the company public news and information. 2020.
4. Rawson TM, Wilson RC, Holmes A. Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID- 19. The COVID-19 resource centre is hosted on Elsevier Connect, the company ' s public news and information. 2020.
5. Arastehfar A, Carvalho A, Nguyen MH, Hedayati MT, Netea MG, Perlin DS, Hoenigl M. COVID-19-associated candidiasis (CAC): an underestimated complication in the absence of immunological predispositions? J. Fungi. 2020; 6:211-223.
6. Kubin CJ, McConville TH, Dietz D, Zucker J, May M, Nelson B, Istorico E, Bartram L, Small-Saunders J, Sobieszczyk ME. Characterization of bacterial and fungal Infections in hospitalized patients with Coronavirus Disease 2019 and factors associated with health Care-Associated Infections. Open Forum Infect. Dis. 2021; 8. https://doi.org/10.1093/ofid/ofab201
7. Blok BA, Arts RJ, van Crevel R, Benn CS, Netea MG. Trained innate immunity as underlying mechanism for the long-term, nonspecific effects of vaccines. J Leukoc Biol 2015; 98: 347-356.
8. De Bree LC, Koeken VA, Joosten LA, Aaby P, Benn CS, van Crevel R. Non-specific effects of vaccines: Current evidence and potential implications. Semin Immunol. 2018; 39: 35-43.
9. Higgins JP, Soares-Weiser K, Reingold A. Systematic Review of the Non-specific Effects of BCG, DTP and Measles Containing Vaccines. Geneva: World Health Organization. 2014.
10. Jensen KJ, Benn CS, van Crevel R. Unravelling the nature of non-specific effects of vaccines a challenge for innate immunologists. Semin Immunol. 2016; 28: 377-383.
11. Aaby P, Benn CS. Beneficial nonspecific effects of oral polio vaccine (OPV): Implications for the cessation of OPV? Clin Infect Dis. 2017; 65: 420-421.
12. Higgins JP, Soares-Weiser K, López-López JA, Kakourou A, Chaplin K, Christensen H. Association of BCG, DTP, and measles containing vaccines with childhood mortality: Systematic review. BMJ. 2016; 355:i5170. doi: 10.1136/bmj.i5170.
13. Upfill-Brown, A, Taniuchi M, Platts-Mills JA, Kirkpatrick B, Burgess SL, Oberste MS. Nonspecific effects of oral polio vaccine on diarrheal burden and etiology among Bangladeshi infants. Clin Infect Dis. 2017; 65: 414-419.
14. Pawlowski C, Puranik A, Bandi H, Venkatakrishnan AJ, Agarwal V, Kennedy R. Exploratory analysis of immunization records highlights decreased SARS-CoV-2 rates in individuals with recent non-COVID-19 vaccinations. Sci Rep. 2021; 11(1):4741. doi: 10.1038/s41598-021-83641-y.
15. Thevar S. More children COVID positive in second wave. Hindustan Times. 2021; Available. https://www.hindustantimes.com/cities/pune-news/more-children-covid- positive-in-second-wave-101618657160956.html
16. Abd El-Aziz TM, Stockand JD. Recent progress and challenges in drug development against COVID-19 coronavirus (SARS-CoV-2)-an update on the status. Infect Genet Evol. 2020; 83:104327. doi:10.1016/j.meegid.2020.104327.
17. Pushpakom S, Iorio F, Eyers P. Drug repurposing: progress, challenges and recommendations. Nat Rev Drug Discov. 2019; 18, 41–58.
18. Lloyd T. A Phase 3 randomized double blind efficacy and safety study of oral Polio Vaccine and NA-831 for Covid-19 (OPV-NA831). Available

<https://clinicaltrials.gov/ct2/show/NCT04540185> (9/9/2022).

19. Sandhya R. 100-year-old TB vaccine now being tested for Covid-19, India may conduct a trial too. 2020 Available <https://theprint.in/health/100-year-old-tb-vaccine-now-being-tested-for-covid-19-india-may-conduct-a-trial-too/387839/> (25/3/2020).
20. Gautret P. Hydroxychloroquine and azithromycin as a treatment of COVID-19: results of an open-label non-randomized clinical trial. Int J Antimicrob Agents. 2020; 20:105949.
21. Zhou Y. Network-based drug repurposing for novel coronavirus 2019-nCoV/SARS-CoV-2. Cell Discov. 2020; 16; 6:14.
22. Cao B, Yeming W. et al. A Trial of Lopinavir Ritonavir in adults hospitalized with severe COVID-19. N Engl J Med. 2020; 382: 1787-1799.
23. Wein MW, Chow M, Hogle JM. Poliovirus: new insights from an old paradigm. Structure 1996; 4:763-767.
24. Hu B, Guo H, Zhou P. et al. Characteristics of SARS-CoV-2 and COVID-19. Nat Rev Microbiol. 2021; 19: 141-154.
25. Shurtleff D. Polio and COVID-19. 2020; https://wcaap.org/polio-and-covid-19/ .
26. Catanzaro M, Fagiani F, Racchi M. Immune response in COVID-19: addressing a pharmacological challenge by targeting pathways triggered by SARS-CoV-2. Sig Transduct Target Ther. 2020; 5, 84; https://doi.org/10.1038/s41392-020-0191-1
27. Aguiar D, Lobrinus JA, Schibler M, Fracasso T, Lardi C. Inside the lungs of COVID-19 disease. Int J Legal Med. 2020;134:1271-1274.
28. Carsana L, Sonzogni A, Nasr A, Rossi RS, Pellegrinelli A, Zerbi P, Rech R, Colombo R, Antinori S, Corbellino M, Galli M, Catena E, Tosoni A, Gianatti A, Nebuloni M. Pulmonary post-mortem findings in a large series of COVID-19 cases from Northern Italy. Lancet Infect Dis. 2020; 20:1135-1140.
29. Sun Y, Abriola L, Niederer RO, Pedersen SF, Alfajaro MM, Monteiro VS, Wilen CB, Ho YC, Gilbert WV, Surovtseva YV, Lindenbach BD, Guo JU. Restriction of SARS-CoV-2 replication by targeting programmed −1 ribosomal frameshifting. Proc Natl Acad Sci USA 2021, 118(26):e2023051118.
30. Kumar, A. COVID-19 gripped the globe with some unnoticed facts and too many questions. VirusDis. 2021; 32: 609–612.

ACHSM Asia-Pacific Journal of Health Management

VIEWPOINT ARTICLE

TOWARDS AN INCLUSIVE RESEARCH CULTURE IN UPCOMING HEALTH AND EDUCATION PRECINCTS IN NEW SOUTH WALES, AUSTRALIA: IMPLICATIONS FOR POLICY AND PRACTICE

Madhan Balasubramanian [1,2], *Victoria Flood* [3,4]

1. Health Care Management, College of Business, Government and Law, Flinders University, Adelaide, Australia
2. Menzies Centre for Health Policy and Economics, School of Public Health, Faculty of Medicine and Health, The University of Sydney, Australia
3. School of Health Sciences, Faculty of Medicine and Health, The University of Sydney, Australia
4. Western Sydney Local Health District, NSW Health, Westmead, Australia

Correspondence: victoria.flood@sydney.edu.au

ABSTRACT

An inclusive research culture is vital towards the maturity of Health and Education Precincts into an active innovation ecosystem. To date, substantial investments have been made in 13 upcoming Health and Education Precincts in varying stages of development in the Greater Sydney region, New South Wales. The political commitment to create an innovative environment for teaching and a vibrant research culture is noticeable. However, it is unclear to what extent government policy engages the breadth of clinical personnel in teaching and research-related activities and contributes towards improving research culture. Based on a study conducted at the central river district of the Greater Sydney region, we argue that better engagement of clinical personnel in teaching/research-related activities and inclusion of research-related roles within the job description of clinical personnel can substantially drive a positive research culture and thereby contribute towards the overall development of Health and Education Precincts. Opportunities for continued education and training of clinical personnel and involvement in graduate research programs also substantially drives research culture. We argue that future policy and practice solutions for upcoming Health and Education Precincts need to foster an inclusive research culture and should be tailored to meet the needs of an innovative ecosystem. Future solutions will need to contribute towards improving research culture as well as the health and wellbeing of people in the region.

KEYWORDS

health and education precincts; innovation; research culture; leadership

INTRODUCTION

The Greater Sydney Commission's (hereon referred to as 'the Commission') vision for the future of Sydney proposes an interconnected metropolis of three cities: western parkland city (Penrith), central river city (Parramatta) and eastern harbour city (Sydney).[1] The Commission's vision brings new thinking to livability, productivity and sustainability so as to radically transform the region into an innovative and high growth economy. [1, 2] Health and education precincts are classified as strategic centres for development by the Commission.

At the basic level, a health and education precinct includes a University collaborating or co-located alongside a major hospital or principal referral hospital.[1, 3] Maturity pathways for such precincts include the development of medical research institutions, commercialisation of research, startup accelerators, venture capital firms, multidisciplinary university settings, residential facilities and enabling an active innovation ecosystem.[3] As precincts evolve in nature, the economic productivity of the precinct is also set to increase substantially.[4] The Commission recognises 13 health and education precincts at various stages of development in the Greater Sydney region.[1] Box 1 provides the list of these precinct names along with their location in the Greater Sydney region and key stakeholders.

BOX 1: HEALTH AND EDUCATION INNOVATION PRECINCTS IN GREATER SYDNEY REGION, NSW

NO.	PRECINCT NAME	GREATER SYDNEY COMMISSION REGION	MAIN INNOVATION PARTNERS†
1	Camperdown-Ultimo	Eastern Harbour City District	Sydney LHD; Royal Prince Alfred Hospital; Sydney Health Partners; TAFE NSW; University of Sydney; University of Technology Sydney; University of Notre Dame; George Institute of Global Health; Woolcock Institute of Medical Research; Sydney City Council
2	Randwick	Eastern Harbour City District	South Eastern Sydney LHD; Prince of Wales Hospital; Sydney Children's Hospital; Royal Hospital for Women, University of New South Wales; TAFE NSW Randwick; Randwick City Council
3	Rhodes East	Eastern Harbour City District	Sydney LHD; Concord Repatriation General Hospital; TAFE NSW; University of Sydney; Canada Bay City Council
4	Westmead	Central River City District	Western Sydney LHD; Westmead Public Hospital; Westmead Private Hospital; Sydney Children's Hospital Network; The Westmead Institute of Medical Research; Children's Medical Research Institute; City of Parramatta Council; Cumberland Council; Sydney Business Chamber
5	Blacktown	Central Riven City District	Western Sydney LHD; Blacktown Public Hospital; Western Sydney University; TAFE NSW Blacktown; Blacktown City Council
6	Greater Penrith	Western Garden City District	Nepean Blue Mountains LHD; Nepean Public Hospital; Nepean Private Hospital; Nepean Blue Mountains Primary Health Network; Wentworth Healthcare; Nepean Blue Mountains Education and Medical Research Council; Western Sydney University; University of Sydney; TAFE NSW; Celestin; Penrith City Council
7	Liverpool	Western Garden City District	South Western Sydney LHD; Liverpool Hospital; South West Sydney Primary Health Network; Western Sydney University; University of Wollongong; University of New South Wales; TAFE NSW; Ingham Institute of Applied Medical Research; Liverpool City Council
8	Campbelltown-Macarthur	Western Garden City District	South Western Sydney LHD; Western Sydney University; Ingham Institute of Applied Medical Research; South Wes Sydney Primary Health Network; University of Wollongong; University of New South Wales; TAFE NSW; Campbelltown-Macarthur City Council
9	St Leonards	North District	Northern Sydney LHD; Sydney Royal North Shore Hospital; North Shore Private Hospital; Ramsay Health Care; North Shore Radiology; Genesis Care; TAFE NSW North Shore; North Sydney, Willoughby and Lane Cove City Councils; NSW Health; Genesis Care

10	Frenchs Forest	North District	Northern Sydney LHD; Northern Beaches Hospital; NSW Health; Northern Beaches Council
11	Macquarie Park	North District	Northern Sydney LHD; Macquarie University; Abbott; AMP Capital; Australian Learning Hub, Cochlear; Johnson and Johnson; 3M Fujistsu; Schneider Electric; Konica Minolta; National Bank of Australia; NSW Government; Optus & Orix Australia; CSIRO; City of Ryde Council
12	Bankstown	South District	South Western Sydney LHD; Bankstown-Lidcombe Hospital, Western Sydney University; TAFE NSW Bankstown; Bankstown-Cantebury Council;
13	Kogarah	South District	South Eastern Sydney LHD; St Georges Hospital; St Georges Private Hospital; Western Sydney University; University of New South Wales; St George & Sutherland Medical Research Foundation; Georges River Council

Note: †List of main innovation partners is not exhaustive. LHD is a Health Local Health District – administrative zones of NSW Health.

The organisational philosophy of a health and education precinct is to build a culture that strengthens collaboration between clinical/health personnel and academic/university personnel.[5] It is recognised that the roles and responsibilities may vary - the main role of academic personnel is teaching and research, while clinical personnel are more engaged in patient care roles. A few traditional measures for collaboration are already in place through teaching and research programs offered by universities within major public hospital settings. For example, the University of Sydney has longstanding clinical teaching and research units based at several public referral hospitals (such as Royal Prince Alfred Hospital, Concord Hospital, Westmead Hospital).[6] Both academic personnel (employed through the University) and clinical personnel (mainly employed by the public hospital and holding a University affiliation) have been involved in teaching and research activities. However, for a large majority of clinical personnel, these activities fall outside the purview of their main patient care roles.

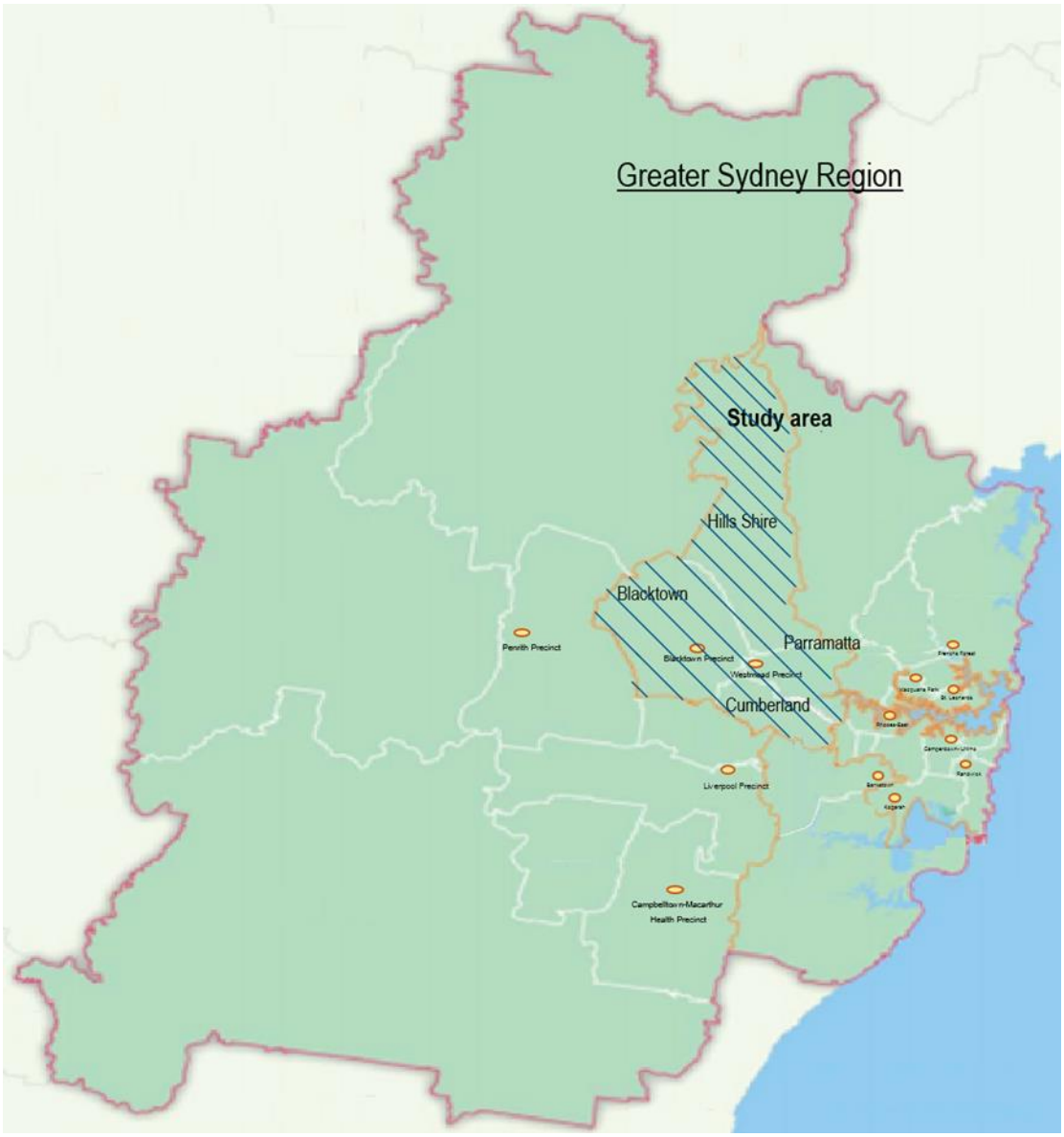
While accommodating the Commission's vision for the future of Sydney, it is necessary to encourage collaboration between health and education sectors and strengthen evidence-based care provision in the upcoming precincts. Building an inclusive research culture is the foundation of evidence-based practice and sound decision making.[7] It is well recognised that health settings that actively engage in research show improved patient and health outcomes.[8] The ability of all health personnel to engage in research-related activities - such as reviewing, utilising, conducting, evaluating and disseminating research evidence - is vital.[9] Creating an inclusive research culture also improves skill sets, job satisfaction and career opportunities for health personnel.[10] Undoubtedly, a positive and inclusive research culture is an essential aspect for an innovative ecosystem, strengthening the global reputation and contributing to the economic development of the upcoming health and education precincts.

LESSONS FROM A WESTERN SYDNEY STUDY

We conducted a study on research culture and capacity of all health personnel (medical, nursing and allied health) located at the central river city district[1] of the Commission's region. [11] The study area included two upcoming health and education innovation precincts at Westmead and Blacktown [12], along with Auburn, Mt Druitt and Cumberland hospitals and community health centres. Together, they formed part of the Western Sydney Local Health District, which is one of the 15 health administrative districts of NSW Health.[13] Geographically, it also includes four local government areas of Parramatta Council, Blacktown Council, Cumberland Council and the Hills Shire. Figure 1 provides an illustration of the study area; locating the study area within the Greater Sydney Region and identifying the upcoming health and education innovation precincts.

[1] The Greater Sydney Commissions plan document classifies the region into five districts: eastern harbour city district, central river city district, western parkland city district, north district and south district

FIGURE 1: A MAP OF GREATER SYDNEY REGION, WITH THE STUDY AREA MARKED IN BLUE



Note: This map has been modified using sources from the Greater Sydney Commission and Western Sydney Local Health District maps. The yellow dots are the health and education precincts. Map not to scale

The Universities of Sydney and Western Sydney are the main higher education universities in the study area and have established bases in the region. Both Universities have made considerable investments and envision the upcoming health and education precincts at Westmead and Blacktown as global centres for excellence and multidisciplinary innovation[14].

Approximately 7150 clinical personnel (2079 medical; 4100 nursing and 968 allied health) were employed in the public health sector (i.e. Western Sydney Local Health District) at the time of the study. Overall, the public health sector serves over one million people in the region. Over 43 percent of the population in the region were born overseas, and about 45 percent speak a language other than English at home.[15] The region is also the home to the highest urban aboriginal population in NSW (about 13,400 aboriginal people based on 2016 census).[15]

All health personnel (medical, nursing and allied health) employed at the study area were invited to participate in a survey through an online questionnaire *via* a Research Electronic Data Capture (REDCap) system[1]. The survey was

[1] REDCap is being widely deployed in NSW Health and used by researchers across the local health districts. The functionality is similar to other online surveys such as Qualtrics/Survey Monkey but provides secure storage functions.

administered between November 2016 to January 2017. A range of data items, including demographic, work status and research biodata were collected. Research culture (outcome variable) was assessed using a battery of 51 items, classified across three domains: individual level (14 items); team level (19 items) and organisational level (18 items). Health professionals (medical, nursing and allied health); gender (male, female); age groups (less than 35 yrs, 35-45 yrs and 55+ yrs); educational qualification (undergraduate, graduate, higher degree research); team role (clinician, management, teaching/research); experience years (5 yrs or less, 6 to 15 yrs, and 15+ yrs); enrolled in a research program and having research in role description - were used as covariates.

Respondents were asked to rank their level of skill/ confidence to each item/statement of the research culture domains ranging from 1 to 10, with 1 being in least agreement and 10 being in strong agreement to that item/statement. Responses were later dichotomised into two groups using mean scores of < 6 as cut-off point (scores < 6 were considered to be a lower level of skill/confidence in the concerned scale/domain and coded as 0; scores of ≥ 6 were considered have a higher level of skill/confidence with the concerned scale/domain, and were coded as 1). These dichotomised scales were first examined by sample characteristics using chi-square tests, and a level of significance set at $p<0.05$. Characteristics found significant at any research culture domain were included as covariates in the multivariate log-binomial regression models. Adjusted odds ratios were generated. Ethics approval for the study was obtained from an approved Human Research Ethics Committee in Australia. In this viewpoint, we have presented results of the logistic regression analysis; a prior publication has examined the descriptive nature of the findings from the study.[11]

Table 1 presents the findings from the regression analysis of the dichotomised research culture domains with selected sample characteristics. Adjusted log-binomial models are presented for each domain. Respondents with a higher degree by research qualification had a consistently higher odds ratio of having a higher level of skill/confidence the three research culture domains compared with respondents with an undergraduate or graduate qualification. Respondents engaged in teaching and research, also had a higher odds ratio of identifying higher skill level / confidence for the team and organisational research culture domains, compared with respondents mainly involved in clinical and management/executive tasks. A further finding was respondents not having research within their role description were less likely to identify higher skills / confidence for each of the research culture domains, and this was significant at the individual and team domains.

TABLE 1: LOGISTIC REGRESSION ANALYSIS | WESTERN SYDNEY STUDY

	INDIVIDUAL LEVEL		TEAM LEVEL		ORGANISATIONAL LEVEL	
VARIABLE	**OR**	**95% CIS**	**OR**	**95% CIS**	**OR**	**95% CIS**
Profession						
Medical	Ref.		Ref.		Ref.	
Nursing	0.29 **	(0.13, 0,62)	0.4 *	(0.17, 0.91)	0.87	(0.4, 1.91)
Allied health	0.57	(0.27, 1.18)	0.39 *	(0.17, 0.86)	0.69	(0.4, 1.47)
Gender						
Male	Ref.		Ref.		Ref.	
Female	1.03	(0.55, 1.95)	1.21	(0.58, 2.52)	0.99	(0.52, 1.9)
Age group						
Less than 35 yrs	Ref.		Ref.		Ref.	
35 to 54 yrs	0.99	(0.45,2.21)	1.07	(0.38, 3.02)	1.25	(0.51, 3.06)
55+ yrs	1.17	(0.44,3.14)	0.65	(0.19, 2.21)	1.11	(0.38, 3.23)
Educational Qualification						
Undergraduate level	Ref.		Ref.		Ref.	

Graduate level	1.59		(0.87,2.93)	1.23		(0.61, 2.48)	1.57		(0.82. 3.03)
HDR level	8.64	**	(3.79,19.72)	2.37	*	(1.01, 5.58)	2.56	*	(1.12, 5.85)
Enrolled in a study/research program									
Yes	Ref.			Ref.			Ref.		
No	0.22	**	(0.12,0.42)	0.63		(0.31, 1.27)	0.81		(0.42, 1.58)
Team role									
Clinician	Ref.			Ref.			Ref.		
Management/Executive	1.32		(0.66,2.64)	1.1		(0.49, 2.47)	1.95		(0.97, 3.9)
Teaching/Research	1.45		(0.77,2.71)	2.96	**	(1.53, 5.73)	1.99	*	(1.05, 3.75)
Years of experience									
5 yrs or less	Ref.			Ref.			Ref.		
6 to 15 yrs	0.8		(0.35,1.84)	0.36	*	(0.13, 0.98)	0.18	**	(0.07, 0.44)
16+ yrs	1.33		(0.51,3.48)	1.18		(0.37, 3.74)	0.23	**	(0.08, 0.7)
Research in role description									
Yes	Ref.			Ref.			Ref.		
No	0.49	**	(0.30,0.81)	0.38	**	(0.22, 0.67)	0.88		(0.53, 1.47)

*p<0.05. **p<0.01.

Ref is Reference Category; OR is Odds Ratio; CI is 95% Confidence Interval.

Multivariate log-binomial regression models; Adjusted odds ratios were generated; Models accommodated selected variables and simultaneously adjusted for the outcome variable.

Only health personnel employed by the public health system (Western Sydney Local Health District) were surveyed. Private hospitals in the region were not included. However, the public sector is the largest employer of health personnel in the region. Further, the study did not evaluate the research culture of the health and education precincts *per se*, but chose to examine only an aspect of the precincts - the health sector. This decision was conscious as the purpose of the study was to build an inclusive research culture for evidence-based practice among the health professionals.

ON REFLECTION: POLICY AND PRACTICE IMPLICATIONS

An inclusive research culture is vital towards the maturity of health and education precincts into an active innovation ecosystem. It is preferable to engage a wide variety of clinical personnel as part of the process of establishing a vibrant research culture. To date, substantial investments have been made in Health and Education Precincts in the Greater Sydney region. In the Westmead precinct alone, over 3 billion has been committed by the government, University and private sector for infrastructure and development projects.[16] Amongst a new central acute services building and a new pediatric services building, the university infrastructure has also been strengthened via conference facilities and dedicated university spaces (for teaching and research) alongside the clinical facilities.[16] While, the political intent to enable a collaborative environment for teaching and research is visible, it is unclear to what extent these changes will contribute to improving the research culture for a large majority of clinical personnel.

In this paper, we have provided insights into enabling factors for improving research culture to drive an innovative ecosystem in the Health and Education Precincts. Our viewpoint, however, is based on findings from two Health and Education Precincts. We recognize that the underlying social determinants, geographic location, population needs, health professionals and universities will determine the inherit nature of upcoming Health and Education Precincts. While our findings are suggestive and should be viewed with some caution, there are considerable implications across all the 13 Health and Education Precincts in NSW. We argue that policy and practice solutions will need to be tailored to meet the emerging population needs in each region. To this end, improving research culture and involving clinical staff in research and teaching related activities will undoubtedly create a vibrant innovative ecosystem.

References

1. Greater Sydney Commission, NSW Government. Greater Sydney Region Plan: A Metropolis of Three Cities. 2018; 1–192.
2. Clark G, Moonen T. *International Case Studies of Connected Cities: Advice to the Greater Sydney Commission*. Sydney, https://gsc-public-1.s3.amazonaws.com/s3fs-public/international_case_studies_of_connected_cities_-_clark_moonen_-_october_2017.pdf (2017).
3. Greater Sydney Commission. Growing and investing in health and education precincts: Maturity pathways for health and education precincts, https://www.greater.sydney/north-district-plan/productivity/jobs-and-skills-city/growing-and-investing-health-and-education (2020, accessed 5 June 2020).
4. Yigitcanlar T, Velibeyoglu K, Martinez-Fernandez C. Rising knowledge cities: The role of urban knowledge precincts. *J Knowl Manag* 2008; 12: 8–20.
5. Harding K, Lynch L, Porter J, et al. Organisational benefits of a strong research culture in a health service: A systematic review. *Aust Heal Rev* 2017; 41: 45–53.
6. The University of Sydney. Clinical schools - Faculty of Medicine and Health, The University of Sydney, https://www.sydney.edu.au/medicine-health/schools/clinical-schools.html (2020, accessed 5 June 2020).
7. Bennett CC. A healthier future for all Australians: an overview of the final report of the National Health and Hospitals Reform Commission. *Med J Aust* 2009; 191: 383–387.
8. NSW Ministry of Health. *NSW Health and Medical Research Strategic Review*. Sydney, https://www.medicalresearch.nsw.gov.au/wp-content/uploads/2018/07/strategic-review-report-2012.pdf (2012).
9. Boaz A, Baeza J, Fraser A. Effective implementation of research into practice: an overview of systematic reviews of the health literature. *BMC Res Notes* 2011; 4: 212.
10. Finch E, Cornwell P, Ward EC, et al. Factors influencing research engagement: research interest, confidence and experience in an Australian speech-language pathology workforce. *BMC Health Serv Res* 2013; 13: 144,
11. Lee S, Byth K, Gifford J, et al. Assessment of Health Research Capacity in Western Sydney Local Health District (WSLHD): A Study on Medical, Nursing and Allied Health Professionals. *J Multidiscip Healthc* 2020; Volume 13: 153–163.
12. Greater Sydney Commission. Western City District Plan. 2018; 135.
13. NSW Health. Local health districts, https://www.health.nsw.gov.au/lhd/Pages/default.aspx (2020, accessed 5 June 2020).
14. University of Sydney. University a partner in vision for Western Sydney - The University of Sydney, https://www.sydney.edu.au/news-opinion/news/2016/07/19/university-a-partner-in-vision-for-western-sydney-.html (2016, accessed 8 August 2020).
15. WSLHD, NSW Health. Western Sydey Local Health District, https://www.wslhd.health.nsw.gov.au/ (2020, accessed 5 June 2020).
16. Health N. Westmead Redevelopment, http://www.westmeadproject.health.nsw.gov.au/news-and-publications/latest-news/july-2016/westmead-s-exciting-future (2020, accessed 5 June 2020).

ACHSM Asia-Pacific Journal of Health Management

VIEWPOINT ARTICLE

THE DARK SIDE OF OVERUSE OF INTERNET: A STUDY OF INDIAN COLLEGE STUDENTS

Binod Kumar Rajak[1], Sumanjeet Singh[2], Minakshi Paliwal[3]*

1. Department of Management Studies, Nalsar University of Law, Hyderabad, India
2. Department of Commerce, Ramjas College, University of Delhi, India
3. Department of Commerce, Daulat Ram College, University of Delhi, India.

Correspondence: binodkumarhr@gmail.com

ABSTRACT

INTRODUCTION

The extensive use of the internet and its effect on our lives can no longer be overlooked. While the internet is a result of the rapid advancement of science and technology, its impact on students depends on how they use it. The present study identifies Internet usage patterns, nature of use, and Internet Addiction (IA) among India's undergraduate and postgraduate students and its consequences on their lives.

METHODS

This empirical examination uses the Multistage Sampling Method (MSM) and cross-sectional method. The structured questionnaire distributed (N=1,200) to ungraduated college students. We included at least ten institutes of every state in India and thirty participants from each institution in this study.

RESULTS

The study revealed that overuse of the internet is statistically significant with internet addiction concerning gender but not with age and education. Overuse of the internet strongly impacts IA. The study further investigates the relationship with the consequences of overuse of the internet with age, gender and education and found that genders significantly differ with the physical and psychological problem but not with a behavioural and relationship problem; level of education has a significant difference with physical and behavioural problem but not with relationship and psychological problems.

CONCLUSION

Our investigation helps college, university or educational policymakers to frame good mental health policies or create programmes to reduce or constrain the adverse effect of overuse of the internet. The results show a compelling need to reduce the overuse of the internet (OI) by promoting psychological competence.

KEYWORDS

Internet Addiction, Overuse of Internet, Gender, Consequences, India, College and Students.

INTRODUCTION

As technological devices become prolific in our lives, they are increasingly embedded and concealed in ourselves as we gradually integrate with them. Extensive merging of humanity and technology is inevitable and such amalgamation is bound to have implications in all aspects of our lives. Technology has tremendously changed lifestyle within a short period, given that instant access to information was unimaginable just a few decades ago.

The proliferation of technology in our personal and professional lives has also changed how we interact with it to the extent of becoming dependent on it. There are ongoing debates and discussions on classifying behaviour characterized by excessive non-work-related technology, especially those related to the internet. Such excessive use has been recognized as an addiction. Overindulgence in Internet-based activities, i.e., gaming, blogging, surfing, chat rooms, shopping and pornography, is now considered an addiction disorder. The disorder has various names, including Problematic Internet Use, Internet Addiction Disorder (IA), Compulsive Internet Use and Impulse Control Disorder. These disorders are akin to conventional addictions such as pathological gambling, which may not necessarily involve narcotic usage. The stark rise in the figure of nternet users in India from 394 million in 2000 to 6 billion in the 4th quarter of 2020 – the second largest in the world, indicates the country's prevalence for digital addiction disorders. [1] These disorders are associated with depression, lack of concentration, high anxiety, psychomotor agitation, salience, mood modification, obsessive thoughts, and sleeplessness. The World Health Organization has included "gaming disorders" into the International Classification of Diseases, highlighting the growing and severe problem of IA throughout the world.

Prominent researchers of internet addiction suggest that internet addicts exhibit the same symptoms as those with impulsive control disorder and drug or alcohol addicts. [2] IA is believed and has proven to have wide-ranging unpropitious outcomes that impact large domains of lives, ranging across physical, emotional, psychological, occupational and interpersonal. The negative impacts have severely impacted young people who spend excessive time online and neglect their family, professional and social life and most importantly, their interests. [3]

Previous literature compares internet usage with cigarette smoking and individual behaviour. [4] Internet usage becomes so addictive that individuals start neglecting their work which can cause many issues such as family conflict, relationship conflict, boredom and low self-esteem. [5] Whether we codify it within a clinical framework or not, the alarming nature of IA is significant in recognizing the potential negative impact of this problem. Studies have been undertaken on internet addiction and the workplace but there is less study on students' internet usage and academic performance. There is an urgent need to attend to the crisis of IA by academics, health experts, professional institutions, society and government. [6] The current study proposes the framework of how Overuse of Internet (OI) becomes internet addiction and its further association with gender, age and educational level.

RESEARCH BACKGROUND & HYPOTHESIS DEVELOPMENT

There have been many studies on IA, as seen in an extensive review by Mak & Young. [7] A seminal introductory study of addiction with computers emerged as early as 1989 in a book by Shotten, which reported the enchantment of students in the UK by machines, to the exclusion of their other activities. [8] Dr Kimberly Young first introduced the notion of 'IA' in August 1996 at the American Psychological Association [9] but this presented many controversies. It was believed the term could only use in substance addiction and abuse, such as in drug addiction; thus, some studies have referred to the overindulgence in internet activities as for IA. [10] Others have called it terms such an IA Disorder [110], pathological operation of internet [12] depression [13] and pathological internet use. [14] Over time, researchers have propounded the term and concept of IA to simplify the exploitation or adverse Usage of Interenet (UOI) and the uncontrollable use of Internet of Things (IoT). [15] Studies have also recognized various disorders caused by IA, similar to drug or alcohol addiction. [6, 16] On comparing internet addicts to non-addicted users of the internet, the former reported more harmful and adverse consequences significantly as a result of excessive Internet use, such as the compulsive need to go online when offline, along with mixed feelings of guilt and anxiety about the amount of time spent on Internet [17] and hiding the details of time spent on the Internet to their peers. [18]

Earlier studies have identified specific negative consequences of OI, such as time mismanagement, lack of sleep, and missed meals [19], all of which could directly affect on personal and professional fronts. [20] Studies have recognised IA symptoms including psychomotor agitation [21], changes in appetite [22], gloominess or depression, lack of self-control [23], impairment of function [24], inability to make decisions [25], disorganized eating habits [26], and irresistible online surfing despite its detrimental effects on personal welfare. [23] Studies revealed that hefty Internet use for leisure is highly connected with decreased Academic Performance because of synchronous chat rooms. [14] Studies have also highlighted common problems created by extensive Internet use like disrupted marriages and marital issues. [27] Studies hitherto have primarily focused on four factors, viz., personal, social, academic and Internet-related to define and explain the problems related to IA. Despite studies discussing and studying IA's impact, few reports study the entire pathway that includes therapy. Most of the studies focused only on the adverse impact rather than the positive impacts of Internet use. [28]

To the best of our knowledge, few studies have assessed the adverse effect of the internet but there is no clarity how internet usage becomes internet addiction. Recent studies revealed that usage of internet vary with gender. [4] For example, in terms of gender, some studies have shown that men are more addicted to the Internet in developed and high-tech economies. [4; 29] while other researchers have shown no such differences between the genders in the extent of UOI. [30] While many studies have tried to assess and analyse the factor of addiction by measuring the amount of time spent online, such studies are complicated by the fact that students are connected to the Internet or Wi-Fi all the time in modern times and rely strongly on the Internet for academic's purposes, acquiring news and information and for communication and entertainment. Thus, IA is now a multidimensional and

multifaceted concept that must be explored across a broad perspective to understand the issue comprehensively. The following hypotheses were proposed to gain such understanding:

- **Ho_1** There is no significant difference in the overuse of internet and Internet Addiction across the (a) gender, (b) age and (c) education.
- **Ho_2** Overuse of internet has no significant impact on Internet Addiction among students.
- **Ho_3** There is no significant difference with consequences of Overuse of Internet across the (a) gender, (b) age and (c) education.

METHODOLOGY

DATA, DEMOGRAPHIC, PROCEDURE AND INSTRUMENT

This empirical examination has used the Multistage Sampling Method (MSM) [31] and the cross-sectional method; [32]. MSM is viewed as reasonable to minimalise and control for bias, which diminishes the study's expense and time. The current survey examination has 39 items (accumulative) scale, and previous research has suggested that 5-10 response for one item is adequate for the study. [32] So, the current study required (39*10) 390 responses, but we distributed the (N= 1200) structured questionnaire to graduate and postgraduate college students of Delhi and NCR, Haryana, Uttrakhand, Himachal Pradesh and Uttar Pradesh states in India regardless of their level, stream of study. We included at least ten institutes from each state and thirty participants from each institution. Previous studies suggests that structured questionnaire surveys circulated through email or by hand are generally more appropriate for social science fit in sociology research. [33] Seven hundred and nineteen responses were obtained, with a response rate of 47% (online survey) and 79% (personal survey method). The final study sample comprised 626 participants (61% male; 39% female; M = 3.372, SD=0.794, with ninety-three rejected because data was imprecise or nonresponsive. The demographic of respondents can be seen in Table 1. The IA Test, developed by Young [21], was used in this work. The data obtained were organised, tabulated, and analysed systematically using SPSS 25 software.

TABLE 1: DEMOGRAPHIC PROFILE OF SURVEY RESPONDENTS

Demographic Characteristics		Frequency	Percentage
Age	15-20 Years	161	25.7
	20-25 Years	382	61.0
	25-30 years	79	12.6
	More than 30 Years	4	.6
Gender	Male	384	61.3
	Female	242	38.7
Education level	Graduation	249	39.8
	Post Graduations	377	60.2
Nature of Accommodation	With Family	429	68.5
	Hostel with friends/rent	197	31.5
Income Categories	Upper Class	15	2.4
	Upper Middle Class	258	41.2
	Lower Middle Class	353	56.4
Nature of Relationship	Single	466	74.4
	In relationship	122	19.5
	Complicated	38	6.1

RESULTS

1 Pattern and Purpose of using Internet in the class

It is impossible to circumvent technology and the internet in modern times but educating users on the right way to engage with it is essential. Students increasingly use the internet and its various educational applications to obtain information for academic purposes, and pattern results (Table 2) of this investigation show that respondents use the internet for about four hours every day. The internet is a source of extensive knowledge where everything can be accessed quickly and easily and these purposes for using the internet was studied. Reliability (a) was calculated for all measurements and found to be .781, indicating that the construct is reliable enough for further statistical analysis (Table 3). The mean (2.19) and SD (1.025) suggests that students were using the internet more other than for class purposes. The descriptive study (Table 3) followed by the texted or checked mailbox or online status while in class with a mean of 1.964 and SD=1.062. Receiving a sexually suggestive photo or video scored the lowest mean of 1.139 with SD=.474 and followed by online gaming in the class with mean =1.362 and SD=.889.

TABLE 2 INTERNET USES PATTERN

Demographic Characteristics		Frequency	Percentage
Average Hours of Uses	0-2Hours	105	16.8
	3-4 hours	261	41.7
	5-6 hours	97	15.5
	7-8 hours	72	11.5
	9-10 Hours	44	7.0
	11-12 hours	36	5.8
	13-14 hours	7	1.1
	15-16 hours	4	.6
Practices of Switching of Notification in class	Yes	536	85.6
	No	90	14.4
Can live without internet	Yes	233	37.2
	No	293	46.8
	can't say/ do not know	100	16.0
Can internet be regulated	Yes	288	46.0
	NO	160	25.6
	Can't Say	178	28.4
Uses of Internet in class room	never	280	44.7
	Sometimes	294	47.0
	Most of the times	52	8.3
Visiting pattern of porn site in a week	1-3 time	440	70.3
	4-6 times	146	23.3
	7-9 times	40	6.4
Feeling of Internet Addiction	Not at All	55	8.8
	Not much	163	26.0
	Some what	257	41.1
	Very Much	151	24.1

TABLE 3 DESCRIPTIVE ANALYSIS (CR, MEAN AND STANDARD VALUE OF CONSTRUCTS)

CONSTRUCTS	CR	MEAN	SD
Using Internet	0.781	1.9649	1.06224
Internet Addiction	0.929	2.0815	0.71876
Causes of internet overuse	0.867	2.8315	0.7946
Physical Problems	0.917	2.2764	0.98478
Psychological Problems	0.938	2.18	1.01878
Behavioural Problems	0.907	2.1465	0.91039
Relationship Problems	0.936	1.7688	0.81293

1.1 Causes of Internet overuse

While the UOI in terms of information and entertainment cannot underestimate, its overuse can cause depression, obsession, anxiety, and even isolation, all of which are IA symptoms. A literature survey identified various causes of Internet Overuse (IO), and students were asked to rate on intrenet use according to their preferences. Reliability (a) (see table 1) was calculated for all the measurements and found to be .867, indicating that the constructs were reliable enough for further statistical analysis. Sexual exploration was one of the fundamental reasons disclosed by students with mean score 3.426 and SD=1.412, followed by the statement "I want to escape harsh realities of life" with a mean of 3.372 and SD of 1.230. Leisure time or Free time scored the lowest mean of 2.126 and SD=1.054.

1.2 Consequences of overuse of Internet

A series of internet overuse consequenecs were identified from the literare including physical problems, psychological problems, behavioral problems and relationship problems and in our survey, students were asked to rate these consequences on a scale of 1 to 5. Reliability (a) (see Table 3) was calculated for all the constructs and found to be between .907 to .938, indicating that the construct was reliable for further statistical analysis. Descriptive statistics showed that 'Physical problem' had the highest mean (mean = 2.276) followed by 'Psychological Problems' (mean = 2.180), 'Behavioral problem' (mean = 2.146) and 'Relationship problem' (mean = 1.768). the attribute' Sleep disturbance" scored highest with a mean of 2.580 and SD of1.298 followed by dry eyes/eye strain, with a mean of 2.539 and SD of 1.245, and backaches had a mean value of 2.492 and SD of 1.263.

For the different measurement variables of psychological problems, "feelings of guilt" scored the highest mean of 2.596 and SD=1.362, followed by "Loss of interest" with a mean of 2.427 and SD of 1.289. In regard to behavioral problems, attributes like "Loss of interest in study/work" scored the highest mean of 2.385 and SD=1.239, followed by "Often losing to track of time when online" with mean =2.379 and SD=1.182. Attributes such as "Displaying anger due to time loss" had the lowest mean of 1.852 and SD=1.071. Regarding relationship problems, attributes such as "Decreased time spent with family and friends" had the highest mean of 2.016 with SD=0.991, followed by attributes like "Deceiving others about the amount of time spent on the Internet" with mean =1.971 and SD=1.035. "Thoughts of "getting online", or of sexual behaviour, seep into your mind when you are not online or engaged in sexual behaviour (i.e., work, with family)" scored the lowest mean of 1.499 and SD=0.824.

2 Hypothesis testing

The values calculated experimentally using the one-way ANOVA; Table value of OI and IA (3.85) found is less than the calculated value (F=5.188, p=.023, p>.05) of IA & Internet overuses (F=5.540, p=.019). Hence, (Ho1) was rejected, which shows that male and female students are significantly different concerning OI and IA. [38; 12; 29] However, the analysis has not found enough evidence to say there is a difference between OI and IA with age and educational levels. F value = 2151.630, p>.05 showed (H2) Overuse of the Internet has a significant difference with Internet Addiction. The pooled mean of all measurement variables calculated for assessing IA; regression analysis was carried out and was found to be moderately significant (f=82521.042, P=.000b, t=287.265, p=.000) and contributed 99.2% (R2 = 0.992) to the IA. IA= (B=0.037+.979*), the results revealed that the beta values for Internet overuse were 0. .979 and thus, it had a strong effect on IA; hence it is concluded that Internet overuse is

a prime cause. OI, the f-value was found to be greater than the table value (3.85) in the case of Physical Problems (11.113) and Psychological Problem (14.15) as against to behavioral problem (2.547) and relationship problem (1.807) at 1 degree of freedom and 0.05 level of significance. Therefore, (Ho3) was rejected; the mean values of the physical problem and psychological problem differed significantly between the genders. However, the mean values of behavioral and relationship problems do not differ significantly between men and women. The f value of (Ho3) was more significant than the table value (3.85) in the case of Physical Problems (5.320), Behavioral Problem (4.065) as against Psychological Problem (3.622) and relationship problem (.999) at 1 degree of freedom and 0.05 level of significance. Therefore, it concludes that the mean of the physical problem and behavioral problem differs significantly across the respondents' level of education but is accepted in psychological problems and relationship problems. Thus, psychological and relationship problems do not differ significantly across respondents' levels of education.

TABLE 3 ONE WAY ANOVA OF MEAN OF INTERNET ADDICTION AND INTERNET OVERUSES ACROSS THE GENDER, AGE AND EDUCATION

GENDER		SUM OF SQUARES	DF	MEAN SQUARE	F	SIG.
Internet addiction	Between Groups	3.141	1	3.141	5.188	0.023
	Within Groups	377.739	624	0.605		
	Total	380.88	625			
Internet overuse	Between Groups	3.473	1	3.473	5.54	0.019
	Within Groups	391.141	624	0.627		
	Total	394.614	625			
AGE		**SUM OF SQUARES**	**DF**	**MEAN SQUARE**	**F**	**SIG.**
Internet addiction	Between Groups	2.307	3	0.769	1.264	0.286
	Within Groups	378.573	622	0.609		
	Total	380.88	625			
Internet overuse	Between Groups	2.208	3	0.736	1.167	0.322
	Within Groups	392.405	622	0.631		
	Total	394.614	625			
EDUCATION		**SUM OF SQUARES**	**DF**	**MEAN SQUARE**	**F**	**SIG.**
Internet addiction	Between Groups	0.435	1	0.435	0.713	0.399
	Within Groups	380.445	624	0.61		
	Total	380.88	625			
Internet overuse	Between Groups	0.488	1	0.488	0.772	0.38
	Within Groups	394.126	624	0.632		
	Total	394.614	625			

TABLE 4: IMPACT OF INTERNET OVERUSE ON INTERNET ADDICTION: REGRESSION ANALYSIS

MODEL		UNSTANDARDIZED COEFFICIENTS		STANDARDIZED COEFFICIENTS	T	SIG.
		B	Std. Error	Beta		
1	(Constant)	.037	.010		3.722	.000
	Internet overuse	.979	.003	.996	287.265	.000
R= .996[a] R^2 .992 F= 82521.042 P=.002[b] Std. Error of the Estimate=0.06768						
a. Dependent Variable: Internetaddiction1						

DISCUSSIONS AND CONCLUSION

Addiction generally refers to compulsive behaviour those results in adverse effects. The amount of time an individual spends on the internet is a critical factor in increasing IA risk. The Study found that IA's sternness levels increase with an OI. [39; 13] Thus, the risk of becoming IA becomes higher as students spend on the Internet increases. This study indicated that OI and IA are more significant among female students than male students. An earlier study also indicated significant differences in Internet overuse and IA between gender categories, age of the students and the students of UG and PG. [36] IA's prevalence is significant with gender, age, and education. [40]

Our study results show that most tertiary level students use the internet for more than 4 hours every day. From the ANOVA results, it can seem that the mean OI differs significantly. The present investigation also highlights the consequences of OI on the internet, such as sleep disturbance, interpersonal relationship issues, eyes strain, backache. [37; 38] Further investigation suggests that OI and IA harm sex life, family life, individual behaviour, loss of interest, lack of concentration, and short temperament. The current examinations also suggest that overuse of the internet has a significant difference in physical and psychological problems faced by each gender. A recent study also suggests that females feel shyer in relation to the internet in comparison to their male counterparts. That could be the reason why males and females face different problems. [4; 5] Male are more expressive, so they express themselves, whereas females are shy (especially in India), which could be a possible gender difference regarding physical and psychological problems. [4; 39] This study also reports that IA was associated with students' physical, psychological, behavioural, and relationship issues. [40] The present study revealed that students are unaware when their usage becomes an addiction. So, institutions and policymakers should come forward to make policies to regularise the usage of the internet. Psychological distress (PD) and addiction to the internet have been positively linked as a predictor of IA. Students need to be tested for PD and IA because there is a significant risk of coexisting and escalating issues. [41; 42]

IMPLICATION, LIMITATION & FUTURE SCOPE

Although the internet is regarded as the most powerful tool of modern times and people use it for various purposes, the user needs to know how it starts to take over life and impede other daily activities. IA in India appears to be a significant emerging mental health disorder among students at all UG and PG levels. Our investigation helps college and university or educational policymakers frame suitable policies or create a Programme to reduce or aware the adverse effect of overuse of the internet. The results of the compelling need to reduce the OI by promoting psychological competence among students. Without clarifying Internet use or abuse outcomes, it is unjustifiable to consider it an issue; the current investigation additionally endeavours this path. These activities would help provide early referrals for diagnosis and care to specialist centers. Thus, raising awareness among students and faculty about IA and its risk factors would be an excellent initial step towards safe Internet use. The study carried out before the Covid pandemic, and Internet usage increased during and after the pandemic due to the online classes. So, future research will explore the relationship between OI, IA and its consequences after the pandemic, which gives more clarity. The cross-sectional technique constrains the casualty, and participants are limited to Delhi NCR College and university, which bound the results the future researcher can work on this and generalize it for a large population. Since the study is limited to quantitative methodology and a single methodology has limitations in relation to when individual behaviour and

perception are involved, future research in this area can have a mixed methods approach so as to present the holistic model of OI, IA and their consequences.

CONFLICT OF INTEREST:

The authors declared no potential conflicts of interest with this article.

References

1. Internet Top 20 Countries - Internet Users 2020 [Internet]. Internetworldstats.com. [cited 2021 Feb 24]. Available from: https://www.Internetworldstats.com/top20.htm
2. Young KS. Internet addiction: A new clinical phenomenon and its consequences. American behavioral scientist. 2004 Dec;48(4):402-15.
3. Cheng C, Li AY. Internet addiction prevalence and quality of (real) life: A meta-analysis of 31 nations across seven world regions. Cyberpsychology, Behavior, and Social Networking. 2014 Dec 1;17(12):755-60.
4. Nayak, J. K. (2018). Relationship among smartphone usage, addiction, academic performance and the moderating role of gender: A study of higher education students in India. Computers & Education, 123, 164-173.
5. Roberts, J., Yaya, L., & Manolis, C. (2014). The invisible addiction: Cell-phone activities and addiction among male and female college students. Journal of behavioral addictions, 3(4), 254–265. http://dx.doi.org/10.1556/JBA.3.2014.015.
6. Schell BH. Online health and safety: From cyberbullying to internet addiction: from cyberbullying to internet addiction. ABC-CLIO; 2016 Feb 22.
7. Mak KK, Young KS. Development and Differential Item Functioning of the Internet Addiction Test-Revised (IAT-R): An Item Response Theory Approach. Cyberpsychology, Behavior, and Social Networking. 2020 May 1;23(5):312-28.
8. Shotton MA. Computer Addiction Pb: A Study of Computer Dependency. CRC Press; 1989 Oct 23.
9. Young KS. Psychology of computer use: XL. Addictive use of the Internet: a case that breaks the stereotype. Psychological reports. 1996 Dec;79(3):899-902.
10. Akın A. The relationships between Internet addiction, subjective vitality, and subjective happiness. Cyberpsychology, Behavior, and Social Networking. 2012 Aug 1;15(8):404-10.
11. Liu X, Bao Z, Wang Z. Internet use and Internet addiction disorder among medical students: a case from China. Asian Social Science. 2010 Jan 1;6(1):28-34.
12. Liang L, Zhou D, Yuan C, Shao A, Bian Y. Gender differences in the relationship between internet addiction and depression: A cross-lagged study in Chinese adolescents. Computers in Human Behavior. 2016 Oct 1; 63:463-70.
13. Boonvisudhi T, Kuladee S. Association between Internet addiction and depression in Thai medical students at Faculty of Medicine, Ramathibodi Hospital. PloS one. 2017 Mar 20;12(3): e0174209.
14. Canbaz S, TEVFIK SA, Peksen Y, Canbaz MA. Prevalence of the pathological Internet use in a sample of Turkish school adolescents. Iranian Journal of Clinical Infectious Diseases.2009; 3:1; 7–11.
15. Romano M, Osborne LA, Truzoli R, Reed P. Differential psychological impact of internet exposure on internet addicts. PloS one. 2013 Feb 7;8(2): e55162.
16. Krishnamurthy S, Chetlapalli SK. Internet addiction: Prevalence and risk factors: A cross-sectional study among college students in Bengaluru, the Silicon Valley of India. Indian journal of public health. 2015 Apr 1;59(2):115.
17. Sherer K. College life on-line: Healthy and unhealthy Internet use. Journal of College Student Development. 1997 Nov; 38:6; 655–665.
18. Kandell JJ. Internet addiction on campus: The vulnerability of college students. Cyberpsychology & behavior. 1998;1(1):11-7.
19. Brenner V. Psychology of computer use: XLVII. Parameters of Internet use, abuse and addiction: the first 90 days of the Internet Usage Survey. Psychological reports. 1997 Jun;80(3):879-82.
20. Young KS. Internet addiction: The emergence of a new clinical disorder. Cyberpsychology & behavior. 1998;1(3):237-44.
21. Young K. The evolution of internet addiction disorder. Internet addiction. Psychology and Behavioral Economics, 2017:3-18.
22. Davey S, Davey A, Singh JV. Emergence of Problematic Internet use among Indian Adolescents: A Multi Method study. Journal of Indian Association for Child & Adolescent Mental Health. 2016 Jan 1;12(1).
23. Rao R. Powered by Leone, India becomes third largest consumer of online porn [Internet]. 2020 [cited 2020 Spring 12]. Available from: www.zdnet.com

24. Charlton JP, Danforth ID. Distinguishing addiction and high engagement in the context of online game playing. Computers in human behavior. 2007 May 1;23(3):1531-48.
25. Oztürk O, Odabasıoglu G, Eraslan D, Genc Y, Kalyoncu OA. Internet addiction: Clinical aspects and treatment strategies. Journal of Dependence. 2007;8(1):36-41.
26. Tsukayama H. This Dark Side of the Internet is Costing Young People Their Jobs and Social Lives. Washington Post. 2016.
27. Lin MP, Wu JY, You J, Hu WH, Yen CF. Prevalence of internet addiction and its risk and protective factors in a representative sample of senior high school students in Taiwan. Journal of Adolescence. 2018 Jan 1; 62:38-46.
28. Lai CM, Mak KK, Watanabe H, Ang RP, Pang JS, Ho RC. Psychometric properties of the internet addiction test in Chinese adolescents. Journal of Pediatric Psychology. 2013 Aug 1;38(7):794-807.
29. Yeh YC, Ko HC, Wu JY, Cheng CP. Gender differences in relationships of actual and virtual social support to Internet addiction mediated through depressive symptoms among college students in Taiwan. Cyberpsychology & behavior. 2008 Aug 1;11(4):485-7.
30. Tran BX, Hinh ND, Nguyen LH, Le BN, Nong VM, Thuc VT, Tho TD, Latkin C, Zhang MW, Ho RC. A study on the influence of internet addiction and online interpersonal influences on health-related quality of life in young Vietnamese. BMC public health. 2017 Dec;17(1):1-8.
31. Sedgwick P. Multistage sampling. Bmj. 2015 Jul 31;351. doi: 10.1136/bmj.h4155
32. Rajak BK, Kunja SR, Singh P. Emotional labour, stress and employee performance: a study of higher education system. International Journal of Economic Policy in Emerging Economies. 2021;14(3):306-18.
33. Chi X, Lin L, Zhang P. Internet addiction among college students in China: Prevalence and psychosocial correlates. Cyberpsychology, Behavior, and Social Networking. 2016 Sep 1;19(9):567-73.
34. Goel D, Subramanyam A, Kamath R. A study on the prevalence of internet addiction and its association with psychopathology in Indian adolescents. Indian Journal of Psychiatry. 2013 Apr;55(2):140.
35. Anand N, Jain PA, Prabhu S, Thomas C, Bhat A, Prathyusha PV, Bhat SU, Young K, Cherian AV. Internet use patterns, internet addiction, and psychological distress among engineering university students: A study from India. Indian journal of psychological medicine. 2018 Sep;40(5):458-67.
36. Sharma B, Ashok L, Chandrasekaran V, Monteiro A. Internet addiction and its correlates among undergraduate college students in Udupi Taluk, Karnataka. Journal of Datta Meghe Institute of Medical Sciences University. 2018 Apr 1;13(2):95.
37. Werner, G., & Eleanor, C. Developing and Using Questionnaires. Program Evaluation and Methodology Division, 1993 October, 242. [Cited on 2021, Feb 24] Retrieved from http://archive.gao.gov/t2pbat4/150366.pdf
38. Bernardi S, Pallanti S. Internet addiction: a descriptive clinical study focusing on comorbidities and dissociative symptoms. Comprehensive psychiatry. 2009 Nov 1;50(6):510-6.
39. Claes L, Müller A, Norré J, Van Assche L, Wonderlich S, Mitchell JE. The relationship among compulsive buying, compulsive internet use and temperament in a sample of female patients with eating disorders. European Eating Disorders Review. 2012 Mar;20(2):126-31.
40. Floros G, Siomos K, Stogiannidou A, Giouzepas I, Garyfallos G. Comorbidity of psychiatric disorders with Internet addiction in a clinical sample: The effect of personality, defense style and psychopathology. Addictive behaviors. 2014 Dec 1;39(12):1839-45.
41. Ko CH, Yen JY, Yen CF, Chen CS, Chen CC. The association between Internet addiction and psychiatric disorder: a review of the literature. European Psychiatry. 2012 Jan;27(1):1-8.
42. Kraut R, Patterson M, Lundmark V, Kiesler S, Mukophadhyay T, Scherlis W. Internet paradox: A social technology that reduces social involvement and psychological well-being? American psychologist. 1998 Sep;53(9):1017.

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

ADOPTION AND USAGE INTENTION OF CONSUMERS TOWARDS TELEMEDICINE AMONG PEOPLE DURING PANDEMIC TIMES

Charu Saxena[1], Pardeep Kumar[1], Pratibha Thakur[2]

1. University School of Business, Chandigarh University, Mohali, Punjab, India.
2. Department of Management, Chandigarh Group of Colleges, Landran, Punjab, India.

Correspondence: saxena.charu16@gmail.com

ABSTRACT

OBJECTIVE:

As COVID-19 engulfed the world, people are shifting to a new way of life with social distancing and self isolation, especially in developing countries. In such a scenario, online retailing has gone through a sea change with a new wave of increased demand and where the healthcare sector has also adjusted with the augmented transition from physical shops to e-commerce. The current study aims to assess the adoption and usage intention of consumers towards telemedicine among people during pandemic times.

METHOD:

The adoption of telemedicine by consumers depends upon some factors such as reliability, affordability, convenience, authenticity, offers and discount; which could enhance the intention to adopt and continual use by consumers. A modified version of 'Technology Acceptance Model' is incorporated in this study to validate the concept of adoption of telemedicine in cities of North India.

RESULTS:

The study has found the positive and significant relationship between the factors of adoption and the intention to adopt telemedicine. Also, the 'Effect of COVID-19' plays a moderating role between the different factors of adoption and the intention to adopt telemedicine.

CONCLUSION:

The adoption of telemedicine by people is significantly associated with different internal and external factors. The intention to adopt telemedicine is the construct that strongly influences the actual usage of telemedicine in developing countries. The scope of this study is restricted to the Northern region of India. A future study can be undertaken in relation to the global perspective of consumers.

KEYWORDS

COVID-19, healthcare, e-commerce, telemedicine.

INTRODUCTION

In the current pandemic situation, developing countries, like India, are struggling to improve the healthcare sector and are taking numerous initiatives to increase health care spending (as a fraction of its GDP). The government's aim is to fortify three major segments—preventive health, curative health and well-being—to boost the developing healthcare sector, is evident from its 137% expenditure increase for health and wellbeing in the Union Budget 2021[1]. Investors around the globe fear that the Coronavirus pandemic will destroy economic growth and the actions taken by governments may not be enough to stop the decline [2]. As lockdowns and the risk of spread of the virus kept most people indoors, consumers, shift towards online deliveries of nearly all necessities—groceries and other equipment for medical services.

Telemedicine is one of the verticals of e-commerce which has started gaining momentum and growing at a significant pace among the people [3]. The telemedicine market will further develop in the coming years with the help of renewed attention of the government and growth of e-commerce and faster adoption of the internet among users. With more people having approachability to the internet, its use in healthcare is becoming more prevalent. The scarcity of the availability of medical services in rural areas has also been overcome by telemedicine [4]. According to a collaboration survey by India's healthcare research organization (HRO) -SMSRC* and Purdue University in the United States, physicians and doctors in India have adopted to a large extent, in the usage of audio calls, WhatsApp and other social media applications in providing medical services [5].

Telemedicine can be understood as a combination of availability of medical services and medicines at the doorstep, with the help of an application or software. The online platform of purchasing medicines by the consumers can also be called e-pharmacy [8]. The expansion of e-pharmacies in recent times has been spurred by easy access to the internet, awareness of digital knowledge leads to digital transition of healthcare services and the urgency of medical services and medicines during the pandemic [9].

Technology adoption can be stated as "an organization's decision to acquire a technology and make it available to its members for supporting or enhancing their task performance" [12]. The term adoption refers to "the decision of potential users to make full use of an innovation as the best course of action available" [11]. Healthcare organizations have growing interest in obtaining and adopting telemedicine technology with an aim to increase or extend the healthcare services, especially during the pandemic times [6] [7].

Using an integrated technology acceptance model, the study examined the impact of factors of online shopping on intending to adopt telemedicine and its influence on the consumer's actual usage. The moderating role of 'Effect of COVID-19' on the relation between different factors of adoption and the intention to adopt telemedicine, is also assessed in the current study.

LITERATURE REVIEW AND FORMULATION OF HYPOTHESIS

Rogers' Diffusion of Innovation theory (1995) delivers a suitable framework to comprehend the adoption of telemedicine [21]. Telemedicine corresponds to the definition of innovation, which is described as an idea, practice or object which the adoption unit considers novel. Although one might argue that the usage of the telephone in the early 1900s launched telemedicine. In order to provide the extended medical services in remote areas the private hospitals of India started telemedicine services in 2000. Later in 2005, a number of telemedicine projects were set up by the health ministry of India with SAARC (The South Asian Association of Regional Cooperation) regional nation groups [48]. The urgency of utilization of telemedicine for drugs and other medical services has been created during lockdown due to pandemic situations all across the world [20]. In the rural areas of developing countries like India, availing the services of telemedicine prove to be gaining interest among the people due to less cost and greater speed [16].

CONCEPTUAL FRAMEWORK

The conceptual model for the current study is based upon internal and external factors. External factors refer to the environment surrounding the system as well as the system itself, while internal factors refer to user behavior and motivation [61]. The internal factors taken in the study are convenience, affordability, and hedonic motivation and the external factors are reliability, social influence, authenticity, offers/discount. Health organizations are benefiting from the increase in patient convenience through telemedicine that leads to satisfaction of patients

[15] [17]. Telemedicine can play a role in the reduction of health care costs for the patient. As per the theory of affordability, if the adoption of a new technology is economically affordable for the people, they would accept it and thus transition from potential users to the actual usage [14]. In line with motivation theory, hedonic motivation is pivotal in influencing technology adoption among users, focused on seeking information relative to the usefulness of the product or service with respect to the technology or the product [17]. If the potential user of technology-based service innovations perceives that the new technology is unreliable and believes that errors may occur, they are not likely to embrace it [19]. Furthermore, in developing countries where people give importance to others' opinion, especially the people belonging to their society, regarding the usage of new technology and develop intention to adopt the technology [19]. Moreover, with the use of telemedicine enable the users to get authenticate information in real time, which guarantee to provide secure and trustworthy medical services [13]. In order to reinforce the intention amongst people, many online telemedicine vendors provide offers and discounts on their online products and use other promotional strategies such as cash back and free delivery. [10]. Based on a literature review and previously published research work, the present research has used actual usage of telemedicine as dependent variable and intentions to adopt telemedicine as a predictor variable of actual usage [2]. Intention to adopt telemedicine further acts a a predictor for examining the actual usage of telemedicine. Actual usage has examined the usage behavior of the respondent towards using telemedicine.

H1: There is a significant impact of reliability on intention to adopt telemedicine.

H2: There is a significant impact of convenience on intention to adopt telemedicine.

H3: There is a significant impact of affordability on intention to adopt telemedicine.

H4: There is a significant impact of SI on intention to adopt telemedicine.

H5: There is a significant impact of the HM on intention to adopt telemedicine.

H6: There is a significant impact of authenticity on intention to adopt telemedicine.

H7: There is a significant impact of offers/discounts on intention to adopt telemedicine.

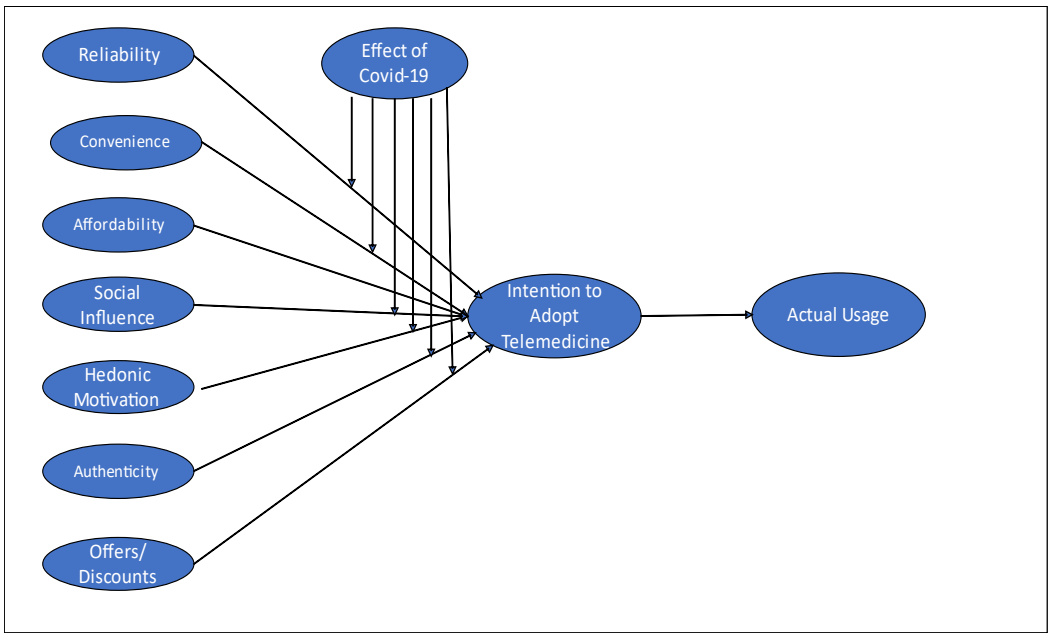
H8: There is a significant impact of intention to adopt telemedicine and actual usage

MODERATING ROLE OF COVID-19

It is stated that telemedicine proposes interactive solutions and helps in restructuring the healthcare by offering various benefits related to cost and time [26]. The present global COVID-19 pandemic offers a new dimension to the literature on telemedicine and its applications. Following the emergence of COVID-19, telemedicine has been quickly and widely adopted [27].

H9: Effect of COVID moderates the relation among the factors affecting the adoption of telemedicine and intention to adopt telemedicine by people.

FIGURE 1. RESEARCH MODEL



METHOD

In this study, an integrated conceptual model has been developed, using variables from the available theories of TAM and past studies of e-pharmacy adoption, to empirically authenticate the data for usage and intention to adopt telemedicine and its impact on actual usage of online mode of buying the medicines and other medical services (shown in Figure 1).

The relationships hypothesized in the framework are tested using SEM, to validate the measurement and structural model, through a survey study that has included customers of telemedicine in the smart cities of India. The random purposive sampling technique is incorporated in data collection, with a purposefully targeted population. The sample size for conducting the survey taken in the present research are 450 respondents (adequate sample size for structural equation modeling, on the basis of effect size on G* power, [18]), selected from the Northern region of India. A structured questionnaire is used both in online and offline modes, as the data collection tool to be used is to serve the purpose and objectives of the study.

DATA ANALYSIS AND INTERPRETATION

SAMPLE DEMOGRAPHICS

This section discusses the findings of the study. The demographic details of the participants of the survey are presented in Table 1

The total number of the respondents in Table 1 328. In Table 1 it is seenthat 51.8% of participants are male and 48.2% are female. The sample consists of 42.4% participants in the age group 20-35 years, followed by the participants in the age group 35-50 years (31.1%) and remaining 26.5% are in the age group of more than 50 years respectively. Table 1 also depicts that 55.5% of the participants have an e-shopping experience of less than 2 years and 33.2% are having an experience of 2-5 years. For 11.3% of the participants have an online shopping experience of above 5 years respectively.

RELIABILITY AND VALIDITY ANALYSIS:

The measurement model is examined for internal consistency reliability [29] and the presence of necessary convergent and discriminant validity in the scale. The results of these statistical methods are reported and discussed below. In order to validate construct validity and reliability before analysing the interrelationship of the constructs in the structural model, the PLS algorithm is applied to the proposed model [25]. The final measurement model indicates the diverse variables affecting the intention to adopt the telemedicine by the consumers is shown in figure 1.

TABLE 1. DEMOGRAPHIC PROFILE OF THE PARTICIPANTS

Demographics	Sub categories	Frequency (Percentage)
Gender	Female	158 (48.2%)
	Male	170 (51.8%)
Age group	Age between 20-35	139 (42.4%)
	35-50	102 (31.1%)
	Above 50	87 (26.5%)
E-shopping experience	Less than 2 years	182 (55.5%)
	Between 2-5 years	109 (33.2%)
	Above 5 years	37 (11.3%)

TABLE 2: RELIABILITY, CONVERGENT VALIDITY AND DISCRIMINANT VALIDITY

Construct	Indicator Variables	Standard Factor Loading	Cronbach Alpha	Composite Reliability	AVE
Affordability	AF1	0.791	0.868	0.91	0.717
	AF2	0.834			
	AF3	0.863			
	AF4	0.896			
Authenticity	AN1	0.912	0.899	0.937	0.832
	AN2	0.918			
	AN3	0.906			
Intention to Adopt Telemedicine	AT1	0.935	0.818	0.894	0.741
	AT2	0.917			
	AT3	0.713			
Convenience	CO1	0.893	0.869	0.919	0.792
	CO2	0.92			
	CO3	0.856			
Hedonic Motivation	HM1	0.716	0.85	0.9	0.693
	HM2	0.878			
	HM3	0.864			
	HM4	0.862			
Actual Usage	IR1	0.847	0.723	0.844	0.644
	IR2	0.728			
	IR3	0.827			
Offers/ Discounts	OD1	0.909	0.893	0.933	0.823
	OD2	0.89			
	OD3	0.923			
Reliability	RL1	0.764	0.869	0.911	0.72
	RL2	0.901			
	RL3	0.849			
	RL4	0.874			
Social Influence	SI1	0.862	0.846	0.906	0.763
	SI2	0.875			
	SI3	0.883			

Authors' Calculation

The internal consistency reliability of the distinct variables taken in the survey is assessed with the help of Cronbach alpha, which are more than 0.7 and which shows (Table 2) a substantial degree of reliability [30]. It can be concluded that the composite reliability each construct in the model is above 0.70 [23], demonstrating that all constructs representing the intention to adopt telemedicine, in the measurement model have good reliability. Convergent validity is also measured by standardized construct loadings [24]. The construct loading of all observed variables in table 2 are found in the range from 0.716 to 0.935, which shows the adequacy of variables and significantly representing their constructs.

TABLE 3: CORRELATION MATRIX AND ROOTS OF AVE'S

	AU	AF	AT	CON	HM	OD	REL	SI
AU	**0.80**							
AF	0.51	**0.85**						
AT	0.34	0.18	**0.91**					
CON	0.38	0.33	0.42	**0.89**				
HM	0.53	0.31	0.28	0.31	**0.83**			
OD	0.40	0.38	0.16	0.19	0.31	**0.91**		
REL	0.54	0.26	0.26	0.28	0.79	0.29	**0.85**	
SI	0.23	0.07	0.2	0.17	0.26	0.11	0.2	**0.87**

*Diagonal in bold represents the square root of AVE from observed variable

FIGURE 2. STRUCTURAL MODEL

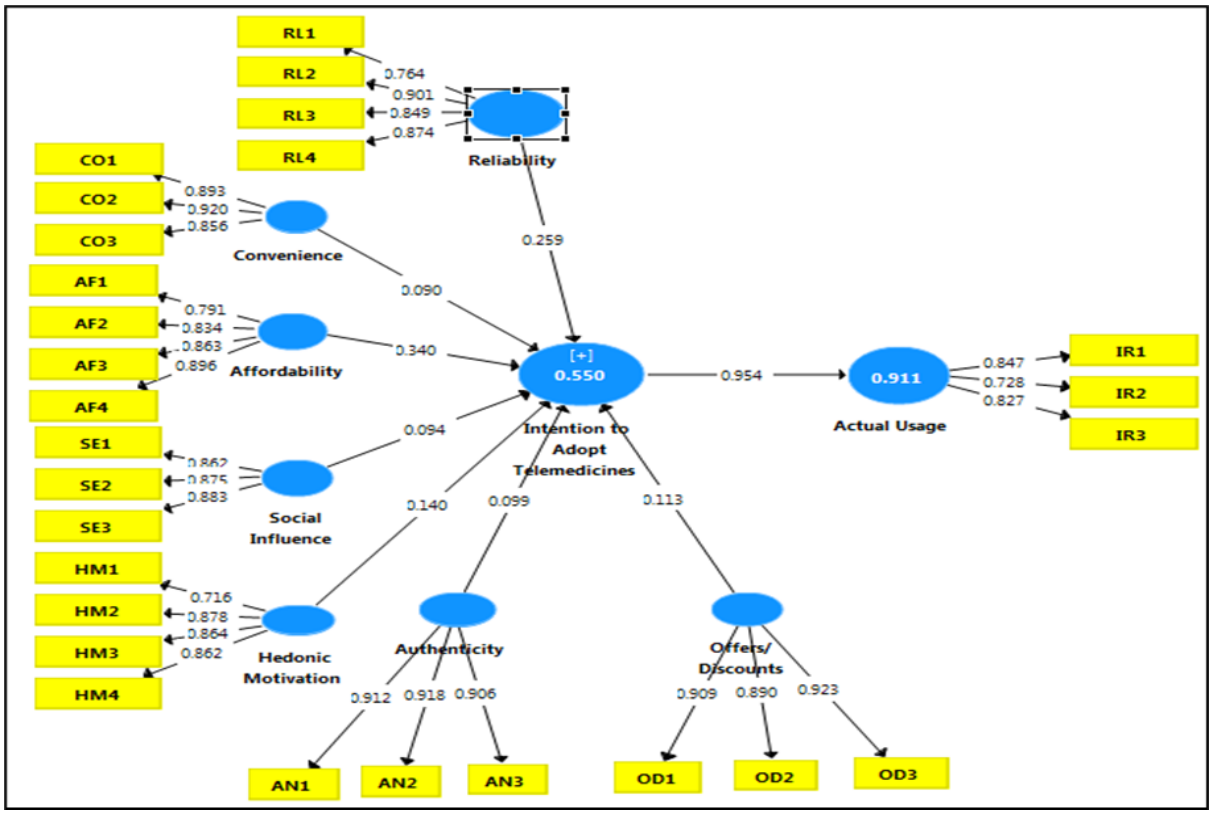


TABLE 4. PATH COEFFICIENTS

Hypothesis	Path	Standardized β	T Statistics	P Values	Result
H1	AF -> IAT	0.34	7.17	0	Supported
H2	AT -> IAT	0.099	2.71	0.007	Supported
H3	CON -> IAT	0.09	2.13	0.034	Supported
H4	HM -> IAT	0.14	2.00	0.046	Supported
H5	IAT > AU	0.954	161	0	Supported
H6	OD-> IAT	0.113	2.82	0.005	Supported
H7	REL -> IAT	0.259	3.81	0	Supported
H8	SI-> IAT	0.094	2.57	0.01	Supported

Authors' Calculation

[DO NOT DELETE SECTION BREAK]TABLE 5. MODERATION EFFECT

Hypothesis	Moderating Effect of Covid-19	Standardized β	T Statistics	P Values	Result
H9(a)	AF -> IAT	0.082	2.72	0.007	Supported
H9(b)	AT -> IAT	0.051	1.85	0.065	Not-Supported
H9(c)	CON->IAT	0.063	2.26	0.024	Supported
H9(d)	HM -> IAT	0.073	2.41	0.016	Supported
H9(e)	OD -> IAT	0.114	3.47	0.001	Supported
H9(f)	REL ->IAT	0.099	2.84	0.005	Supported
H9(g)	SI-> IAT	0.059	1.73	0.084	Not-Supported

Authors' Calculation

Discriminant validity of the scale is assessed using the Forner and Lacker criteria, shown in Table 3 and found to be significant [23].

STRUCTURAL MODEL

The structural model was examined using SEM in SMART PLS3 software. The structural model is shown in Figure 2 and results of SEM analysis is reported in Table 4

Table 4 represents the estimated values of the sample mean (β), t-statistics, its p value and result. All the path coefficient is found positive in nature. The selected seven factors, namely reliability, convenience, affordability, social influence, hedonic motivation, authenticity and offers/discounts are observed to have noteworthy influence on the intention to adopt telemedicine.

Due to these findings the hypotheses H1, H2, H3, H4, H5, H6 and H7 are accepted. The most significant factor influencing the intention to adopt telemedicine is affordability as compared to the remaining factors (path coefficient = 0.340). Further, the intention to adopt tele-medicine found to have significant positive influence on the actual usage of the telemedicine (path coefficient = 0.954). The results supported the hypothesis H8.

The R square value which evaluates the strength of the proposed model explains 55% of the intention to adopt tele-medicine, which signifies that the variables taken in the conceptual model shows 55% variation in the construct-intention to adopt telemedicine. Furthermore, 91.1% of variations in the actual usage of telemedicine among the people in the sample study.

MODERATING EFFECT OF COVID-19

PLS-SEM bootstrapping procedure empirically examined the moderating role of Covid-19 on the relation among various factors and intention to adopt telemedicine. The bootstrapping results in Table 5 show that 'Effect of COVID-19' supportable and positively moderates the effect of Affordability (β=0.082), Reliability (β=0.099), Convenience (β=0.063), HM (β=0.073) and Offers/Discounts (β=0.114), on Intention to Adopt Telemedicine. The results of bootstrapping also show that "Effect of Covid-19" do not moderate the effect of "Social Influence" and "Authenticity" on "Intention to adopt telemedicine" [22].

PREDICTIVE RELEVANCE AND EXTERNAL VALIDITY

The predictive relevance of the results of the study is examined after the application of blindfolding on smart PLS 3. The value of Q-square is 0.58 for 'Actual Usage' and 0.40 for 'Intention to adopt telemedicine', which is more than 0.35 and shows that the study is moderately relevant and valid externally.

IMPLICATIONS OF THE STUDY

The increasingly busy and connected schedules of people in the cities leaves a little time to physically shop for medicines and other health products, hence telemedicine has given an opportunity to buy the medicines online without approaching the medical stores and other shops. The current study has highlighted the different factors which are encouraging the customers to adopt the telemedicine and continue to its actual usage. The findings of the study provide implications with the opportunities, application, and factors that can be used by retailers and suppliers of medical services and medicines to attract more and more customers.

CONCLUSION

COVID-19 outbreak forced the government of different countries to undertake lockdown and instructed people to maintain social distancing. It has become difficult for people to approach markets and obtain medicines. During the lockdown period, when people were compelled to depend on e-shopping for their day-to-day basic needs, these consumers also utilized the services of telemedicine. Currentlyin the epidemic, this study has examoned distinct influential variables of intention to adopt telemedicine by the people. The intention to adopt telemedicine is the construct that strongly influences the actual usage of telemedicine in developing countries. The scope of the study is restricted to the northern region of Indiatherefore future studies can be conducted in relation a whole global perspective of consumers.

References:

1. Union Budget 2021:137 percent increase in health spending; key highlights for healthcare. Timesnownews.com 2021 Available from: https://www.timesnownews.com/health/article/union-budget-2021-health-sector-rs-64180-cr-new-aatmanirbhar-health-scheme-key-highlights-for-healthcare/714369 [Last accessed on 2021 Feb 15]
2. Sidhu, G.S., Rai, J. S., Khaira, K. S. Kaur, S. The Impact of COVID-19 Pandemic on Different Sectors of the Indian Economy: A Descriptive Study. Int J Eco Fin Iss 2020; 10(5): 113-120.
3. Hertling, S., Hertling, D., Martin, D., Graul, I. Acceptance, Use, and Barriers of Telemedicine in Transgender Health Care in Times of SARS-CoV-2: Nationwide Cross-sectional Survey. JMIR 2021; 7(12): e30278.
4. Menachemi, N., Burke, D., & Ayers, D. (2005). Factors Affecting the Adoption of Telemedicine—A Multiple Adopter Perspective. Journal of Medical Systems, 28, 617–632. https://doi.org/10.1023/B:JOMS.0000044964.49821.df
5. IANS. (2020, October 3). At least 81% doctors in Northern India have adopted telemedicine: Report. Business Standard India. https://www.business-standard.com/article/current-affairs/at-least-81-doctors-in-northern-india-have-adopted-telemedicine-report-120100300645_1.html
6. Srivastava M, Raina M. Consumers' usage and adoption of e-pharmacy in India. Int J Pharm Healthc Mark 2021; 15(2): 235-250.
7. Straub ET. Understanding technology adoption: Theory and future directions for informal learning. Rev Educ Res 2009; 79(2): 625-649.
8. Okereafor K, Adebola O, Djehaiche R. Exploring the potentials of telemedicine and other noncontact electronic health technologies in controlling the spread of the novel coronavirus disease (covid-19) IJITE 2020; 8(4): 1-13.
9. Nicola M, Alsafi Z, Sohrabi C, Kerwan A, Al-Jabir A, Iosifidis C, Agha M, Agha R. The socio-economic implications of the coronavirus pandemic (COVID-19): A review. Int J Surg 2020; 78:185-193.
10. Ministry of Chemicals & Fertilizers, Annual Report 2020-21. Available:<https://pharmaceuticals.gov.in/sites/default/files/english%20Annual%20Report%202020-21.pdf> (Accessed 03/09/21)
11. Wani, T. A., & Ali, S. W. (n.d.). Innovation Difusion Theory. 19.
12. Chaturvedi AK, Singh UK, Kumar A. Online pharmacy: An e-strategy for medication. Int J Pharm Front Res 2011; 1(1): 146-158.
13. Bokolo, A. Jnr. (2021). Exploring the adoption of telemedicine and virtual software for care of outpatients during and after COVID-19 pandemic. Irish Journal of Medical Science (1971 -), 190(1), 1–10. https://doi.org/10.1007/s11845-020-02299-z
14. Kichloo, A., Albosta, M., Dettloff, K., Wani, F., El-Amir, Z., Singh, J., Aljadah, M., Chakinala, R. C., Kanugula, A. K., Solanki, S., & Chugh, S. (2020). Telemedicine, the current COVID-19 pandemic and the future: A narrative review and perspectives moving forward in the USA. Family Medicine and Community Health, 8(3), e000530. https://doi.org/10.1136/fmch-2020-000530
15. Riew GJ, Lovecchio F, Samartzis D, Bernstein DN, Underwood EY, Louie PK, Germscheid N, An HS, Cheung JP, Chutkan N, Mallow GM. Spine surgeon perceptions of the challenges and benefits of telemedicine: an international study. Eur Spine J 2021; 16:1-9.
16. Almathami, H. K. Y., Win, K. T., & Vlahu-Gjorgievska, E. (2020). Barriers and Facilitators That Influence Telemedicine-Based, Real-Time, Online Consultation at Patients' Homes: Systematic Literature Review. Journal of Medical Internet Research, 22(2), e16407. https://doi.org/10.2196/16407
17. Rahi S, Khan MM, Alghizzawi M. Factors influencing the adoption of telemedicine health services during COVID-19 pandemic crisis: an integrative research model. Enterp Inf Syst 2021; 15(6):769-793.

18. Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Research Methods, 39(2), 175–191. https://doi.org/10.3758/BF03193146.
19. Kamal SA, Shafiq M, Kakria P. Investigating acceptance of telemedicine services through an extended technology acceptance model (TAM). Technol Soc 2020; 60:101212.
20. Kronenfeld, J. P., & Penedo, F. J. (2021). Novel Coronavirus (COVID-19): Telemedicine and remote care delivery in a time of medical crisis, implementation, and challenges. Translational Behavioral Medicine, 11(2), 659–663. https://doi.org/10.1093/tbm/ibaa105
21. Miller, R. L. (2015). Rogers' Innovation Diffusion Theory (1962, 1995) [Chapter]. Information Seeking Behavior and Technology Adoption: Theories and Trends; IGI Global. https://doi.org/10.4018/978-1-4666-8156-9.ch016
22. Saxena C, Baber H, Kumar P. Examining the moderating effect of perceived benefits of maintaining social distance on e-learning quality during COVID-19 pandemic. J Educ Technol Syst 2021; 49(4): 532-554.
23. Fornell C. Partial least squares. In: Advanced methods of marketing research. Cambridge: Blackwell; 1994.
24. Hair Jr JF, Sarstedt M, Hopkins L, Kuppelwieser VG. Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. Eur bus rev 2014; 31(1): 2-24.
25. Fornell C, Larcker DF. Structural equation models with unobservable variables and measurement error: Algebra and statistics. J Mark Res 1981; 18(3): 382-388.
26. Wen CL. Telemedicine, ehealth and remote care systems. In: Global Health Informatics. Academic Press; 2017.
27. Mann DM, Chen J, Chunara R, Testa PA, Nov O. COVID-19 transforms health care through telemedicine: evidence from the field. JAMIA 2020; 27(7): 1132-1135.
28. Ali F, Rasoolimanesh SM, Sarstedt M, Ringle CM, Ryu K. An assessment of the use of partial least squares structural equation modeling (PLS-SEM) in hospitality research. Int J Contemp Manag Res 2018; 30(1): 514-538.
29. Sekaran U, Bougie R. Research methods for business: A skill building approach (7th edition). John Willey and Sons Limited, West Sussex, United Kingdom

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

SENIOR MANAGER PERCEPTIONS OF THE HUMAN DIMENSION OF HEALTH SERVICES MANAGEMENT: AUSTRALIA AND BRAZIL

Jo. M. Martins[1], Godfrey Isouard[2], Ana Maria Malik3, Brenda Freshman[4]

1. Adjunct Professor, International Medical University, Kuala Lumpur, Malaysia
2. Adjunct Professor, University of New England, Sydney, Australia
3. Professor, School of Business Administration, Sao Paulo, Brazil
4. Professor, Health Care Administration, California State University, Long Beach CA, USA

Correspondence: gisouard@optusnet.com.au

ABSTRACT

Practice and research show the importance of the human dimension of health service management and related skills/competences. However, a review of curriculum content of postgraduate courses in Australia showed a lack of content in this area. It was in this context, an enquiry was undertaken to assess the perceptions of senior health service managers in Australia in this field. To provide a contrast with Australian perceptions, senior health service managers in Brazil were also asked for their understandings. Findings from this enquiry in the two countries show similar but some variance in nuance, possible due to differences in culture and corporate environment. The result of the enquiry points to the importance given by these senior managers to skills/competences in this area, and perceptions of shortfalls, in contrast with the lack of importance given to postgraduate training in this field.

KEYWORDS

Health management, human skills/competence, managers' perceptions, curriculum lags.

INTRODUCTION

Health services outcomes are dependent on the combined efforts of a large and varied range of people. Therefore, the practice of health service management is faced with the interaction among people often coming from different backgrounds and professional cultures. Further, research findings have shown the importance of essential personal skills in the management of health services, and that related training can result in improved management and outcomes. This would lead to the assumption that the content of postgraduate training in health services management would include the practice of relevant personal skills. Yet, a review of curricula of postgraduate courses in health services management in Australia showed that there is a lack of content in this area [1] [2]. A relevant question is whether the lack of course content reflects the perceptions of health services managers regarding the importance of these skills and their practice, thence lack of demand for related training. It was in this context that the present enquiry was undertaken, to ascertain whether the low importance given to

postgraduate health management training on these skills in Australia reflected the perceptions of senior health managers of their relative importance. In order, to provide some contrast to the perceptions of Australian health services managers on these skills, a similar enquiry was also undertaken among some senior health service managers in Brazil, in a different cultural and social environment. The aim of this contrast was to ascertain whether the perceptions of the relative importance of personal skills in health services management were peculiar to Australian health service managers or might have wider perceived relevance. The responses from this enquiry need to be seen more as qualitative in nature, as an input into the assessment of the perceived need for training in personal skills in health services management in Australia.

LITERATURE REVIEW

A brief review is now provided of the extensive literature, with focus on salient features of concepts, their assessment, association with performance, and effective training.

A review of systemic changes in the Australian health services led to the identification of salient management issues arising from them. In turn, these concerns led to the identification of management competencies and/or skills that would enhance related services management. This pathway, based on real-world events documented empirically, led to a framework of predisposing, enabling and transforming competencies and/or skills of relevance from the available inventory of health management competencies and/or skills identified [3]. A direct link had been established between the identified competencies to enhance leadership and management effectiveness.

Among the salient management issues identified, a number were related to personal motivation, reflection and behaviour in relation to others in the work setting. These are of importance in health services because of the interdependence among a wide range of professionals and practice that affects personal and organisational outcomes and the effectiveness of services [4]. However, there is evidence that current practices can stifle motivation and result in a lack of satisfaction with work, stress, burnout and even exit from the professions [5] [6]

The related literature shows there are three applicable concepts that meet the four tests of validity, association with performance, identifiable features capable of measurement and possible training:

- work engagement
- emotional intelligence
- conflict resolution

The concept of personal engagement at work was described by Kahn [7] as the simultaneous employment and expression of a person's 'preferred self' in task behaviour that promote connections with work and others. Emotional intelligence has been defined by Salovey & Mayer [8] as the ability to monitor one's own and others' feelings and emotions to discriminate among them and use this information to guide one's thinking and actions. Rahim [9] stated that conflict is an interactive process manifested in incompatibility, disagreement, or dissonance within or between social entities; and De Breu et al [10] saw its resolution (management) as behaviour oriented towards the intensification, reduction, and resolution of tension caused by conflict. There are affective, cognitive and behavioural dimensions in these three concepts. They intercept with each other and notions of involvement and satisfaction, organisational commitment, burnout, personality traits and regulation of emotions, motivation, cognitive intelligence and self-efficacy. Nevertheless, they have been found valid and different constructs.

A review of the concept of personal engagement at work by Schaufeli [11] pointed to four main perspectives concerned with (1) needs satisfying, (2) burnout-antithesis, (3) work satisfaction and engagement, and (4) a multidimensional perspective. May et al [12] found evidence of the linkage between personal engagement and Khan's three conditions of psychological meaningfulness, safety, availability as antecedent variables of expression of personal engagement in terms of physical, emotional and cognitive engagement. The burnout-antithesis perspective considers engagement at one end of a continuum with burnout at the other end. Another perspective relates engagement to involvement, enthusiasm and satisfaction at work. The multidimensional perspective relates engagement and role performance [13]. Christian et al [14] in their meta-analysis of the concept of personal work engagement found that although it shares an association with job attitudes it is a unique concept that had incremental validity in predicting job performance. Kim et al [15] found that the association of work engagement and performance applied to different industries and occupations in Africa, Asia, Europe, Australia and the US.

The framework of emotional intelligence (EI) as drawn by Salovey & Mayer [8] has three major features: (1) appraisal and expression of emotions of self and others, (2) regulation of emotions, and (3) use of emotions in an adaptive manner. A book by Goleman [16] made the concept better known. A review of the subject by Fernandez-Berrocal & Extremadura [17] identified three theoretical streams with emotional components that made up EI and related processes: (1) the Salovey & Mayer's ability model, (2) Bar-On's emotional-social intelligence model, and (3) the Goleman & Boyatziz emotional competence model.
In a later review of EI models, Boyatzis [18] found three theoretical modes of EI. The first was the ability perspective with two versions, one by Mayer et al [19] and the other by Schutte et al [20]. The second was the behaviour perspective with four versions. One version was the Boyatziz & Goleman [21] approach concerned with effective performance. Other versions included one by Bar-On [22], another by Dulewicz et al [23], yet another by Bradberry & Su [24] using a variety of measuring tools. A third perspective was concerned with Internal (Self) Perception with four versions by Bar-On, Schutte et al, Law & Wong [25] and Petrides &Furnham [26] using varied self-reporting measurement instruments.

A more recent review by O'Connor et al [27] identifies three main streams of EI: (1) consists of ability measures based on the Mayer and Salovey model, (2) based on trait measures also based on Mayer and Salovey's approach, (3) based on what is termed mixed EI, which indicates measures that combine competences as well as traits.

Research has also been carried out on the association between EI and work engagement. In an example in a healthcare context, Zhu et al [28] found that EI was associated with work engagement of Chinese nurses expressed in terms of vigour, dedication and absorption. Boyatziz et al [29] also found that shared vision and emotional and social intelligence affected engineers' work effectiveness and also job engagement.

Galtung [30] proposed a triangular model of conflict consisting of contradiction, attitude and behaviour. He proposed that conflict consists of differences in perceived interests, values and behaviour between those involved. These led to attitudes with affective, cognitive and behaviour elements that may be positive or negative. Consequent behaviour may be cooperative or coercive. In conflict transformation, Galtung perceived that for conflict transformation to take place those involved must be conscious of the totality of the conflict. Thus, allowing the identification of the contradiction, its reappraisal and possible behavioural changes towards its resolution.

Thomas [31] proposed that there are five ways of conflict handling: problem solving, smoothing, forcing, withdrawal and sharing. Rahim [32] built a matrix of these elements that led to five different styles: (1) integrating, arising from high concern for both self and others' interests; (2) avoiding, arising from low concern for both self and others' interests; (3) obliging, arising from high concern for others' and low concern for own interests; (4) dominating, arising from high concern for self and low concern for others' interests; (5) compromising, reflecting a combination of interests. Rahim tested the independence of each style, their reliability and validity and built the Rahim Organizational Conflict Inventory II (ROCI-II) measurement scale. Further research by Rahim & Magner [33] found that the framework had a satisfactory fit and there was convergent validity in the scales used. Giacomantonio et al [34] aggregated the five types of conflict handling into three: (1) non-confrontational (avoiding and obliging), (2) control (dominating and competing), and (3) solution oriented (integrating or collaborating and compromising). Concerns with the psychometric properties of ROCI-II led to De Breu et al [35] alternative measurement instrument to measure a similar five-factor model: Dutch Test for Conflict Handling (DUTCH). This research showed reasonable discriminating validity between the five factors. In a healthcare context, Zulfadil et al [36] in a study of health care workers observed that higher level of EI led to better performance associated with greater knowledge sharing. The study also indicated that managers' EI is important on communication and conflict management.

Further review showed that gains can be made through interventions such as coaching/training aimed at enhancing competence in human skills that lead to better personal and organizational performances. Meta-analysis of the effectiveness of work engagement interventions by Knight et al [37] indicated that interventions were associated with overall positive improvement in work engagement. The assessment of work engagement expressed in terms of vigour showed greater effect in the more immediate post-intervention period than at later follow-up. While work engagement in terms of dedication and absorption were expressed more at a later follow-up than immediately after intervention. More recent studies also indicated that training opportunities supported employee work engagement (e.g. Palaez et al [38] &

Sawasdee et al [39]). A number of studies indicate that coaching/training in EI can improve performance as well as wellbeing of students, health workers and others (e.g. Slaski & Cartwright [40]; Hen & Sharabi-Nov [41]; Choi et al [42]; Gilar-Corbi et al [43]; Karimi et al [44]). Similarly, studies have shown that coaching/training in conflict management resulted in improved practice (e.g. Haraway & Haraway [45]; Leon-Perez et al [46]; Wolfe et al [47]).

METHOD AND DATA

The enquiry was undertaken to assess perceptions of senior managers regarding the relative importance of human skills in health services management. The method used was that of a qualitative nature of perceptions held rather than tested actual situations. The enquiry used a questionnaire developed to assess senior managers' perceptions regarding:

- adequacy of competence in human skills in healthcare management
- obstacles to human skills enhancement in healthcare management
- possible steps to enhance these skills

The enquiry relied on written answers to a questionnaire (See Appendix). A draft questionnaire had been prepared originally and reviewed for suitability by an experienced senior manager. Consequently, some amendments were made. The enquiry involved senior and busy health service managers, and by its very nature relied on the willingness of senior managers to take the time involved. Senior in this context relates to the relative high position of the manager rather their length of experience. The respondents to the questionnaire worked in hospitals, aged-care residential services (hostels and nursing homes), and in the administration of health services. The answers to each open question were reviewed independently by two of the authors, both in the case of Australia and Brazil. The itemised themes of the answers were then revised by the two reviewers using relevant criteria, to resolve any differences, to get agreed response items for each question. The enquiry has a number of limitations. The convenience samples used both in Australia and Brazil are not random in nature, and, as stated, relied on the willingness of senior managers to spend their usually busy time in sharing their opinions. The sample sizes were relatively small (14 in Australia and 18 in Brazil). Nevertheless, the relative consistency in the responses provide worthwhile insights about the perceived relevance of these skills/competences by the responding senior managers of health services in the two countries.

PERCEPTIONS OF SENIOR MANAGERS OF HEALTHCARE IN AUSTRALIA AND BRAZIL

Following the outlined method, the analysis of responses provides a qualitative measure of the opinion of the responding senior managers regarding human skills in the management of health services.

CONTRIBUTION OF COMPETENCE IN HUMAN SKILLS

In both countries, the importance of competence in human skills was recognised by all respondents. They also felt that they were essential in most cases but more so in Brazil than Australia (57% in Australia and 67% in Brazil). While Brazilian managers expressed their perspectives in terms of commitment and communication, Australians did so in terms of teamwork, efficiency and effectiveness (Table 1).

TABLE 1 IMPORTANCE OF ESSENTIAL HUMAN SKILLS

IMPORTANCE	PERCENTAGE OF RESPONDENTS	
	AUSTRALIA	BRAZIL
Working with and engagement with others	100	100
Essential/decisive/fundamental/basic	57	67
Conflict management	36	39
Efficiency/productivity/effectiveness	50	33
Commitment/engagement	…	39
Communication	…	17
Team work	64	…

ADEQUACY OF COMPETENCE IN HUMAN SKILLS

The responses to the question of the adequacy of competence in human skills were expressed considerably different in the two countries. It is possible that cultural differences may account for some of the differences in the expression of perceptions. About three quarters of respondents in Australia (73%) expressed the opinion that generally healthcare managers did not possess adequate competence in human skills versus only 6% in Brazil. However, half of Brazilian respondents (50%) felt that competence was inconsistent or less than adequate. Agreement was close on the proportion who felt that managers had adequate skills in human relationships (13% in Australia and 17% in Brazil) (Table 2).

LACKING ENHANCEMENT IN HUMAN SKILLS

Senior managers in both countries perceived that there was need for greater skills in teamwork/collaboration (53% and 50% in Australia and Brazil respectively), but also in conflict management and listening and communication with others (40% and 39% respectively in each case).

Australian managers placed greater emphasis on self-awareness (27% in Australia and 17% in Brazil) and emotional intelligence (same respectively), while Brazilian managers placed some emphasis on the issue of critical appraisal and problem identification (33%) (Table 3)

OBSTACLES TO HUMAN SKILL DEVELOPMENT AND HOW TO ADDRESS THEM

In both countries, obstacles to the development of human skills were perceived to be due to priority to technical training and competence (27% and 28% in Australia and Brazil respectively). Time and resource constraints were found to be more important in Australia (33%) but they were also found in Brazil (22%). Authoritarian/bureaucratic structure and culture were seen as obstacles in Brazil by more than a quarter of managers (28%), but in Australia learned and rewarded negative behaviour was seen as an obstacle by about a fifth (20%). Lack of awareness of the value of human skills was seen as an obstacle by a third of managers in Brazil (33%) but less so in Australia (13%) (Table 4).

TABLE 2 ADEQUACY OF COMPETENCE IN ESSENTIAL HUMAN SKILLS

ADEQUACY	PERCENTAGE OF RESPONDENTS	
	AUSTRALIA	BRAZIL
Yes, but inconsistent/less than adequate	7	50
Managers have adequate skills in in human relationships	13	17
Few/exception	7	28
Generally, no	73	6

TABLE 3 LACKING ENHANCEMENT IN HUMAN SKILLS

LACK	PERCENTAGE OF RESPONDENTS	
	AUSTRALIA	BRAZIL
Teamwork/collaboration	53	50
Conflict management/negotiation/conciliation	40	39
Communication/listening to others	40	39
Critical appraisal/problem identification	…	33
Self-awareness	27	17
Emotional intelligence	27	17

TABLE 4 OBSTACLES TO HUMAN SKILL DEVELOPMENT

OBSTACLES	PERCENTAGE OF RESPONDENTS	
	AUSTRALIA	BRAZIL
Lack of clarity about soft skills/self-awareness/ their value	13	33
Authoritarian/bureaucratic/hierarchical structure and culture	…	28
Technical training emphasis/priority	27	28
Time and resource constraints/priorities	33	22
Learned and rewarded negative behaviour	20	…

STEPS TO INSTIL HUMAN SKILLS IN HEALTHCARE

Training capacity and opportunity to acquire these skills were seen as the major issue in both countries (73% and 78% in Australia and Brazil respectively). Discussion of the importance of essential human skills was seen as greatly important in Brazil (61%) and in Australia to a lesser extent (33%). The adoption of related values and practice of these skills were perceived as more important in Brazil (44%) but it was also so in Australia (22%). Role modelling by senior managers was seen to be relevant by about one fifth in both countries (20% and 22% in Australia and Brazil respectively). In Brazil, the linking of selection, promotion and remuneration was seen as a step in the instilling human skills by about one third of respondents (33%) (Table 5).

INSTILLING MOTIVATION AND ORGANIZATION CULTURE TO ENHANCE HUMAN SKILLS

In both countries, the demonstration and recognition of the value of human skills was perceived as the most important means by which to develop relevant organisational culture and practices (77% and 61% in Australia and Brazil respectively). Training was also seen to be important between a quarter (28%) and a third (31%) of respondents in Australia and Brazil. The linking of selection, promotion and remuneration was also put forward by about a third of respondents in Brazil (33%) (Table 6).

CONTRIBUTIONS OF HUMAN SKILLS TO PRODUCTIVITY AND MORAL

Senior managers in each country felt that human skill competence made significant contributions to engagement at work (60% and 78% in Australia and Brazil respectively), team building and work (71% and 67% in Australia and Brazil respectively), that resulted in better performance and results in productivity and outcomes (57% and 56% in Australia and Brazil respectively), and conflict management (14%) in the case of Australia (Table 7).

TABLE 5 STEPS TO INSTIL HUMAN SKILLS

STEPS	PERCENTAGE OF RESPONDENTS	
	AUSTRALIA	BRAZIL
Training capacity/opportunity	73	78
Communication and discussion of the importance of human skills	33	61
Adoption of values, practicing of skills	22	44
Linking with performance assessment, selection, promotion, and remuneration	…	33
Role modelling from more senior managers	20	22

TABLE 6 HOW TO DO IT

MEANS	PERCENTAGE OF RESPONDENTS	
	AUSTRALIA	BRAZIL
Demonstration/discussion/recognition of value of these skills	77	61
Linking with performance assessment, selection, promotion, and remuneration	…	33
Training	31	28
Do not know	…	11
Self-assessment and sharing of individual strengths and challenges	15	…

TABLE 7 CONTRIBUTIONS TO PRODUCTIVITY AND MORAL

CONTRIBUTIONS	PERCENTAGE OF RESPONDENTS	
	AUSTRALIA	BRAZIL
Work engagement, feel valued, moral	60	78
Team building and work, relationships, communication	71	67
Better performance, results/outcomes, productivity	57	56
Conflict management	14	…

BETTER NAME FOR THESE SKILLS

There were a wide range of suggestions, especially in the case of Brazil for a better name than *soft skills*. Nevertheless, about a fifth of respondents in Australia (21%) and a lower proportion in Brazil (6%) were happy with *soft skills*. In Brazil, *behaviour skills* had the largest backing (22%), while *personal/interpersonal/people skills* had the largest appeal (28%) among Australian healthcare managers. A large proportion of Australian respondents (43%) found that the term *soft skills* is derogative and not indicative of the importance of these skills.

DISCUSSION

The responses of Australian senior healthcare managers indicated that they placed great importance to competence in human skills in healthcare management and most felt that they were essential or fundamental in team work, and to the effectiveness of healthcare. However, most observed that competence in these skills was inadequate among healthcare managers. This was associated with the lack of team work and collaboration. A number of factors were seen as obstacles, such as time and resource constraints, and lack of priority given to training in these skills. Thus, most perceived training capacity and greater opportunity to acquire these skills as possible steps to instil human skills in healthcare managers. They also saw the need for a greater discussion and recognition of the importance of these skills. Further, most saw the value of human skills in terms team building, work engagement and related performance in productivity and outcomes.

The responses by Brazilian senior healthcare managers provided a test of the perception of the importance of human skills in healthcare management, by the degree of consistency, or lack of it, between the responses of Australian and Brazilian senior managers. The responses of Brazilian senior managers followed closely those of the Australians. However, there were some differences in tone, possibly reflecting cultural nuances. Accordingly, while Australian managers mentioned the importance of teamwork, Brazilian managers mentioned communication/commitment and engagement. Similarly, while only a minority of Australian and Brazilian managers felt that managers had adequate skills in human relationships, most Australian managers stated that they

were generally inadequate, while Brazilian managers expressed their opinion in terms of less than adequate.

The enquiry showed that the interviewed senior managers felt that human skills were essential/important to the outcome of healthcare, and that competence in them to be lacking, with need for training and competence in them. Thus, their near absence in the curriculum of postgraduate training in healthcare management [1] diverge from their perceived value and seen need for training in them. It is also in contrast with their demonstrated value and successful available training programs (see literature review).

CONUNDRUM:

SENIOR MANAGER PERCEPTIONS AND LACK OF ACADEMIC RESPONSES

The results of this enquiry among senior managers in health services showed that respondents felt that health services are essentially a human enterprise, where personal relationships are intrinsic to their effectiveness and efficiency. These senior managers indicated that competence in human management skills are essential/basic yet lacking in practice, in spite of the perception of its relevance to productivity and personal relationships, and the availability of operational concepts and training possibilities. It is also in contrasts to the lack of import given in postgraduate training in healthcare management documented [1]. This contrast presents a challenge to all stakeholders of health services and academic institutions concerned with postgraduate training in healthcare management.

APPENDIX:

AN ENQUIRY INTO SENIOR MANAGER PERCEPTIONS OF THE IMPORTANCE OF HUMAN SKILLS IN HEALTH SERVICES

Questions

1. Soft skills are concerned with interpersonal relationships, stimulation of engagement at work and conflict management. What do these skills contribute to healthcare management effectiveness?

2.In your experience, do managers in health services demonstrate adequate skills in this area?

3. If you feel that greater attention should be given to management training in these areas, what specific skills do you feel are lacking in your workforce?

4. Do obstacles get in the way of this skill development? If yes, what are they and how can these obstacles be addressed?

5. What steps would you take to instil soft skills into your healthcare workforce?

6. How can motivation to develop soft skills be inspired in individual employees and throughout the organizational culture?

7. How can soft skills contribute to team productivity and morale?

8. Do you think there is a better term for this skill set and why?

ACKNOWLEDGMENTS

The authors wish to express their gratitude to the busy senior managers in health services who took the time to respond and share their insights on the importance of human skills in health service management. The authors would also like to show their appreciation of the critical comments made by anonymous peer reviewers, especially one, who gave detailed comments on areas that needed clarification and led to additional explanation of the objective and methods used, as well as discussion of findings.

References

1. Martins JM, Isouard G, Freshman B. (2019). Human dimension of health service management. *Australian Health Review*; 43: 103-110. Doi:10.1071/AH17063.
2. Martins JM, Isouard G, Freshman B. *Senior managers' perceptions and curriculum content: The human dimension*. Paper presented at AUPHA (Association of University Programs in Health Administration) National Congress, June 2018. Philadelphia PA, USA.
3. Martins JM, Isouard G. (2015). An evidence-based framework: competencies and skills for managers in Australian health services. *Asia Pacific Journal of Health Management*; 10: 8-23.
4. Mickan SM. (2005). Evaluating the effectiveness of health care teams. *Australian Health Review*; 29: 211-217. Doi:10.1071/AH050211.

5. Barret L, Yates P. (2002). Oncology/haematology nurses: a study of job satisfaction, burnout, and intention to leave the speciality. *Australian Health Review*; 25: 109-121. doi: 10.1071/AH020109.
6. Joiner TA, Bartram T. (2004). How empowerment and social support effect Australian nurses' work stressors. *Australian Health Review*; 28: 56-64. Doi:10/1071/AH040056.
7. Kahn WA. (1990). Psychological conditions of personal engagement and disengagement at work. *Academy of Management Journal*; 33: 692-724. doi:10.2307/256287.
8. Salovey P, Mayer JD. (1990). Emotional intelligence. *Imagination, Cognition and Personality*; 9: 185-211.doi:10.2190/DUGG-P24E-52WK-CDG.
9. Rahim MA. (2002). Towards a theory of managing organisational conflict. *International Journal of Conflict Management*; 13 (3): 206-235. doi:10.1108/eb022874.
10. De Dreu CKW, Harinck F, Van Vianen AEM. (1999). Conflict and performance in groups and organisations. *International Review of Industrial and Organisation Psychology*; 14: 376-405.
11. Schaufeli W. (2013). What is engagement? In Truss C, Alfes K, Deldridge R, Shantz A, Soane E, editors. *Employee engagement in theory and practice*. London: Rutledge.
12. May DR, Gilson GL, Harter LM. (2004). The psychological conditions of meaningful, safety and availability and the engagement of the human spirit at work. *Journal of Occupational and Organizational Psychology*; 77:11-37. doi:10.1348/096317904322915892.
13. Saks AM. (2006). Antecedents and consequences of employee engagement. *Journal of Managerial Psychology*; 21: 600-619. doi:10.1108/02683940610690169.
14. Christian MS, Garza AS, Slaughter JE. (2011). Work engagement: a quantitative review and tests of its relations with task and contextual performance. *Personal Psychology*; 64: 89-136. doi:10.1111/j.1744-6570.2010.
15. Kim W, Kolb JA, Kim T. (2013). The relationship between work engagement and performance: a review of the empirical literature and proposed research agenda. *Human Resources Development Review*; 12: 248-276. doi:10.1177/1534484312461635.
16. Goleman D. (1995*). Emotional intelligence – why it can matter more than IQ.* New York NY: Batam Books.
17. Fernandez-Berrocal P, Extremera N. (2006). Emotional intelligence: a theoretical and empirical review of its 15-year history. *Psicothema*; 18 (Suppl): 7-12.
18. Boyatzis RE. (2009). Competencies as a behavioural approach to emotional intelligence. *Journal of Management Development*; 28: 749-770. doi:10.1108/02621710910987647.
19. Mayer JD, Caruso DR, Salovey P. (1999). Emotional intelligence meets traditional standards for an intelligence. *Intelligence*; 27: 267-298. doi.10.1016/S160-2896(99)00016-1.
20. Schutte NS, Malouf JM, Hall LE, Haggerty D, Cooper JT, Golden CJ, Dornheim L. (1998). Development and validation of a measure of emotional intelligence. *Personality and Individual Differences*; 25: 167-177. doi.10.1016/S0191-8869(98)00001-4.
21. Boyatziz RE & Goleman D. (1998). *Emotional Competence Inventory*. Boston MA: The Hay Group.
22. Bar-On R. (2006). The Bar-On model of emotional-social intelligence (ESI). *Psicothema*; 18 (Suppl.): 7-12.
23. Dulewicz V, Higgs M, Slaski M. (2003). Measuring Emotional Intelligence: content, construct and criterion-related validity. *Journal of Management Psychology*; 18: 405-420. doi:10.1108/02683940310484017.
24. Bradberry TR, Su LD. (2006). Ability-versus skill-based assessment of emotional intelligence. *Psicothema*; 18 (Suppl.): 59-66.
25. Law KS, Wong C-S, Song LG. (2004). The construct and criterion validity of emotional intelligence and its potential utility for management studies. *Journal of Applied Psychology*; 89: 483-496. doi:10.1037/0021-9010.89.3.483.
26. Petrides KV, Furnham A. (2003). Trait emotional intelligence: behavioural validation in two studies of emotion recognition and reactivity to mood induction. *European Journal of Personality*; 17: 39-57. doi.10.1002.1002/per.466.
27. O'Conner PJ, Hill A, Kaya, M Martin B. (2019). The measurement of emotional intelligence: a critical review of the literature and recommendations for researchers and practitioners. *Frontiers in Psychology*; 10:116. doi.10.3389/fpsyg.2019.01116.
28. Zhu Y, Liu C, Guo B, Zhao L, Lou F. (2015). The impact of emotional intelligence on work engagement of registered nurses: the mediating role of organisational justice. *Journal of Clinical Nursing*; 24: 2115-2124. doi:10.1111/jocn.12807.
29. Boyatzis R, Rochford K, Cavanagh KV. (2017). Emotional intelligence competencies in engineer's effectiveness and engagement. *Career Development International*, 22(1): 70-86. doi.10.1108/CDI-08.2016.0136

30. Galtung J. (1969). Violence, peace and peace research. *Journal of Peace Research;* 6: 167-191. doi:10.1177/002234336900301.
31. Thomas KW. (1976). Conflict and conflict management. In Dunnette, M D (ed) *Handbook of industrial and organizational psychology*. Chicago: Rand-McNally, 1976:889-935.
32. Rahim, MA. (1983). A measure of styles of handling interpersonal conflict. *Academy of Management Journa*l; 26: 368-376. doi.10.2397/255985.
33. Rahim MA & Magner NR. (1995). Confirmatory factor analysis of the styles of handling interpersonal conflict: first-order model and its invariance across groups. *Journal of Applied Psychology*; 80: 122-132.doi.10.1037/0021-9010.80.1.122.
34. Giacomantonio M, Pierro A, Kruglanski AW. (2011). Leaders' fairness and followers conflict handling style. *International Journal of Conflict Management*; 22:358-372. doi:10.1108/10444061111171369.
35. De Dreu CKW, Evers A, Beersma B, Kluwer ES, Nauta A. (2001). A throaty-based measure of conflict management strategies in the work place. *Journal of Organizational Behaviour*; 22: 645-668.doi.10.1002/job.107.
36. Zulfadil, Hendriani S, Machasin. (2020). The influence of emotional intelligence on team performance through knowledge sharing, team conflict, and the structure mechanism. *Journal of Management Development*; 39(3): 269-292. doi:10.1108/JMI/12.2018.0354.
37. Knight C, Patterson M, Dawson J. (2017). Building work engagement: a systematic review and meta-analysis investigating the effectiveness of work engagement interventions. *Journal of Organizational Behavior*; 38: 792-812.
38. Palaez M J, Coo C, Salanova M. (2020). Facilitating work engagement and performance through strength-based micro-coaching: A controlled trail study. *Journal of Happiness Studies*; 21: 1265-1284. doi.org/10.1007/s10902-019-00127-5
39. Sawasdee A, Saengchai S, Jermsittiparset K. (2020). The role of emotional demands, supervisor support and training opportunities towards work engagement among employees in pharmaceutical companies of Thailand. *Systematic Review Pharmacy*; 11(3): 176-184.
40. Slaski M, Cartwright S. (2003). Emotional intelligence training and its implications for stress, health and performance. *Stress and Health: Journal of the International Society for the Investigation of Stress*; 19(4): 233-239.
41. Hen M, Sharabi-Nov A. (2014). Teaching teachers: emotional intelligence for teachers. *Teaching Education*; 25(4). doi.org/10.1080/10476210.2014.908838.
42. Choi K, Vickers K, Tassone A. (2014). Trait emotional intelligence, anxiety sensitivity, and experiential avoidance in stress reactivity and their improvement through psychological methods. *Europe's Journal of Psychology*; 10(2). doi.org/10.59464/ejop.v100iz.754.
43. Gilar-Corbi R, Pozi-Rico, Pertegal-Felices ML, Sanchez B. (2018). Emotional intelligence training intervention among trainee teachers: a quasi-experimental study. *Psicologia: Reflexao e Critica;* 3(33). prc.springeropen.com/articles/10.1186/s41155-018-0112-1.
44. Karimi L, Leggat SG, Bartram T, Rada J. (2020). The effects of emotional intelligence training on the job performance of Australian aged care workers. *Health Care Management Review*; 45(1): 41-51.
45. Haraway DL, Haraway WM. (2010). Analysis of the effect of conflict-management and resolution training on employee stress at a health care organization. *Hospital Topics*; 83(4). doi:10.3200/HTPS.83.4.11-18.
46. Leon-Perez JM, Notelaers G, Leon-Rubio JM. (2015). *European Journal of Work and Organizational Psychology*; 25(1). doi:10.1080/1359432X.2015.1010520.
47. Wolfe, AD, Hoang KB, Denniston SF. (2018). Teaching conflict resolution in medicine: lessons from business, diplomacy, and theatre. *AAMC Journal of Teaching and Learning Resources*; 14: 10672. doi:10.15766/mep_2374-8265.10672.

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

A PROSPECTIVE STUDY ASSESSING PATIENT PERCEPTION OF THE USE OF ARTIFICIAL INTELLIGENCE IN RADIOLOGY

A/Prof Warren Clements [1,2,3], Dr Louisa P Thong [1], Mr Adil Zia [1], Dr Heather K Moriarty [1,2] A/Prof Gerard S Goh [1,2,3]

1. Department of Radiology, Alfred Health, Melbourne, Australia
2. Department of Surgery, Monash University, Australia
3. National Trauma Research Institute, Central Clinical School, Monash University, Melbourne, Australia

Correspondence: G.goh@alfred.org.au

ABSTRACT

OBJECTIVE

Radiology has been at the forefront of medical technology including the use of artificial intelligence (AI) and machine learning. However, there remains scant literature on the perspective of patients regarding clinical use of this technology. This study aimed to assess the opinion of radiology patients on the potential involvement of AI in their medical care.

DESIGN

A survey was given to ambulatory outpatients attending our hospital for medical imaging. The survey consisted of questions concerning comfort with radiologist reports, comfort with entirely AI reports, comfort with in-part AI reports, accuracy, data security, and medicolegal risk.

SETTING

Tertiary academic hospital in Melbourne, Australia.

MAIN OUTCOME MEASURES

Patients were surveyed for their overall comfort with the use of AI in their medical imaging using a Likert scale of 0 to 7.

RESULTS

283 patient surveys were included. Patients rated comfort in their imaging being reported by a radiologist at mean of 6.5 out of 7, compared with AI alone at mean 3.5 out of 7 ($p<0.0001$), or in-part AI at mean 5.4 out of 7 ($p<0.0001$). Patients felt AI should have an accuracy of mean 91.4% to be able to be used in a clinical environment. Patients rated their current comfort with data security at mean 5.5 out of 7 however comfort with data security using AI at mean 4.4 out of 7, $p<0.0001$.

CONCLUSIONS

Patients are trusting of the holistic role of a radiologist however, remain uncomfortable with clinical use of AI as a standalone product including accuracy and data security. If AI technology is to evolve then it must do so with appropriate involvement of stakeholders, of which patients are paramount.

KEYWORDS: Artificial intelligence; AI; survey; patient

INTRODUCTION

The clinical specialty of Radiology has always been intimately associated with cutting edge medical technology. As such, it has been no surprise to see artificial intelligence (AI) and machine learning enter the territory of diagnostic medical imaging [1]. This role has been acknowledged by major imaging societies from North America, Europe, and other countries [2,3]. A 2019 joint consensus statement on ethics which included input from the American College of Radiology and the Radiological Society of North America, commented on the potential for the advancing role of AI in medicine [2]. While AI was initially used in a research capacity, advancements in accuracy of image interpretation has now seen this take a clinical role in hospitals. There is a complex interplay between the technical, ethical, and medicolegal obstacles required to implement such technology [2].

There are varying opinions from radiologists on the future of AI in diagnostic imaging [4-7]. While there exists optimism and excitement for new technology [4], there are also those with scepticism and a fear of the potential for future redundancy [7]. These concerns were highlighted in a 2019 survey from Collado-Mesa et al. which assessed perceptions on training and the future role of radiologists [8,9].

Despite these concerns, there is no doubt that AI will have some role in diagnostic imaging moving forward [10,11]. A nation-wide survey of Italian radiologists in 2021 suggested that rather than believing the profession will be replaced, radiologist concern was more towards the potential effects on their professional reputation [7]. At early stages of implementation, it is important to integrate this technology in a manner which suits the ultimate reason for medical practice – our patients. Human nature has arguably been one of the most vital barriers to implementation of existing autonomous technological aids using AI such as self-driving cars and self-flying aircraft.

While literature to support accuracy and training of AI technology is evolving rapidly, there remains little on the perspective of patients in regard to clinical use of this technology. A 2019 study from Haan et al. sought to address this by interviewing 20 patients on the topic of AI in radiology [12]. They identified 6 domains which were important to consider: proof of technology, procedural knowledge, competence, efficiency, personal interaction, and accountability. The authors concluded that patients' level of knowledge of AI is limited. In a 2020 follow-up study the same group developed a questionnaire and implemented this to 155 patients. They concluded that patients remain pessimistic about AI performing the role of radiologists, with patients valuing human interaction. The authors also highlighted the importance placed by patients on ethics and the legal framework for this technology [13]. A 2022 scoping review assessed the opinion of a range of different stakeholders on AI in radiology, including 62 publications of which 4 were from the perspective of the general public [14]. The authors identify a similar framework suggesting radiologists are unlikely to be replaced, but that there is a general lack of understanding and knowledge of AI [14]. Issues of accountability and medicolegal implications remain a question for patients [14]. These views are held by most stakeholders including non-radiologist clinicians [15]

This study aimed to assess the opinion of patients on the potential involvement of AI in their medical care, by seeking to identify whether patients would be happy for AI technology to provide image interpretation for their studies at our centre, comparing the existing radiologist model of care with AI-alone, and a radiologist-AI hybrid model. This study will add to the current very small pool of knowledge on this topic and guide future directions of education concerning AI implementation.

MATERIALS AND METHODS

ETHICS

Ethics approval was provided for this prospective study by our institutional review board. Participation was voluntary and implied informed consent.

SURVEY

The survey used is shown in Appendix 1 and included questions relating to age, gender, education, confidence with technology, knowledge of imaging interpretation, opinion on AI, report accuracy, data security, and medicolegal implications. Patient perspectives were assessed using numerical ranges, Likert scale from 1 to 7 (7 being highest relevant to the question type), or yes/no response as appropriate to the question type. The model of AI integration was framed as AI alone, hybrid AI and radiologist (e.g. decision support), or radiologist-alone. This

distinction was chosen as it reflects potential directions for the use of this technology in the future based on previous literature [16].

INCLUSION CRITERIA

The Hospital is a state-wide tertiary and teaching hospital with **a** University. Patients were invited to voluntarily participate in the study on attendance to the department for any outpatient ambulatory imaging. The study recruited patients from 1 August 2018 to 1 December 2018.

All patients over the age of 18 years were invited and the written survey was in English. 500 surveys were printed, and reception staff asked to hand out the survey to any patient attending for a scan or procedure. Completed surveys were placed by the patient into an anonymous collection box and were collated by study investigators. Surveys were excluded if they were not fully completed, or if the answers not legible.

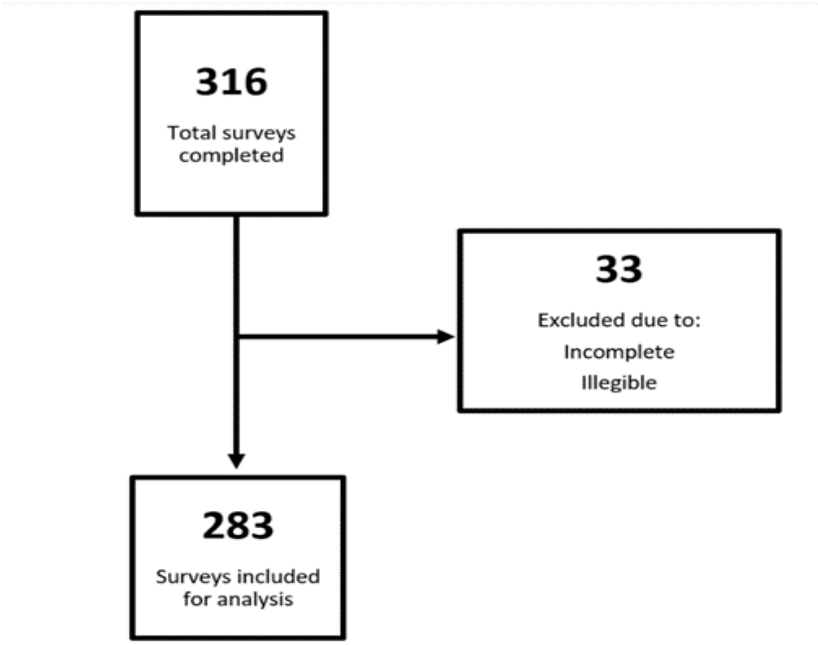
STATISTICAL ANALYSIS

Data was pooled using Microsoft Excel (Microsoft, USA) and analysed using the Real Statistics Resource Pack software (Release 6.8) [17]. Presentation of the data was appropriate to the data type using mean (standard deviation), median (range), or frequency (percentage). Using student's t-test, a two-sided p-value less than 0.05 was chosen to indicate statistical significance.

RESULTS

During the time period, 316 surveys were completed (63.2% response). 33 surveys were excluded including 32 where the second page of the survey was not completed, and 1 which contained illegible notes and the survey itself was not filled. 283 surveys were included for the final analysis as shown in figure 1.

FIGURE 1: FLOW CHART SHOWING RECRUITMENT OF PATIENTS INTO THE STUDY.



As shown in table 1, of the cohort who responded to the survey, 52.7% were male. The median age range of participants was 51-60 years old (range 18-30 to 71+ years). Participants who responded to the survey were in attendance at our department for a range of different imaging studies including MRI in 31.4%, ultrasound in 21.9%, plain radiograph in 21.2%, CT in 6.7%, procedure in 2.8%, and an other study in 15.9%. Other studies included nuclear medicine scan, bone densitometry, and mammography. 33.2% of patients reported completing high school, 27.9% a bachelor degree, 27.6% a master's degree, and 11.3% other.

TABLE 1: PARTICIPANT INFORMATION AND BACKGROUND

Participants	283
Male gender (number, percentage)	149 (52.7%)
Age of participants in range of years (number, percentage)	18-30: 32 (11.3%) 31-40: 39 (13.8%) 41-50: 42 (14.8%) 51-60: 71 (25.1%) 61-70: 53 (18.7%) 71+: 46 (16.3%)
Reason for attendance at radiology department (number, percentage)	CT: 19 (6.7%) MRI: 89 (31.4%) Plain radiograph: 60 (21.2%) Ultrasound: 62 (21.9%) Procedure: 8 (2.8%) Other: 45 (15.9%)
Background highest level of education (number, percentage)	High school: 94 (33.2%) Bachelor's degree: 79 (27.9%) Master's degree: 78 (27.6%) Other: 32 (11.3%)
Background use of technology aids including smart phone, tablet, and computer in range of number how hours per week (number, percentage)	0-5: 44 (15.5%) 6-10: 41 (14.5%) 11-20: 65 (23.0%) 21+: 133 (47.0%)

Patient comfort with day-to-day technology use was a mean of 5.1 (SD 1.8) out of 7. 70% of participants used technology for over 11 hours a week. Patients were also familiar with the system of medical image interpretation, with 97.9% of respondents aware of the role of a radiologist, and the mean score for familiarity of the steps in performing, acquiring, and reporting imaging was 5.0 (SD 1.6) out of 7. Only 105 patients (37.1%) were aware clinical AI technology that could provide image interpretation was available.

Patients rated their comfort in their imaging being reported by a radiologist at a mean 6.5 out of 7 (SD 1.1) as shown in table 2. However, patient comfort in AI providing a report without radiologist involvement was a mean of 3.5 out of 7 (SD 1.8), $p<0.0001$. This compared to patient comfort in AI providing a report in part by AI and part radiologist at a mean of 5.4 out of 7 (SD 1.6), $p<0.0001$ (figure 2). Patients felt that AI would provide a faster time to report (AI 63.3%, radiologist 15.9%, equal 20.8%), that radiologists would provide better accuracy (AI 10.6%, radiologist 52.3%, equal 37.1%), whilst AI would provide a less expensive solution (AI 54.8%, radiologist 13.1%, equal 32.2%). Patients reported that AI should have an accuracy of mean 91.4 +/- 16.6% to be able to be used in a clinical environment, and 94.4% of patients wanted AI to be either the same or of higher accuracy to a radiologist in order to be implemented.

FIGURE 2: BAR GRAPH COMPARING THE MEAN SCORE ON A LIKERT SCALE (OUT OF 7) FOR PATIENT COMFORT IN REPORTS BEING ISSUES BY RADIOLOGIST, AI, OR A HYBRID MODEL. ASTERIX INDICATES P<0.05 USING STUDENT'S T-TEST.

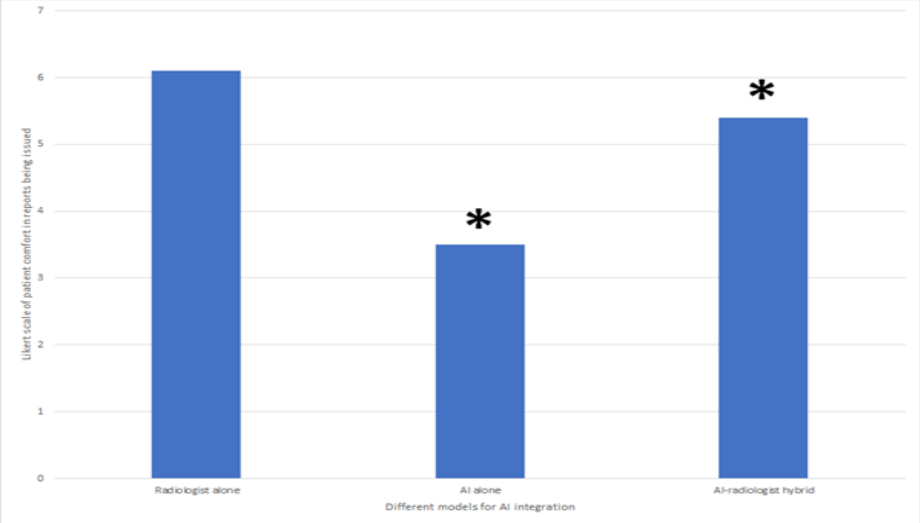


TABLE 2: PATIENT COMFORT WITH ACCURACY OF REPORT

PARAMETER #	MEDIAN (RANGE)	MEAN (SD)
Patient comfort in report being issued by radiologist alone	7 (1-7)	6.1 (1.1)
Patient comfort in report being issued by AI alone	4 (1-7)	3.5 (1.8)*
Patient comfort in report being issued in part by AI	6 (1-7)	5.4 (1.6)*

reported on Likert scale 1 to 7, with 7 indicating highest comfort

* p<0.0001 compared to radiologist alone

Comparing male (n=150) and female (n=133) participants, males rated their comfort in radiologist reporting as a mean of 6.4 (SD 1.2) out of 7 compared with females who reported a mean of 6.6 (SD 0.9) out of 7, p=0.02. No mean difference was seen between genders for reports entirely by AI (males 3.7 (SD 1.8), females 3.3 (SD 1.8), p=0.10) and for reports in part by AI (males 5.5 (SD 1.6), females 5.3 (SD 1.6), p=0.27).

Comparing the background technology usage with comfort in reporting, participants were grouped as 10 or less hours technology use per week (n=85), or 11 or more hours (n=198). The results on a Likert scale from 1 to 7 showed no difference in the mean comfort for radiologist reports (10 or less 6.3 (SD 1.3), 11 or more 6.6 (SD 1.0), p=0.11) and there was no difference in the overall comfort of AI providing a report entirely on its own (10 or less 3.4 (SD 1.6), 11 or more 3.6 (SD 1.9), p=0.11). However, those who used 10 or less hours technology per week were less comfortable in AI issuing a report in part compared with those who used technology for 11 or more hours per week (10 or less hours mean 4.8 (SD 1.6), 11 or more hours mean 5.6 (SD 1.6), p=0.0001).

Comparing the influence of background participant highest education level, participants were grouped as high school education (n=94) or university education (n=157). Patients in the "other" category (n=32) were not included in this sub-analysis. The results on a Likert scale from 1 to 7 showed no difference in the mean comfort for radiologist reports (high school mean 6.3 (SD 1.3), university mean 6.6 (SD 1.0), p=0.06) and there was no difference in the overall comfort of AI providing a report entirely on its own (high school mean 3.9 (SD 1.8), university mean 3.5 (SD 1.8), p=0.10). However, those with high school education were less comfortable in AI issuing a report in part compared with those who had received university education (high school mean 5.0 (SD 1.7), university mean 5.5 (SD 1.1), p=0.008).

Patients overall rated their comfort with data security in the

current radiologist reporting model as a mean of 5.5 out of 7 (SD 1.7) however, when proposed that AI would be involved in data assessment, patients rated their comfort with data security as a mean of 4.4 out of 7 (SD 2.0), p<0.0001. This is shown in table 3.

TABLE 3: PATIENT COMFORT WITH DATA SECURITY

PARAMETER #	MEDIAN (RANGE)	MEAN (SD)
Patient comfort in data security with radiologist	6 (1-7)	5.5 (1.7)
Patient comfort in data security with AI technology	4 (1-7)	4.4 (2.0)*

reported on Likert scale 1 to 7, with 7 indicating highest comfort

* p<0.0001 compared to radiologist alone

In terms of clinical accuracy and responsibility, patients rated the following healthcare stakeholders as having medicolegal responsibility for any potential error in AI imaging reports using a yes/no answer: hospital or healthcare network 76.3%, computer program 60.1%, radiologist 37.5%, referring doctor 10.3%, patient 4.2%, and other 1.8%. Of the 5 patients who selected "other", 4 out of 5 wrote in free text that they would place responsibility on the government and 1 patient wrote they were unsure.

DISCUSSION

There is no doubt that the future of medical practice, including diagnostic imaging, will involve the use of artificial intelligence in some capacity [1,11]. While literature to support machine learning and accuracy of AI is growing [11], there is a relative lack of evidence supporting patients' perception on the use of this technology as a health care decision maker, at an individual patient-level. The majority of patients in this study (62.9%) were not even aware that AI technology to interpret imaging was in existence, let alone already in clinical use.

This study showed that patients have an extremely high level of confidence in reports being issued by radiologists but are significantly less trustworthy with the use of AI in health care at this stage. This is more evident in patients with low technology use compared to those who use technology more than 11 hours per week, and in those who do not have university-level education - both these groups were shown to have less trust in a hybrid radiologist-AI reporting model compared with radiologist alone. This information supports the recent study from York et al. who assessed the perception of 216 patients on the use of AI in skeletal radiology. The authors concluded that patients held clinician assessment in the highest regard [18] and this acknowledges the nuances of the radiologist role in providing a holistic report taking into consideration the entire medical history, not just the current imaging. Other studies have suggested a similar level of distrust in emerging AI technology both within healthcare and in non-healthcare settings [19-22]. While there was a similar degree of comfort in AI technology between males and females, females showed a significantly higher confidence in radiologist reports than for males, although the reason for this is not clear from our study.

Our study also showed that patients' confidence in data security with the introduction of AI was significantly lower than for the current radiologist-model of healthcare interaction. The 2019 North American and European position statement expressed the importance of data security and accountability in the ethics of AI [2]. In addition, a recent commentary from Peterson describes the challenges in assessing health information from the patients' perspective. The author describes privacy as a unique factor individual to each patient and which can take many forms and that we must use our emotional intelligence to understand and balance the needs of our patients. Kerasidou describes current day as a point where there is the potential for AI to cause a fundamental shift in the empathy, compassion, and trust in healthcare, and that we must re-evaluate how we can incorporate these values in the early adoption of AI [23]. However, Feldman et al. suggested that some patients don't fully understand modern medicine anyway, and that there are multiple facets of their health care treatment which currently already requires them to place their trust within the care of their physician [19,24]. In this context, Feldman suggests that rather than developing trust in AI from the ground up, we should place more of a focus on *shifting* their trust from medicine and their physician to a new model involving AI.

If an AI report were to be inaccurate, it is interesting to see in our study that patients felt a range of different stakeholders were to be accountable. Patients felt that the developer of the technology (60.1%) and the healthcare facility (76.3%) would be afforded the most responsibility. Even radiologists who weren't issuing the report were considered accountable (37.5%). Interestingly a small percentage of patients even held themselves or their referring doctor accountable. Until this is tested in a court of law, we won't know which parties will ultimately be held

most liable. However, as supported by major consensus statements [2,3], the ethics of responsibility should be decided before the technology fully matures. Considering patients will apportion blame to their referring doctor, we must also consider their opinion on the use of AI and this is an area which has yet to be explored.

The majority of patients reported that they felt AI would be faster and less expensive than a radiologist, but also less accurate. Patients expected AI to be a mean of 91.4% accurate to be used in clinical medicine, and 94.4% of patients expected this accuracy to either meet or exceed radiologist accuracy before being used. This supports the argument from Haan et al. that a degree of scepticism remains amongst patients regarding AI technology [12], and they are acknowledging that the technology must be proven to be accurate as we enter this life-changing era in radiology. This also acknowledges the high regard patients currently hold for the integral work that radiologists do in their healthcare interaction [18].

The results of this study suggest to us all that if we are to integrate with AI, we must work on a number of factors to improve patient perception and trust [25]. This should start with education, with our study showing a higher trust in both radiologists and AI for those with university-level education compared to high-school education. This education concept would be no different to educating patients that magnetic resonance technology is safe or that ionizing radiation in diagnostic imaging is also safe when used appropriately. Education responsibility can be shared amongst radiologists, hospital networks, major societies, specialty colleges, and even computer technology companies. The study also implied that increasing background technology usage will be positively correlated with improving patient comfort. Finally, for patients to adopt the technology as a physician-assistant then there must be transparency on data use, security, and the role of consent [20].

While this study has a large sample size in an area without significant pre-existing literature, we must acknowledge that this study was single-centre and performed without a formally validated questionnaire. It is also open to selection bias due to the specific catchment of our hospital and reflects social and educations biases within our country. This includes the relatively high background level of education reported in our cohort which, based on the results, may positively influence patient comfort with AI. In addition, the authors have no documentation of patients who declined to participate or where patients weren't offered the opportunity to participate, both are biases inherent with written surveys. Finally, the authors acknowledge that there was a wide variability in results with all scaled questions receiving opinions varying from 1 to 7, resulting in a large standard deviation. This reflects healthy individual opinions, but doesn't affect the ability to interpret the mean in a dataset which was normalised.

CONCLUSIONS

The authors remain cautious of the longer-term implications of AI on the profession of diagnostic radiology. Patient expectations remain that human interaction is essential in medical care as evidenced by significantly higher confidence in radiologist involvement in their healthcare than for AI. If AI technology is to evolve then it must do so with appropriate involvement of stakeholders, of which patients are paramount. This will include balancing data security and medicolegal risk. This must happen before it is implemented, otherwise the technology is at risk of advancing too rapidly for the contentment of our patients.

References

1. Pesapane F, Codari M, and Sardanelli F. Artificial intelligence in medical imaging: threat or opportunity? Radiologists again at the forefront of innovation in medicine. Eur Radiol Exp 2. 2018. 35. https://doi.org/10.1186/s41747-018-0061-6
2. Geis JR, Brady AP, Wu CC, et al. Ethics of Artificial Intelligence in Radiology: Summary of the Joint European and North American Multisociety Statement. Can Assoc Radiol J. 01 Oct 2019, 70(4):329-334. DOI: 10.1016/j.carj.2019.08.010
3. Royal Australian and New Zealand College of Radiologists. Artificial Intelligence: The State of Play 2019 [internet]. Available from URL: https://www.ranzcr.com/college/document-library/artificial-intelligence-the-state-of-play-2019. Accessed 23 July 2020.
4. Pakdemirli E. Artificial intelligence in radiology: friend or foe? Where are we now and where are we heading?. Acta radiologica open. 2019 Feb;8(2):2058460119830222.
5. Waymel Q, Badr S, Demondion X, Cotten A, Jacques T. Impact of the rise of artificial intelligence in radiology: what do radiologists think?. Diagnostic and Interventional Imaging. 2019 Jun 1;100(6):327-36.

6. Abuzaid MM, Elshami W, Tekin H, Issa B. Assessment of the Willingness of Radiologists and Radiographers to Accept the Integration of Artificial Intelligence Into Radiology Practice. Academic Radiology. 2022. 29(1) pp87-94. https://doi.org/10.1016/j.acra.2020.09.014
7. Coppola F, Faggioni L, Regge D, Giovagnoni A, Golfieri R, Bibbolino C, Miele V, Neri E, Grassi R. Artificial intelligence: radiologists' expectations and opinions gleaned from a nationwide online survey. La radiologia medica. 2021 Jan;126(1):63-71.
8. Pakdemirli E. Perception of artificial intelligence (AI) among radiologists. Acta radiologica open. 2019 Sep;8(9):2058460119878662.
9. Collado-Mesa, F, Alvarez, E, Arheart, K. The role of Artificial Intelligence in diagnostic radiology: a survey at a single radiology residency training program. J Am Coll Radiol 2018; 15:1753–1757.
10. Chan S and Siegel EL. Wiill machine learning end the viability of radiology as a thriving medical specialty? Br J Radiol. 2019 Feb;92(1094):20180416
11. Honsy A, Parmar C, Quackenbush J, et al. Artificial intelligence in Radiology. Nat Rev Cancer 2018 Aug; 18; 18(8):500-510. doi: 10.1038/s41568-018-0016-5.
12. Haan M, Ongena YP, Hommes MA, et al. A Qualitative Study to Understand Patient Perspective on the Use of Artificial Intelligence in Radiology. J Am Coll Radiol. 2019 October. 16(10) pp1416-1419. https://doi.org/10.1016/j.jacr.2018.12.043
13. Ongena YP, Haan M, Yakar D. et al. Patients' views on the implementation of artificial intelligence in radiology: development and validation of a standardized questionnaire. Eur Radiol, 2020. 30, 1033–1040. https://doi.org/10.1007/s00330-019-06486-0/
14. Yang L, Ene IC, Arabi Belaghi R, Koff D, Stein N, Santaguida PL. Stakeholders' perspectives on the future of artificial intelligence in radiology: a scoping review. European Radiology. 2021 Sep 21:1-9.
15. Lim SS, Phan TD, Law M, Goh GS, Moriarty HK, Lukies MW, Joseph T, Clements, W. Non-radiologist perception of the use of artificial intelligence (AI) in diagnostic medical imaging reports. J Med Imaging Radiat Oncol. 2022. https://doi.org/10.1111/1754-9485.13388
16. Liew C. The future of radiology augmented with Artificial Intelligence: A strategy for success. Eu J Rad. 2018. 102 pp 152-156. https://doi.org/10.1016/j.ejrad.2018.03.019
17. Zaiontz C. Real Statistics Using Excel [internet]. Available from URL: www.real-statistics.com
18. York T, Jenney H, Jones G. Clinician and computer: a study on patient perceptions of artificial intelligence in skeletal radiography. BMJ Health Care Inform 2020;27:e100233. doi:1
19. Feldman RC, Aldana E, and Stein K. Artificial intelligence in the health care space: how we can trust what we cannot know. Stan. L. & Pol'y Rev. 2019. 399.
20. Nundy S, Montgomery T, Wachter RM. Promoting Trust Between Patients and Physicians in the Era of Artificial Intelligence. JAMA. 2019;322(6):497–498. doi:10.1001/jama.2018.20563
21. Fast E, and Horvitz E. Long-Term Trends in the Public Perception of Artificial Intelligence. Proceedings of the AAAI Conference on Artificial Intelligence. 2017. 31(1).
22. Kovarik CL. Patient Perspectives on the Use of Artificial Intelligence. JAMA Dermatol. 2020;156(5):493–494. doi:10.1001/jamadermatol.2019.5013
23. Kerasidou A. Artificial intelligence and the ongoing need for empathy, compassion and trust in healthcare. Bull World Health Organ. 2020;98(4):245-250. doi:10.2471/BLT.19.237198
24. Peterson C. Through Patients' Eyes: Regulation, Technology, Privacy, and the Future. Yearb Med Inform 2018; 27(01): 010-015. https://doi.org/ 10.1055/s-0038-1641193
25. Syed AB and Zoga AC. Artificial Intelligence in Radiology: Current Technology and Future Directions. Semin Musculoskelet Radiol 2018; 22(05): 540-545. https://doi.org/10.1055/s-0038-1673383

APPENDIX

APPENDIX 1: SURVEY ON PATIENT PERCEPTION OF ARTIFICIAL INTELLIGENCE IN DIAGNOSTIC RADIOLOGY

Age	18-30 31-40 41-50 51-60 61-70 71+
Gender	Male Female Non-binary
Reason for attending outpatient radiology service	CT MRI X-ray Ultrasound Procedure Other
Highest level of education	High school Adult higher education Bachelor's degree Masters' degree Other
What is the average number of hours per week that you use computer technology	<5 hours 5-10 hours 11-20 hours 20+ hours
Rate your comfort with using technology in day-to-day activities	Likert scale 1 (uncomfortable) to 7 (comfortable)
Rate your familiarity with the steps in which your imaging will be taken and reported	Likert scale 1 (unfamiliar) to 7 (familiar)
Today there is a specialist doctor called a radiologist who will look at and interpret your scans after they are done. They will send the report/ results to your referring doctor. Were you aware of this?	No Yes
How comfortable are you with having your imaging interpreted and results issued by a specialist radiologist doctor?	Likert scale 1 (uncomfortable) to 7 (comfortable)
Are you aware that there are computer/artificial intelligence programs being developed that may be able to analyze your radiology scans and issue and report?	No Yes
How comfortable would you be with having your imaging interpreted and results issued ENTIRELY by a computer program without a specialist radiologist doctor input?	Likert scale 1 (uncomfortable) to 7 (comfortable)
How comfortable would you be with having your imaging interpreted and results issued IN PART by a computer program without a specialist radiologist doctor input?	Likert scale 1 (uncomfortable) to 7 (comfortable)

In the following categories, which do you believe would perform better: computer/artificial intelligence, specialist radiologist doctor, or equal?	Time to report Accuracy of the report Cost of imaging
Currently the specialist radiologist doctor assesses and reports on your imaging. How comfortable are you about your PRIVACY and SECURITY of this data	Likert scale 1 (uncomfortable) to 7 (comfortable)
If your imaging was assessed by a computer program/AI, how comfortable would you be about your PRIVACY and the SECURITY of your data?	Likert scale 1 (uncomfortable) to 7 (comfortable)
How accurate should a computer/AI program be in making the right diagnosis before you would feel comfortable with having your imaging ENTIRELY reported by a computer without a specialist radiologist doctor reviewing the scan?	Likert scale 0 – 100%
How accurate should a computer/AI program be compared to a specialist doctor radiologist before you would trust it to interpret your imaging?	Less accurate Same accuracy More accurate
If your report was made entirely by a computer program/AI without a specialist radiologist doctor reviewing your imaging, who's responsibility should it be if the computer program missed an important medical condition on your scan or made the wrong diagnosis?	Answer yes/no for the following: Computer program company Hospital / radiology practice Referring doctor You, the patient The radiologist Other

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

EVALUATION OF SERVICE-ORIENTED NURSING SUPERVISOR STRATEGY BASED ON DATA ENVELOPMENT ANALYSIS (DEA)

Farhad Hamzehzadeh, MD; Fateme Mirzaee, MSc; Alireza Jalali, MD; Bahareh Ahmadinejad, MSc; Hoshang Shahmoradi, MSc; Anis Navand, MSc*

Health Systems Engineering Research Center, Milad hospital, Tehran, Iran.

Correspondence: bahare_ahmadi1365@yahoo.com

ABSTRACT

BACKGROUND:

This study introduced a service-oriented nursing supervisor strategy to increase the performance efficiency of different hospital wards. The efficiency of this strategy, in 12 wards under the supervision of 12 supervisors, was evaluated using Data Envelopment Analysis (DEA).

MATERIALS AND METHODS:

The efficiency of the service-oriented nursing supervisor strategy was evaluated using DEA. This study aims to evaluate the relative efficiency of hospital wards before and after implementing the service-oriented nursing supervisor strategy at Milad hospital. Data were evaluated using two basic models of data envelopment analysis technique, i.e., CCR and BCC output-oriented methods. Then, the relative performance efficiencies of 12 wards in 2 periods, including the first half of 2020 (before service-oriented nursing supervisor strategy) and the second half of 2020 (after service-oriented nursing supervisor strategy) were analyzed. Finally, efficient wards were ranked using the Anderson-Peterson method based on the results.

RESULTS:

According to the CCR output-oriented method, after implementing service-oriented nursing supervisor strategy, Urology, Gastroenterology, and Neurosurgery wards, as well as ENT, had the highest and lowest efficiency rates, respectively. Based on the BCC output-oriented method, Urology, Renal Transplant, Neurosurgery, and Gynecology wards had the highest efficiency in performance, while ENT had the lowest efficiency.

CONCLUSION:

In conclusion, the findings of this study offer a service-oriented nursing supervisor strategy that improves the efficiency of different wards of the hospital.

KEYWORDS

Supervisor, DEA, Nurse, Hospital, Efficiency, strategy

INTRODUCTION

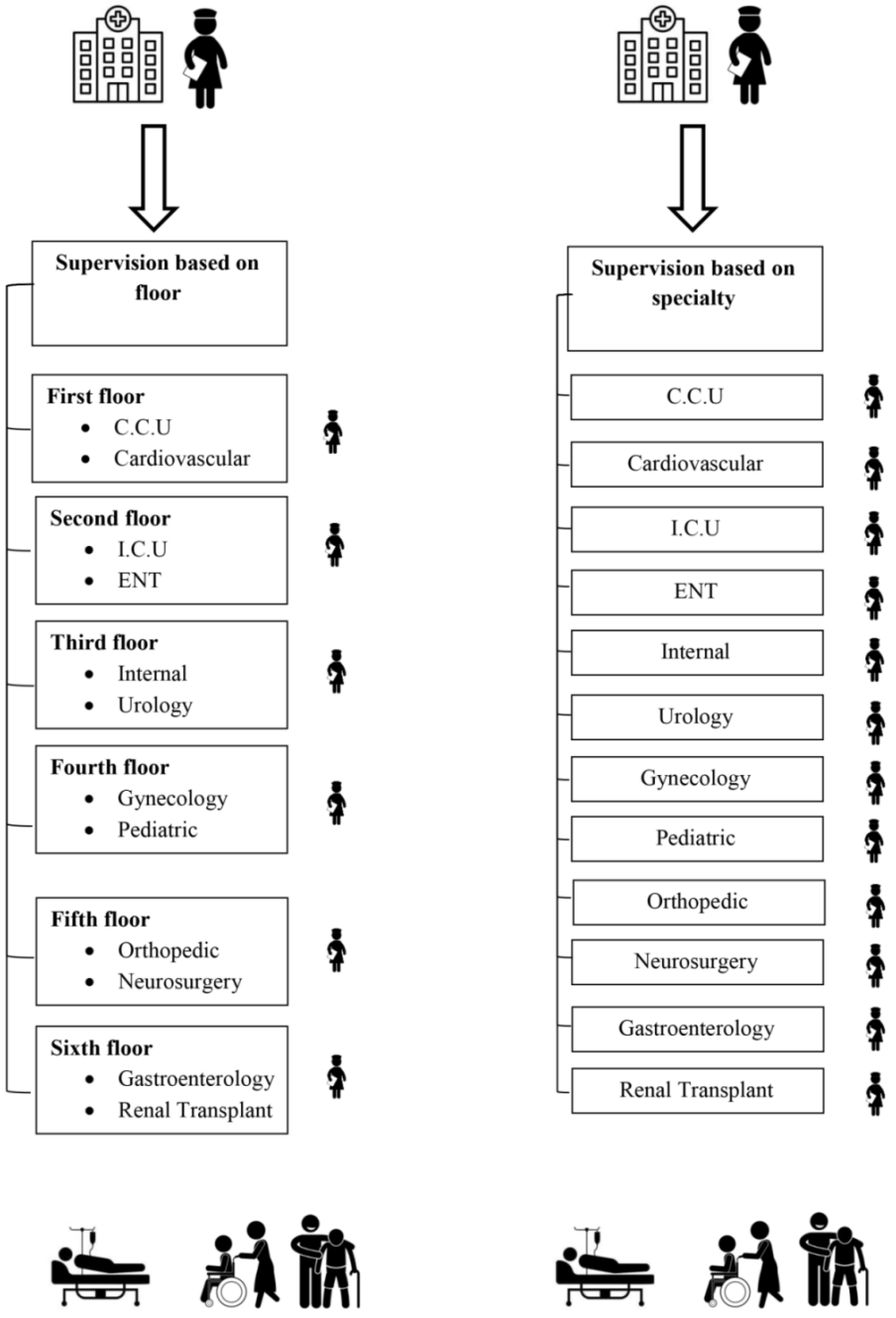
Hospitals can be understood as institutions that have the mission to provide health improvements, both at a broader level, such as the communities in which they are located and, more specifically, for patients to whom they directly offer assistance [1]. The quality of health care and the nursing care management reflect the hospital's image. For the success of health services, scientific and systematic activities are needed. Accordingly, the participation of all staff and understanding the perceptions and expectations of patients is necessary to increase productivity and improve and improve healthcare processes. Nursing services are one of the essential components of hospital services that play an influential role in meeting the nursing needs of the community [2]. The clinical supervisor plays a critical role in guaranteeing the quality of treatment while improving patient care and efficiency. The nurse supervisor's duty is still mostly unknown. Depending on the organization, the nurse supervisor may be referred to as a shift supervisor, clinical coordinator, administrative coordinator, shift administrator, or patient care coordinator[3]. Some nurse supervisor tasks include staffing, clinical quality, patient safety, executive presence, emergency response, customer satisfaction, census management, throughput, and nursing resource [4]. Thus, establishing a proper process is vital for implementing hospital management, which leads to the identification and scope of organizational effectiveness [5]. Accordingly, in the clinical or medical environment, performance management can be translated into the systematic development and constant monitoring of the standards applied to this specific environment to guarantee particular outcomes [6]. One of performance management's crucial challenges in hospital organizations is to avoid mismatching wards workload. Consequently, once hospitals investigate extending care quality while reducing costs [7], it also looks for an optimal balance between resource planning and the necessary resources, represented by beds, ward staff, outpatient clinics, etc.. Consequently, hospitals seek to optimize resource planning and the necessary resources, represented by beds, ward staff, outpatient clinics, etc. In other words, it is up to the hospital performance management to ensure the best allocation to the specialties, according to the available budget and resources[1]. In recent years, healthcare providers have attempted to improve the quality of nursing services; however, instead of facing numerous obstacles, they have been practically unsuccessful. Based on the fierce competition rampant in healthcare, attention to the quality and services provided to patients can be considered an influential factor in the success of healthcare institutions. In this study, to increase the efficiency of Milad Hospital wards, a different strategy was presented to promote the services of supervisors. The opinions of health managers and medical staff opinions were employed to design a service-oriented nursing supervisor strategy. In general, at Milad Hospital, each floor was managed by one supervisor. In the new strategic plan, to improve the efficiency of the hospital wards, the number of supervisors increased. For each specialty, a trained and experienced supervisor was assigned in the same specialty. Then, the DEA method was used to evaluate the efficiency of the wards before and after implementing the supervisor strategy.

SERVICE-ORIENTED NURSING SUPERVISOR STRATEGY

Supervision is staff observation during work and providing formal guidance. In health care sectors, protecting life, human health, and nullifying clients' needs are the main goals; hence, much complexity has been observed in health sectors that duplicate the importance of supervision[3]. Supervision has been introduced as clinical supervision in health care organizations. The Department of Health's clinical supervision has been defined as "a formal process for supporting, training, and professional learning." It provides a safe and confidential environment for the staff to reflect on and discuss their work, enhancing their awareness and clinical skills and improving competency. The supervisee should accept responsibility for their performance[8]. In nursing, clinical supervision is a process in which between two or more professionals (novice nurse and practitioner nurse), the focus is to provide a basis for monitoring, assessing, examining practice, and receiving feedback at work, which could lead to the development of professional skills[3]. Clinical supervision is done in hospitals by clinical supervisors. A clinical supervisor is a nurse responsible for supervising nursing services directly and helps reach the organization's goals by supporting and expanding knowledge, skills, commitment, and performance[9]. Supervision is helpful in the identification of clinical problems, and supervisors may help nurses in the admission of new roles[10]. Experts and fully trained clinical supervisor/s can inform nurses what and when to do while supervising and bringing development to the organization;

they support and strengthen the supervised nurse and maintain and enhance the quality of care[11]. Milad Hospital is the largest specialized and subspecialized hospital in Iran. This hospital is a complementary health service provider in Iran's Social Security organization (SSO) hospitals. Supervisors at Milad Hospital were based on floor-oriented, and a supervisor managed each floor. In order to elevate the efficiency and reduce the number of accommodations and the rate of bed employment (increasing the patients' discharge from the hospital), a service-oriented nursing supervisor strategy is performed experimentally in the case of 6 floors and 12 specialties at the hospital.

FIGURE 1. SERVICE-ORIENTED NURSING SUPERVISOR STRATEGY



According to Figure 1, there are two specialties on each floor which are normally managed by one supervisor, and a total of 12 wards are managed by 6 supervisors. After the implementation of the service-oriented nursing supervisor strategy, 2 supervisors are hired on each floor so that each specialty is managed by a trained and experienced supervisor. Overall the number of supervisors is doubled.

DATA ENVELOPMENT ANALYSIS (DEA)

Data envelopment analysis (DEA) measures the efficiency of homogeneous decision-making units (DMUs) with multiple inputs and outputs. The DMUs may be companies, schools, hospitals, shops, bank branches, etc. Efficiency is a management concept with a long management science history[12]. Efficiency shows that an organization has used its resources well to produce the best performance at some point in time. If the DMU has an input and an output, its efficiency is defined $\frac{Output}{Input}$ as the same unit. In 1975, Farrell introduced a method for measuring efficiency based on economic theories in an article referring to the problems of measuring the efficiency of units with multiple inputs and outputs[13]. Farrell considered the measure of relative efficiency when there are numerous and incomparable data and outputs and suggested that an efficient hypothetical department be constructed based on the weighted average of the efficient unit to be used as a comparative basis for using an inefficient unit. The ordinary equation for measuring the relative efficiency of DMUs despite multiple data and outputs is as follows:

$$Efficiency: \frac{\text{Total output weights}}{\text{Total input weights}}$$

Which function is as follows:

$$Efficiency\ \ of\ \ unit_j = \frac{u_1 y_{1j} + u_2 y_{2j} + \ldots}{v_1 x_{1j} + v_2 x_{2j} + \ldots}$$

Where in:

U_1 Weight given to output number 1, Y_{1j} the output of number 1 from unit j, V_1 Weight given to input number 1, X_{1j} is the input value of number 1 to unit j. In the term relative efficiency, the resulting efficiency is the result of comparing units. In the term relative efficiency, the resulting efficiency is the result of comparing units with each other, which efficiency of each DMU to be numerically between[14]. Usually, the maximum value can be considered after calculating efficiency, and all values can be divided. In this case, the change range is between [0 1]. Relative efficiency for unit k:

$$\mathrm{RE_k}: \frac{y_k / x_k}{Max\{y_j / x_j : j = 1,\ldots,n\}}$$

Due to the limitations of the Farrell method, in terms of constant efficiency compared to scale, this method did not find much practical application. Over time, practical methods for measuring efficiency were provided.[15] later proposed a practical method for determining the efficiency of a set of DMUs with multiple data and outputs, known as data envelopment analysis. Bunker, Charans, and Cooper (1984) developed the concepts and models of data envelopment analysis and introduced the BCC model for determining performance without assuming constant returns to scale (RTS) [16]. Charnes and Cooper (1985) introduced the collective model as another model for data envelopment analysis that simultaneously considers reducing inputs and the increase of outputs [17]. Suppose the unit under evaluation consists of n DMUs as $(j = 1,\ldots,n)$ and DMU_j, which consumes m input $(x_{1j}, \ldots, x_{mj})$ to produce s output $(y_{1j}, \ldots, x_{mj})$. In addition, suppose that the inputs and outputs of each DMU are all negative and that each DMU has at least one positive input and one positive output. Also, in most organizations, managers of the organization must examine the performance of DMUs consistent with similar inputs and outputs and compare their performance. One of the principles of DEA models is the relationship between the number of inputs, outputs, and DMU. Usually, restrictions such as $n \geq 3(m+s)\ or\ n \geq 2m+s$ are applied in the DEA, where n, m, and s are the number of units, inputs, and outputs, respectively. This problem can be solved by controlling the weights. Managers must follow the principle of the correct selection of inputs and outputs. In other words, inputs and outputs must be selected to include all the factors that affect the efficiency or inefficiency. For example, comparing two hospitals regardless of where they are located makes the evaluation results unrealistic. Determining the efficiency or inefficiency and ranking of each DMU, is one of the strengths of data envelopment analysis models compared to the other methods.

MATERIAL AND METHOD

This research is descriptive and analytical in terms of purpose, quantitative in terms of method, and practical for results. For this study, the efficiency of 12 different wards (Data were collected through Milad Hospital Information System H.I.S) of Milad Hospital was evaluated based on the data envelopment analysis (DEA) method. The ethical approval for the publication of this study was obtained by Milad hospital.

The primary data envelopment analysis models are divided into CCR and BCC. These methods can be examined in two ways: input-oriented and output-oriented. The difference between the two models, CCR and BCC, is assumed to be a constant or variable return on the scale. The CCR model assumes a constant return and the BCC model assumes a variable return on the scale. Constant return on the scale means that outputs change relative to inputs; for example, if inputs double, outputs double. However, the meaning of variable returns to scale is that the outputs do not change in proportion to the inputs. The constant return to scale assumption is only valid if units operate at an optimal scale. In evaluating DMUs by data envelopment analysis, efficiency scores were assigned between [0 1], and if the efficiency value is 1, this DMU is efficient. Several methods have been proposed for ranking efficient DMU in data envelopment analysis. In this research, for ranking DMUs, Anderson and Peterson's model have been used. One of the reasons for using this method is that the computational process of this method is low. The technology of ranking production does not change concerning efficiency. The exact ratio as the performance score obtained is calculated with the same ranking pattern. The A&P model does not accurately assess the nature of the input for the DMU with data close to 0, so using this model with the nature of the output solves this problem. The indicators essential to evaluating the performance of hospital wards based on the literature are as follow:

TABLE 1: INPUT / OUTPUT INDICATORS

input	Fall	Bedsore	Medical Errors
output	Bed Occupancy Rate	Average Stay	

The service-oriented nursing supervisor was first implemented in the second half of 2020 by assigning a supervisor separately for each ward specialty (Table 2).

CCR OUTPUT-ORIENTED

This model has a return to constant scale. Output-based models seek to increase or maximize outputs as long as there is no increase (without change or decrease) in the number of inputs. Suppose there are n DMUs, each of which uses the input m to generate the output s. X_{ik} is the input value i $(i = 1,2,\ldots, m)$, which is used by $(k = 1,2, .., n\ DMU_k)$ and y_{rk} is the output value r produced by $(k = 1, 2, .., n)$ DMU_k The variables u_r and v_i are the weights of output indices and input indices, respectively. The technical efficiency of DMU_j is calculated according to the multiplicative model as follows:

$$minE_j = \sum_{i=1}^{m} v_i x_{ij}$$

$$\sum_{i=1}^{s} u_r y_{rj} = 1$$

$$\sum_{r=1}^{s} u_r y_{rk} - \sum_{i=1}^{m} v_i x_{ik} \le 0$$

$$ur, v_i \ge 0; k = 1,2,\ldots,n; r = 1,2,\ldots,s; i = 1,2,\ldots,m$$

BCC OUTPUT-ORIENTED

In 1984, Bunker, Charans, and Cooper introduced a vital factor called "return to scale" and added it to the CCR model. With this change, they created the BCC model, whose mathematical model was quite similar to the CCR model, except that the efficiency factor was added to the W scale to the objective function and the unequal constraint of the CCR model [16].

$$minE_j = \sum_{i=1}^{m} v_i x_{ij} + W$$

$$S.t \sum_{i=1}^{s} u_r y_{rj} = 1$$

$$\sum_{r=1}^{s} u_r y_{rk} - \sum_{i=1}^{m} v_i x_{ik} + W \le 0$$

$$W \text{ free}, U_r \ge 0, V_i \ge 0$$

RTS means that if we multiply our input by x, our output by y. If $y > x$, the RTS is incremental; if $y = x$, the return to the scale is constant; if $y < x$, the RTS is declining [18].

ANDERSON-PATTERSON OUTPUT-ORIENTED MODEL

In this method, in the linear programming model related to performance DMU, $(j \le 0)$ is removed. This constraint causes the maximum value of the objective function to be 1. The efficiency is >1 after removing this limitation. Thus, the most efficient unit has higher efficiency.

$$Maxy_j = \theta$$

$$S.t \sum_{k=1}^{n} \lambda_r y_{ik} + S_s^- = X_{ij}$$

$$i=1,2,...,n; k \neq j$$

$$s\theta \sum_{k=1}^{n} \lambda_r y_{rk} + S_s^+ = y_{rj}$$

$$r=1,2,...,n; k \neq j$$

$$\sum_{k=1}^{n} \lambda_k = 1$$

$$k=1,2,...,n; k \neq j$$

SCALE EFFICIENCY

[16] showed that the performance score obtained by the CCR method indicates total technical efficiency and the performance score obtained by the BCC method indicates the pure technical efficiency.

$$SEj = \frac{\theta_{CCR}}{\theta_{BCC}}$$

In an envelopment analysis model, the output-oriented $(SE = 1)$ indicates deductive efficiency and $(SE > 1)$ indicates deductive inefficiency. In other words, if the DMU operates under efficiency conditions relative to the scale of increase or decrease, it is deductive inefficiency [19].

RESULTS

Selecting the best set of inputs and outputs is one of the most critical steps in calculating performance using data envelopment analysis. According to inputs and outputs (Table 1), envelopment analysis methods were adopted, and their relative efficiency was determined. After forming the desired models based on the data associated with wards, they were evaluated using DEA Solver Pro software. The performance of each ward and its ranking were obtained. In the next step, the Anderson-Peterson model was implemented in Lingo software for the wards with an efficiency coefficient of 1. The problem-solving results based on two data envelopment analysis models are presented in Tables 2 and 3 based on the CCR and BCC output-oriented methods. Selecting the best set of inputs and outputs is one of the most critical steps in calculating performance using data envelopment analysis. The indicators essential to evaluating the performance of hospital wards based on the literature were Fall, Bedsore, and Medical Errors as input factors along with Bed Occupancy Rate and Average Stay as output factors. According to inputs and outputs, envelopment analysis methods were adopted, and their relative efficiency was determined. After forming the desired models based on the data associated with wards, they were evaluated using DEA Solver Pro software, and the performance of each ward and its ranking were obtained. In the next step, the Anderson-Peterson model was implemented in Lingo software for the wards with an efficiency coefficient of 1. The problem-solving results based on two data envelopment analysis models are presented in Tables 2 and 3 based on the CCR and BCC output-oriented methods.

TABLE 2: EFFICIENCY COEFFICIENT AND RANK OF WARDS BASED ON OUTPUT CCR AND AP MODEL

	FIRST HALF OF 2020 (BEFORE SERVICE-ORIENTED NURSING SUPERVISOR STRATEGY)				SECOND HALF OF 2020 (AFTER SERVICE-ORIENTED NURSING SUPERVISOR STRATEGY)			
Wards	Efficiency in the CCR method	Rank based on CCR method	Efficiency in the AP method	Rank based on AP method	Efficiency in the CCR method	Rank based on CCR method	Efficiency in the AP method	Rank based on AP method
C.C.U	0.853	5		5	0.646	5		5
Cardiovascular	0.891	3		3	0.756	4		4
ENT	0.092	11		11	0.143	11		11
Gynecology	0.432	8		8	0.575	6		6
I.C.U	0.614	6		6	0.515	9		9

Internal	.0254	10		10	0.133	12		12
Neurosurgery	0.086	12		12	0.212	10		10
Gastroenterology	0.999	2	1.193	2	1	1	1.028	2
Orthopedic	0.394	9		9	0.518	8		8
Pediatric	0.443	7		7	0.521	7		7
Renal Transplant	0.873	4		4	0.936	3		3
Urology	1	1	1.667	1	1	1	1.629	1

Following the implementation of the service-oriented nursing supervisor strategy based on the CCR method, Urology and Gastroenterology wards had the highest efficiency. Cardiovascular, I.C.U, and Internal wards followed a downward trend for efficiency; however, C.C.U, ENT, Pediatric wards and Renal Transplant, Neurosurgery, Orthopedics, and Gynecology wards had a constant and increasing efficiency rate.

According to the BCC method, Urology, Renal Transplant, Neurosurgery, and Gynecology wards had the highest efficiency rate, while ENT had the lowest efficiency. C.C.U, I.C.U, and Internal wards and Cardiovascular, Neurosurgery, Orthopedic, and Pediatric wards had lower and higher efficiency rates, respectively. Based on the total technical efficiency coefficient and pure technical efficiency, the scale efficiency coefficient can be calculated for each period using Equation 3. The scale efficiency coefficient for the desired period for each ward is given in Table 4

TABLE 3: EFFICIENCY COEFFICIENT AND RANK OF WARDS BASED ON OUTPUT BCC AND AP MODEL

Wards	FIRST HALF OF 2020 (BEFORE SERVICE-ORIENTED NURSING SUPERVISOR STRATEGY)				SECOND HALF OF 2020 (AFTER SERVICE-ORIENTED NURSING SUPERVISOR STRATEGY)			
	Efficiency in the BCC method	**Rank based on BCC method**	**Efficiency in the AP method**	**Returns to scale (RTS)**	**Efficiency in the BCC method**	**Rank based on BCC method**	**Efficiency in the AP method**	**Returns to scale (RTS)**
C.C.U	1	1	1.059	Decrease	0.746	7		Decrease
Cardiovascular	0.942	7		Decrease	0.789	6		Decrease
ENT	0.104	12		Increase	0.164	12		Increase
Gynecology	1	1	1.74	Increase	1	1	1.3	Increase
I.C.U	0.776	8		Decrease	0.535	10		Increase
Internal	1	1	1.32	Increase	0.199	11		Increase
Neurosurgery	0.467	10		Increase	1	1	1.105	Increase
Gastroenterology	1	1	1.539	Constant	1	1	1.4	Constant
Orthopedic	0.6	9		Decrease	0.629	8		Decrease
Pediatric	0.453	11		Decrease	0.538	9		Increase
Renal Transplant	1	1	3.043	Decrease	1	1	2.990	Decrease
Urology	1	1	1.816	Constant	1	1	1.728	Constant

TABLE 4: AVERAGE EFFICIENCY OF THE WARDS SCALE AND RANKING

WARDS	SCALE EFFICIENCY (SE)			RANK BASED ON EFFICIENCY
	First half of 2020	Second half of 2020	Average	
C.C.U	0.583	0.865	0.724	8
Cardiovascular	0.945	0.958	0.951	4
ENT	0.884	0.871	0.877	6
Gynecology	0.432	0.575	0.503	10
I.C.U	0.719	0.962	0.840	7
Internal	0.254	0.668	0.461	11
Neurosurgery	0.184	0.212	0.198	12
Gastroenterology	0.999	1	0.999	2
Orthopedic	0.581	0.823	0.702	9
Pediatric	0.977	0.968	0.972	3
Renal Transplant	0.873	0.936	0.904	5
Urology	1	1	1	1

After implementing the CCR and BCC data envelopment analysis method of the output-oriented, for 12 wards, in two periods (before and after implementing the service-oriented nursing supervisor strategy), It indicates that the number of efficient, inefficient wards is different before after the strategy. For example, in the first half of 2020, when each supervisor was floor-specific and monitored a floor (regardless of departmental expertise), departmental performance was much lower than after strategy execution.

DISCUSSION

There is no doubt that various elements may help supervisors and advanced nursing roles perform better [20]. Tavrow's study implied that supervisors devoted <5% of their time to patient care issues [21]. The study's essential contribution is introducing a new strategy for the work of the nursing supervisor. In recent years, the DEA Model has been widely used in the research field of efficiency, but there have been no studies evaluating the supervisor model. According to Kilmenster et al., supervision should be structured and carried out regularly following the program. Content of supervision should be agreed upon and the aims specified before beginning supervision [22]. Knudsen et al. founded that clinical supervision quality is substantially influenced by autonomy or authority at work [23]. Supervisors must act successfully in their tasks (staffing, clinical quality, patient safety, executive presence, emergency response, and customer satisfaction, census management) to enhance patient care. Several factors have been identified as influencing effective practice in novel nurse roles in acute settings, with opposition to self-directed nursing advances being higher in larger acute/general hospital trusts than in "small enterprises." Feedback, performance evaluation, and reflective practice Feedback from other health care professionals can promote professional development. Performance measurement can also aid personal and professional development[24]. Also, Graduate level education and leadership courses could influence the innovativeness of supervisors, hence making acting better in line with hospital goals [25]. In this study, the service-oriented nursing supervisor strategy was first presented to increase the performance efficiency of wards and the management of each ward by a experienced supervisor. Then, the efficiency of the ward before and after the strategy was evaluated using DEA method. The results demonstrated that based on the CCR output-oriented method after implementing service-oriented nursing supervisor strategy, Urology and Gastroenterology wards and Neurosurgery and ENT had the highest and lowest efficiency rates, respectively. However, according to the BCC output-oriented method, Urology, Renal Transplant, Neurosurgery, and Gynecology wards had the highest efficiency, while ENT had the lowest efficiency.

CONCLUSION

In conclusion, the findings of this study offer a service-oriented nursing supervisor strategy that improves the efficiency of different wards of the hospital. Given the importance of hospitals in providing health services, using data envelopment analysis (DEA) to compare and model can be an essential step for the continuous improvement of different wards efficacy with the new strategy service-oriented nursing supervisor.

LIMITATIONS

Some of our research limitations should be highlighted at this time. Because causal inferences might be challenging to draw from cross-sectional data, relationships between research variables should be carefully studied before drawing any conclusions. Furthermore, the primary data's convenience reduced the generalizability of the findings. Thus, future research should adopt samples from other hospital wards in the long run. Future research should focus on replicating this study in a more extensive and multicenter representative population of nurse supervisors. However, more work is required to optimize the hospital wards' efficiency fully.

ACKNOWLEDGMENT

The researchers are grateful to health systems engineering research center that collaborated with this research.

FINANCIAL SUPPORT AND SPONSORSHIP

Health Systems Engineering Research Center, Milad Hospital, Tehran, Iran.

CONFLICTS OF INTEREST

Nothing to declare

References

1. Peixoto MGM, Musetti MA, de Mendonça MCA. Performance management in hospital organizations from the perspective of Principal Component Analysis and Data Envelopment Analysis: the case of Federal University Hospitals in Brazil. Computers & Industrial Engineering. 2020;150:106873.
2. Hoseini M. Management principles of nursing services. Tehran: Boshra-Tohfeh. 2007:65-71.
3. Dehghani K, Nasiriani K, Salimi T. Requirements for nurse supervisor training: A qualitative content analysis. Iranian journal of nursing and midwifery research. 2016;21(1):63.
4. Matsumoto A. Effective human resource management strategy for hospital nursing organizations. Management Science Letters. 2019;9(2):243-52.
5. Sebashe S, Mtapuri O. Implementation of a performance management system: A case study of Ba-Phalaborwa Municipality in Limpopo. Journal of Public Administration. 2011;46(4):1323-37.
6. Harnett P, Bowles N, Coughlan A. Refocusing acute psychiatry, performance management, standards and accountability, a new context for mental health nursing. Journal of psychiatric and mental health nursing. 2009;16(5):434-9.
7. Weir TB, Sardesai N, Jauregui JJ, Jazini E, Sokolow MJ, Usmani MF, et al. Effect of Surgical Setting on Hospital-Reported Outcomes for Elective Lumbar Spinal Procedures: Tertiary Versus Community Hospitals. Global spine journal. 2020;10(4):375-83.
8. Rwelamira DM. The perceptions of clinical physiotherapists of their role in supervising undergraduate students in selected tertiary hospitals in Tanzania. 2019.
9. SIROLA-KARVINEN P, Hyrkäs K. Clinical supervision for nurses in administrative and leadership positions: a systematic literature review of the studies focusing on administrative clinical supervision. Journal of Nursing Management. 2006;14(8):601-9.
10. Kelly B, Long A, McKenna H. A survey of community mental health nurses' perceptions of clinical supervision in Northern Ireland. Journal of psychiatric and mental health nursing. 2001;8(1):33-44.
11. Holloway E. Clinical supervision: A systems approach: Sage; 1995.
12. Witzel M. A short history of efficiency. Business Strategy Review. 2002;13(4):38-47.
13. Farrell MJ. The measurement of productive efficiency. Journal of the Royal Statistical Society: Series A (General). 1957;120(3):253-81.
14. Aggarwal L, Goswami P, Sachdeva S. Multi-criterion Intelligent Decision Support system for COVID-19. Applied Soft Computing. 2021;101:107056.
15. Charnes A, Cooper WW, Rhodes E. Measuring the efficiency of decision making units. European journal of operational research. 1978;2(6):429-44.
16. Banker RD, Charnes A, Cooper WW. Some models for estimating technical and scale inefficiencies in data envelopment analysis. Management science. 1984;30(9):1078-92.
17. Charnes A, Cooper WW. Preface to topics in data envelopment analysis. Annals of Operations research. 1984;2(1):59-94.

18. Färe R, Grosskopf S, Norris M, Zhang Z. Productivity growth, technical progress, and efficiency change in industrialized countries. The American economic review. 1994:66-83.
19. Munisamy S, Jun OB, editors. Efficiency of Latin American container seaports using DEA. Proceedings of 3rd Asia-Pacific business research conference; 2013.
20. Glasofer A, Lapinsky AB. Delineation of the Nursing Supervisor Role: A Pilot Study. JONA: The Journal of Nursing Administration. 2019;49(7/8):359-65.
21. Tavrow P, Kim Y-M, Malianga L. Measuring the quality of supervisor–provider interactions in health care facilities in Zimbabwe. International Journal for Quality in Health Care. 2002;14(suppl_1):57-066.
22. Kilminster S, Cottrell D, Grant J, Jolly B. AMEE Guide No. 27: Effective educational and clinical supervision. Medical teacher. 2007;29(1):2-19.
23. Knudsen HK, Ducharme LJ, Roman PM. Clinical supervision, emotional exhaustion, and turnover intention: A study of substance abuse treatment counselors in the Clinical Trials Network of the National Institute on Drug Abuse. Journal of substance abuse treatment. 2008;35(4):387-95.
24. Jones ML. Role development and effective practice in specialist and advanced practice roles in acute hospital settings: systematic review and meta-synthesis. Journal of advanced nursing. 2005;49(2):191-209.
25. CLEMENT-O'BRIEN K, Polit DF, Fitzpatrick JJ. Innovativeness of nurse leaders. Journal of Nursing Management. 2011;19(4):431-8.

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

THE USE OF INFOGRAPHICS, TABLES AND GRAPHS IN THE HOSPITALS AND HEALTH SERVICES QUALITY ACCOUNT IN AUSTRALIA

Abdel K Halabi, Lee Brown

Federation Business School, Federation University Australia

Correspondence: abdel.halabi@federation.edu.au

ABSTRACT

OBJECTIVE: This study will investigate whether removing the Quality Accounts purpose and aim led to differences in the number of Infographics, Tables and Graphs used over four years.

DESIGN:

A content analysis was performed on the Quality Accounts of six Hospitals and Health Services from 2016 to 2019. Statistical analysis was then performed to examine differences in the use of Infographics, Tables and Graphs in the Quality Account

SETTING:

The six Hospitals and Health Services were operating in a rural geographical area in the state of Victoria, Australia.

RESULTS:

Even though some significant differences were found, this was largely due to yearly variability in the use of Infographics, Tables and Graphs. The six Hospitals were quite different in their Quality Account presentations because these reports are structured to a particular community.

CONCLUSIONS:

The removal of the purpose and aim has not affected the number of Infographics, Tables and Graphs. While limitations are noted, a number of future research opportunities stem from this study to enhance the Quality Account and overall understandability of Hospital reports.

KEYWORDS

Quality Account; Hospitals; Understandability; Infographics; Tables; Graphs; Management

INTRODUCTION

This paper examines how six rural Hospitals and Health Services (HHS) in Australia use Infographics, Tables and Graphs within their Quality Account. The Quality Account (formerly called a Quality of Care report) provides an annual snapshot of hospital operational performance information, including how quality and safety of care are measured and monitored [1]. In the Australian state of Victoria, all HHS are required to produce a yearly Quality Account based on government reporting guidelines and an Annual Report.

The release of hospital performance data to the general public aims to fulfil a healthcare provider's duty to disclose quality or performance information to the public, thereby increasing transparency and accountability of the healthcare system to its citizens [2] and improving the quality of care [3]. The Victorian Government [1] Quality Account reporting guidelines for HHS acknowledge the purpose is to provide accessible information about the service's quality of care and in doing so demonstrate the service's transparency and accountability and the aim is to meet diverse quality and safety health literacy needs by providing a report that is accessible and easy to understand.

In terms of health performance reporting, Islam [4] noted that adhering to high governance standards by implementing accountability for health service organisations can enhance the quality of health service delivery. Reporting systems, however, can often be complex, and the sector requires support with data reporting to make it easier to understand [3]. As a result, the Victorian Government's Quality Account guidelines [5] suggest the written content needs to be easy to read and understand for consumers, carers and the community. The Quality Account guidelines are structured to ask the community what specific content they would like to see and note that hospitals should think about how you can use images, graphs and graphic elements to help the community comprehend the report. Research has shown that accountability and transparency can be discharged by presenting information in a format that community members can easily understand. To this end, Infographics, Tables and Graphs can assist understandability because they convert complex technical data into information that is useful to stakeholders with little to no professional knowledge of the subject matter [6]. Healthcare performance management, visualisations, such as "emergency care" through charts and graphs, help administrators interpret performance and take appropriate actions [7].

The purpose of the Quality Account (to demonstrate transparency and accountability) and the aim (to provide information that is easy to understand) were outlined in the Victorian Government reporting guidelines from 2016 to 2018. In 2019, however, both the purpose and aim were excluded and not replaced. Given the request to consider the use of images, graphs and graphic elements, this study will investigate whether the exclusion of the purpose and aim led to differences in the number of Infographics, Tables and Graphs used in the Quality Account over the four years from 2016 to 2019, and particularly between 2018 and 2019.

Infographics, Tables and Graphs have been widely used to help users understand financial and non-financial information. In terms of infographics, Mindu *et al.* [8] explain that these are graphic visual representations of information, data or knowledge and that apart from being beautiful, engaging and easier to understand, … also present complex information effectively. Research on the effects of infographics within publicly available reports has shown that these increase understandability [6] and uphold legitimacy [9]. Dunlap & Lowenthal [10] added that Infographics could deliver the maximum amount of content in the least amount of space while still being precise and clear. Hall [11] found that younger people preferred infographics, while Cox and De Goeij [6] noted that infographics are most effective for investors who lack literacy. Finally, Jahan *et al.* [12] found well-planned content within an infographic can lead to better understandability and increased dissemination of the key message.

In terms of graphs, previous research has examined and evaluated their use within publicly available reports. Courtis [13] for example, noted organisations use graphs to focus a 'reader's interest, attract and hold attention, facilitate understanding, save time in analysing data, help memory recall, highlight trends, clarify relationships and generally break down language barriers. Courtis [13] also stated that "the basic messages portrayed through a graph should be visually apparent and understandable to readers regardless of their educational or experience background". Frownfelter-Lohrke & Fulkerson [14] and Beattie [15] confirmed that graphs could assist report understandability, while Usmani *et al.* [16], noted that graphs assist readers to understand detailed information by giving a richer perspective of data, and this facilitates informed decision-making. Graphs can summarise data which assists readers to process information, and this saves time when analysing data [17,6].

Tables within publicly available reports can also facilitate understandability and improve disclosure quality [18]. The more frequent use of tables helps users of financial statements to understand and compare information quickly [19]. Tables can improve reader retention by clearly displaying statistical data [20] and can be used to emphasise symbolic information (numbers) and make information more understandable [21].

METHODS

Given the literature reviewed, the research question investigates whether removing the Quality Accounts purpose and aim led to differences in the number of Infographics, Tables and Graphs used over four years. The sample was restricted to Hospitals and Health Services operating in the rural geographical area of Gippsland in the state of Victoria, Australia. While some research exists in regional hospitals [22] very few studies have been undertaken in regard to the Quality Account [4], and in the Australian context. The six Shire Councils from where the Hospitals were drawn within Gippsland are shown in Figure 1.

FIGURE 1 - VICTORIA'S GIPPSLAND REGION

Source: Regional Development Victoria [23]

This study chose to examine one Hospital and Health Service from each Shire Council. The hospital chosen was that with the highest 2019 total income from transactions – a method that eliminated any perceived researcher bias [24,25].

The list of Hospitals and Health Services were Bass Coast Health (BCH), Bass Coast Shire; West Gippsland Healthcare Group (WGHG) Baw Baw Shire; Latrobe Regional Hospital (LRH) Latrobe Council; Gippsland Southern Health Service (GSHS) South Gippsland Shire; Bairnsdale Regional Health Service (BRHS) East Gippsland Shire, and Central Gippsland Health (CGH) Wellington Shire.

The Quality Accounts of the six HHS were identified and then downloaded from each website for four years to 2019. A content analysis was then used to individually count the number of Infographics, Tables and Graphs within the Quality Account. A consistent data coding framework was developed, which focused on clear definitions of Infographics [8], Tables [26] and Graphs [27], which ensured reliability [24,25]. Examples of Infographics (see Figure 2), Tables (see Figure 3) and Graphs (see Figure 4) are provided.

FIGURE 2 - INFOGRAPHIC EXAMPLE

(Source: Bass Coast Health [28])

FIGURE 3 - TABLE EXAMPLE

Victorian Healthcare Experience Survey (VHES) Results 2018 – 2019

Patient Experience	Q1 2018-19 (Jul-Sept)	Q2 2018-19 (Oct-Dec)	Q3 2018-19 (Jan-Mar)	Q4 2018-19 (Apr-Jun)
Overall positive patient experience (Target 95%)	97%	96%	90%	88%
Transition of care - patient discharge (Target 75%)	83%	80%	71%	80%
Perception of cleanliness (Target 70%)	74%	83%	73%	79%

FIGURE 4 - GRAPH EXAMPLES

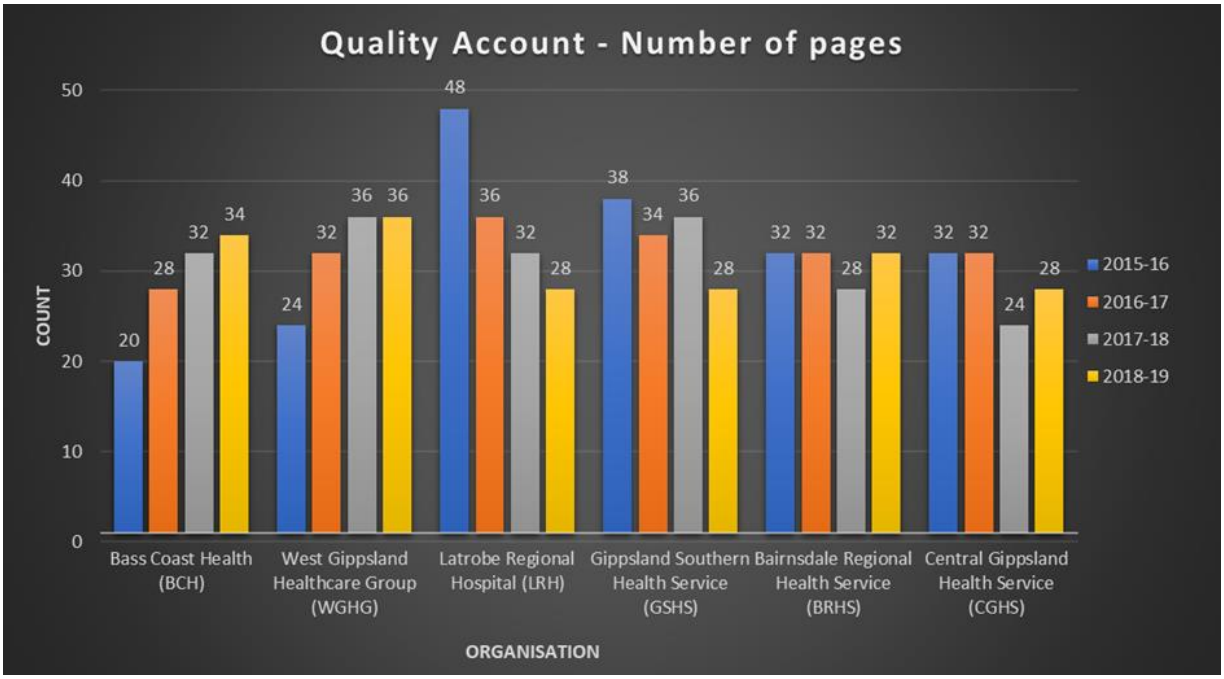
RESULTS

Page Length

The Quality Accounts were colourful and contained staff and client pictures to make them vibrant and attractive. Because of the uniqueness of these reports to their communities, the documents varied in page length.

Figure 5 shows that a clear year on year pattern is not evident. BRHS and CGHS have similar page lengths, while GSHS had slightly more. BCH and WGHG generally increased year on year, whereas LRH decreased. The longest Quality Account was the LRH in 2019 (48 pages), while the least was BCH in 2016 (20 pages).

FIGURE 5 - QUALITY ACCOUNT – NUMBER OF PAGES (INCLUDING FRONT AND BACK COVERS) FOR SIX GIPPSLAND BASED HOSPITALS AND HEALTH SERVICES 2016 TO 2019



Quality Account analysis

Table 1 shows the total number of Infographics, Tables and Graphs used within the Quality Account over four years and the yearly mean. The results show that the yearly total number was highest in 2017 (113) and lowest in 2018 (79). Of the individual organisations, CGHS had the highest (94) and LRH the least (38).

A chi-square test examined whether the organisations consistently use Infographics, Tables and Graphs. Table 1 shows the p-value is 0.015, indicating a significant difference between how each organisation uses Infographics, Tables and Graphs. In terms of each organisation BCH, CGHS and 'BRHS's show variability over the years, while GSHS, WGHG and LRH show a downward trend in total numbers. The results also show that only BRHS and CGHS increased the use from 2018 to 2019. Over the four years, CGHS used the highest number (94).

Of importance to the study was whether the removal of the purpose and aim from the 2019 guidelines impacted the collective use of Infographics, Tables and Graphs. A chi-square test was conducted. Table 2 confirms no significant difference in the usage pattern for three organisations (LRH, GSHS & BRHS). BCH's p-value of 0.070 (between 0.05 to 0.10) indicates a weak statistical difference, while both WGHG & CGHS show a significant difference (p-value below 0.05). Upon further examination, CGHS's p-value (0.021) is because there is an unusual number in 2018 (where the total was only 11 - see Table 1) and does not indicate the usage altered in 2019. WGHG is showing the most significant statistical difference, yet Table 1 confirms the total usage is declining every year, and the change in 2019 may be due to this trend rather than the removal of the purpose and aim.

The communication tool used most in the Quality Account:

Analysis was undertaken on the separate use of Infographics, Tables and Graphs and the results in Table 3 shows there are more graphs (252, average 63) used compared to Infographics (72, average 18) and Tables (52, average 13). The total mean usage between 2018 and 2019 showed no real difference (13.17 in 2018 compared to 13.67 in 2019), which further substantiates that the removal of the purpose and aim in the 2019 guidelines did not impact the use of these communication tools.

TABLE 1 - QUALITY ACCOUNT TOTAL NUMBER OF INFOGRAPHICS, TABLES AND GRAPHS 2016 TO 2019

TOTAL NUMBER OF INFOGRAPHICS, TABLES AND GRAPHS WITHIN THE QUALITY ACCOUNT							
ORGANISATION	**2016**	**2017**	**2018**	**2019**	**4 YEAR TOTAL**	**MOVEMENT BETWEEN 2018 AND 2019**	**YEARLY MEAN**
Bass Coast Health (BCH)	14	28	26	16	**84**	**-10**	**21.00**
West Gippsland Healthcare Group (WGHG)	18	11	8	4	**41**	**-4**	**10.25**
Latrobe Regional Hospital (LRH)	14	9	8	7	**38**	**-1**	**9.50**
Gippsland Southern Health Service (GSHS)	13	12	11	5	**41**	**-6**	**10.25**
Bairnsdale Regional Health Service (BRHS)	19	24	15	20	**78**	**5**	**19.50**
Central Gippsland Health Service (CGHS)	24	29	11	30	**94**	**19**	**23.50**
Total	**102**	**113**	**79**	**82**	**376**	**3**	**94.00**
Two way P- value	0.015						

TABLE 2 - QUALITY ACCOUNT ONE-WAY CHI-SQUARE TEST RESULTS PER ORGANISATION, 2016 TO 2019

ORGANISATION	QUALITY ACCOUNT CHI-SQUARE P-VALUE
Bass Coast Health (BCH)	0.070
West Gippsland Healthcare Group (WGHG)	0.017
Latrobe Regional Hospital (LRH)	0.384
Gippsland Southern Health Service (GSHS)	0.286
Bairnsdale Regional Health Service (BRHS)	0.551
Central Gippsland Health Service (CGHS)	0.021

TABLE 3 - QUALITY ACCOUNT TOTAL HOSPITALS AND HEALTH SERVICES USE OF EACH COMMUNICATION TOOL

QUALITY ACCOUNT - TOTAL HOSPITAL AND HEALTH SERVICE USE OF EACH COMMUNICATION TOOL								
TYPE	2016	2017	2018	2019	TOTAL	YEARLY MEAN USAGE	2018 HHS MEAN USAGE	2019 HHS MEAN USAGE
Infographic	16	16	26	14	72	18.00	4.33	2.33
Table	11	16	12	13	52	13.00	2.00	2.17
Graph	75	81	41	55	252	63.00	6.83	9.17
Total	102	113	79	82	376	94.00	13.17	13.67

Analysis was then undertaken to determine if the usage of Infographics, Tables and Graphs had changed over the period. A one-way chi-square test was conducted. The results reported in Table 4 show that there is no statistical change in the use of Infographics and Tables. However, there was a change in the use of graphs ($p = 0.001$). The change in Graphs was largely due to yearly variability (refer to Table 3) because the number declined between 2017 (81) and 2018 (41) then increased in 2019 (55).

TABLE 4 - QUALITY ACCOUNT ONE-WAY CHI-SQUARE TEST RESULTS PER COMMUNICATION TOOL FROM 2016 TO 2019

COMMUNICATION TOOL	P-VALUE
Infographic	0.180
Table	0.783
Graph	0.001

DISCUSSION

The objective of this study was to examine whether the removal of the purpose and aim from the 2019 Quality Account guidelines had an impact on how six Gippsland Hospitals and Health Services used Infographics, Tables and Graphs. There has been a desire for HHS to consider the use of Images, Graphs and Graphic elements to engage readers and demonstrate accountability and transparency [5].

Results found that the change in 2019 guideline wording has not influenced the use of Infographics, Tables and Graphs between 2018 to 2019, and this was confirmed in Tables 1 and 2. Any movement was attributable to yearly fluctuations naturally occurring, and this can be seen clearly in CGSH, which increased the total number of Infographics, Tables and Graphs in 2019 (from 11 to 30) to previous levels in 2016 and 2017. The one-way chi-square test (Table 4) again indicates no statistical change in the use of Infographics and Tables, and while there is a significant change in the use of Graphs, this is because of natural fluctuations.

Infographics, Tables and Graphs can assist understandability because they convert complex technical data into information that is useful to stakeholders with little professional knowledge [6, 31]. Because each HHS is operating in a different geographical area, and the Victorian Government [5] Quality Account guidelines request the HHS ask the community what content they would like to see, it was anticipated that each Quality Account would be unique.

The individual count of Infographics, Tables and Graphs within the Quality Account shows that HHS prefers to use graphs. Previous literature has recommended that graphs better show overall trends and patterns [32]. Graphs are highlighted in the reporting guidelines because they show operational trends, performance against targets and outcomes [5]. As the Quality Account is written and distributed among the community to all stakeholders regardless of age, gender, education and background, graphs may be preferred because these groups can better comprehend the 'HHS' information without engaging professional advice [13,16].

CONCLUSION

The principal finding of this study is that removing the Quality Accounts purpose and aim in 2019 did not lead to differences in the number of Infographics, Tables and Graphs used over between 2018 to 2019. The research has also highlighted that HHS use Infographics, Tables or Graphs in large numbers to explain performance data. An implication is that in the future, regulators may need to consider creating a framework and further guidelines

around how these communication tools can be used within the Quality Account to further enhance understandability.

A further implication is that while prior research has found that Infographics, Tables and Graphs assist understanding (6,7,10,13], graphs are more widely used in this instance. The management of HHS may use this research to embed more graphs in their Quality Accounts. Infographics are a newer way of presenting data, and these could also become more utilised in future Quality Accounts.

Why the Victorian Government removed the purpose and aim from the Quality Account is not evident. Even with the removal, this research has shown there is little differences in how Infographics, Tables or Graphs were used over the four years. Quality Accounts are produced based on content targeted for a specific community and may help explain why there were no real differences.

The main limitation of this study is that it looked at six HHS in a specific regional area of Victoria over four years, so caution should be taken when making generalisations about larger populations based on these results [24,25]. However, opportunities exist to expand this study into other HHS across regional and rural areas and over a longer period. Of interest here is the announcement that due to the COVID-19 pandemic, public health services were not required to submit a Quality Account for 2020-21 [33].

Future academic research could also be undertaken from other perspectives. Firstly, the effectiveness of the Quality Account in engaging the community and meeting stakeholders' information needs could be independently confirmed. Currently, the HHS is self-regulating how effective they are at engaging the community and gaining feedback about how they are at meeting community needs. Independent research could undertake interviews or surveys with community members to understand how effective the Quality Account meets their information requirements about performance care. It would also be interesting to determine how much information users can understand in the Quality Account report and what benefits the report gives them.

There is also an opportunity to expand this study by determining what type of data is included in each communication tool. For example, what actual performance data is usually conveyed by tables, and what is data is more suited to graphs? This research was primarily a content analysis and did not go into the details of the information portrayed. However, some research has indicated that emergency care may be best displayed through graphs [7].

A further question to be considered is whether Infographics, Tables and Graphs are being used as impression management tools instead of assisting understandability and supporting accountability and transparency. Previous literature in this area confirms that communication tools can be used for impression management where visuals can be systematically manipulated to project a favourable image [34]. Zhang [35] also suggests that positive or neutral financial performance is presented using vivid graphs, so nonprofessional investors perceive the results as better than they are.

Finally, the scope of this study was restricted to the Quality Account and did not consider the financial statements and supporting financial notes. Infographics, Tables and Graphs may be included in these reports, and a similar study could be targeted to the Annual Reports of HHS to see how these communication tools are used.
Observations of academic literature suggest the Victorian HHS publicly available reports are an under-researched area, and there exist opportunities to undertake additional research on these entities. This particularly study is useful to HHS, particularly as they continually try to meet their accountability and the understandability of their operational performance.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

References

1. Victorian Government (2016). Victorian quality account Reporting guidelines for 2015–16. Available at https://www2.health.vic.gov.au/about/publications/policiesandguidelines/victorian-quality-account-reporting-guidelines-2015-16 [verified 31 October 2020].
2. Canaway R, Bismark M, Dunt D, *et al.* What is meant by public Stakeholder views on strengthening impacts of public reporting of hospital performance data. *Social Science & Medicine* 2018; 202: 143-150.
3. Zaga C, Leggat SG, Hill S. Partnering with consumers in the public reporting of quality of care: review of the Victorian quality of care report. *Aust Health Rev* 2018; 42, 550-556.

4. Islam, M. The Influence of Politics on Accountability of Health Professionals in Bangladesh: An Analysis of the Quality of Health Service Delivery. *Asia Pacific Journal of Health Management* 2017; 12: 1, 75-82.
5. Victorian Government (2019). Victorian quality account Reporting guidelines for 2018–19. Available at https://www.bettersafercare.vic.gov.au/our-work/governance/quality-accounts [verified 31 October 2020].
6. Cox R, de Goeij P. Infographics and Financial Decisions. Available at https://www.netspar.nl/assets/uploads/P20200624_Netspar-Design-Paper-148-WEB.pdf [verified 31 October 2020].
7. Victor S, Farooq, A. Dashboard Visualisation for Healthcare Performance Management: Balanced Scorecard Metrics. *Asia Pacific Journal of Health Management* 2021; 16(2): i625. doi:10.24083/apjhm.v16i2.625
8. Mindu T, Kabuyaya M, Chimbari MJ. Edutainment and infographics for schistosomiasis health education in Ndumo area, Kwazulu-Natal, South Africa. *Cogent Medicine* 2020; *7*(1): 1-18.
9. Chwastiak M, Young JJ. Silences in Annual Reports. *Critical Persp on Acc* 2003; 14(5): 533-552.
10. Dunlap JC, Lowenthal PR. Getting graphic about infographics: design lessons learned from popular infographics. *J of Visual Literacy* 2016;*35*(1): 42-59.
11. Hall J. Infographics and Annual Reports for Nonprofit Organizations. Available at https://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?article=1119&context=grcsp [verified 15 November 2020].
12. Jahan S, Al-Saigul AM, Alharbi AM. Assessment of health education infographics in Saudi Arabia. *Health Ed J* 2021; 80(1): 3-15.
13. Courtis, JK. Corporate Annual Report Graphical Communication in Hong Kong: Effective or Misleading. *J of Bus Comm* 1997; 34(3): 269-288.
14. Frownfelter-Lohrke C, Fulkerson CL. The Incidence and Quality of Graphics in Annual Reports: An International Comparison. *The J of Bus Comm* 2001; 38(3): 337-358.
15. Beattie V, Dhanani A, Jones MJ. Investigating presentational change in UK annual reports: a longitudinal perspective. *J of Bus Comm* 2008; 45(2): 181-222.
16. Usmani M, Davison J, Napier, CJ. The production of stand-alone sustainability reports: visual impression management, legitimacy and functional stupidity". *Acc Forum* 2020; 44(4): 315-343.
17. Varachia Z, Yasseen Y. The use of graphs as an impression management tool in the annual integrated reports of South African listed entities. *J of Eco and Fin Sci* 2020; 13(1): 1-11.
18. El-Haj M, Alves P, Rayson P, *et al.* Retrieving, classifying and analysing narrative commentary in unstructured (glossy) annual reports published as PDF files. *Acc and Bus Res* 2020; 50(1): 6-34.
19. International Accounting Standards Board (2017). Disclosure Initiative - Principles of Disclosure. Discussion Paper DP/2017/1. Available at https://cdn.ifrs.org/content/dam/ifrs/project/disclosure-initative/disclosure-initiative-principles-of-disclosure/discussion-paper/published-documents/discussion-paper-disclosure-initiative-principles-of-disclosure.pdf [verified 19 February 2021].
20. Peterson BK. Tables and Graphs Improve Reader Performance and Reader Reaction. *J Of Bus Comm* 1983;20(2): 47–55.
21. Vessey I. Cognitive Fit: A Theory-Based Analysis of the Graphs Versus Tables Literature. *Dec Sci* 1991; 22(2): 219–240.
22. Nicol J, Wilks J, Wood M. Tourists as inpatients in Queensland regional hospitals. *Aust Health Rev* 1996; 19: 55-72.
23. Regional Development Victoria. Victoria's Gippsland Region. Available at https://www.rdv.vic.gov.au/victorias-regions/gippsland [verified 8 August 2020].
24. Selvanathan A, Selvanathan S, Keller G, et al. Australian Business Statistics (2nd ed.). Melbourne: Cengage Learning Australia
25. Clark KR, Veale BL. Strategies to Enhance Data Collection and Analysis in Qualitative Research. *Radiologic Tech* 2018; 86(5): 482CT – 485CT.
26. Metrworks. Mathematics. Available at https://sites.google.com/site/mathclc/graphs#:~:text=A%20table%20is%20a%20set,organizing%20numerical%20information%20or%20data [verified 12 September 2020].
27. Collins Dictionary. Definition of 'graph'. Available at https://www.collinsdictionary.com/dictionary/english/graph [verified 12 September 2020].
28. Bass Coast Health. Annual Report 2018-2019. Available at https://www.gha2.net.au/site/DefaultSite/filesystem/uploads/20200930130953436 7/BCH%20Annual%20Report%202018-19_FINAL-for-web.pdf [verified 12 August 2020].

29. West Gippsland Healthcare Group. Annual Report 2018-19. Available at https://www.gha2.net.au/site/DefaultSite/filesystem/uploads/20161117142152393 1/WGHG%20Annual%20Report%202016_final.pdf [verified 12 August 2020].
30. Central Gippsland Health. Annual Report 2018-19. Available at http://www.cghs.com.au/wp-content/uploads/2020/01/cgh-annual-report-2019-ReducedSize.pdf [verified 12 August 2020].
31. Beattie V, Jones MJ. A Comparative Study of the Use of Financial Graphs in the Corporate Annual Reports of Major U.S. and U.K. Companies. *J of Int Fin Man and Acc* 1997; 8(1): 35-68.
32. Falschlunger LM, Eisl C, Losbichler H, *et al.* Impression management in annual reports of the largest European companies, A longitudinal study on graphical representations. *J of App Acc* 2015; 16(3): 383-399.
33. Victorian Agency for Health Information. available at https://www.bettersafercare.vic.gov.au/support-and-training/clinical-governance/quality-accounts [verified 22 May 2021].
34. Cho CH, Michelon G, Patten DM. Impression Management in Sustainability Reports: An Empirical Investigation of the use of Graphs. *Acc and the Pub Interest* 2010; 12(1): 16-37.
35. Zhang J. The Impact of Vivid Graphical Presentation of Financial Information in Digital Annual Reports on Investors' Impressions of Management and Firm Performance. *J of Inf Sys* 2020; 34(3): 233-253.

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

DETERMINING THE BARRIERS TO ACCESS DENTAL SERVICES FOR PEOPLE WITH A DISABILITY: A QUALITATIVE STUDY

Nicholas Liu[1], Maxine Drake[2], Estie Kruger[1], Marc Tennant[1]

1. School of Human Sciences, The University of Western Australia, Perth, Australia
2. Developmental Disability Western Australia, Perth, Australia

Correspondence: estie.kruger@uwa.edu.au

ABSTRACT

AIM:

To determine the perceptions of carers of people with a disability in terms of the problems they face in accessing dental care.

METHOD:

The survey was based on the modified Penchansky's 5A classification. It focused on members of a local disability support agency and was completed as part of their ongoing quality improvement processes.

RESULT:

A total of 169 carers took part, with a quarter indicating that the person they cared for did not have a regular dentist. Nearly 25% of the participants found it extremely difficult to obtain appropriate oral health care. Amongst the participants 10% had to abandon dental treatment due to difficulties, while 13% have yet to receive any sort of dental care. Amongst school-aged children, 64.5% were unable to receive dental care from the school dental service.

CONCLUSION:

The study was conducted to obtain an insight and understanding of how people with a disability and their primary caregivers experience dental care. Several concerns were identified, with most related to the process of providing care (patient-professional interaction factors) and the structure of the dental health system and its operation (factors related to access, affordability and information systems.) Targeted strategies aimed at providing affordable and appropriate services to people with disabilities should be prioritised.

SO WHAT?

The study showed emerging concerns among the participants relating to providing information regarding dental care options, as well as concerns regarding the availability and accessibility of the services. Further research will be conducted using the standardized tool the Measure of Processes of Care, and findings will translate to help initiate a program with the help of Developmental Disability Western Australia to provide information.

KEYWORDS

disability, dental care, access, Australia.

INTRODUCTION

The World Health Organisation's (WHO) global disability action plan 2014–2021, defines disability as "an umbrella term for impairments, activity limitations and participation restrictions, denoting the negative aspects of the interaction between an individual (with a health condition) and that individual's contextual (environmental and personal) factors" [1]. According to the WHO it is estimated that more than 1 billion people are living with any sort of disability, and this accounted for roughly 15% of the global population, or one in seven people [1]. In 2019 the Australian Institute of Health and Welfare (AIHW) reported that about 4.4 million people in Australia, or about 18% of the population, have a disability [2].

The population distribution of disability status is not even, with prevalence rates of disability higher in women, older people and people from lower socio-economic status [1,2]. Numerous studies have been conducted enumerating various barriers to accessing health care for people living with a disability [1-5]. These barriers include longer waiting times, affordability of the services, limited availability of the services, difficulty accessing facilities and buildings, discrimination by health professionals, lack of communication between different health services and insufficient skills and knowledge of health professionals [6]. Disability is recognized not only as a global public health issue, but also a basic human rights issue [1,4,5,7]. People living with a disability have equal rights to have good oral health and should enjoy equal access to health care and equal quality of health care [4, 5,7-9].

Previous studies showed that people with a disability have a higher risk of having dental caries and periodontal disease, coupled with poorer oral hygiene than people without disabilities [1,4,5,8,10-12]. A major portion of people living with a disability also depend on carers for their oral hygiene and dental visits [3,13]. The dental treatment of people with a disability is also more time consuming and requires additional emotional and physical involvement from health professionals along with their primary care givers [4, 14]. All these factors play a significant role in placing a burden on the total quality of life of the affected individual, his/her immediate family, and the community in which they live.

The disability sector in Western Australia (WA) consists of a combination of both government and non-government services. This can be confusing for families in navigating the system. Local area co-ordinator (LAC) services are there to support families however, and their primary function is to assist with the co-ordination of various services (Disability Services Commission WA 2003).

Against this background, a survey was carried out amongst members of a disability support agency in Western Australia, one of the States in Australia. The aim of this study was to obtain an insight and understanding of how people with a disability and their primary caregivers experience dental care and access to dental services.

MATERIALS AND METHODS

SURVEY DESIGN

The survey was designed by a small community reference group of local advocates working for Developmental Disability WA. The membership of the group included people with any disability and their families residing in Western Australia.

This survey (anonymous questionnaires) focused on members of a local disability support agency, and was completed as part of the agency's ongoing quality improvement processes. The opportunistic survey was completed in the middle of 2016 and was carried out to identify problems relating to dental service access. Secondary analysis of these questionnaires was then carried out.

DATA COLLECTION

The survey was conducted using Survey Monkey online services, with anonymous open-ended questions. The answers to the survey questions were in the form of yes and no options, with an open section for qualitative expression of their views. The participants were the primary care givers or family members reporting on behalf of the person living with a disability.

These anonymous questionnaires were then reviewed and deductively mapped to their related themes based on the modified Penchansky's definition of access [16,17]. According to Penchansky and Thomas, access reflects the fit between characteristics and expectations of the health providers and their clients. They grouped these characteristics into five as of access to care: affordability, availability, accessibility, accommodation, and acceptability. A sixth dimension, namely awareness, was

later added to a modified version of the framework 16,17]. A total of 8 questions in the survey were related to access. Ethics approval: Ethics approval was sought (and exemption provided) from the Human Ethics Committee at The University of Western Australia (RA/4/20/4088).

RESULTS

QUANTITATIVE STUDY

There were a total of 169 participants who were the primary carers or family members of a person with a disability, and among those, 24% did not have any regular dentist (Figure 1). Amongst the participants, 28% found it extremely difficult or nearly impossible to provide proper daily oral care for the person with a disability (Figure 2). The majority of the participants (79%) also reported as having difficulties in participation when receiving dental examinations or treatment (Figure 3). Participants who responded that it was "extremely difficult" to provide proper oral care for the person living with a disability, were 8 times more likely to respond that the person living with a disability had difficulties to participate in dental treatment or examination (Figure 3).

One in ten (9.7%) of the participants indicated that dental treatment of the person with a disability had to be abandoned due to difficulties, while 13% have yet to receive any sort of dental care (Figure 4). Among the participants who had school-aged children with any disability, the vast majority (64.5%) faced the problem of the school dental service being unable to provide their treatment (Figure 5).

FIGURE 1. PERSONS WITH A DISABILITY HAVING A REGULAR DENTIST.

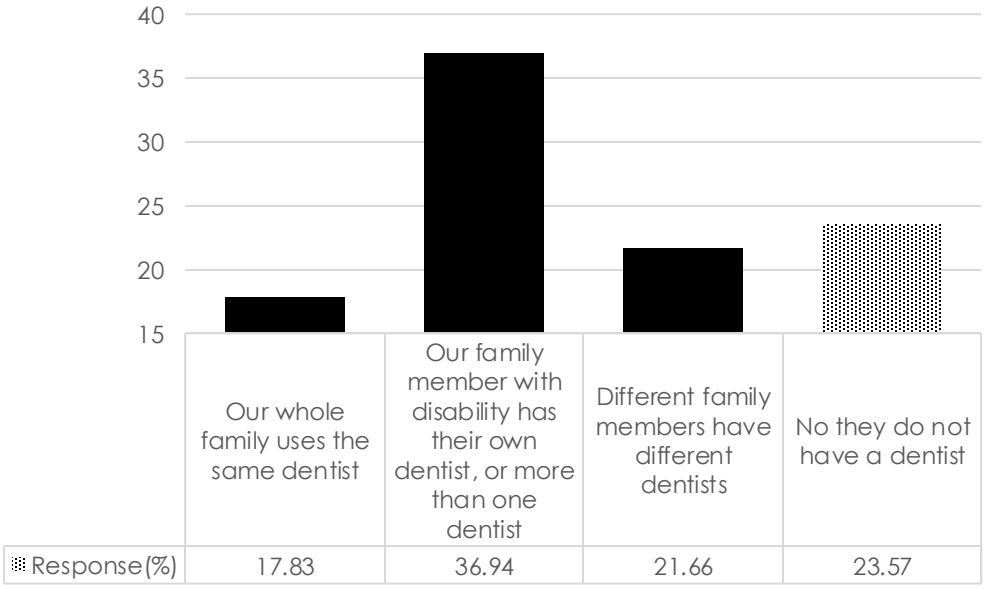


FIGURE 2. EASE OF TEETH CLEANING

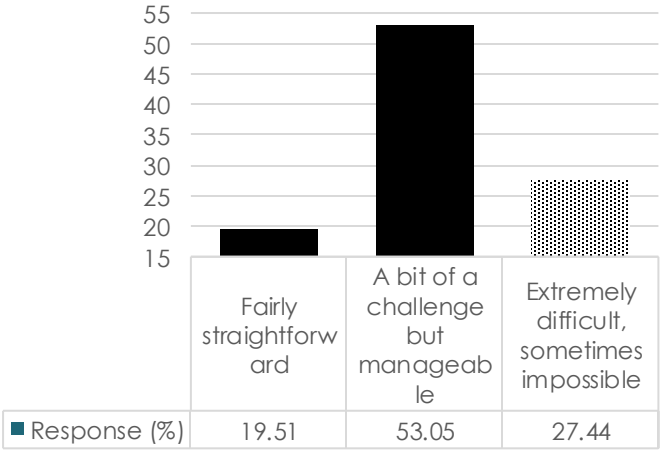


FIGURE 3. ABILITY AND CAPACITY OF PERSON WITH INTELLECTUAL DISABILITY TO PARTICIPATE IN DENTAL EXAMINATIONS AND TREATMENT

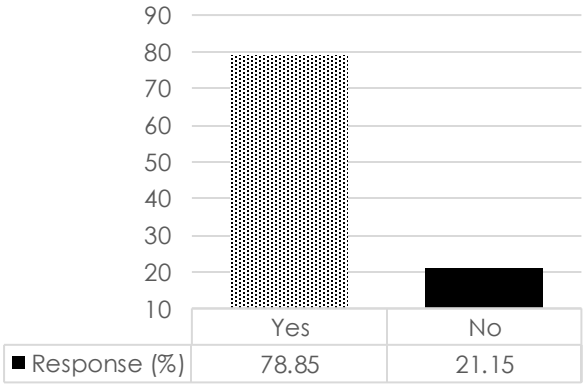


FIGURE: 4. ACCESS TO DENTAL TREATMENT.

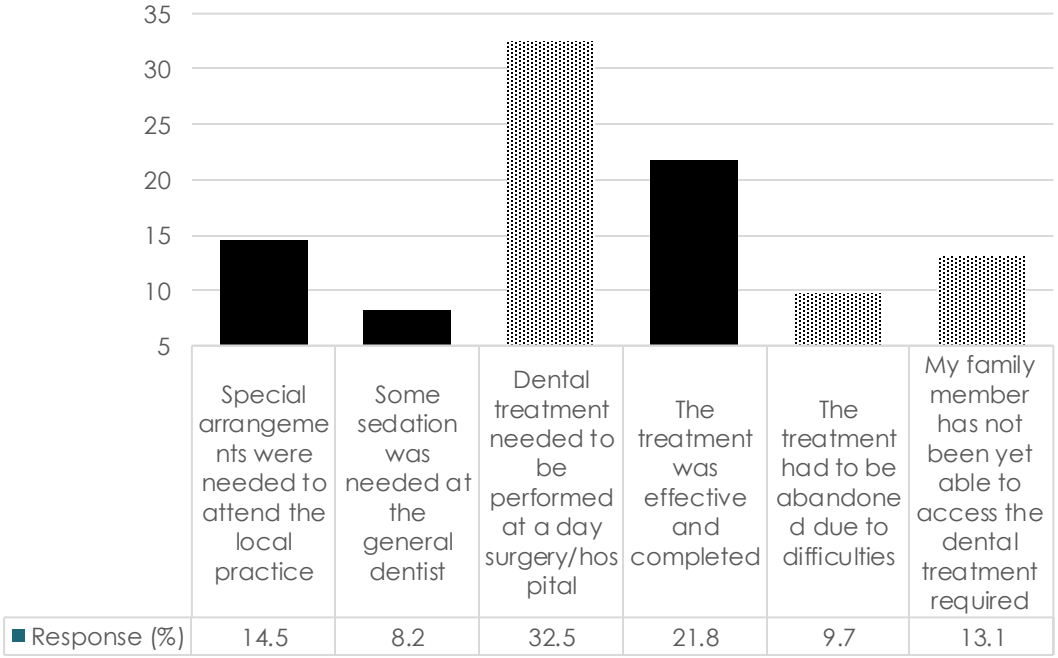
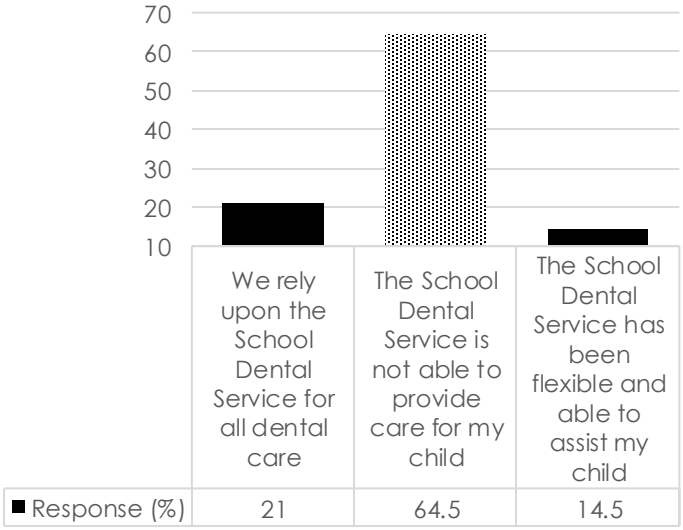


FIGURE 5. EXPERIENCE WITH SCHOOL DENTAL SERVICES



QUALITATIVE STUDY

Open-ended questions provided the opportunity for participants to share their views and experiences in terms of accessing dental care. Their perceptions were analysed and themed according to the five dimensions of the term "accessibility" [16,17] as proposed by Pechancsky:

AVAILABILITY

Availability measures the extent to which the provider has the requisite resources, such as personnel and technology, to meet the needs of the client. The participants reported lack of service, long waiting times, or refusal of dental care either due to inappropriate dental equipment or no dentist available to meet the special needs of people with a disability.

"Still waiting to hear from dental surgery about his treatment for surgery and braces but it's been 3yrs so I think it won't happen."

"My child (now 28) requires an anaesthetic every 3 - 5 years for dental treatment. If these treatments had been closer together, she would not have needed to have 9 extractions at the second to last operation. I do not like having to wait months for a simple check-up at dentist - a procedure that should be carried out regularly every 12-18 months without me reminding them, and I am very angry at being told there was a two year waiting list for treatment in 2013, a wait I managed to get down to one year after writing to members of parliament and others, although we still had to travel to Perth because she is supposedly an anaesthetic risk."

"The waiting list for my son to see an Orthodontist I have been told is about 2 years. What if this is too late? Some of his adult teeth are coming through as a double tooth with the adult tooth above the baby tooth. More needs to be done so the wait list isn't so long."

"He had tooth pain and was on a waiting list for six weeks until we could get him seen. During that time, I had to give him pain relief and because he was so distressed by the pain he pulled out 3 of his teeth one of them with the roots intact. Psychologically this was extremely difficult to have to see my child go through this not to mention the distress he was in."

"The negatives was the time it took to access emergency dental services the first time took six weeks the second time a month. I think this is way too long for a child to be in pain and almost caused me to have a nervous breakdown due to stress."

ACCESSIBILITY

Accessibility refers to geographic accessibility, which is determined by how easily the client can physically reach the provider's location. The participants did not visit a dentist because the service was too far or the service was not optimised structurally and functionally for them to access.

"It's all too far away school clinics should be for all school kids disabled or not why should we have to stressfully travel?"

"We travel a long way for my son to visit the private practice of the paediatric dentist he had previously as they have a good relationship, but this is not ideal, and not affordable."

"In general, the health system has been accommodating of the challenging behaviours etc. but a negative is travelling to city (a long distance for home) to have dental work done. Not been told clearly what happening on the day etc...."

"Attending general practise dentists is expensive and many of them don't cater for wheelchairs, due to restricted spaces, many being in older renovated homes."

AFFORDABILITY

Affordability is determined by how the provider's charges relate to the client's ability and willingness to pay for services The participants reported insufficient financial funds, extra out of pocket payments, and dental services being too expensive.

"I have 2 children with autism. Both of them need to be sedated in day hospital for basic treatment e.g. fillings, baby teeth removal. It was very expensive. Despite having private health insurance, I was out of pocket $2800.00. I am dismayed that private practice dentists don't recognise the health concession card and charge well above the rate that health insurers cover, hence why I was so much out of pocket."

"Very good service but user pay and expensive will exclude a lot of people on low income. Anything more detailed means seeing a specialist in Perth. 4.5 hours away. Careful

coordination must happen regarding X-rays need a cons first then treatment needs to be next day or means another trip, no subsidy huge addition of costs need accommodation and transport."

"Living in the country, on a low income and reliant on the public dental clinic means that there is little ability to meet the dental care needs for someone who requires anaesthetic for treatment unless we take a trip to Perth (at our own cost - not covered by Patient Assisted Transport) so it gets put in the too hard basket, with the hope that there is not a crisis requiring urgent dental treatment."

"We access the special needs dental centre, though it can be unreliable. I'm a student so struggle with the costs associated with dental care for my son to access private, though have the entry considered doing that instead."

ACCOMMODATION

Accommodation reflects the extent to which the provider's operation is organized in ways that meet the constraints and preferences of the client. Of greatest concern are hours of operation, how telephone communications are handled, and the client's ability to receive care without prior appointments. The participants reported negative experience with booking appointments and a poor referral system.

"All previously mentioned - HUGE Stress to go to Perth for dental work and especially as they will not book him for surgery over phone and make us go back and forth... cannot express the impact this has on our family and little son."

"And despite URGENT need, it took weeks to get a Princess Margaret Hospital dental appointment, made to drive 900km round trip for exam and back for surgery again.... HUGE impact for a super stressed little boy. He was in severe pain and could be again now whilst we wait again just for a check-up."

"We have only seen school dental once, we attend the special needs dental clinic in North Perth. Even then it's never regular enough and I always have to ring and follow up even though they say he will get a recall!"

"We were referred by school dental nurse as it was identified that my child had a need for a filling and my child would not sit for the work and would need sedation, it took couple of months before we could then see to the school dental dentist who then referred us to the special needs dentist for the same reason, it took a few more months to get into the special needs dentist who agreed my child would not sit for the work required and would require sedation, we were then referred to PMH, it took a few more months and then when we were seen by the dental nurse there they agreed again that my child would not sit for the work and would require sedation and there was a one year wait list however if the tooth got infected and formed an abscess I should come in for emergency. I then opted to go private to the paediatric dentist and had it sorted in 6 weeks, unfortunately it took us so long getting referred from service to service that my child had to have the tooth removed completely."

ACCEPTABILITY

Acceptability captures the extent to which the client is comfortable with the more immutable characteristics of the provider, and vice versa. These characteristics include the age, sex, social class, and ethnicity of the provider (and of the client), as well as the diagnosis and type of coverage of the client. The participants reported feelings of insecurity and discrimination at the dental service. Many also reported a negative attitude of the dentist or staff and their knowledge of how to handle people with a disability.

"Dentist experience as a toddler was horrific and extremely traumatising. Dentist rammed a piece of polypipe in his mouth and examined his teeth while he screamed (held him down)."

"When my son initially attended a paediatric dentist, despite them having a very good reputation, they did not accommodate for my son at all. Consultations were rushed, I was encouraged to restrain my son so that examinations could take place, and my son's anxieties increased."

"Some dentists are totally unaware of the needs of children with autism, and how enormously stressful they find the experience from a sensory perspective. Extreme patience and kindness is required!"

"I would never recommend this service, I explained the situation and asked for the first appointment they told me they understood ASD and yet they shoved a mirror in his mouth never explaining what they were going to do (this was his first dentist appointment) then a polisher my son became very anxious and they started telling him to be still

I tried to intervene but was told they know what they are doing, I couldn't get out of there quick enough."

"I tried using the School Dentist, but they had no understanding of ASD and refused any of my advice and made his first dental session extremely scary and had no idea the damage they had done, nor did they care. I am furious that the public dentist are so uncaring including admin staff."

AWARENESS

Awareness refers to a service that is aware of the local context and population need (and could then provide more appropriate and effective care), and patients could better access and use such services if they were simply aware of them in the first place. The participants had poor oral health awareness and little knowledge of the services available and their options.

"Are there any private dentists/oral surgeons who are prepared to treat people with high intellectual and physical needs? At this stage I see there is no advantage to my sister having private medical as she does not receive any benefit - cannot choose any practitioner, cannot receive immediate treatment. Sadly, even money can't buy her service/treatment."

"14-year-old son with intellectual disability finished primary school end of 2014; no more school dentists appointments have been made (I thought they were to be until end high school (?)) - So, he will commence seeing our family dentist in January 2016."

"We have never known that school has a dental service for special need kids."

"The fact is that my child is now out of the age range to access School Dental Services. Unsure of where to go for ongoing dental services."

"Princess Margaret Hospital have been great, but my son is now at the age he won't be able to access princess Margaret so need to know where to go."

"Regional Hospital does not seem to be geared to dental work at all-no facility to take x rays while under anaesthetic, very little time allocated to dentists. Dr Y used to be available but not last year. Dr X was fantastic. Where do we go next time?"

DISCUSSION

This study provides insight to the perspectives and experiences of the members of Developmental Disability WA in regard to dental care and barriers to access dental services.

Findings showed that many participants did not have a regular dentist, some have not received any dental care at all, and many commented that dentists were not aware of the needs of people with disabilities and did not have adequate experience to manage their care. Previous studies have shown the lack of trained special care dentists as a barrier to access of dental care for people with a disability [3-7], which also result in longer waiting times.

School dental services were also not able to provide appropriate services to children with disabilities. The results overall is an indication of problems with availability and accessibility of services, and other specific service-related issues, such as inadequate knowledge and experience of staff, and lack of infrastructure. Similar problems have been identified in a U.S study [20], and many studies have also shown that access to dental care and dental visits was generally better for people living in dedicated care institutions than those living independently or in family homes [3,5,18]. The participants in this study were mostly living independently or in family homes, thereby encompassing people at higher risk for experiencing unmet dental needs [3, 5, 18].

Similar problems with affordability and accessibility, including cost, travel distances, waiting times, wheelchair access, and disability parking have also been highlighted by previous studies [3-7, 22-23]. Patients in this study also reported feelings of discrimination, insecurity, anxiety and fear. A recent study from Canada [8] also reported the experience of discrimination and insecurity among wheelchair users, where many participants reported feeling insecure in a dental chair. It is also seen that some people with a disability are unwilling to seek dental care due to feelings of discrimination [8]. In 2019 the AIHW reported that about 42% of the reports lodged to Australian Human Rights Commission are about disability discrimination [2].

The Measure of Processes of Care (MPOC) is the instrument used to measure the success of a family-centred service [19], and it is used to measure the range to which the

provided services are family centred. It includes the following five domains: Enabling and partnership; providing specific information; providing general information; respectful and supportive care; and co-ordinated and comprehensive care. A previous survey [19] showed that the highest rated domain was 'respectful and supportive care' while 'providing general information' was rated as the worst. Many participants in the current survey also reported issues with the lack of an appropriate information system, especially around referral pathways. The reported lack of general information confirms findings of other studies using the MPOC, which showed that providing general information was rated the lowest in their study [19,21].

In Australia's National Oral Health Plan 2015-2024, "people with additional and/or special health care needs" is listed as one of the four priority populations in Australia that experience the most significant barriers to accessing oral health care and have the greatest burden of oral disease [24]. Overall, findings in this study support this, and identified both structure and process-related problems. In the public sector the structure-related problems, such as spatial access, lack of facilities, service availability, unclear information, affordability, referral pathways, resource shortages and waiting lists, can be improved at a health service/system level. Data collection on exactly where services are most needed, and at what level, is necessary, with ongoing monitoring. Targeted and sustainable strategies aimed at providing affordable or subsidised, appropriate services and interventions to people with disabilities should be prioritised.

Process-related problems mostly identified issues in terms of the patient-professional interaction, with comments on behaviour management skills and experience of dental health professionals, as well as shortages in special needs dentistry specialists. This indicates a need for improved training and competency of dentists in the management and treatment of patients with special needs, as well as building a specialist workforce capacity to meet the identified needs.

CONCLUSION

The study was conducted to obtain an insight and understanding of how people with a disability and their primary caregivers experience dental care. Several concerns were identified, with most related to the process of providing care (patient-professional interaction factors) and the structure of the dental health system and its operation (factors related to access, affordability and information systems.) Targeted strategies aimed at providing affordable and appropriate services to people with disabilities should be prioritised.

CONFLICTS OF INTEREST

None to declare

References

1. World Health Organization. WHO global disability action plan 2014-2021. Better health for all people with disability. ISBN 978 92 4 150961 9. Available at: https://www.who.int/publications/i/item/who-global-disability-action-plan-2014-2021
2. Australian Institute of Health and Welfare 2020. People with disability in Australia 2020. Canberra: AIHW. Available from: https://www.aihw.gov.au/reports/disability/people-with-disability-in-australia/contents/people-with-disability/prevalence-of-disability
3. Pradhan A, Slade GD, Spencer AJ. Access to dental care among adults with physical and intellectual disabilities: residence factors. Australian Dental Journal. 2009 Sep;54(3):204-211.
4. Gerreth K, Borysewicz-Lewicka M. Access Barriers to Dental Health Care in Children with Disability. A Questionnaire Study of Parents. Journal of Applied Research in Intellectual Disabilities. 2015; 29. 10.1111/jar.12164.
5. Sermsuti-Anuwat N, Pongpanich S. Perspectives and experiences of Thai adults using wheelchairs regarding barriers of access to dental services: a mixed methods study. Patient Prefer Adherence. 2018;12:1461-1469.
6. da Rosa SV, Moysés SJ, Theis LC, Soares RC, Moysés ST, Werneck RI, Rocha JS. Barriers in Access to Dental Services Hindering the Treatment of People with Disabilities: A Systematic Review. International Journal of Dentistry. 2020; vol. 2020, ID 9074618, https://doi.org/10.1155/2020/9074618
7. McColl M, Forster D, Shortt S, Hunter D, Dorland J, Godwin M, et al. Physician Experiences Providing Primary Care to People with Disabilities. Healthcare Policy. 2008;4(1):e129-e47.
8. Rashid-Kandvani F, Nicolau B, Bedos C. Access to Dental Services for People Using a Wheelchair.

American Journal of Public Health. 2015;105(11):2312–2317.

9. Dougall A, Fiske, J. Access to special care dentistry, part 1. Access. British Dental Journal. 2008; 204. 605-16. 10.1038/sj.bdj.2008.457.
10. Anders PL, Davis EL. Oral health of patients with intellectual disabilities: A systematic review. Special Care Dentistry 2010; 30: 110–117. doi:10.1111/j.1754-4505.2010.00136.x
11. Kancherla V, Van Naarden Braun K, Yeargin-Allsopp M. Dental care among young adults with intellectual disability. Research in Developmental Disabilities. 2013; 34 1630–1641 http://doi.org/10.1016/j.ridd.2013.02.006
12. Owens PL, Kerker BD, Zigler E, Horwitz SM. Vision and oral health needs of individuals with intellectual disability. Mental Retardation and Developmental Disabilities Research Reviews. 2006;12(1):28-40. doi:10.1002/mrdd.20096
13. Cumella S, Ransford N, Lyons J, Burnham H. Needs for oral care among people with intellectual disability not in contact with community dental services. Journal of Intellect Disability Research. 2000; 44:45-52. DOI: 10.1046/j.1365-2788.2000.00252.x
14. Burtner AP, Jones JS, McNeal DR, Low DW. A survey of the availability of dental services to developmentally disabled persons residing in the community. Special Care in Dentistry. 1990;10, 182–184.
15. Disability Services Commission WA (2003) Review of the Local Area Coordination Program, Western Australia. Disability Services Commission, Perth, Australia. Available at: http://www.derby.gov.uk/media/derbycitycouncil/contentassets/documents/adultsocialcare/WesternAustraliaGorvernment-Review-of-Local-Area-Coordination.pdf Accessed January 2017
16. Penchansky R, Thomas JW. The concept of access: definition and relationship to consumer satisfaction. Medical Care. 1981 Feb;19(2):127-40.
17. Saurman E. Improving access: modifying Penchansky and Thomas's Theory of Access. Journal of Health Services Research Policy. 2016;21(1):36-39. doi:10.1177/1355819615600001
18. Horner-Johnson W, Dobbertin K, Beilstein-Wedel E. Disparities in dental care associated with disability and race and ethnicity. Journal of the American Dental Association. 2015;146(6):366–374.
19. Dyke, P, Buttigieg P, Blackmore A, Ghose A. Use of the Measure of Processes of Care for families (MPOC-56) and service providers (MPOC-SP) to evaluate family-centred services in a paediatric disability setting. Child Care Health Development. 2006; 32, 167–176. doi:10.1111/j.1365-2214.2006.00604.x
20. Mofidi M, Rozier RG, King RS. Problems With Access to Dental Care for Medicaid-Insured Children: What Caregivers Think. American Journal of Public Health. 2002 ;92(1):53-8.
21. Raghavendra P, Murchland S, Bentley M, Wake-Dyster W, Lyons T. Parents' and service providers' perceptions of family-centred practice in a community-based, paediatric disability service in Australia. Child Care Health Development. 2007; 33: 586–592. doi:10.1111/j.1365-2214.2007.00763.x
22. Rocha LL, de Lima Saintrain VM, Pimentel Gomes Fernandes Vieira-Meyer A. Access to dental public services by disabled persons. BMC Oral Health. 2015;15:35.
23. Rouleau T, Harrington A, Brennan M, et al. Receipt of dental care and barriers encountered by persons with disabilities. Special Care Dentistry. 2011; 31(2):63–67.
24. COAG (Council of Australian Governments) Health Council 2015. Healthy mouths, healthy lives: Australia's National Oral Health Plan 2015–2024. Adelaide: South Australian Dental Service.

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

THE IMPORTANCE OF ENVIRONMENTAL SUSTAINABILITY FOR HEALTHY AGEING AND THE INCORPORATION OF SYSTEMS THINKING IN EDUCATION FOR A SUSTAINABLE ENVIRONMENT

Wang-Kin Chiu, Ben Y. F. Fong, Wing Yi Ho*

Division of Science, Engineering and Health Studies, College of Professional and Continuing Education, The Hong Kong Polytechnic University, Hong Kong, China

Correspondence: oscar.chiu@cpce-polyu.edu.hk

ABSTRACT

Environmental sustainability is important to public health and of particular significance considering the rapidly growing ageing population. While advancement in chemical science has contributed to enhanced quality of life, increasing levels of chemical pollutions and the impact of chemicals on human health and the environment have led to serious concern. The deterioration of environmental quality has been largely due to chemical pollution and the elderly group in the population are more susceptible to the hazardous effects of industrial chemicals and airborne pollutants. This situation also presents uphill challenges to the promotion of healthy ageing which requires a sustainable clean environment, contributed through the advancement of sustainable and green chemistry. However, innovations in green chemistry require a systems thinking mindset which is also important in realizing the impact of chemicals on human health and the environment. The adoption of the Sustainable Development Goals (SDGs) by the United Nations has called for immediate actions in adopting the SDGs as a central concern in the reform of different domains for the invention of a sustainable future. The practice of chemistry has various impacts on many interconnected systems, re-orientation of chemistry education has been proposed with the implementation of inter-disciplinary approaches as informed by systems thinking, with a growing number of reports suggesting its potentials and applications in chemical education. Despite the vast opinions suggesting the promising prospects of applying systems thinking in education, reports on the development of relevant tools and educational resources are only of a limited amount, with recent perspectives identifying the design of educational tools and resources as one of the priority areas. In this study, we report the collaborative work across the disciplines of health and chemical sciences in the pedagogic design of incorporating systems thinking in chemistry education adopting the theoretical framework. The design of a system-oriented concept map extension (SOCME) diagram is described, with reference to a case study of chemicals released from the degradation of plastics. The work presented illustrates the potential of systems thinking in sustainable education and adds to the collections of educational resources for incorporation of systems thinking in teaching and learning.

KEYWORDS

Environmental sustainability, healthy ageing, systems thinking, sustainable education.

INTRODUCTION

A green environment has long been regarded as an important factor contributing to human well-being, with a continued growth of studies reporting the associated psychological and physiological health benefits. [1, 2] In recent years, lower fertility rates and increase in life expectancy have led to the ageing of the world's populations, further intensifying the prominent need for a sustainable green environment. [3] A green environment is essential to support healthy ageing and the sustainability of a healthy environment is considered a top priority of major global health issues. While advancement of chemical technologies and various applications of chemicals have enhanced quality of life with a significantly added level of convenience to the public, the heavy use of chemicals is still of alarming concern and poses global challenges to environmental sustainability. The impact of chemicals on human health and the environment cannot be overlooked despite their versatile functions and various benefits brought to industrial processes and society. Extensive use of chemicals in daily life has led to chemical pollution posing a significant threat to human health. This is especially so for older adults who are more vulnerable to chemical attack, with the higher susceptibility of this population group resulting from weakened bodily functions and degeneration of organs. [4] For example, it has been well documented that exposure to fine particulate matter (PM2.5) is a leading risk factor which contributes substantially to a heavy global disease burden. [5] Long-term exposure to ambient air pollution is also reported to have led to decreased life expectancy and increased incidence of morbidity and mortality from cardiovascular disease, pulmonary disease and lung cancer. [6] In addition and not just limited to air pollution, various types of chemical contaminants released from different sources also contribute to serious water and food pollution, leading to further deterioration of environmental quality. Chemical pollution of water and food has been reported to pose significant health risks. Consumption of chemically contaminated food can have serious health implications ranging from minor gastric problems to fatal diseases. [7] It is noteworthy that one of the major sources of chemical pollution originates from daily consumption of a variety of chemical products. Recently, a comprehensive study has reported the production of greenhouse gases such as methane and ethylene from the widely used plastics. [8] The findings indicate that plastics is a hitherto unrecognized source of climate-relevant gases, with increasing impact on climate variation due to increased production and accumulation of plastics in the environment. In addition, human exposure to microplastics can lead to serious health consequences including disruption of immune systems, inflammatory lesions and neurodegenerative diseases. [9] Overall, the adverse health effects of chemical pollution are significantly aggregated due to population ageing, as well as increasing prevalence of non-communicable diseases over the recent decades. [5]

Under these circumstances, it is therefore not surprising to see the recent development of various strategies to reduce the use of hazardous chemicals, as well as the implementation of regulatory frameworks and policies for new chemicals. [10] In recent years, there has also been a growing amount of research investigating the advancement and applications of green chemistry and emerging technologies in the transformation of the chemical industry. In the interim, there are also emerging studies that have investigated sustainable chemistry and its development for achieving the Sustainable Development Goals (SDGs), as well as moving society towards a sustainable future. [2, 11, 12] While these research investigations are valuable contributions, it is noteworthy that health promotion and education also plays an important role in the achievement of a sustainable environment. Recent studies have also reported the importance of nurturing future global citizens and called for more educational research in the promotion of environmental sustainability through education. In the educational context, increasing studies have identified the promising prospects of incorporating systems thinking in the teaching of core science subjects, especially in chemistry education. [13] Chemistry is a central science and provides the fundamentals which link up different science disciplines. It plays an indispensable role in the contribution of inter-disciplinary efforts from various established and emerging science disciplines leading to the outstanding advancement of human health and well-being in the past decades. [14] While advancement of chemical science has contributed to the development of functional materials, pharmaceuticals, industrial processes and drug production, which leads to substantial enhancement of quality of life, however, attitudes towards chemical science and its practitioners by various stakeholders, including the

general public and policy-makers, have been complex and controversial. [15]

Chemistry continues to provide valuable sources of innovative processes and products. On the other hand, it is also criticized as one of the factors inadvertently attributing to the emerging global problems. The adoption of the Sustainable Development Goals (SDGs) by the United Nations has profound impact which calls for urgent actions for adopting the SDGs as a central concern in the reform of different domains for the invention of a sustainable future. [14] Notably, many contributions that chemistry can make for moving towards the SDGs require concerted efforts and close collaborations with other disciplines for identifying the practical and sustainable solutions. Therefore, it has been emphasized that the teaching and practice of chemistry should not be restricted within the specific subject content knowledge, while advocating an in-built consideration and integration of wider perspectives and relationships. [14, 16] This re-orientation of chemistry education has been proposed with the implementation of inter-disciplinary approaches as informed by systems thinking, with a growing number of reports suggesting its potentials and applications in chemical education. [13, 17, 18]

Recently, system-oriented concept map extension (SOCME) diagrams have been proposed as important visualization tools which serve as valuable resources for educators and students to adopt a systems approach in realizing some of the connections between isolated chemistry topics, as well as their dynamic interactions with many other systems. [13, 19] Currently, there are only a small number of studies reporting the pedagogic design of SOCME diagrams. Examples include the creation of two alternative SOCME diagrams regarding the famous Haber-Bosch process, which is a fundamental topic discussed in virtually all general chemistry reference books. [20] The reported SOCME diagrams illustrate the connections of the Haber process with the broader earth and societal systems. The design of SOCME also emphasizes the distinction between the renewable and non-renewable natural resource sub-systems involved in the production of the gas reactants, while highlighting the important linkage to global food security. Typical coverage of the Haber reaction reveals the common adoption of a reductionist approach and presentation of chemical processes as isolated systems, with due consideration of specific chemical principles and mathematical calculations. By adopting the systems thinking approach, the reported visualization tools have significant roles in the introduction of systems thinking to chemistry education which helps the practitioners and students to view a chemical reaction or process from a wider perspective instead of a reductionist coverage, as well as to realize the importance of a molecular basis of sustainability. [20]

The potential of SOCME and the limited reports on the design of relevant resources have prompted our interests in the current study. Here, we report the collaborative work across the disciplines of health and chemical sciences for the pedagogic design to incorporate systems thinking in chemistry education. Based on the theoretical framework of systems thinking in chemical education, an example of system visualization tools is presented based on a case study of chemicals released from the degradation of plastics. The work presented in this paper illustrates the potential applications of systems thinking in the educational context and adds to the collections of educational resources for incorporation of systems thinking in teaching and learning.

METHODOLOGY

The theoretical framework for developing and incorporating systems thinking in chemistry education, proposed by the Systems Thinking in Chemistry Education (STICE) project team, is adopted in this study. [21, 22] The framework describes the approach of visualizing a learner at the centre of a system with three interconnected subsystems, which are the Educational Research and Theories Node, the Chemistry Teaching and Learning Node, and the Earth and Societal Systems Node. The elements of orienting chemistry education to meet the environmental needs are the focus in this study. This approach is integrated with concepts of a molecular basis of sustainability as proposed by Anastas and Zimmerman which emphasizes the derived environmental concern on the basis of molecular considerations. [23] The material basis in the context of society and economy is considered while educational resources are designed in view of the need for chemistry practice and education to address important aspects related to the sustainability of earth and societal systems. [13] Challenges of applying systems thinking in educational contexts include the intrinsic complexity to both instructors and students. The implementation of systems thinking approaches and the delivery of teaching should be supported by appropriately designed teaching materials for which the development of relevant resources and activities has been identified as one

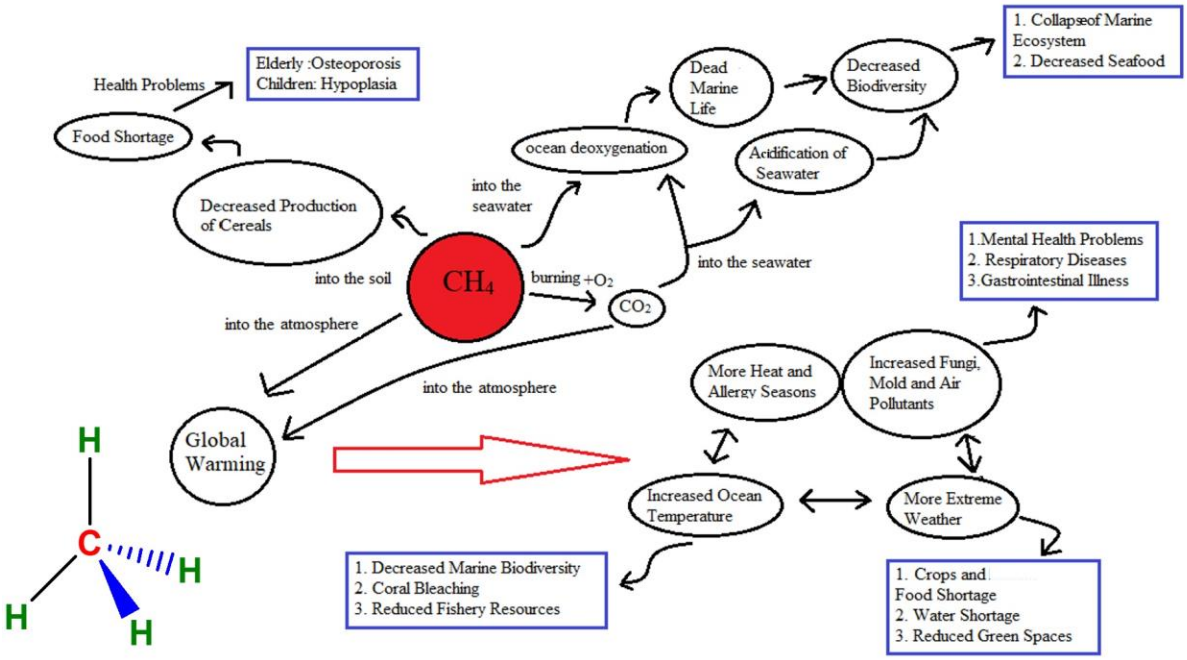
of the priority areas. [22] Regarding the delivery of lecture or learning content, added complexity would lead to difficulty in the expression and visualization of many interconnected ideas thereby leading to reduced learning motivation. Development of tools for visualizing the complex ideas instead of only word descriptions is an important step for implementation of systems thinking approaches in education. Taking reference from relevant studies reporting the creation of SOCME diagrams, a SOCME diagram focusing on methane (CH_4), an example of greenhouse gases, is presented in this study. The interconnections between this chemical compound with various systems including those of food supply, ecosystem and human health were identified. Recent findings on the impact of methane on these systems were reviewed and relevant effects were included to give an updated SOCME diagram. The identified components were linked by arrows to indicate the cause-and-effect relationships. In the design of the SOCME, the subject content and learning outcomes of a general-education (GE) chemistry course in the College were considered. The SOCME diagram would be delivered to students in the General Education subject to illustrate the application of systems thinking approach in the understanding of the various impacts that a simple molecule, released from daily consumption of chemical products, can bring to the environment and health systems. The delivery of the systems diagram in the teaching materials would be supported by the use of digital technology adopted in previous reports. [24]

RESULTS AND DISCUSSION

In this study, we have created a SOCME diagram based on methane, an example of chemical released from daily consumption of chemical products. The current work also represents an example of collaborative work across the disciplines of health and chemistry, contributing to the limited educational resources for incorporating systems thinking to view the big picture of chemical impact on the environment and health systems.

The extensive use of plastic products in daily life has aroused significant scientific and societal concern over human health and environmental sustainability due to the toxicity of plastics. [25] Recently, the study by Royer et al. reported the production of greenhouse gases from plastics which added further concern over the human and environmental health. [8] Methane is one of the greenhouse gases that may be produced in the degradation of some commonly used plastics such as polyethene (PE). PE is a very common polymer with extensive applications in our daily life. Its degradation can result in the release of methane, which is a discrete molecule having a simple structure. However, the release of this simple gas can lead to profound consequences to the environment, which are not easily realized if teaching is confined to restricted discipline with narrow perspectives. A student cannot just learn the scientific knowledge of chemicals without looking at the impact of extensive productions and uses of these chemicals. In addition to the teaching of specific subject content knowledge, emphasis should also be put on how the production and use of chemical products can have adverse effects on human health and the environment, as informed by systems thinking and facilitated with specific visualization tools. The linkage to other systems should be realized and reflected in the graphical tool to accomplish widened viewpoints in the process of learning. In addition to human health aspects, the impacts of methane on the atmosphere and marine systems are also considered. [26] These form the basis for the design of a SOCME diagram which considers the interconnections between this chemical release with various systems including the food supply, ecosystem and human health. The developed SOCME diagram is presented in Figure 1. The interconnections of the chemical system with specific components in dynamic systems of human and environmental health are indicated. The extent of boundaries was decided with reference to the subject content and learning outcomes of a general-education chemistry course in the College. The associated topics include chemicals in daily life and polymer materials.

FIGURE 1: SYSTEM-ORIENTED CONCEPT MAP EXTENSION (SOCME) DIAGRAM ILLUSTRATING THE INTERCONNECTIONS OF METHANE (CH_4) WITH OTHER SYSTEMS.



FUTURE WORK

While there is increasing advocacy for applying systems thinking in education for a sustainable future, reports on the development of relevant tools and educational resources for specific topics are only of limited amount. Future work includes further development of systems thinking resources for educators and students. [22] Furthermore, the possibility of supporting the implementation of systems thinking with emerging technologies in the digital era should be explored. [27] Teachers, researchers, academic and educational institutions, and government should work towards the adoption of systems thinking approach in school, college and community education for the promotion of population health and sustainability development of the world. Global citizens, particularly younger generations, must learn the significance and impact of health and the environment on lives on earth.

CONCLUSION

In this paper, we have demonstrated an example of collaborative efforts from health and science disciplines in applying systems thinking in the context of sustainable education. A SOCME approach and diagram, which signifies the interconnections of a chemical system with human health and environmental systems, has been developed and is presented. Further development of systems thinking visualization tools and resources for educators and students, as well as evaluation of the teaching practice, are worth investigating. Understanding the interconnections of the chemical system with the environment and health systems is important for sustaining a clean environment, which is an essential component for the promotion of healthy ageing. More concerted efforts across disciplines are imperative for incorporation of systems thinking in education for a sustainable future.

ACKNOWLEDGEMENT

The work described in this presentation was supported by a research grant from the College of Professional and Continuing Education of The Hong Kong Polytechnic University, Hong Kong, China (project reference no.: SEHS-TF-2021-005(J)).

References:

1. Haluza D, Schönbauer R, Cervinka R. Green Perspectives for Public Health: A Narrative Review on the Physiological Effects of Experiencing Outdoor Nature. International Journal of Environmental Research and Public Health. 2014;11(5):5445-61.

2. Sofia D, Gioiella F, Lotrecchiano N, Giuliano A. Mitigation strategies for reducing air pollution. Environmental Science and Pollution Research. 2020;27(16):19226-35.
3. Fong BYF, Chiu W-K, Chan WFM, Lam TY. A Review Study of a Green Diet and Healthy Ageing. International Journal of Environmental Research and Public Health. 2021;18(15):8024.
4. Simoni M, Baldacci S, Maio S, Cerrai S, Sarno G, Viegi G. Adverse effects of outdoor pollution in the elderly. Journal of Thoracic Disease. 2015;7(1):34-45.
5. Liang F, Liu F, Huang K, Yang X, Li J, Xiao Q, et al. Long-Term Exposure to Fine Particulate Matter and Cardiovascular Disease in China. Journal of the American College of Cardiology. 2020;75(7):707-17.
6. Cohen AJ, Brauer M, Burnett R, Anderson HR, Frostad J, Estep K, et al. Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015. The Lancet. 2017;389(10082):1907-18.
7. Rather IA, Koh WY, Paek WK, Lim J. The Sources of Chemical Contaminants in Food and Their Health Implications. Frontiers in Pharmacology. 2017;8.
8. Royer S-J, Ferrón S, Wilson ST, Karl DM. Production of methane and ethylene from plastic in the environment. PLOS ONE. 2018;13(8):e0200574.
9. Prata JC, da Costa JP, Lopes I, Duarte AC, Rocha-Santos T. Environmental exposure to microplastics: An overview on possible human health effects. Science of The Total Environment. 2020;702:134455.
10. Matus K. Factoring in Public Policy and Perception. How to Commercialize Chemical Technologies for a Sustainable Future2021. p. 103-18.
11. Barra R, González P. Sustainable chemistry challenges from a developing country perspective: Education, plastic pollution, and beyond. Current Opinion in Green and Sustainable Chemistry. 2018;9:40-4.
12. Matlin SA, Mehta G, Hopf H, Krief A, Keßler L, Kümmerer K. Material circularity and the role of the chemical sciences as a key enabler of a sustainable post-trash age. Sustainable Chemistry and Pharmacy. 2020;17:100312.
13. Mahaffy PG, Matlin SA, Holme TA, MacKellar J. Systems thinking for education about the molecular basis of sustainability. Nature Sustainability. 2019;2(5):362-70.
14. Matlin SA, Mehta G, Hopf H, Krief A. The role of chemistry in inventing a sustainable future. Nature Chemistry. 2015;7(12):941-3.
15. Matlin SA, Mehta G, Hopf H, Krief A. One-world chemistry and systems thinking. Nature Chemistry. 2016;8(5):393-8.
16. Talanquer V, Bucat R, Tasker R, Mahaffy PG. Lessons from a Pandemic: Educating for Complexity, Change, Uncertainty, Vulnerability, and Resilience. Journal of Chemical Education. 2020;97(9):2696-700.
17. Hardy JG, Sdepanian S, Stowell AF, Aljohani AD, Allen MJ, Anwar A, et al. Potential for Chemistry in Multidisciplinary, Interdisciplinary, and Transdisciplinary Teaching Activities in Higher Education. Journal of Chemical Education. 2021;98(4):1124-45.
18. Orgill M, York S, MacKellar J. Introduction to Systems Thinking for the Chemistry Education Community. Journal of Chemical Education. 2019;96(12):2720-9.
19. Aubrecht KB, Dori YJ, Holme TA, Lavi R, Matlin SA, Orgill M, et al. Graphical Tools for Conceptualizing Systems Thinking in Chemistry Education. Journal of Chemical Education. 2019;96(12):2888-900.
20. Mahaffy PG, Matlin SA, Whalen JM, Holme TA. Integrating the Molecular Basis of Sustainability into General Chemistry through Systems Thinking. Journal of Chemical Education. 2019;96(12):2730-41.
21. Mahaffy PG, Krief A, Hopf H, Mehta G, Matlin SA. Reorienting chemistry education through systems thinking. Nature Reviews Chemistry. 2018;2(4):0126.
22. Flynn AB, Orgill M, Ho FM, York S, Matlin SA, Constable DJC, et al. Future Directions for Systems Thinking in Chemistry Education: Putting the Pieces Together. Journal of Chemical Education. 2019;96(12):3000-5.
23. Anastas Paul T, Zimmerman JB. The Molecular Basis of Sustainability. Chem. 2016;1(1):10-2.
24. Chiu W-K. Implications for the Use of PowerPoint, Classroom Response Systems, Teams, and Whiteboard to Enhance Online Teaching of Chemistry Subjects in Community College. Journal of Chemical Education. 2020;97(9):3135-9.
25. Rodrigues MO, Abrantes N, Gonçalves FJM, Nogueira H, Marques JC, Gonçalves AMM. Impacts of plastic products used in daily life on the environment and human health: What is known? Environmental Toxicology and Pharmacology. 2019;72:103239.
26. Di P, Feng D, Chen D. The Distribution of Dissolved Methane and Its Air-Sea Flux in the Plume of a Seep Field, Lingtou Promontory, South China Sea. Geofluids. 2019;2019:3240697.
27. Chiu W-K. Pedagogy of Emerging Technologies in Chemical Education during the Era of Digitalization and Artificial Intelligence: A Systematic Review. Education Sciences. 2021;11(11):709

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

EVALUATING AN AUTOMATED TEMPERATURE-MONITORING SYSTEM IN MEDICINE AND VACCINE STORAGE FACILITIES OF A HOSPITAL NETWORK

Mazdak Zamani, Paul Wembridge

Eastern Health Pharmacy Department, Melbourne, Victoria, Australia

Correspondence: mazdak.zamani@easternhealth.org.au

ABSTRACT

OBJECTIVE

The aims of this study were to evaluate the effectiveness of a new automated continuous temperature monitoring system in detecting temperature excursions and describe the challenges of implementing such a system.

DESIGN

This study is an observational before-and-after audit comparing temperature excursions detected in the three months before and three months after the implementation of the new monitoring system at Eastern Health. Inclusion criteria consisted of all medicine and vaccine storage facilities monitored by the new automated temperature monitoring system. Four sites not connected to the new monitoring system were excluded.

SETTING

Eastern Health is a large tertiary metropolitan health service in Melbourne, Australia. It operates from 21 locations including seven teaching hospitals, with medicines and vaccines stored in 124 refrigerators, 6 freezers and 101 ambient room temperature storage locations.

MAIN OUTCOME MEASURES

An analysis of post-implementation data identified a potential association between refrigerator brands and temperature excursion rate.

RESULTS

There was a large increase in the number of temperature excursions detected post-implementation of the new automated monitoring system. 28,746, 24 and 8,966 temperature excursions were detected post-implementation compared to 344, 0 and 0 pre-implementation in refrigerators, freezers and ambient locations, respectively. The majority of temperature excursions detected in medicine and vaccine fridges were below +2°C (98.4%). One brand of refrigerators was linked to 27,231 (94.7%) excursions ($p<0.001$).

CONCLUSIONS

The new temperature monitoring system detects higher number of excursions which provides better visibility of performance, identifies areas of non-compliance, and guides and evaluates solutions. This study recommends that freezers and ambient storage locations are monitored as robustly as refrigerators, temperature monitoring devices are placed in close proximity to pharmaceuticals, and that healthcare organisations avoid purchasing unreliable medicine and vaccine refrigerators. Finally, this study suggests the development of a National Medicine Storage Guideline.

KEYWORDS

Medicine, medication, vaccine, excursion, automated, temperature, monitoring.

INTRODUCTION

Correct storage temperature of medicines and vaccines ensures their effectiveness and safety. Besides clinical risks to individual patients, inappropriate storage of medicines and vaccines imposes considerable financial wastage and creates potential public health risks such as the outbreak of measles in the Federated States of Micronesia in 2014. [1-3] The National Safety and Quality Health Service Standards require Australian hospitals to implement systems that continuously monitor and preserve the integrity of temperature-sensitive medicines and vaccines.[4]

In October 2020, Eastern Health implemented a centralised automated temperature monitoring system in its medicine storage facilities. Eastern Health is geographically the largest metropolitan health service in Melbourne, Victoria, Australia. It operates from 65 sites across 21 locations including seven teaching hospitals, four nursing homes, and multiple community health and mental health services. Eastern Health has over 10,000 staff and volunteers, 1,500 beds and provides over 1.3 million episodes of patient care per annum.[5] At Eastern Health, medicines and vaccines are stored in 124 refrigerators, six freezers and 101 ambient room temperature storage locations including seven pharmacy departments and 94 medicine rooms and cabinets. Prior to implementing the new monitoring system, the temperate monitoring of refrigerators and freezers was conducted through a combination of manual and automated monitoring systems. The ambient room temperature was only monitored in the seven pharmacy departments. Eastern Health has a clear process for managing temperature excursions, when they are identified, to ensure patient safety is not compromised.

The primary aim of this study was to evaluate the effectiveness of the new centralised automated temperature monitoring system in detecting temperature excursions. The secondary aim was to describe the main challenges of implementing this new system and how they were addressed.

METHODS

This study is an observational before-and-after audit. It compares the temperature excursions detected three months before and three months after the implementation of a new centralised continuous temperature monitoring system, Invisible Systems™ (Manchester, England). The pre-implementation study phase was from 1 July 2020 until 30 September 2020 and the post-implementation from 1 October 2020 until 31 December 2020. Pre-implementation data was retrospectively collected by reviewing paper temperature monitoring records and electronic reports from the previous temperature monitoring systems. Post-implementation data was extracted from Invisible Systems™ online portal.

Inclusion criteria consisted of all medicine and vaccine storage facilities monitored by the calibrated and certified Invisible Systems™. Information about the temperature monitoring sensors and their specifications is available from the manufacturer's website (www.invisible-systems.com). Four medicine and vaccine storage facilities not yet connected to the new system were excluded. The ward medicine trolleys, resuscitation trolleys, anaesthetic trolleys, and patient bedside drawers were considered out of scope.

Age, brand and size of refrigerators were manually audited. Air temperature control mechanisms in ambient storage locations were manually audited. Data was compared and analysed using R (version 3.5.2). Mann-Whitney U test was used to compare the temperature excursion rates of different brands of refrigerators. Fisher's exact test was used to compare different room temperature control mechanisms in ambient storage locations.

The storage temperature range for refrigerators was defined as between +2°C and +8°C (5±3°C).[6,7] Ambient room temperature was defined as below +25°C.[7] The acceptable temperature range for freezers were defined as below -15°C or -70°C depending on the type, function and products stored in that freezer. One temperature excursion was defined as a single occasion of temperature deviating outside the recommended range until it returned within the range, regardless of the length of time it remained outside the range.

RESULTS

The number of temperature excursions in medicine and vaccine storage facilities pre- and post-implementation of the new automated temperature monitoring system are shown in table 1. There were large increases in the number of temperature excursions detected by the new monitoring system compared to the previously recorded data. The

majority of post-implementation temperature excursions in the refrigerators were below +2°C.

TABLE 1. TEMPERATURE EXCURSIONS DETECTED PRE- AND POST-IMPLEMENTATION OF AN AUTOMATED TEMPERATURE MONITORING SYSTEM

	PRE	POST
Refrigerators (+2°C to +8°C)		
Number of refrigerators monitored	116	120
Total number of temperature excursions detected	344	28746
Temperature excursions above +8°C	263	459
Temperature excursions below +2°C	81	28287
Temperature excursions at or below 0°C	0	604
Refrigerators without any temperature excursion (%)	74 (64%)	67 (56%)
Freezers (<-15°C or <-70°C)		
Number of -20°C freezers monitored	5	5
Number of -80°C ultra-low freezers monitored	0	1
Temperature excursions above -15°C	0	23
Temperature excursions above -70°C	0	1
Total number of temperature excursions detected	0	24
Temperature excursions at or above 0°C	0	0
Freezers without any temperature excursion	5	2
Ambient room temperature (<+25°C)		
Number of ambient storage locations monitored	7	97
Total number of temperature excursions above +25°C	0	8966
Temperature excursions above +30°C	0	7
Storage locations without any temperature excursion	7	41

Table 2 shows the specifications and characteristics of the refrigerators. An analysis of the characteristics data against the post-implementation temperature excursions identified a potential correlation with the brand of refrigerators (Table 3). Direct comparison between refrigerator brands using Mann-Whitney U test confirmed statistically significant differences in the mean number of excursions per refrigerator between brand A and brands B (P<0.001), C (P<0.001), D (P<0.001) and E (P=0.04). Additionally, brand A was found to have significantly more temperature excursions per refrigerator than all other brands combined (P<0.001). The number of excursions per refrigerator did not differ significantly between brand A and domestic refrigerators (P=0.72). Other brands (n=16) included those with four or less units installed at Eastern Health were treated as one group in this analysis. The majority of brand A refrigerators were 5-10 years old (n=42), serviced every six months (n=31) and connected to the back-to-base Building Management System (BMS) (n=30). No other potential correlations between the characteristics data and post-implementation temperature excursions were identified.

Table 4 illustrates refrigerator temperature excursions per month as the faulty refrigerators were identified, adjusted, repaired or replaced. 2021 data is displayed in table 4 but not included in data analysis.

TABLE 2. EASTERN HEALTH MEDICINE AND VACCINE REFRIGERATOR DEMOGRAPHIC DATA

MEDICINE AND VACCINE REFRIGERATORS (N=120)	NUMBER OF REFRIGERATORS (%)
Type of refrigerators:	
Purpose-built refrigerators	114 (95%)
Domestic refrigerators	6 (5%)
Size of refrigerators:	
Small (<200L)	70 (58.3%)
Medium (300-500L)	30 (25%)
Large (>900L)	20 (16.7%)
Estimated age of refrigerators:	
<5 years	24 (20%)
5-10 years	66 (55%)
>10 years	30 (25%)
Scheduled maintenance/service of refrigerators:	
Every 3 months	8 (6.7%)
Every 6 months	34 (28.3%)
Every 12 months	2 (1.7%)
Unknown or None	76 (63.3%)
Method of temperature monitoring pre-intervention:	
Manual paper chart (± data logger)	65 (54.2%)
Building Management System	42 (35%)
Comark™ automated monitoring system	9 (7.5%)
Omnicell™ automated dispensing system	2 (1.7%)
Audible alarm and data logger	2 (1.7%)

TABLE 3. COMPARISON OF POST-IMPLEMENTATION TEMPERATURE EXCURSIONS AGAINST REFRIGERATOR BRANDS

BRANDS OF MEDICINE AND VACCINE REFRIGERATORS (N=120)	BRAND A	BRAND B	BRAND C	BRAND D	BRAND E	BRAND – OTHER	DOMESTIC REFRIGERATORS
Number of refrigerators installed	45	20	18	10	5	16	6
Percentage of all refrigerators installed	37.5%	16.7%	15%	8.3%	4.2%	13.3%	5%
Number of temperature excursions post-implementation	27,231	197	13	2	7	572	724
Temperature excursions above +8°C	85	196	13	2	2	13	148
Temperature excursions below +2°C	27,146	1	0	0	5	559	576

Temperature excursions at or below 0°C	507	1	0	0	0	0	96
Percentage of all temperature excursions (n=28746)	94.73%	0.69%	0.05%	0.01%	0.02%	1.99%	2.52%
Mean temperature excursions per refrigerator of this brand	605.1	9.8	0.7	0.2	1.4	35.7	120.7

TABLE 4. NUMBER OF TEMPERATURE EXCURSIONS DETECTED EACH MONTH IN THE MEDICINE AND VACCINE REFRIGERATORS

REFRIGERATOR TEMPERATURE EXCURSIONS	≤0°C	<+2°C	>+8°C	TOTAL
Pre-implementation				
July 2020	0	0	95	95
August 2020	0	77	86	163
September 2020	0	4	82	86
Post-implementation				
October 2020	508	24100	328	24428
November 2020	89	1936	72	2008
December 2020	7	2251	59	2310
Follow-up data (not analysed)				
January 2021	1	69	91	160
February 2021	0	219	55	274
March 2021	2	102	95	197

Out of six medicine and vaccine freezers, one recorded 21 excursions, three had one excursion each and two had no excursions post-implementation. No further data was collected or analysed for freezers.

The ambient room temperature storage locations were audited to determine the possibility of adjusting air temperature independently from the surrounding areas. An analysis of room temperature excursions against the audit results did not identify any possible correlation (table 5). Further analyses of ambient temperature excursions against other variables such as the number, size and brand of medicine and vaccine refrigerators in each location did not suggest any potential correlations either.

TABLE 5. AUDIT OF ROOM TEMPERATURE CONTROL IN THE MEDICINE AND VACCINE AMBIENT STORAGE FACILITIES

AMBIENT STORAGE AIR TEMPERATURE CONTROL (N=97)	TOTAL NUMBER OF LOCATIONS	LOCATIONS WITHOUT EXCURSIONS	COMPARISON
A. Locations *with* air-conditioned air supply but *without* independent temperature control	66 (68%)	29 (43.9%)	A versus B (P=0.62)
B. Locations *with* air-conditioned air supply and *with* independent temperature control	22 (22.7%)	8 (36.4%)	B versus C (P=0.70)
C. Locations *without* air-conditioned air supply	9 (9.3%)	4 (44.4%)	C versus A+B (P=1.00)

DISCUSSION

Following the installation of an automated continuous temperature monitoring system at a large hospital network, the number of temperature excursions detected in medicine and vaccine refrigerators, freezers and ambient storage locations increased.

Temperature excursions of refrigerated medicines and vaccines are common in hospitals and health service managers are not necessarily aware of them.[8,9] Even though exposure to extreme temperatures including heat and freezing does not cause the formation of toxic substances, it may reduce the potency of medicines and vaccines.[10,11] Vaccines and some medicines such as insulins and monoclonal antibodies are complex biological molecules and denature if frozen.[12-14] Ineffective medicines can harm patients by failing to deliver therapeutic effects.[15] Similarly, ineffective vaccines can harm individuals and pose serious public health risks.[3] The inconvenience of revaccination, potential lawsuits and financial wastage are some of the other adverse outcomes of inappropriate storage.[10] Despite advances in the vaccine supply chain, temperature excursions are still common in Australian health system and result in an estimated $16 million dollars wastage per annum.[2]

Refrigerators

This study has highlighted that a large number of temperature excursions in medicine and vaccine refrigerators go undetected when using the conventional monitoring methods. The main difference between the new temperature monitoring system and previous methods used at Eastern Health was the source of temperature data. Pre-implementation, temperature data was obtained either manually once or twice daily from the refrigerator digital thermometers or electronically through BMS. Both methods rely on the built-in refrigerator thermostats to provide the temperature data. This created the biggest challenge of implementing the new temperature monitoring system as it was reporting different readings to those measured by the refrigerator thermostats and staff were questioning its accuracy. This finding was, however, consistent with published literature. Kartoğlu, Nelaj and Maire found the temperature data provided by built-in refrigerator thermometers to be inaccurate and suggested abandoning their use.[16] After numerous tests with calibrated thermometers and digital data loggers, three possible reasons for the temperature discrepancies were suggested.

Firstly, internal refrigerator thermometers are generally installed on top of the refrigerator cabinets for manufacturing convenience. The location of thermometer probe is critical as temperature can vary considerably in different parts of a refrigerator cabinet. In Australia, purpose-built medicine and vaccine refrigerators are required to maintain a stable, uniform and controlled temperature between +2°C and +8°C, close to +5°C.[6] However, local guidelines do not elaborate on the location of built-in refrigerator thermometers although they recommend temperature mapping to identify cold spots.[6,7] Furthermore, the local guidelines provide conflicting information about the location of external data loggers. They recommend both placing digital data loggers in the middle of medicines and vaccines and co-locating them with inbuilt minimum/maximum thermometers to "prevent different readings".[6,7] As a result, the back-to-base BMS probes in the 42 BMS-connected refrigerators at Eastern Health were co-located with the inbuilt thermometers. Conversely, international guidelines recommend placing digital data loggers in the centre of refrigerators and in close proximity to medicines and vaccines. [17,18]

Secondly, observation from this study suggests that some brands of purpose-built refrigerators are more successful in achieving a stable and uniform temperature through more effective air circulation and cooling system design. The analysis of temperature excursion data against different brands of refrigerators identified one brand of purpose-built refrigerators to have the highest rate of temperature excursions, followed by domestic refrigerators. Thirdly, inbuilt thermometers are typically exposed to air temperature. Thus, they record rapid fluctuations in temperature, for instance, when the refrigerator door is opened briefly. On the other hand, the new monitoring system uses validated lagged or buffered temperature probes which are placed inside solid thermal blocks to simulate the core temperature of medicines and vaccines, and avoid rapid fluctuations and false alarms.[6]

The challenges related to medicine and vaccine refrigerators were the most difficult to address. Initially, a review of the national and international guidelines was conducted to verify the new monitoring system probes were correctly installed. [6,7,17-19] Relevant stakeholders were consulted and a consensus was reached to place the Invisible Systems™ temperature probes in the centre of refrigerators, in the middle of medicines and vaccines.

Next, the accuracy of the new monitoring system probes were confirmed using calibrated thermometers and digital data loggers. The frequent temperature excursions below +2°C, including subzero readings, were consistent with the literature. Hanson et al [20] conducted a review of 21 published research articles and concluded that cold chain breach of vaccines is an ongoing global issue and exposing refrigerated vaccines to freezing temperatures continues to be a major problem. This review highlighted that many frontline healthcare workers are unaware of the risks associated with exposure to subzero temperatures and their focus has been on preventing exposure to heat. [20,21]

Moreover, the most common brand of refrigerators at Eastern Health was found to have the highest rate of excursions. To ensure appropriate medicine and vaccine refrigerators are purchased at Eastern Health, a group of representatives from the Pharmacy, Nursing, Infrastructure/Maintenance and Procurement Departments convened and recommended a list of criteria for future purchases such as certified purpose-built medicine and vaccine refrigerator, frost-free, double-glazed glass door, self-closing door, audible door ajar alarm, lockable door, low energy consumption and low noise level.

Freezers

More temperature excursions were detected in freezers post-implementation. One freezer recorded 21 temperature excursions which was found to be due to placing unfrozen ice bricks inside the freezer near the temperature probe. This issue was addressed by placing a dedicated container for unfrozen ice bricks inside the freezer, away from the temperature sensor and frozen pharmaceuticals.

The main challenge with the freezer temperature monitoring was that, contrary to refrigerated medicines, there were no national guidelines regarding the frozen storage thresholds and how to manage freezer temperature excursions. [6,7,17-19,22,23]

Ambient room temperature

A large number of temperature excursions were detected in ambient storage locations post-implementation compared to zero in the seven monitored locations pre-implementation. Of the monitored locations pre-implementation, one recorded temperature excursions post implementation. This was due to staff changing the settings of the air conditioning unit for personal comfort. This finding in addition to the analysis of the temperature excursion data in ambient locations with independent air temperature controls has demonstrated that installing local air conditioning units is not a fail-proof solution as the stand-alone air conditioners can be adjusted or turned off by staff. Additionally, it is not practical to remove the air-conditioner controllers as they may be hardwired on the wall or must be readily accessible to turn on the units following interruptions to power supply. We expected to observe higher rates of temperature excursions in medicine rooms with more heat generating sources such as those with more than one refrigerator or with refrigerators that consume more electricity. However, this was not observed which we believe is due to the complex nature of room temperature control and the many variables involved such as room size, temperature and volume of air entering the room, heat generation, source of heat, presence of air vents or exhaust fans and location of temperature sensors.

Similar to freezers, another challenge was the limited number and variability of guidelines and published articles regarding ambient room temperature monitoring for medicines and vaccines.[22,23] For instance, local guidelines only recommend a high threshold of +25°C for ambient room temperature.[7] However, it is important to also have a low threshold as liquid medicines presented in the forms of solution or suspension may crystalize or precipitate if exposed to cold temperatures.[24] Besides, some automated temperature monitoring systems require both high and low thresholds to be programmed. Therefore, +8°C was programmed in the Invisible Systems™ as the minimum room temperature. The lowest temperature recorded post-implementation was +13.7°C.
The World Health Organisation recommends 'controlled room temperature' to be between +15°C and +25°C and 'cool place temperature' between +8°C and +15°C.[22] The United States Pharmacopeia defines 'controlled room temperature' to be between +20°C and +25°C and allows excursions between +15°C and +30°C as long as Mean Kinetic Temperature (MKT) remains below +25°C.[23] These definitions are not currently included in the Australian guidelines and not used at Eastern Health although Invisible Systems™ reports MKT values.

The third challenge has been the difficulty in managing ambient temperature excursions. Unlike refrigerator temperature excursions where the affected stock can be quarantined and moved to another refrigerator until the faulty refrigerator is repaired or replaced, there are larger

amounts of medicines stored in ambient storage facilities and it is not always practical to move them. Moreover, changing the temperature of air supply to medicine rooms often impacts the surrounding areas potentially making it uncomfortably cold for patients and staff.

Strengths and weaknesses

A major strength of this study is the inclusion of three different temperature storage conditions across an entire healthcare network. Another strength is including all temperature excursions detected over three months pre- and three months post-implementation. It suffices to say that the new system is programmed to record the temperature every 5 minutes which means it could record up to 144 excursions per day for one probe if the temperature repeatedly goes in and out of the recommended range. In contrast, the manual monitoring was undertaken once or twice daily. Furthermore, the new monitoring system continued to record temperature excursions while the faulty refrigerators were being assessed, adjusted, repaired or replaced, and the affected medicines and vaccines were quarantined. This data was not excluded as the primary aim of this study was to evaluate the ability of the new monitoring system in detecting temperature excursions. To ensure patient safety, Eastern Health policy requires affected medicines and vaccines to be immediately quarantined until their safety for use is determined; and the faulty equipment is not used for storage of pharmaceuticals until repaired or replaced.

A limitation of this study was the inability to locate 14 pre-intervention monthly manual temperature recording charts. Despite this, a search of Eastern Health incident management system identified no pre-intervention reported temperature excursions for these locations. Another limitation was that we introduced additional four refrigerators and one freezer at the time of the intervention, and commenced monitoring of ambient temperature in 90 locations resulting in mismatch in total storage locations pre- and post-intervention. It is of note that this study was undertaken during winter and spring in Melbourne. It is important to reassess the effect of higher outdoor temperatures over summer on ambient room temperatures.

Implications for practice

Health service managers should ensure this critical yet basic aspect of patient safety is adequately addressed at their organisations.[4] Effective monitoring of medicines and vaccines temperature is the first step in the quality management process. It provides better visibility of performance, highlights areas of risk, and guides and evaluates mitigation strategies. It is recommended that:

- Inbuilt refrigerator thermometers are not solely relied upon to monitor the storage temperature of medicines and vaccines
- Temperature monitoring loggers and sensors are co-located with medicines and vaccines if mapping data is unavailable
- Medicine and vaccine freezers and ambient room temperature storage locations are monitored as robustly as refrigerators
- Health services avoid using unreliable or domestic refrigerators for storage of medicines and vaccines

Unanswered questions and future research

This study has identified some areas for future research and improvement. Firstly, it has been noted there is no National Medicine Storage Guideline in Australia. Secondly, it is recommended to explore the use of MKT in managing temperature excursions with the aim to incorporate in the relevant local guidelines. Thirdly, it is suggested to temperature map different medicine and vaccine refrigerators based on brand, size, type, etc. The findings of this research will guide correct placement of built-in thermometers and temperature monitoring devices and whether more than one sensor is needed for larger refrigerators.

CONCLUSIONS

An automated continuous temperature monitoring system was installed in all medicine and vaccine storage locations at Eastern Health. Comparison of temperature excursions pre- and post-implementation has shown the new system can detect higher numbers of excursions compared to previous temperature monitoring methods. This provides better visibility of performance, identifies areas of non-compliance, and guides and evaluates solutions. Analysis of temperature excursions identified most temperature excursions were in refrigerators and below +2°C. One brand of purpose-built medicine and vaccine refrigerators was flagged to have the highest rate of excursions, followed by the domestic refrigerators. It has been noted that national and international guidelines do not elaborate on the monitoring of freezers and ambient storage to the same extent as refrigerators. Finally, this study recommends the development of a National Medicine Storage Guideline.

ACKNOWLEDGEMENTS

We like to thank Mrs Saly Rashed, Wantirna Health Pharmacy Manager, for assisting with the implementation of the new temperature monitoring system and review of this article. We also like to thank Mr Bruce Leslie, Director of Infrastructure at Eastern Health, for arranging the audit of ambient storage locations and assisting with the implementation of the new temperature monitoring system.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

ETHICAL APPROVAL

This study did not involve human or animal subjects and therefore did not require ethics approval. The manuscript was reviewed by Eastern Health Pharmacy Practice Research Group.

References

1. Khan MH, Hatanaka K, Sovannarith T, Nivanna N, Casas LC, Yoshida N, et al. Effects of packaging and storage conditions on the quality of amoxicillin-clavulanic acid–an analysis of Cambodian samples. BMC Pharmacol Toxicol. 2013 Dec;14(1):1-7. https://doi.org/10.1186/2050-6511-14-33
2. D'Onise K, Almond S, MacDonald B, Watson M, Scrimgeour S. Have purpose built vaccine refrigerators reduced the cost of vaccine losses in South Australia? Aust N Z J Public Health. 2012 Dec;36(6):572-6. https://doi.org/10.1111/j.1753-6405.2012.00932.x
3. Breakwell L, Moturi E, Helgenberger L, Gopalani SV, Hales C, Lam E, et al. Measles outbreak associated with vaccine failure in adults—Federated States of Micronesia, February–August 2014. Morb Mortal Wkly Rep. 2015 Oct 2;64(38):1088-92. https://doi.org/10.15585/mmwr.mm6438a7
4. Australian Commission on Safety and Quality in Health Care. National Safety and Quality Health Service (NSQHS) Standards: Medication Safety Standard [Internet]. Sydney NSW: Australian Commission on Safety and Quality in Health Care; 2019 [cited 2021 Jan 27]. Available from: https://www.safetyandquality.gov.au/standards/nsqhs-standards/medication-safety-standard
5. Eastern Health. About us [Internet]. Melbourne VIC: Eastern Health; 2020 [cited 2021 Jan 27]. Available from: https://www.easternhealth.org.au/images/Eastern_Health_Quick_Facts_2020.pdf
6. Australian Government Department of Health. National Vaccine Storage Guidelines – Strive for 5, 3rd edition [Internet]. Canberra ACT: Commonwealth of Australia; 2019 [updated 2020 Apr 16; cited 2021 Jan 27]. Available from: https://www.health.gov.au/sites/default/files/documents/2020/04/national-vaccine-storage-guidelines-strive-for-5.pdf
7. Victorian Pharmacy Authority. Victorian Pharmacy Authority Guidelines [Internet]. Melbourne VIC: Victorian Pharmacy Authority Guidelines; 2019 [cited 2021 Jan 27]. Available from: https://www.pharmacy.vic.gov.au/cms_files/VPA%20Guidelines%20effective%201%20November%202019.pdf
8. Dubrava S, Tait PA, Humphris MA. Identification of Potential and Actual Breaches in the Cold Chain within a Tertiary Hospital. J Pharm Pract Res. 2007 Mar;37(1):16-8. https://doi.org/10.1002/j.2055-2335.2007.tb00650.x
9. Levinson DR, General I. Vaccines for children program: vulnerabilities in vaccine management. Department of Health and Human Services: Office of Inspector General. 2012 Jun. Available from: https://www.coldchain-tech.com/images/documents/VaccineForChildrenProgram.pdf
10. Hibbs BF, Miller E, Shi J, Smith K, Lewis P, Shimabukuro TT. Safety of vaccines that have been kept outside of recommended temperatures: reports to the vaccine adverse event reporting system (VAERS), 2008–2012. Vaccine. 2018 Jan 25;36(4):553-8. https://doi.org/10.1016/j.vaccine.2017.11.083
11. Vimalavathini R, Gitanjali B. Effect of temperature on the potency & pharmacological action of insulin. Indian J Med Res. 2009 Aug 1;130(2):166-70. Available from: https://medgreen.com.tw/images/productnews/5d11fd08e6e87558eb51c761d8dc1c67.pdf
12. Carter AW, Heinemann L. Insulin concentration in vials randomly purchased in pharmacies in the United States: considerable loss in the cold supply chain. J Diabetes Sci Technol. 2018 Jul;12(4):839-41. https://doi.org/10.1177/1932296817747292
13. Matthias DM, Robertson J, Garrison MM, Newland S, Nelson C. Freezing temperatures in the vaccine cold chain: a systematic literature review. Vaccine. 2007

May 16;25(20):3980-6. https://doi.org/10.1016/j.vaccine.2007.02.052

14. Lazar KL, Patapoff TW, Sharma VK. Cold denaturation of monoclonal antibodies. MAbs. 2010 Jan 27;2(1):42-52. https://doi.org/10.4161/mabs.2.1.10787
15. Bassat Q, Tanner M, Guerin PJ, Stricker K, Hamed K. Combating poor-quality anti-malarial medicines: a call to action. Malar J. 2016 Dec;15(1):1-2. https://doi.org/10.1186/s12936-016-1357-8
16. Kartoğlu Ü, Nelaj E, Maire D. Improving temperature monitoring in the vaccine cold chain at the periphery: An intervention study using a 30-day electronic refrigerator temperature logger (Fridge-tag®). Vaccine. 2010 May 28;28(24):4065-72. https://doi.org/10.1016/j.vaccine.2010.03.076
17. Hamborsky J, Kroger A, editors. Centers for Disease Control and Prevention (CDC). Epidemiology and prevention of vaccine-preventable diseases, E-Book: The Pink Book – Chapter 5: Vaccine Storage and Handling [Internet]. Washington DC: Public Health Foundation; 2015 Oct 19 [updated 2020 Jul; cited 2021 Jan 27]. Available from: https://www.cdc.gov/vaccines/pubs/pinkbook/vac-storage.html
18. Public Health Agency of Canada. Storage and handling of immunizing agents: Canadian Immunization Guide [Internet]. Ottawa ON: Public Health Agency of Canada; 2015 [updated 2017 Mar; cited 2021 Jan 27]. Available from: https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-1-key-immunization-information/page-9-storage-handling-immunizing-agents.html
19. Ramsay M, editor. Immunisation against infectious disease (the green book): Chapter 3 - Storage, distribution and disposal of vaccines [Internet]. London: Public Health England; 2006 [updated 2013 Jun; cited 2021 Jan 27]. Available from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/223753/Green_Book_Chapter_3_v3_0W.pdf
20. Hanson CM, George AM, Sawadogo A, Schreiber B. Is freezing in the vaccine cold chain an ongoing issue? A literature review. Vaccine. 2017 Apr 19;35(17):2127-33. https://doi.org/10.1016/j.vaccine.2016.09.070
21. Lloyd J, Cheyne J. The origins of the vaccine cold chain and a glimpse of the future. Vaccine. 2017 Apr 19;35(17):2115-20. https://doi.org/10.1016/j.vaccine.2016.11.097
22. World Health Organisation. TRS 1025 - Annex 7: Good storage and distribution practices for medical products [Internet]. Geneva: World Health Organisation; 2020 Apr 20 [cited 2021 Jan 27]. Available from: https://www.who.int/publications/m/item/trs-1025-annex-7-gdp-medical-products
23. United States Pharmacopeia and National Formulary (USP 43-NF 38). Chapter ‹659› Packaging and Storage Requirements [Internet]. Rockville MD: United States Pharmacopeia; 2017 [updated 2020 Dec; cited 2021 Feb 19]. Available from: https://www.uspnf.com/
24. Allegra JR, Brennan J, Lanier V, Lavery R, MacKenzie B. Storage Temperatures of Out of Hospital Medications. Acad Emerg Med. 1999 Nov;6(11):1098-103. https://doi.org/10.1111/j.1553-2712.1999.tb00110.x.

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

FACTORS ASSOCIATED WITH THE FOUR-VISIT ANC IN INDONESIA: A POPULATION-BASED STUDY

Helen Andriani[1], *Valencia Natasha*[2], *Salma Dhiya Rachmadani*[2], *Adila Saptari*[3]

1. Department of Health Policy and Administration, Faculty of Public Health, Universitas Indonesia, Depok, Indonesia
2. Public Health Science Undergraduate Study Program, Faculty of Public, Universitas Indonesia, Depok, Indonesia
3. Master of Public Health Program, School of Public Health, Boston University, Boston, USA

Correspondence: helenandriani@ui.ac.id

ABSTRACT

INTRODUCTION:

The number of maternal, neonatal and child mortality remains high in developing countries, including Indonesia. Antenatal care (ANC) coverage is an indicator of health-care use and access during pregnancy. Receiving at least four visits of ANC increases the chances of receiving appropriate maternal health interventions as one of the tracer indicators for universal health coverage in the Global Strategy for Women's, Children's, and Adolescents' Health Monitoring Framework (SDG indicator 3.8.1). The study aims to investigate the distribution and the factors associated with the four-visit ANC across urban and rural areas in Indonesia.

METHODS:

We used data from the 2017 Indonesia Demographic and Health Survey which is a large-scale nationally representative cross-sectional survey of women aged 15–49 years old (n=15,288). The use of ANC for the MNCH system is the dependent variable. The determinants are individual characteristics, family factors, and community factors.

RESULTS:

Age, parity, household income, and distance from health facilities are significant factors associated with the four-visit ANC, as the first step in achieving continuum of care for MNCH. Urban women who had been pregnant 1–2 times or 3–4 times were 6.475 (95% Confidence Interval (95%CI) = 4.750–9.306) and 3.109 (95% CI = 2.268–4.262) times more likely to have at least four ANC visits than those who had been pregnant five times or more.

CONCLUSION:

Developing a health system, human resources, health facilities, and infrastructure are crucial for overcoming maternal and child health problems, especially in rural areas to make ANC universally affordable and accessible.

KEYWORDS

pregnancy; Indonesia; antenatal care; population-based study

INTRODUCTION

Over the years, maternal child health has improved ever since countries worldwide have committed to reducing Maternal Mortality Ratio (MMR) as a result the Sustainable Development Goals (SDGs) of the United Nations [1]. SDGs encourage every country to achieve SDG target 3.1 (i.e. reduce the global MMR to less than 70 per 100,000 live births by 2030) and target 3.2 (i.e. end preventable deaths of newborns and children under 5 years of age by 2030, with all countries aiming to reduce neonatal mortality to at least 12 per 1,000 live births and under-5 mortality to at least 25 per 1,000 live births) [2]. By 2017, the global MMR is 211 per 100,000 live births with 295,000 cases of maternal death. This rate has decreased by 38% with a 2.9% reduction annually since 2000 (342 per 100,000 live births). More than three-fourth of maternal deaths are related to direct obstetric causes, such as hemorrhage, sepsis, abortion, ruptured uterus and hypertensive pregnancy diseases, which are easily preventable and treatable. Moreover, 77% of death occur during or shortly after birth (within 24 h) [3]. However, MMR remains high across the world. Notwithstanding national and global initiatives, the indices of maternal and newborn morbidity or mortality have indicated no improvement or only modest declines over the last five years.

In parallel with the global trends, Indonesia was unable to reach the SDG target as the MMR was 305 per 100,000 live births in 2015 [6]. This notion is demonstrated by the WHO in 2017 at 177 per 100,000 live births with 8,600 deaths. This number is higher than that for South-east Asia, which is 152 per 100,000 live births [7]. With this progress, Indonesia became one of the developing countries with high maternal, neonatal and child mortality. In 2016, the United Nations Children's Fund reported that the under-five mortality rate in Indonesia was 27 per 1,000 live births, whereas neonatal mortality rate reached 14 per 1,000 live births [8]. Furthermore, the WHO recommended that all pregnant women should undergo at least four Antenatal Care (ANC) visits during pregnancy [7] to maintain and monitor the health of the mother and fetus, detect pregnancy complications early and react accordingly, respond to complaints, prepare for childbirth and promote a healthy lifestyle [9].

Adequate ANC visits can be used as an indicator for SDGs to ensure coverage of maternal health services. Previous research demonstrated a negative correlation between ANC and maternal mortality ($r = -0.5$; $P < 0.0001$). Mothers who did not receive ANC had 3.9 higher odds of neonatal death (95% Confidence Interval [CI] = 2.3–6.3) than mothers with four or more ANC visits. Moreover, neonates with mothers who had one to three ANC visits had 1.3 higher odds of death (95% CI = 1.0–1.8) than mothers who had four or more ANC visits [10]. Despite this result, a gap in the four-visit ANC continues to occur due to demographic, geographical, cultural and socioeconomic differences in developing countries, such as Indonesia. Disparities occur as a result of inability to access services, service affordability and service quality [11]. The study aims to investigate the distribution and the factors associated with the four-visit ANC across urban and rural areas in Indonesia.

METHODS

Data were derived from the Indonesia Demographic and Health Survey (IDHS), a national survey conducted in 2017 using a cross-sectional method. The sample of the survey includes 1,970 census blocks with 49,250 households in rural and urban areas. The IDHS sample design uses two-stage probability sampling. The first stage selects a number of blocks using the probability proportional to size system based on the listing result of Population Census 2010. The second stage then systematically selects 25 households from the abovementioned census blocks.

Data from IDHS covered a total of 49,267 women aged 15–49 years old. The criteria for inclusion in the survey were ever-married women aged 15–49 years who had given birth in the last 5 years prior to the survey. After screening, data from 15,288 women were used for the study. The reason for selecting women who gave birth in the last 5 years prior to the survey was to avoid memory bias from mothers.

The use of ANC for the maternal, neonatal and child health (MNCH) system is designated as the dependent variable. The determinants of the dependent variable are individual characteristics, such as respondent's age, age at first birth, educational level, employment status, parity, and autonomy in health care decisions. Apart from individual factors, the family also plays a role in the use of ANC. Thus, social demographic characteristics were measured through the educational level and employment status of husbands, household income and mass media exposure (frequency of watching television, listening to the radio or reading newspapers). Lastly, community factors denote

the form of geographical conditions that divide the respondents into urban or rural areas and distance from health facilities.

SPSS (version 25) was used for data analysis. Frequency and percentage from descriptive statistics are used to report the outcomes of MNCH services during ANC. The relationships among factors are defined by logistic regression with simple, bivariate, and multivariate analyses. The relationship is analyzed at three levels: odds ratio (OR), adjusted odds ratio (aOR) with 95% CI, and p-value with significance at p-value < 0.05.

The IDHS program collects data periodically for policy development and program planning, monitoring and evaluation. Respondents provided written informed consent before each interview. The statements include voluntary participation, refusal to answer question or termination of participation at any time and confidentiality of identity and information. Consent prior to a child's participation is provided by a parent or guardian. The Institutional Review Board (IRB) of the Inner-City Fund International Inc., Fairfax, VA, USA, reviewed and approved the procedures and survey protocols. After the IDHS provided authorization to use the dataset, additional ethical review approval was obtained from the IRB at Universitas Indonesia, Indonesia.

RESULTS

There were 13,510 (88.4%) women who obtained at least four ANC visits (ANC4+). Table 1 provides the socioeconomic and demographic characteristics of the respondents. Women aged 25–34 years old (51.9%), aged 20–29 years old (66.5%) and above 29 years old (6.5%) at first birth, who had secondary (57.4%) and higher (18.3%) levels of education, have husbands with secondary (57.9%) and higher (15.7%) levels of education, have employed husbands (99.3%), had 1–2 parity (67.8%), have autonomy in health care decisions (44.2%), had any two (28.0%) and all three (27.7%) types of mass media exposure, belonged to the richest (18.4%), Q4 (19.2%) or Q3 (19.5%) household income, without issues regarding distance from health facilities (89.3%) and lived in urban areas (51.4%) tend to have at least four ANC visits during pregnancy.

TABLE 1. SOCIOECONOMIC AND DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS WITH ADEQUATE AND INADEQUATE ANTENATAL CARE

	Pregnancy level (ANC4+)		*p*
	≥4 visits n (%) (n = 13,510)	<4 visits n (%) (n = 1,778)	
Age			<0.001
15–24	2,402 (17.8)	396 (22.3)	
25–34	7,005 (51.9)	790 (44.4)	
>34	4,103 (30.4)	592 (33.3)	
Age at First Birth			<0.001
<20	3,652 (27.0)	755 (42.5)	
20–29	8,984 (66.5)	942 (53.0)	
>29	874 (6.5)	81 (4.6)	
Educational Level			<0.001
No education	116 (0.9)	88 (4.9)	
Primary	3,159 (23.4)	683 (38.4)	
Secondary	7,759 (57.4)	832 (46.8)	
Higher than secondary	2,476 (18.3)	175 (9.8)	
Husband's Educational Level			<0.001
No education	171 (1.3)	84 (5.0)	
Primary	3,289 (25.0)	603 (36.1)	
Secondary	7,613 (57.9)	853 (51.0)	
Higher than secondary	2,067 (15.7)	131 (7.8)	

Employment Status			0.005
Employed	6,201 (45.9)	878 (49.5)	
Unemployed	7,299 (54.1)	897 (50.5)	
Husband's Employment Status			<0.001
Unemployed	94 (0.7)	26 (1.6)	
Employed	12,909 (99.3)	1,636 (98.4)	
Parity			<0.001
5 or more	645 (4.8)	275 (15.5)	
3–4	3,699 (27.4)	570 (32.1)	
1–2	9,166 (67.8)	933 (52.5)	
Autonomy in Health Care Decisions			<0.001
No	7,321 (55.8)	1,022 (61.2)	
Yes	5,809 (44.2)	648 (38.8)	
Mass Media Exposure			<0.001
Not at all	413 (3.1)	181 (10.2)	
Any one	5,572 (41.2)	805 (45.3)	
Any two	3,784 (28.0)	407 (22.9)	
All three	3,741 (27.7)	385 (21.7)	
Household Wealth			<0.001
Q1 (poorest)	3,144 (23.3)	893 (50.2)	
Q2	2,661 (19.7)	361 (20.3)	
Q3	2,628 (19.5)	255 (14.3)	
Q4	2,588 (19.2)	166 (9.3)	
Q5 (richest)	2,489 (18.4)	103 (5.8)	
Distance from Health Facilities			<0.001
With issues	1441 (10.7)	362 (20.4)	
Without issues	12,059 (89.3)	1,415 (79.6)	
Residence			<0.001
Urban	6,938 (51.4)	610 (34.3)	
Rural	6,572 (48.6)	1,168 (65.7)	

Table 2 indicates that women aged 25–34 years (aOR = 1.368; 95% CI = 1.168–1.603) and older than 34 years (aOR = 1.678; 95% CI = 1.363–2.065) were more likely to have ANC4+ than women aged 15–25 years. Women who give first birth at 20–29 years old (aOR = 1.270; 95% CI = 1.123–1.436) are more likely to have ANC4+ than those who gave birth before 20 years. Women with secondary education are 2.327 (95% CI = 1.645–3.292) times more likely to have ANC4+ than those without education. Women who had been pregnant for 1–2 times or 3–4 times were 3.617 (95% CI = 2.916–4.486) and 2.127 (95% CI = 1.761–2.568) times more likely to have ANC4+ than those who had been pregnant five times or more. Compared with women without exposure to any mass media, women with two mass media exposures are 1.553 (95% CI = 1.230–1.963) times more likely to have ANC4+. Women with higher household wealth (Q2 to Q5) were 1.587 (95% CI = 1.369–1.839), 1.953 (95% CI = 1.648–2.314), 2.767 (95% CI = 2.255–3.397) and 4.131 (95% CI = 3.187–5.355) times, respectively, more likely to have ANC4+ than the poorest group. Women without issues regarding distance from health facilities (aOR = 1.463; 95% CI = 1.270–1.686) were more likely to have ANC4+ than those with issues.

TABLE 2. FACTORS ASSOCIATED WITH USE OF ANTENATAL CARE

	Care at pregnancy (ANC4+)			
	Bivariate OR	*p*	Multivariate aOR (95% CI)	*P*

Age				
15–24	1		1	
25–34	1.462	<0.001	1.368 (1.168–1.603)	<0.001
>34	1.143	0.056	1.678 (1.363–2.065)	<0.001
Age at First Birth				
<20	1		1	
20–29	1.972	<0.001	1.270 (1.123–1.436)	<0.001
>29	2.231	<0.001	1.083 (0.813–1.444)	0.585
Educational Level				
No education	1		1	
Primary	3.509	<0.001	1.805 (1.289–2.526)	0.001
Secondary	7.075	<0.001	2.327 (1.645–3.292)	<0.001
Higher than secondary	10.733	<0.001	1.821 (1.221–2.174)	0.003
Husband's Educational Level				
No education	1		1	
Primary	2.679	<0.001	1.693 (1.238–2.315)	0.001
Secondary	4.384	<0.001	1.625 (1.182–2.234)	0.003
Higher than secondary	7.751	<0.001	1.896 (1.294–2.777)	0.001
Employment Status				
Unemployed	1		1	
Employed	1.152	<0.005	1.186 (1.061–1.324)	0.003
Husband's Employment Status				
Unemployed	1		1	
Employed	2.183	<0.001	1.972 (1.234–3.150)	0.005
Parity				
5 or more	1		1	
3–4	2.767	<0.001	2.127 (1.761–2.568)	<0.001
1–2	4.189	<0.001	3.617 (2.917–4.486)	<0.001
Autonomy in Health Care Decisions				
No	1		1	
Yes	1.251	<0.001	1.138 (1.020–1.270)	0.021
Mass Media Exposure				
None	1		1	
Any one	3.033	<0.001	1.427 (1.147–1.775)	0.001
Any two	4.075	<0.001	1.553 (1.230–1.963)	<0.001
All three	4.258	<0.001	1.396 (1.098–1.774)	0.006
Household Wealth				
Q1 (poorest)	1		1	
Q2	2.094	<0.001	1.587 (1.369–1.839)	<0.001
Q3	2.927	<0.001	1.953 (1.648–2.314)	<0.001
Q4	4.428	<0.001	2.767 (2.255–3.397)	<0.001
Q5 (richest)	6.684	<0.001	4.131 (3.187–5.335)	<0.001
Distance from Health Facilities				
With issues	1		1	
Without issues	2.141	<0.001	1.463 (1.270–1.686)	<0.001
Residence				
Urban	1		1	
Rural	0.495	<0.001	0.919 (0.810–1.043)	0.190

TABLE 3 FACTORS ASSOCIATED WITH USE OF ANTENATAL CARE IN URBAN AND RURAL AREAS

	Care at pregnancy (ANC4+)							
	Urban				Rural			
	Bivariate OR	*p*	Multivariate aOR (95% CI)	*p*	Bivariate OR	*p*	Multivariate aOR (95% CI)	*p*
Age								
15– 24	1		1		1		1	
25–34	1.394	0.004	1.341 (1.015–1.772)	0.039	1.398	<0.001	1.366 (1.125–1.659)	0.002
>34	1.117	0.363	1.857 (1.303–2.647)	0.001	1.043	0.630	1.559 (1.204–2.019)	0.001
Age at First Birth								
<20	1		1		1		1	
20–29	2.172	<0.001	1.247 (1.007–1.545)	0.043	1.686	<0.001	1.280 (1.102–1.487)	0.001
>29	2.535	<0.001	0.874 (0.558–1.371)	0.558	1.625	0.003	1.227 (0.841–1.789)	0.288
Educational Level								
No education	1		1		1		1	
Primary	2.783	0.009	2.440 (1.064–5.596)	0.035	3.397	<0.001	1.677 (1.162–2.421)	0.006
Secondary	5.644	<0.001	3.411 (1.485–7.839)	0.004	5.939	<0.001	2.126 (1.448–3.121)	<0.001
Higher than secondary	9.097	<0.001	2.985 (1.231–7.239)	0.016	7.827	<0.001	1.535 (0.964–2.444)	0.071
Husband's Educational Level								
No education	1		1		1		1	
Primary	1.102	0.815	0.907 (0.378–2.177)	0.826	3.015	<0.001	1.890 (1.344–2.658)	<0.001
Secondary	1.585	0.257	0.746 (0.312–1.786)	0.511	4.455	<0.001	1.953 (1.375–2.773)	<0.001
Higher than secondary	3.063	0.008	0.903 (0.356–2.294)	0.831	6.276	<0.001	2.151 (1.374–3.367)	0.001
Employment Status								
Employed	1		1		1		1	
Unemployed	1.232	0.013	1.147 (0.952–1.382)	0.148	1.110	0.100	1.208 (1.052–1.387)	0.007
Husband's Employment Status								
Unemployed	1		1		1		1	
Employed	3.496	<0.001	2.852 (1.487–5.417)	0.002	1.533	0.191	1.340 (0.678–2.646)	0.399

Parity								
5 or more	1		1		1		1	
3–4	5.854	<0.001	3.109 (2.268–4.262)	<0.001	2.226	<0.001	1.787 (1.413–2.260)	<0.001
1–2	3.538	<0.001	6.475 (4.505–9.306)	<0.001	3.183	<0.001	2.699 (2.067–3.525)	<0.001
Autonomy in Health Care Decisions								
No	1		1		1		1	
Yes	0.856	0.080	1.134 (0.945–1.360)	0.177	0.824	0.004	1.144 (0.977–1.314)	0.055
Mass Media Exposure								
None	1		1		1		1	
Any one	2.378	<0.001	1.448 (0.801–2.617)	0.220	2.620	<0.001	1.426 (1.125–1.807)	0.003
Any two	3.037	<0.001	1.476 (0.808–2.696)	0.205	3.392	<0.001	1.609 (1.239–2.089)	<0.001
All three	3.036	<0.001	1.317 (0.719–2.412)	0.372	3.514	<0.001	1.464 (1.115–1.922)	0.006
Household Wealth								
Q1 (poorest)	1		1		1		1	
Q2	1.584	<0.001	1.305 (0.983–1.733)	0.066	2.292	<0.001	1.743 (1.457–-2.084)	<0.001
Q3	2.426	<0.001	1.738 (1.301–2.320)	<0.001	2.988	<0.001	2.065 (1.651–2.582)	<0.001
Q4	3.891	<0.001	2.668 (1.950–3.650)	<0.001	3.955	<0.001	2.539 (1.881–3.429)	<0.001
Q5 (richest)	5.926	<0.001	3.865 (2.704–5.526)	<0.001	5.636	<0.001	3.712 (2.327–5.923)	<0.001
Distance from Health Facilities								
With issues	1		1		1		1	
Without issues	1.187	<0.001	1.549 (1.180–2.035)	0.002	1.994	<0.001	1.451 (1.229–1.714)	<0.001

Source: Add source

Table 3 illustrates the differences in the use of ANC between urban and rural areas. Women from rural areas who gave first birth at more than 29 years old (aOR = 1.227; 95% CI = 0.841–1.789) were more likely to have ANC4+ than those who gave birth before 20 years old. In addition, women with primary, secondary and higher levels of education were 2.440 (95% CI = 1.064–5.596), 3.411 (95% CI = 1.485–7.839) and 2.985 (95% CI = 1.231–7.239) times, respectively, more likely to have ANC4+ than urban women without education. However, husband's educational level (i.e., primary, secondary and higher levels of education) in rural areas had higher aOR compared with those in urban areas. Women with husbands who worked and lived in urban areas were 2.852 times (95% CI = 1.487–5.471) more likely to have ANC4+ than unemployed husbands. Urban women who had been pregnant 1–2 times or 3–4 times were 6.475 (95% CI = 4.750–9.306) and 3.109 (95% CI = 2.268–4.262) times more likely to have ANC4+ than those who had been pregnant five times or more.

DISCUSSION

Each component of the Continuum of Care (CoC) is important for the provision of critical and lifesaving maternal services. ANC plays a key role in CoC as the first step in achieving continuity for MNCH services. Medical professionals educate expectant mothers about the importance of giving birth in health facilities through ANC, including exclusive breastfeeding, postnatal and postpartum care and family planning services. Facilitating ANC for women who live far from health facilities, are poorly educated, have financial constraints and other barriers is crucial for the reduction of the current health and healthcare access inequities [12]. The study identified several factors associated with the four-visit ANC in Indonesia.

Age, age at first birth, educational level, parity, mass media exposure, household wealth and distance from health facilities were significantly associated with the four-visit ANC. Women aged 25 years old were more likely to have ANC4+ compared with other age groups. This result is similar to findings from other studies in Nepal [13], Shanghai [14], and analysis of national survey data from Bangladesh, Cambodia, Cameroon, Nepal, Peru, Senegal and Uganda [15]. Younger women have a higher risk of inadequate ANC than older women [16]. However, a study conducted on seven regions of Indonesia found that as the age of the mother increases, they are less likely to use ANC services, especially mother aged more than 25 years [17].

Our finding was consistent with a study in Canada. Women who first gave birth at 20–29 years old tend to use ANC [16]. Women who are victims of underage marriages and gave birth at aged 19 years or less were 26% less likely to use ANC services [18]. A study in Nepal proposed that child marriage hinders access to maternal health care due to economic and social barriers. This condition drives women to gain limited autonomy in decision-making and access to maternal services [18]. Policy makers need to review the negative consequences of child marriage and set a minimum age for legal marriage to mitigate this issue.

Women with higher educational level were more likely to receive the four-visit ANC compared with the other group. A systematic review and meta-analysis in Ethiopia also revealed that educated women were more likely to use ANC compared with uneducated women [19]. Literate mothers paid more attention to health and family development [13]. Similar study using the IDHS data for 2002/2003 and 2007 in Indonesia demonstrated that the increased educational level exerted a greater impact on the four-visit ANC for women from poor households than those from the richest households [20]. Several factors of the four-visit ANC can be modified by empowering women through education and increasing decision-making power [19]. Health promotion should target women with low levels of education to increase their consciousness about the importance of ANC services [20].

Women with 1–2 and 3–4 pregnancies are more likely to use ANC than women who had been pregnant for five or more. Women with two or more pregnancies (multipara) were more likely to use ANC than women giving birth for the first time (primipara) [21]. Women who had been pregnant four times or more were likely to receive inadequate prenatal care [16]. The frequencies of ANC decreased as the number of births increased from the first to second until the fifth or more births [15]. Women with higher parity are more likely to depend on experiences from past pregnancies. As such, they feel confident about their pregnancy, which lessens the urgency to seek ANC services. Moreover, women with higher parity did not expect to become pregnant again, such that they tend to use less ANC [22].
Our study found that there was a strong connection between mass media exposure and the four-visit ANC [19]. Women with less exposure to mass media were at higher risk for the under-utilization of antenatal services [20].

Women with exposure to mass media were 1.52 times more likely to use ANC during pregnancy than those without exposure [23]. In rural areas, health workers struggle to reach all mothers. Instead, mass media can be used to disseminate messages about the importance and availability of ANC services in their communities. In addition, advocating ANC in mass media can be a strategy for increasing the four-visit ANC [19, 24]

Household wealth has a significant association with ANC4+. A study in Lao PDR showed that women with high income were 2.6 times more likely to obtain ANC services than women with low income [25]. Another study in Brussels emphasized that women with high and moderate incomes had 14% and 9%, respectively, more antenatal visits compared with those with low income [21]. The four-visit ANC was improved with the increase in household wealth [15, 17] and 20.2% of mothers experience inadequate ANC because they often lacked money to access ANC [14].
In certain countries, ANC services are free. However, it does not completely solve the under-utilization of ANC service. In Ghana, the number of women receiving less than four ANC visits remains high because these mothers continue to face barriers related to direct (consultation and medication) and indirect (transportation and waiting time) costs [26]. In addition, long waiting hours is another barrier for expecting mothers who work in informal sectors as hours spent in health facilities may reduce their daily income. Thus, increasing the number of service providers and physicians is vital to reduce waiting time to enable women to leave early and take care of their families [26].

The opportunities for the four-visit ANC increase among mothers without distance barriers to health facilities. The under-utilization of ANC tends to occur among mothers who reported distance from health services as a major problem [20]. Pregnant women who live far from health facilities had lower rates of ANC visits than those who lived near health facilities. A study in Burkina Faso illustrated that if distance to the closest health facilities increases by 1 km, the odds of a woman receiving ANC4+ will decline by 0.05 and 0.113, respectively [27]. The availability of transportation (bicycle) at the community level was positively associated with the likelihood of women receiving any ANC. The prioritization of investment in transportation infrastructure supports the improvement of MNCH [25, 27].

The present study also assessed the urban–rural differences in the four-visit ANC. Previous studies indicated that women who live in urban areas are more likely to receive ANC services, as they have better information and access to health facilities [17, 19, 21]. Mothers from under-developed areas in Indonesia, such as the rural areas of Sumatera and Eastern Indonesia region, are more likely to under-utilize ANC services compared with women from the urban areas of the Java–Bali region. The government should prioritize the strategies for improving the distribution of human resources, health facilities, roads and infrastructure to be more accessible and available to women who lived in rural areas [20, 26].

We used the IDHS dataset, which is representative of the Indonesian population. The survey was conducted using standard procedures and measurement units to select the sampling units, respondents and household strata. Therefore, the generalizability of the study can be increased. In addition, the possibility of recall bias has been reduced by restricting the study sample only to women who had given birth in the last five years prior to the survey. The study has several limitations. The secondary data can only analyze and explain the risk factors based on available variables. The study design restricted the explanation of the causality of factors associated with the four-visit ANC. Moreover, the data used are subject to recall bias as they were based on self-reported data. Future research, such as a qualitative study, and cultural influence as a community factor can be considered to further understand women's perception as individual factors regarding the four-visit ANC.

CONCLUSION

A total of 88.4% of women in the study received ANC4+ during pregnancy. Age, age at first birth, educational level, parity, household wealth and distance from health facilities were associated with the four-visit ANC. Women living in urban areas received adequate ANC services compared with those living in rural areas. Therefore, future policies should focus on teenage pregnancy and women empowerment issues to overcome maternal health problems. Health promotion and advocacy should also be specifically tailored to reach the underprivileged population. This problem is multisectoral in nature as the distribution of human resources, health facilities and infrastructure should be built to provide rural residents with access to better healthcare services. Indonesia's national health insurance also plays a vital role in making healthcare affordable.

DECLARATIONS

Authors' contributions

Conceptualization: HA Formal analysis: SDR and VN Methodology: HA and AS Supervision: H.A Writing—original draft preparation: HA Writing—review and editing: HA, SDR, VN, and AS. All authors contributed to the drafting, review, and approval of this manuscript.

Acknowledgments

We are grateful to the Indonesia Demographic and Health Survey Program for access to data. The project was fully supported by the Directorate of Research and Community Engagement of Universitas Indonesia, grant number NKB-923/UN2.RST/HKP.05.00/2020. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

Conflicts of interest/Competing interests

The authors have no conflicts of interest associated with the material presented in this paper.

References

1. McArthur JW, Rasmussen K, Yamey G. How many lives are at stake? Assessing 2030 sustainable development goal trajectories for maternal and child health. BMJ (Clinical research ed). 2018;360:k373.
2. Nations U. Goal 3: Ensure healthy lives and promote well-being for all at all ages 2015.
3. UNFPA. Trends in maternal health in Ethiopia: challenges in achieving the MDG for maternal mortality" in In-Depth Analysis of the EDHS 2000–2011. Addis Ababa, Ethiopia: United Nations Population Fund (UNFPA); 2012 [cited 2020 August 16]. Available from: http://apps.who.int/iris/bitstream/handle/10665/194254/9789241565141_eng.pdf;jsessionid=41AA93706262194653B29C9FE1DA0532?sequence=1.
4. Fund TCsD. Accelerating Reductions in Maternal and Newborn Mortality: Challenges and Opportunities: The Children's Defense Fund; 2006 [cited 2020 June 10]. Available from: http://cdf.childrensdefense.org/site/DocServer/Accelerating_Reductions_in_MNM.pdf?docID=2148.
5. Choulagai B, Onta S, Subedi N, Mehata S, Bhandari GP, Poudyal A, et al. Barriers to using skilled birth attendants' services in mid- and far-western Nepal: a cross-sectional study. BMC international health and human rights. 2013;13:49.
6. Laksono A, Paramita A, Dwi Wulandari R. Socioeconomic Disparities of Facility-Based Childbirth in Indonesia2019.
7. Organization WH. Maternal mortality : level and trends 2000 to 2017 Geneva: World Health Organization; 2019 [cited 2020 July 14]. Available from: https://www.who.int/reproductivehealth/publications/maternal-mortality-2000-2017/en/.
8. UNICEF. Maternal and Newborn Health Disparities in Indonesia. New York: UNICEF, 2016.
9. Hijazi HH, Alyahya MS, Sindiani AM, Saqan RS, Okour AM. Determinants of antenatal care attendance among women residing in highly disadvantaged communities in northern Jordan: a cross-sectional study. Reproductive health. 2018;15(1):106.
10. Arunda M, Emmelin A, Asamoah BO. Effectiveness of antenatal care services in reducing neonatal mortality in Kenya: analysis of national survey data. 2017;10(1):1328796.
11. Laksono AD, Rukmini R, Wulandari RD. Regional disparities in antenatal care utilization in Indonesia. 2020;15(2):e0224006.
12. McNellan CR, Dansereau E, Wallace MCG, Colombara DV, Palmisano EB, Johanns CK, et al. Antenatal care as a means to increase participation in the continuum of maternal and child healthcare: an analysis of the poorest regions of four Mesoamérican countries. BMC Pregnancy Childbirth. 2019;19(1):66.
13. Awasthi MS, Awasthi KR. Utilization of Antenatal Care Services in Dalit Communities in Gorkha, Nepal: A Cross-Sectional Study. 2018;2018:3467308.
14. Zhao Q, Huang ZJ, Yang S, Pan J, Smith B, Xu B. The utilization of antenatal care among rural-to-urban migrant women in Shanghai:a hospital-based cross-sectional study. BMC public health. 2012;12(1):1012.
15. Saad-Haddad G, DeJong J, Terreri N, Restrepo-Méndez MC, Perin J, Vaz L, et al. Patterns and determinants of antenatal care utilization: analysis of national survey data in seven countdown countries. Journal of global health. 2016;6(1):010404.
16. Heaman MI, Martens PJ, Brownell MD, Chartier MJ, Thiessen KR, Derksen SA, et al. Inequities in utilization of prenatal care: a population-based study in the Canadian province of Manitoba. BMC Pregnancy Childbirth. 2018;18(1):430.
17. Tripathi V, Singh R. Regional differences in usage of antenatal care and safe delivery services in Indonesia: findings from a nationally representative survey. BMJ open. 2017;7(2):e013408.

18. Sekine K, Carter DJ. The effect of child marriage on the utilization of maternal health care in Nepal: A cross-sectional analysis of Demographic and Health Survey 2016. PLoS One. 2019;14(9):e0222643.
19. Tekelab T, Chojenta C, Smith R, Loxton D. Factors affecting utilization of antenatal care in Ethiopia: A systematic review and meta-analysis. PLoS One. 2019;14(4):e0214848.
20. Titaley CR, Dibley MJ, Roberts CL. Factors associated with underutilization of antenatal care services in Indonesia: results of Indonesia Demographic and Health Survey 2002/2003 and 2007. BMC public health. 2010;10:485.
21. Beeckman K, Louckx F, Putman K. Determinants of the number of antenatal visits in a metropolitan region. BMC public health. 2010;10:527.
22. Ali AA, Osman MM, Abbaker AO, Adam I. Use of antenatal care services in Kassala, eastern Sudan. BMC Pregnancy Childbirth. 2010;10:67.
23. Singh R, Neogi SB, Hazra A, Irani L, Ruducha J, Ahmad D, et al. Utilization of maternal health services and its determinants: a cross-sectional study among women in rural Uttar Pradesh, India. Journal of health, population, and nutrition. 2019;38(1):13.
24. Acharya D, Khanal V, Singh JK, Adhikari M, Gautam S. Impact of mass media on the utilization of antenatal care services among women of rural community in Nepal. BMC research notes. 2015;8:345.
25. Ye Y, Yoshida Y, Harun-Or-Rashid M, Sakamoto J. Factors affecting the utilization of antenatal care services among women in Kham District, Xiengkhouang province, Lao PDR. Nagoya journal of medical science. 2010;72:23-33.
26. Arthur E. Wealth and antenatal care use: implications for maternal health care utilisation in Ghana. Health economics review. 2012;2(1):14.
27. Tanou M, Kamiya Y. Assessing the impact of geographical access to health facilities on maternal healthcare utilization: evidence from the Burkina Faso demographic and health survey 2010. BMC public health. 2019;19(1):838.

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

EXPLORING THE CHALLENGES OF PREHOSPITAL EMERGENCY PERSONNEL IN COVID-19 PANDEMIC: A QUALITATIVE STUDY

Zohreh Sarchahi[1], Hasan Ghodsi[1], Rasool Iakziyan[2], Razieh Froutan[3, 4]*

1. Department of Nursing, School of Nursing and Midwifery, Neyshabur University of Medical Sciences, Neyshabur, Iran
2. Department of Nursing, Sabzevar University of Medical Sciences, Sabzevar, Iran.
3. Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
4. Department of Medical-Surgical Nursing, School of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran

Correspondence: Hasan Ghodsi; ghodsih1@nums.ac.ir

ABSTRACT

OBJECTIVES:

To explore the challenges and experiences of Prehospital Emergency Personnel in the context of the COVID-19 pandemic in Iran.

DESIGN:

Qualitative study

SETTING:

Prehospital Emergency Medical Services (EMS), Iran.

PARTICIPANTS:

15 Prehospital Emergency personnel were invited to participate. Semi-structured in-depth interviews were conducted between Januarys to March 2021.

RESULTS:

Themes relating to challenges of Prehospital Emergency Personnel in COVID – 19 were: Lack of preparedness of EMS for the pandemic, shortage of Personal Protective Equipment (PPE), psychological distress and negative emotions, shortage of staff and challenges associated with delivering care for patients using PPE.

CONCLUSIONS:

The current study found that Health Care Workers (HCWs) in the prehospital emergency field had multiple challenges in caring for their patients during COVID-19. Therefore, they are vulnerable in this situation. These challenges must be addressed in order to protect them in pandemics.

KEYWORDS

Pandemics; COVID-19; Personal Protective Equipment; Emergency Medical Services; Psychological Distress.

INTRODUCTION

On 1 December 2019, the global outbreak of the novel Severe Acute Respiratory Corona Virus-2 (SARS-CoV-2), known as COVID-19, was reported by the World Health Organization. This was the first pandemic caused by the virus. [1] By December 14, 2021, more than 271 million confirmed cases and 5.3 million deaths of COVID-19 globally were reported. [2] In Iran, the number of confirmed cases has been recorded at more than 3 million with 82,217 deaths as of June 15, 2021. Due to exposure to patients with COVID-19, front-line Health Care Workers (HCWs) were at high risk of this infection which may contribute to death. In Iran, ithas been registered that over 12,000 HCWs have been infected and 164 HCWs have died from COVID-19 so far. [3] The HCWs who are in contact with the pandemic COVID-19 may develop different psychological and mental disorders including symptoms of depression, insomnia, anxiety, posttraumatic stress disorder (PTSD), and burnout.

In a study conducted in Wuhan, China, it was found during the COVID-19 pandemic that a significant percentage of HCWs have been experiencing symptoms of depression (50.4%), anxiety (44.6%), insomnia (34%) and distress (71%). [4] Another study conducted on HCWs during COVID-19 showed that 39.1% of front-line HCWs during the fight against COVID-19 had been challenged with psychological problems. [5]

Prehospital Emergency Personnel are among the front-line HCWs who provide urgent care to people, are at a different risk of infections because they have close contact with both symptomatic and asymptomatic cases. Therefore, during the COVID-19 crisis, in providing essential care to patients, Emergency Medical Services (EMS) may encounter the factors associated with increased risk of anxiety, fear of infection, and burnout. [6]

Due to the fact that there is still not enough information available about this disease, and its form is getting changed every day, this intensifies the difficult decision-making for HCWs who have faced in these situations. [7] However, a number of studies have been conducted on previous challenges facing pre-hospital emergency care staff, [3-8] the challenges will be certainly different than before considering the different nature, spread rate and mortality of SARS-CoV-2.

The aim of this study was to investigate the challenges experiences with Prehospital Emergency Personnel in the context of the COVID-19 pandemic in Iran.

METHODS

DESIGN AND SETTING

This study adopted a conventional approach to qualitative content analysis. [9] Semi-structured interviews were conducted with Prehospital Emergency Personnel from the different provinces of Iran from 20 January to 30 March 2021. EMS Iran is an affiliate of Iran's Ministry of Health. There are 2,190 Emergency bases in 31 provinces of Iran.

PARTICIPANTS

The participants were chosen using a purposive sampling method with maximum diversity in education, age and gender. We selected the participants who had at least six-months experience in caring for patients with COVID-19 in the field through prehospital emergency medical services to obtain realistic perspectives from the challenges EMS faced. Sampling continued until a point of theoretical saturation was reached, i.e., when no new data were generated. The research participants were asked to sign a consent form in which the participants have a right to withdraw from the study at any time.

DATA COLLECTION

Semi-structured in-depth interviews were conducted with participants to explore the challenges EMS faced during the COVID-19 pandemic period. On average, the interviews lasted between 45 and 60 minutes and were conducted by the same interviewer H Gh (in Persian). The time and location of the interviews were arranged by agreement with the participants. The interview guide and questions were developed and modified after review of the related literature using opinions from experts and was tested in two pilot interviews. One major question and several minor ones were set.

An interview guide containing a list of general open-ended questions, such as "How do you describe your work experiences in EMS during the COVID-19?", "What challenges have you been facing during missions with patients who needed care for COVID-19?" and if needed, a probe question, "Could you describe in detail what you mean?" was used. The interviews continued until data saturation. To ensure data saturation, two additional participants were interviewed.

DATA ANALYSIS

The deployed analytical approach was a qualitative content analysis (Graneheim and Lundman approaches). [10] Audio-recorded interviews were transcribed verbatim and verified by participants. For immersion, the interviews were read several times and the data analysis was started line by line and the initial codes were extracted. Data were compared to find similarities and differences, then labeled and classified into categories and subcategories. Finally, the underlying meanings were interpreted as themes. Data from the interviews were initially coded by H Gh and codes were cross-checked with R F.

RIGOR

Trustworthiness of research was established through credibility, dependability, conformability and transferability. To fulfill this objective, prolonged engagement with data, constant comparison analysis, member checks, peer checks and maximum variation of sampling were accomplished. [11]

ETHICAL CONSIDERATIONS

The Ethical Committee of Neyshabur University of Medical Sciences, Iran approved this study (IR.NUMS.REC.1400.013). The principles of informed consent and confidentiality were observed carefully. All participants were assured about their anonymity and confidentiality of any information. Moreover, all of them were assured that they could quit the study at will.

RESULTS

15 participants consisting of six paramedics, three dispatchers, one anesthesiology assistant, two physicians and three nurses were studied. They were within the age range of 24-48 years, with an average age of 33.8 ± 8.29 years (66.7% male) and a mean working history of 9.67 ± 6.37 years (Table 1).

TABLE 1. PARTICIPANT CHARACTERISTICS

NO	AGE(YEARS)	POSITION	WORKING EXPERIENCE(YEARS)
1	25	Paramedic	3
2	45	Nurse	20
3	36	Dispatcher	5
4	43	Paramedic	15
5	24	Paramedic	5
6	32	Paramedic	8
7	24	Anesthesiology assistant	3
8	35	Nurse	12
9	48	Paramedic	22
10	43	Dispatcher	18
11	38	Physician	10
12	34	Nurse	8
13	25	Paramedic	5
14	25	Dispatcher	3
15	34	Physician	8

Challenges facing Prehospital EMS staff were classified under five main categories including: 1- lack of preparedness of EMS for pandemic 2- Shortage of personal protective equipment (PPE) 3- Psychological distress and negative emotions in staffs 4- Shortage of staff 5-Challenges associated with delivering care for patients using PPE (Table 2).

TABLE 2. THEMES AND SUB-THEMES

N	THEME	SUB-THEMES
1	lack of preparedness of EMS for pandemic	- Education & training gap - Inconsistent Guidelines - Lack of operational plan
2	Shortage of Personal Protective Equipment	-Shortage of mask, hand rub, PPE - Barrier in access - Lack of alternative
3	Psychological distress and negative emotions in staffs	- Risk of disease - Transition disease to family members - Unknown nature of disease - Fear of death - Sympathy with family of patients
4	Shortage of staff	-Self isolation period - Positive test - Increased missions - Leave the job - Setting up new EMS centers
5	Challenges associated with delivering care for patients using PPE	- Providing care problem - Communication problem - Uncomfortable PPE - Hardness of eating & drinking with PPE

LACK OF PREPAREDNESS OF EMS FOR PANDEMIC

Most participants agreed that all pre-hospital emergency care staff were not sufficiently prepared for this pandemic. They also stated that at the start of the COVID-19 outbreak, the operational plan to respond to this pandemic was not clearly delineated.

"*We were deeply surprised; it was difficult to believe that such a thing had happened. First few days, there were no special procedures and safety instructions for receiving and transporting a patient, ambulance cleaning and disinfection and so on. We felt as if we were drowning in the sea while we were not prepared to deal with that*". P8

"*No one, even, had thought that we've faced such a global catastrophe, we were all stunned. We weren't adequately trained and qualified to deal with this disease. Even, in early days, we didn't know how to put the PPE on and take it out to avoid being contaminated. It was the first time I had experienced dealing with an infectious disease*". P4

"*Early on, there weren't any specific instructions, dispatch protocols and standard operating procedures for receiving the patients with COVID-19. We were limited by inadequate information, and every day we received a new circular that might be different from the last-day one and this can make a person confused. Everything seemed to be going wrong. It can be said that we weren't well-prepared to deal with such this unknown infectious disease*". P14

SHORTAGE OF PERSONAL PROTECTIVE EQUIPMENT (PPE)

All participants noted the shortage of personal protective equipment that was required for doing missions early in the pandemic. The biggest shortage was profound among personal protective equipment and N95 filtering masks.

They were really worried about being infected with COVID-19 due to the lack of equipment (especially those with underlying medical conditions or pregnant women).

"*Early days, there were shortages of essential PPE for everyone such as respirators masks. We had to wear the same clothes for more than one mission without changing them. We don't have enough appropriate gloves and glasses*". P11

Sometimes, there wasn't an appropriate size of personal protective clothing for us. You know, most of these clothes are equal in size and they weren't well-fit for me because I'm short. The masks were not correctly fixed and fitted on my face well. Some filtering respirators didn't meet the quality of standards and their filters got detached.

PSYCHOLOGICAL DISTRESS AND NEGATIVE EMOTIONS IN STAFFS

The participants were sharing their experiences including the fear of getting infected and seriously ill due to the coronavirus which would result in death.It being a horrible disease because of its unknown nature and of being a carrier and transmitting it to another person. Also, they were worried about returning home and infecting their family with the virus.

"*Every day, on the way to go to work, I thought it was the last time that I would see my family. Because our mission was to give care to COVID-19 patients every day, I was afraid of becoming infected by the virus. I got nervous when I heard of the death of patients and my colleagues*". P5

"*There is no*(sic) *enough information about the disease including how to transmit, treat and bury the bodies. These patients were dying alone in hospital rooms. The hospital neither allows the patients to have visitors and nor delivers the dead patients' bodies to their families. Nobody is permitted to participate in their burial ceremonies. This is too deep anxiety that I feel like I'm going insane. I don't want to die like this (having a lump in his throat)*". P15

SHORTAGE OF STAFF

All participants pointed out the severe shortage of staff, due to the 14-day self-isolation period when they tested positive for COVID-19, the increased number of EMS missions and the need to establish new bases at EMS centers during the COVID-19 pandemic.

"*According to instruction, the staff had to self-isolate when they developed the early symptoms of the COVID-19. Also, the test results were given within 2 days. These compulsory leaves and subsequently 14-day sick leaves for a positive COVID-19 test result put a great deal of pressure on other staff who had to take mandatory overtime*." P1

"*First days, the people callings to EMS center was harassment. They called EMS center to ask their questions about Corona and the number of deaths and hospitalizations caused by COVID-19. We had to put more staff in the dispatch to answer the calls, while most of the staff went on sick leave and the shortage of staff was suffering*." P3

"*In the past one year, 80% of our pre-hospital emergency staff have tested positive. Therefore, these staff go on 14-day sick leave and it's necessary to find the replacement staff. On the other hand, since the number of missions was increasing, we had to establish some mobile bases that it caused the double shortage*." P2

CHALLENGES ASSOCIATED WITH DELIVERING CARE FOR PATIENTS USING PPE

Most of the participants claimed that providing care for patients was difficult and tedious when wearing PPE. They also explain their other problems with PPE including profuse sweating, shortness of breath, local pain and damage to their ears and face with prolonged use of a mask.

"*You know, working in this coverall is really difficult. It's hard to breathe during PPE use. You sweat profusely and they are cumbersome. Totally, it's better to say that you get sweltered when you use PPE and respirator for a long time. I'm not comfortable with them at all*." P8

"*When I have to intubate the patients, either I should be afraid of being infected intubating or we have to work in impermeable PPE that makes us feel someone ties our hands and then asks us to continue working. My face shield gets foggy and hard to see out. Providing care for patients is really hard in this clothing*." P 7

"*We have to put on the PPE when the dispatch has announced a COVID-19 mission. This means a twofold increase in mission time. However, this wasted time is vital in prehospital care, but there is no choice. As a result, we have to speed up the ambulance to compensate for this wasted time*." P12

DISCUSSION

This study found the challenges facing prehospital emergency personnel during COVID-19 pandemic included inadequate preparedness of EMS for the pandemic, shortage of personal protective equipment, psychological distress and negative emotions in staffs, shortage of staff and challenges associated with delivering care for patients using PPE. To our knowledge, this study is the first qualitative study explaining the challenges of prehospital emergency personnel during the COVID-19 pandemic in Iran.

The results of our study showed that the first category of challenges was inadequate pandemic preparedness levels of EMS. This theme was pointed out by other researchers. [7, 12] The preparedness of EMS is a key factor to control and manage any disaster such as natural, manmade or pandemics. If they aren't prepared for such a situation, they may be scared, confused, or can't do their jobs properly. According to the above, it is necessary that prehospital emergency medical managers have a preparedness plan to control and manage the pandemic. They must have ongoing policies to address the epidemic or pandemic.

Another category that is identified by this research was the shortage of personal protectiveeEquipment. PPE is one of the most important pieces of equipment to deal with a pandemic like COVID-19. [13, 14] Shortage of PPE has been reported due to the increasing worldwide demand (15). Nearly, all the participants reported a severe shortage of PPE in their workplaces. Shortage of PPE can lead to infection in the EMTs; hence, perceived shortages were a major source of stress for participants in this study, which is reported in different studies. [12, 16-18] The participants reported several adaptations in delivering care in prehospital emergency medical services in order to save PPE. Availability of PPE in the right quality and the right quantity at the right place and right time to reduce the stress of the staff is necessary. Adequate stock of PPE must be prepared by all healthcare organizations especially for frontline HCWs such as EMS staff.

When people encounter an unknown disease and pandemic, they become gripped by fear and anxiety. [19] This phenomenon is not new for COVID-19. [20] Almost all participants explained that fear and anxiety affected their work after this pandemic which is reported in different Studies. [5, 7, 21-23] The reasons for fear and anxiety which were explained by participants included suspicion/confirmation for COVID-19, insufficient PPE, insufficient knowledge about disease, risk of infection transmission in the family. Health care managers have inevitably established psychological support systems to counter fear and anxiety in pandemics such as COVID-19 amongst their staff. Moreover, it is important for EMS staff to learn coping strategies to deal with fear and anxiety in various situations.

Another theme drawn from interviews was the shortage of staff which is explained in other studies. [7, 24, 25] The reasons for this shortage of staff are increased daily EMS calls and dispatches, staff absence, extremely vulnerable absence and 14-day self-isolation after a positive test. The average number of daily calls and dispatches in the post-outbreak periods was increased significantly. There was a substantially higher number of EMS phone calls during the post-outbreak period compared to the pre-outbreak period. [25]

Most participants described that using PPE is necessary to prevent infection, but it makes everything more difficult for health care workers. Face sgields or glasses fog up whilst performing procedures on patients such as intubation. When using several layers of gloves, palpitations were less effective in physical examination. When you are wearing PPE communication with hearing-impaired older patients is difficult; so, some participants reported removing their masks when speaking about important issues with them. Also putting on the PPE can reduce the activity of EMTs while they drive an ambulance. These findings were reported in previous studies. [12, 26, 27] Comfortable PPE is an essential issue for health care providers such as EMS staff. Participants said PPE coverall could reduce their activity and focus at the scene. They noticed prolonged use of PPE had led to some complications such as headache, skin damage, and facial pain, difficulty in breathing and physical tiredness. Participants said that PPE use is not comfortable for a long time, it being time-consuming, hot, tiring and restrictive in delivery of care. Our findings showed that delay between a 115 call and EMS arrival, increased about 1.5 minutes.

STRENGTH AND LIMITATIONS

To our knowledge this is the first research study to explore challenges experiences with prehospital emergency personnel in the context of the COVID-19 pandemic in Iran.

This research has provided a comprehensive account of challenges associated with delivery cares to patients with COVID –19 in the prehospital field in Iran.

CONCLUSION

The results of this study regarding the challenges of prehospital emergency personnel in COVID-19 pandemic showed that they are not adequately equipped to an encounter with pandemics. Therefore, in preparation for further pandemics or public health emergencies, more efforts and coordination should be made to remove or reduce challenges for health care workers.

This qualitative study was conducted only utilizing interviews. In the future, research involving other methods may be needed to cover all aspects of this issue. Another limitation was the small number of participants. For this limitation, we chose our participants with maximum diversity and all of them were experienced in EMS. Supplemental employee assistant such as financial, emotional or other supports can reduce their pressure and useful for the staff in order to improve their psychological state.

ACKNOWLEDGEMENTS

The authors would like to thank all the participants for their contribution to the study.

AUTHOR CONTRIBUTIONS

The conception and design of the work was by HGH, RF and EM. Interviews conducted by HGH. Data from the interviews were coded by HGH and codes were cross-checked with RF. HGH, RF, ZS and MA were involved in the acquisition, analysis, or interpretation of data. All authors approved the submitted version and agree to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work will be answered.

FUNDING/SUPPORT

This study was funded by Neyshabur University of Medical Sciences, Grant/Award number: 99-01-218.

CONFLICT OF INTEREST

None declared.

DATA AVAILABILITY STATEMENT

Data are available in a public, open access repository. Data are available upon reasonable request. The data used for this study are qualitative, and the original transcripts can be made available from the first author upon reasonable request.

ETHICS APPROVAL

The Ethical Committee of Neyshabur University of Medical Sciences, Iran approved this study (IR.NUMS.REC.1400.013).

References

1. World Health Organization (WHO). Director-General's opening remarks at the media briefing on COVID-19-11 March 2020. [Available from: https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarksat-the-media-briefing-on-COVID-19—11-march-2020. Accessed 12 April 2021.
2. Johns Hopkins University. COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU). https://coronavirus.jhu.edu/map.html . Accessed 15 June 2021.
3. Erdem H, Lucey DR. Healthcare worker infections and deaths due to COVID-19: A survey from 37 nations and a call for WHO to post national data on their website. Int J Infect Dis. 2021;102:239-41. doi: 10.1016/j.ijid.2020.10.064
4. Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, et al. Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. JAMA Network Open. 2020;3(3):e203976-e. doi: 10.1001/jamanetworkopen.2020.3976.
5. Dai Y, Hu G, Xiong H, Qiu H, Yuan XJM. Psychological impact of the coronavirus disease 2019 (COVID-19) outbreak on healthcare workers in China. 2020.03.03.20030874. doi: https://doi.org/10.1101/2020.03.03.20030874.
6. Anderson C, Pooley JA, Mills B, Anderson E, Smith EC. Do Paramedics Have a Professional Obligation to Work During a Pandemic? A Qualitative Exploration of Community Member Expectations. Disaster medicine and public health preparedness. 2020;14(3):406-12. DOI: 10.1017/dmp.2020.212.

7. Nyashanu M, Pfende F, Ekpenyong M. Exploring the challenges faced by frontline workers in health and social care amid the COVID-19 pandemic: experiences of frontline workers in the English Midlands region, UK. Journal of interprofessional care. 2020;34(5):655-61. https://doi.org/10.1080/13561820.2020.1792425
8. Sorani M, Tourani S, Khankeh HR, Panahi S. Prehospital Emergency Medical Services Challenges in Disaster; a Qualitative Study. Emergency (Tehran, Iran). 2018;6(1):e26. PMCID: PMC6036538
9. Strauss a cj. Basics of qualitative research: Grounded theory procedures and techniques.4 ed. Losangeles: Sage publications; 2015.
10. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. Nurse education today. 2004;24(2):105-12. DOI: 10.1016/j.nedt.2003.10.001
11. Boswell C CS. Introduction to Nursing Research: Incorporating Evidence Based Practice. Boston, MA: Jones & Bartlett Publishers; 2007.
12. Hoernke K, Djellouli N, Andrews L, Lewis-Jackson S, Manby L, Martin S, et al. Frontline healthcare workers' experiences with personal protective equipment during the COVID-19 pandemic in the UK: a rapid qualitative appraisal. BMJ open. 2021;11(1):e046199. DOI: 10.1136/bmjopen-2020-046199
13. Cook TM. Personal protective equipment during the coronavirus disease (COVID) 2019 pandemic – a narrative review. 2020;75(7):920-7. DOI: 10.1111/anae.15071
14. Sharma N, Hasan Z, Velayudhan A, M. A. E, Mangal DK, Gupta SD. Personal Protective Equipment: Challenges and Strategies to Combat COVID-19 in India: A Narrative Review. 2020;22(2):157-68. https://doi.org/10.1177/0972063420935540.
15. World Health Organization & United Nations Children's Fund (UNICEF). (2020). Water, sanitation, hygiene, and waste management for the COVID-19 virus: interim guidance, 19 March 2020. World Health Organization. https://apps.who.int/iris/handle/10665/331499. License: CC BY-NC-SA 3.0 IGO.
16. Liu Q, Luo D, Haase JE, Guo Q, Wang XQ, Liu S, et al. The experiences of health-care providers during the COVID-19 crisis in China: a qualitative study. The Lancet Global health. 2020;8(6):e790-e8 DOI: 10.1016/S2214-109X(20)30204-7 .
17. Shanafelt T, Ripp J, Trockel M. Understanding and Addressing Sources of Anxiety Among Health Care Professionals During the COVID-19 Pandemic. JAMA. 2020;323(21):2133-4. doi:10.1001/jama.2020.5893
18. Gordon A, Lyons C, Rao S, Finoli L. Health Care Workers' Challenges in the Care of a COVID-19 Patient. Critical care nursing quarterly. 2020;43(4):400-6 DOI: 10.1097/CNQ.0000000000000325 .
19. DeJean D, Giacomini M, Vanstone M, Brundisini F. Patient experiences of depression and anxiety with chronic disease: a systematic review and qualitative meta-synthesis. Ontario health technology assessment series. 2013;13(16):1-33. PMCID: PMC3817854
20. Camara A, Sow MS, Touré A, Sako FB, Camara I, Soumaoro K, et al. Anxiety and depression among HIV patients of the infectious disease department of Conakry University Hospital in 2018. Epidemiology and infection. 2020;148:e8. doi: 10.1017/S095026881900222X
21. Du J, Dong L, Wang T, Yuan C, Fu R, Zhang L, et al. psychological symptoms among frontline healthcare workers during COVID-19 outbreak in Wuhan. Gen Hosp Psychiatry. 2020; 67:144-5 doi: 10.1016/j.genhosppsych.2020.03.011.
22. Sanghera J, Pattani N, Hashmi Y, Varley KF, Cheruvu MS, Bradley A, et al. The impact of SARS-CoV-2 on the mental health of healthcare workers in a hospital setting-A Systematic Review. Journal of occupational health. 2020; 62(1):e12175 https://doi.org/10.1002/1348-9585.12175
23. Fathi E, Malekshahi Beiranvand F, Hatami Varzaneh A, Nobahari A. Health Care Workers Challenges during Coronavirus Outbreak: The Qualitative Study. mui-jbs. 2020;18(2):237-48. URL: http://rbs.mui.ac.ir/article-1-745-en.html
24. Xu H, Intrator O, Bowblis JR. Shortages of Staff in Nursing Homes During the COVID-19 Pandemic: What are the Driving Factors? Journal of the American Medical Directors Association. 2020;21(10):1371-7. doi: 10.1016/j.jamda.2020.08.002
25. Saberian P, Conovaloff JL, Vahidi E, Hasani-Sharamin P, Kolivand P-H. How the COVID-19 Epidemic Affected Prehospital Emergency Medical Services in Tehran, Iran. West J Emerg Med. 2020;21(6):110-6. DOI: 10.5811/westjem.2020.8.48679

26. Kim Y. Nurses' experiences of care for patients with Middle East respiratory syndrome-coronavirus in South Korea. American journal of infection control. 2018;46(7):781-7. DOI: 10.1016/j.ajic.2018.01.012

27. Lam KK, Hung SY. Perceptions of emergency nurses during the human swine influenza outbreak: a qualitative study. International emergency nursing. 2013;21(4):240-6. DOI: 10.1016/j.ienj.2012.08.008

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

IMPACT OF COVID-19 ON MENTAL HEALTH ISSUES IN INDIA: UNDERSTANDING THE FACTORS OF SUICIDES DUE TO PANDEMIC

Subhra Rajat Balabantaray, Deepak Bangwal, Upananda Pani

University of Petroleum and Energy Studies, India

Correspondence: subhrarajat@gmail.com

ABSTRACT

This study seeks to evaluate how the COVID-19 pandemic is not just impacting tremendously on physical health, rather it has a serious effect on the psychological health as well as the mental health of individuals. This needs to be addressed on an urgent basis. The paper looks forward to examing the various kinds of repercussions the current pandemic is having with regards to the deterioration of mental health conditions among individuals, resulting in suicide. The outbreak of Coronavirus has brought about massive changes in India. A lot of misinformation is circulating and this has subsequently led to the creation of anxiety issues among individuals.

KEYWORDS

Covid-19; mental health; suicide; India

INTRODUCTION

The COVID-19 pandemic has infected 178,964,181 in the world and it claimed lives of 3,875,656 individuals across the globe (as on 20th June 2021) [38]. India has witnessed 2,98,81,405 cases with 3,86,741 deaths as on20th June 2021) [38]. The only silver lining that provides a ray of hope is the discharged/ cured number of cases in India which stands at 2,87,58,560 as on 20th June 2021[38]. The disease which started from Wuhan, China [1] is seen o be spreading across the world [2] like a wildfire and is responsible for causing high degrees of morbidity and mortality. The World Health Organisation (WHO) [3] declared COVID-19 as a pandemic as it led to this global health crisis. The pandemic has shaken healthcare systems worldwide. [4, 32]

The pandemic is considered as one of the deadliest and biggest challenge at the global level and can be designated as a global health crisis. [5, 31] During these testing times, issues of mental health were reported from across the globe. [6, 20] Mental health is the combination of emotional, psychological and social well being. It has an impact they way individuals, feel, think and display various behaviours. This also assists in determining as how people handle stress and also make various choices.

Considering the catastrophe the pandemic is capable of, it was witnessed that several countries initiated a lockdown process thereby to ensure maximum social distancing among individuals to curb the spread. [7–10] The mitigation strategies adopted by various countries included cancelling all mass gatherings as well as shutting down

educational institutions, places of work, religious places and places of worship [4,11] which could potentially trigger the spread of the pandemic. As a result, this led to a spike in the mental health issues.

In the testing times of the unavailability of vaccine for the virus and huge amount of population being susceptible to it, the need of the hour was to ensure mechanisms to avoid human contact, for which the lockdown was the best possible policy strategy developed. Lockdowns initiated by various countries had tremendous effect on the economy and several research studies raised concerns regarding enhancement of mental health issues. [12, 33] Scholarly studies have documented that lockdown and isolation has resulted in enhancement of psychological issues like, anxiety, panic attacks, depression, trauma and extreme levels of stress. [5, 13–17] Mamun and Griffiths [15] have stated in their studies that psychological issues might have contributed to around 90% of suicides.

COVID-19 is not only a national concern but has become a challenge faced at the global level, with almost all countries affected by it. In most countries, the healthcare sector is facing tremendous challenges to deal with the pandemic. In addition to that, no individual can make a proper forecast as how long the virus is going to stay and what number of individuals will be casualties. A pertinent challenge to deal with the pandemic is the asymptomatic nature of the disease. A major problem the pandemic is posing is that close to 80% of individuals with COVID-19 show mild or no symptoms of the same, which is termed "asymptomatic", and only 14% of affected individuals are said to be severe and another 6% are believed to be critically ill. A chain reaction has started, owing to the lock down initiated by the pandemic, which has resulted in salary reductions, job loss and rising rates of unemployment [18]. People are more than worried, as the world had not experienced anything of this kind before. These circumstances of job loss and unemployment appear to have huge psychological effects in terms of anxiety, depression and stress on people worldwide. [4] Sher in his article [1] has highlighted the fact that the tendency of suicidal thoughts among individuals may be a result of both neurobiological factors and psychological factors.

Social Media is largely responsible for creating unnecessary panic among individuals thereby spreading false and half-baked information. [34] Considering the large-scale uncertainty surrounding the virus and thereby the role of social media in compounding the misinformation, it is a perfect breeding ground for posing large scale threats to the mental health issues of individuals. [34] COVID-19 has certainly aroused several narratives and discussions about the state of healthcare systems.

METHODOLOGY

An extensive review of literatures was basically conducted to carry out the study. The study is a narrative review trying to focus on the issues of suicides due to pandemic. The research paper included literature focussing on issues of suicides due to pandemic. Plenty of research paers are available on impact of COVID-19, however, only the research paers focussing on issues of mental helath and suicide due to the impact of COVID-19 were taken into consideration.

The present research paper relies on information collected from secondary sources. Research papers, newspaper articles, books and reports were analysed for the present study. The keywords used to search for research articles were suicide, suicidal tendencies, COVID-19, and mental health. The central objective of this research paper is to understand the psychosocial impact of the current pandemic on individuals and subsequent development of suicidal thoughts and suicidal tendencies among Indians.

1.CONCEPTUAL FRAMEWORK:

The effect of pandemic is unimaginable and unpredictable. Such pandemics have brought about in the past tremendous burden on the economy as well as having had an impact on the mental health of various segments of the population. Issues like anxiety, stress, depression related issues are believed to be able to be addressed by social interaction. However, the current pandemic and its contagious nature, has demonstrated, has severely minimised social interactions. Lockdown, shut down and social distancing practices has even made things worse. Subsequently, it had a tremendous toll on the mental health of people. Suicides or suicidal tendencies are a byproduct of two extreme situations in society. As has been pointed by Durkheim, [36] extreme or less social integration can lead to suicide and extreme or minimal social regulation can lead to suicidal measures. [36]

2. STATEMENT OF THE PROBLEM

Various disease outbreaks, pandemics and epidemics are largely responsible for generating widespread fear and have the potential of inflicting negative thoughts in the minds of individuals. [4, 30] de Hoog, Stroebe and de Wit

[19] have defined fear as an unfavourable state of mind, which is the result of anticipation of a threat. There have been instances where persons have committed suicide only by the thought that they have contracted COVID-19 whereas the later autopsies have exhibited that they are not affected by the virus. The fear of the virus is looming larger than the virus itself. [15, 20]

Patients who have survived COVID-19 should be screened and kept under review as they are the ones who are more vulnerable and are more prone to commit suicide. [37] The prime reason or the cause of suicide is the presence of large amount of depression. It can be inferred here that the patients who have recovered from COVID-19 face tremendous amounts of mental stress and agony, which can result in suicidal tendencies. [1] Sher has pointed out [1] that the individuals who have recovered from COVID-19 still need psychological guidance considering the fact that they have undergone through a lot of mental turmoil. Moreover, there is a need to examine the various interventions that could be helpful to reduce suicidal tendencies and psychiatric morbidity.

Considering the rate at which the COVID-19 is spreading, it is evident that there will be far reaching effects of the same and they will be largely responsible for an impact on the psychology of individuals. [21] Negative consequences of COVID-19 may extend far beyond its considerable death toll, having a significant impact on psychological well-being. The World Health Organization reports [22], suicide happens to be one among the leading causes of death worldwide. In this context there is a need to seriously consider the case of COVID-19 and subsequent repercussions on the mental health issues of individuals. In addition to that, when we have instances of people committing suicide with the apprehension of having contracted COVID-19, there is a serious need to revisit and debate these issues.

COVID-19 has become a global health concern that is impacting both physical and mental health across populations. Alongside depression, anxiety, distress, phobia, and many other psychological impacts, [23, 24] COVID-19 is also found to be associated with suicidal behavior (1). Several cases of suicide are reported amid COVID-19, [15, 20, 25] where the affected individual experienced psychosocial stressors attributable to fears and misconceptions on COVID-19. COVID-19 may directly impact mental health and wellbeing among individuals and populations; however, infection prevention measures like lockdown may have indirect socioeconomic and psychological implication. [13, 26] There is a need to acknowledge the fact that India being a developing country is not well equipped to deal with mental health issues and the number of mental professionals is also very less in number. In addition to that, it may be highlighted here that the limited mental health professionals will never be able to address to the needs and demands of the large scale up surging cases relating to mental health. Hence, a large number of mental health issues might go unnoticed which are bound to create and pose large degree of problems in future. This might further lead to issues in employment and general lifestyle of various individuals affected by COVID-19.

In this research paper, we describe suicides committed by various individuals in India, evaluate the social and psychological determinants of suicidal behavior in that context, and discuss potential interventions addressing the same.

REVIEW OF RELATED LITERATURE

The World Health Organisation [22] sets out that 703,000 people commit suicide every year and there are more than 20 suicide attempts per each suicide. The degree of seriousness regarding the magnitude of mental health issues can be gauged from the above information. Hence, a detailed review of literature will help to understand as how the global pandemic has made worse the already problematic situation.

Halford, Lake and Gould in their article [27] "Google searches for Suicides and suicide risk factors in the early stages of the COVID-19 pandemic" have documented the fact that due to COVID-19 there has been paramount changes in the lifestyle of individuals. Speaking of the various stressors, which come alongside the pandemic, poses a serious threat to issues of mental health and subsequently increases chances of individuals being vulnerable to suicidal tendencies. This study was conducted in United States of America to examine the effect of COVID-19 on suicidal tendencies at the early stage of this pandemic and it was based on the data collected by Google trends. It revealed that there was a drop in Google search regarding suicide and its related concepts but in long run, there was a chance of increased suicide ideation and known risk factors of suicide. As after the crisis of September 11, there was a decrease in suicide

rates but in the long-run aftermath of the influenza pandemic, there was an increase in suicide rates.

The authors Kakunje et al. [28] have highlighted that due to COVID-19, people are forced to stay indoors and their regular activities have been disturbed and restricted. Due to this confinement and reduced social interaction, many psychological problems started which includes high stress levels, sleeplessness, and subsequently anxiety and suicide cases were reported. To face this challenging time mental health awareness, mindfulness and digital psychiatry has played major roles.

In Asian countries, the research data is also corroborating with the western research output in terms of mental health issues like anxiety, depression and suicide during this COVID-19 pandemic. Mamun and Ullah reported in their study [24] have documented that in developing countries people die not just because of CORONA rather many other factors were there. Those were fear of infection, economic recession and distress, fear of COVID-19 and work stress. The data were collected from the cases reported at Government level for the first time in their country to monitor the suicide cases and to plan for intervention programmes in line with need.

Mamun and Griffiths in their study [15] on Bangladesh have documented first suicide case from the country as a result of fear due to COVID-19. A man of Ramchandrapur village in Bangladesh had returned from Dhaka and subsequently he exhibited certain symptoms related to COVID-19 like cold, fever and weight loss. Despite of being empathetic towards his condition, villagers exhibited severe degree of social avoidance and discrimination. This compelled him to commit suicide but from biopsy, it was revealed that he did not contract COVID-19 virus. The authors have suggested that bias and prejudice claimed the life of an inncocent person which could have been otherwise saved.

Rajkumar conducted a pilot study [23] of media reports on suicides related to COVID-19 outbreak in India. They have collected the data through media reports in the period of 12th March to 10th April 2020. The author has highlighted various impact of COVID-19 on the mental health of individuals.

The findings suggests that few of the suicides are due to a direct outcome of COVID-19 related stress. The drastic and sudden change in lifestyle induced by the pandemic has caused potential threats to mental health and is leading to suicidal tendencies and suicides. It can also be ascertained that the state of mental health of majority of people has comprehensively deteriorated during the COVID-19 phase as compared to the pre COVID-19 phase. The lockdown, social distancing and quarantine measures initiated by the Government has led to sudden confinement and has reduced as well as restricted social interaction. The reduction in social interaction has paved the way for emergence of various psychological issues like anxiety, sleeplessness and suicide ideation. Moreover, the loss of jobs, economic recession, work related stress and financial insecurity is adding to the existing mental health issues. In addition to that, the discriminatory practices targeted towards an infected person is worsening the mental strength of a person to deal with the virus.

FINDINGS AND DISCUSSIONS

The first suicide in India due to COVID-19 was reported from the state of Andhra Pradesh on 12th February 2020 [35]. The person belonging to the Chitoor district communicated to a doctor he consulted that he was having some kind of viral illness. However, with the extreme level of false news going on around he believed that he has contracted COVID-19. It was reported that for quite some time he was obsessed with several videos where he saw many Chinese people collapsing in public. Moreover, he was under the impression that people who have contracted the virus will be forced to stay in a quarantine facility against their will where the treatment will be inhuman in nature. The very thought process that he might contract other people or his friend sand family, resulted in resistance by him as he was supposedly throwing stones to family members and his close friends who tried to come close to him. After a few days, he was found hanging from a tree apparently having committed suicide and the fear he had was that he had contracted the virus.

Several developing and underdeveloped countries including India are reporting cases of suicides. [20] According to the reports of the United Nations Development Programme (UNDP) [29] approximately 55% of the world's population do not have access to adequate mechanisms relating to social protection and the current pandemic poses serious threat to their level of subsistence. It can also be highlighted that their basic accessibility to education is severely compromised and in general it can be said that their basic human rights are vulnerable as well.

The Indian Government initiated lockdown to contain the virus and effectively manage the spread of the disease. However, the lockdown initiatives have resulted in serious and severe psychological distress among individuals leading them to commit suicide or at least have suicidal tendencies. Lockdown measures have resulted in unavailability of alcohol and drugs, which has led to an extreme situation of psychological distress. [35] This has further resulted in individuals with serious degree of addiction succumbing to self-harm activities. Moreover, lockdown has resulted in economic crisis amounting to unemployment and subsequent poverty thereby creating a fertile ground for forcing people into psychological distress. Excessive amount of psychological distress is largely responsible for suicidal tendencies.

Media is primarily responsible for creating panic among vulnerable individuals. Therefore, contemporary need is for media houses to display a higher degree of integrity in delivering their responsibilities and to ensure that the transmission of news happens in such a manner that it should not scare people.

CONCLUSION

COVID-19 is imposing psychosocial challenges among individuals and populations, which can be unique and severe among marginalized population. It is inferred from our discussion that COVID-19 has brought about massive changes in the social structure, which is largely responsible for putting psychology of individuals under severe duress. This has also resulted in surge in suicides in the country. This requires adequate and comprehensive support of services (mental health). Under the circumstances when the face-to-face meeting with the psychologists is not a viable task, several other options can be explored like tele-mental health care. In addition to that, adequate and correct knowledge of COVID-19 should be available for the public. This would largely play a role in reducing unnecessary panic and stress among individuals. Social Media platforms, news channels, and other media platforms should shoulder responsibilities to promote positive mental health in dealing with COVID-19.

POLICY RECOMMENDATIONS:

- Organizing mass media campaigns and infotainment programs to alleviate the fear of COVID-19 and promote regular activities with preventive measures
- Reliable and authentic information programmes about COVID-19 and promotion of tele-medical care
- Arranging community-based mental health promotion programs engaging community stakeholders and psychosocial care providers
- Incorporating mental health services in primary care as well as telemedicine programs with provisions of referral for qualified cases
- Providing targeted individual and group-based interventions for individuals who have acute or chronic psychosocial problems

References

1. Sher L. Are COVID-19 survivors at increased risk for suicide? Acta Neuropsychiatrica. 2020 Oct; 32(5):270.
2. Ahmed SF, Quadeer AA, McKay MR. Preliminary Identification of Potential Vaccine Targets for the COVID-19 Coronavirus (SARS-CoV-2) Based on SARS-CoV Immunological Studies. Viruses. 2020 Feb 25; 12(3): E254.
3. Lipsitch M, Swerdlow DL, Finelli L. Defining the Epidemiology of Covid-19 — Studies Needed. N Engl J Med. 2020 Mar 26; 382(13):1194–6.
4. Pakpour AH, Griffiths MD. The fear of COVID-19 and its role in preventive behaviors. J Concurr Disord. 2020; 2(1):58–63.
5. Carbone SR. Flattening the curve of mental ill-health: the importance of primary prevention in managing the mental health impacts of COVID-19. Ment Health Prev. 2020 Sep;19:200185.
6. Roy A, Singh AK, Mishra S, Chinnadurai A, Mitra A, Bakshi O. Mental health implications of COVID-19 pandemic and its response in India. Int J Soc Psychiatry. 2021 Aug;67 (5):587–600.
7. Iacobucci G. Covid-19: UK lockdown is "crucial" to saving lives, say doctors and scientists. BMJ. 2020 Mar 24;368:m1204.
8. Pulla P. Covid-19: India imposes lockdown for 21 days and cases rise. BMJ. 2020 Mar 26; 368:m1251.
9. Passavanti M, Argentieri A, Barbieri DM, Lou B, Wijayaratna K, Foroutan Mirhosseini AS, et al. The psychological impact of COVID-19 and restrictive measures in the world. J Affect Disord. 2021 Mar 15; 283:36–51.
10. Rubin GJ, Wessely S. The psychological effects of quarantining a city. BMJ. 2020 Jan 28; 368:m313.
11. Anderson RM, Heesterbeek H, Klinkenberg D, Hollingsworth TD. How will country-based mitigation measures influence the course of the

COVID-19 epidemic? The Lancet. 2020 Mar 21; 395(10228):931–4.
12. Shigemura J, Ursano RJ, Morganstein JC, Kurosawa M, Benedek DM. Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: Mental health consequences and target populations. Psychiatry Clin Neurosci. 2020; 74(4):281–2.
13. Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. The Lancet. 2020 Mar 14; 395(10227):912–20.
14. Shammi M, Bodrud-Doza Md, Towfiqul Islam ARMd, Rahman MdM. COVID-19 pandemic, socioeconomic crisis and human stress in resource-limited settings: A case from Bangladesh. Heliyon. 2020 May 1; 6(5):e04063.
15. Mamun MA, Griffiths MD. First COVID-19 suicide case in Bangladesh due to fear of COVID-19 and xenophobia: Possible suicide prevention strategies. Asian J Psychiatry. 2020 Jun; 51:102073.
16. Robertson E, Hershenfield K, Grace SL, Stewart DE. The Psychosocial Effects of Being Quarantined following Exposure to SARS: A Qualitative Study of Toronto Health Care Workers. Can J Psychiatry. 2004 Jun 1; 49(6):403–7.
17. Sakib N, Bhuiyan AKMI, Hossain S, Al Mamun F, Hosen I, Abdullah AH, et al. Psychometric Validation of the Bangla Fear of COVID-19 Scale: Confirmatory Factor Analysis and Rasch Analysis. Int J Ment Health Addict. 2020 May 11;1–12.
18. Shader RI. COVID-19 and Depression. Clin Ther. 2020 Jun;42(6):962–3.
19. de Hoog N, Stroebe W, de Wit JBF. The processing of fear-arousing communications: How biased processing leads to persuasion. Soc Influ. 2008 Jun;3(2):84–113.
20. Goyal K, Chauhan P, Chhikara K, Gupta P, Singh MP. Fear of COVID 2019: First suicidal case in India ! Asian J Psychiatry. 2020 Mar;49:101989.
21. Sood S. Psychological effects of the Coronavirus disease-2019 pandemic. Res Humanit Med Educ. 2020 Apr 1; 7:23–6.
22. Suicide worldwide in 2019 [Internet]. [cited 2021 Aug 26]. Available from: https://www.who.int/publications-detail-redirect/9789240026643
23. Rajkumar RP. COVID-19 and mental health: A review of the existing literature. Asian J Psychiatry. 2020 Aug; 52:102066.
24. Mamun MA, Ullah I. COVID-19 suicides in Pakistan, dying off not COVID-19 fear but poverty? – The forthcoming economic challenges for a developing country. Brain Behav Immun. 2020 Jul;87:163–6.
25. Sahoo S, Rani S, Parveen S, Pal Singh A, Mehra A, Chakrabarti S, et al. Self-harm and COVID-19 Pandemic: An emerging concern – A report of 2 cases from India. Asian J Psychiatry. 2020 Jun;51:102104.
26. Bonaccorsi G, Pierri F, Cinelli M, Flori A, Galeazzi A, Porcelli F, et al. Economic and social consequences of human mobility restrictions under COVID-19. Proc Natl Acad Sci. 2020 Jul 7; 117(27):15530–5.
27. Halford EA, Lake AM, Gould MS. Google searches for suicide and suicide risk factors in the early stages of the COVID-19 pandemic. PLOS ONE. 2020 Jul 24; 15(7):e0236777.
28. Kakunje A, Mithur R, Kishor M. Emotional well-being, mental health awareness, and prevention of suicide: Covid-19 pandemic and digital psychiatry. Arch Med Health Sci. 2020 Jan 1; 8(1):147–53.
29. COVID-19: Looming crisis in developing countries threatens to devastate economies and ramp up inequality [Internet]. United Nations Development Programme. [cited 2021 Aug 26]. Available from: https://www.undp.org/press-releases/covid-19-looming-crisis-developing-countries-threatens-devastate-economies-and-ramp
30. Dash DP, Dash AK, Sethi N. Understanding the Pandenomics: Indian Aviation Industry and Its Uncertainty Absorption. The Indian Economic Journal. 2021:00194662211013211.
31. Haldar A, Sethi N. The News Effect of COVID-19 on Global Financial Market Volatility. Buletin Ekonomi Moneter dan Perbankan. 2021 Mar 8;24:33-58.
32. Dash DP, Sethi N, Dash AK. Infectious disease, human capital, and the BRICS economy in the time of COVID-19. MethodsX. 2021 Jan 1;8:101202.
33. Haldar A, Sethi N. The effect of country-level factors and government intervention on the incidence of COVID-19. Asian Economics Letters. 2020 Oct 27; 1(2):17804.
34. Banerjee D, Rao TS. Psychology of misinformation and the media: Insights from the COVID-19 pandemic. Indian Journal of Social Psychiatry. 2020 Oct 1;36(5):131.
35. Dsouza DD, Quadros S, Hyderabadwala ZJ, Mamun MA. Aggregated COVID-19 suicide

incidences in India: Fear of COVID-19 infection is the prominent causative factor. Psychiatry research. 2020 Aug 1; 290:113145.

36. Lester D. A test of Durkheim's theory of suicide using data from modern nations. International journal of comparative sociology. 1989 Jan 1; 30(3-4):235-8.

37. Brown E, Gray R, Monaco SL, O'Donoghue B, Nelson B, Thompson A, Francey S, McGorry P. The potential impact of COVID-19 on psychosis: a rapid review of contemporary epidemic and pandemic research. Schizophrenia research. 2020 Aug 1;222:79-87.

38. Ministry of Health and Family Welfare, Government of India. COVID-19 INDIA. 2020. Available: https://www.mohfw.gov.in/ [Accessed 20 June2021]

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

COVID-19 RELATED FACTORS ASSOCIATED WITH ANTENATAL CARE IN RURAL BANGLADESH: A QUALITATIVE STUDY

S. M. Mostafa Kamal[1], M Anisur Rahman[1], Sonia Singh[2]*

1. Department of Mathematics, Islamic University, Kushtia-7003, Bangladesh
2. Toss Global Management, International City Dubai, UAE.

Correspondence: kamaliubd@yahoo.com

ABSTRACT

OBJECTIVE

The available literature reveals that usage of Maternal Health Care Services (MHCSs), including antenatal care (ANC), has decreased significantly in developing countries due to the Corona Virus Disease (COVID-19) pandemic. However, the COVID-19 related factors on MHCSs utilization in Bangladeshi women are yet to be examined. Therefore, this study examines the effect of COVID-19 on the use of ANC services among rural communities in Bangladesh.

METHOD

A community-based qualitative study was conducted from May 01, 2021, to July 20, 2021, among selected pregnant women residing in ten villages of the Kushtia District, Bangladesh. A total of ten focus group discussions (FGDs) were conducted. Open Code 4.0 software was used to transcribe, translate, and analyze the data thematically.

RESULTS

Findings suggest that the measures taken by the government against the COVID-19 pandemic have significantly decreased the optimum usage of ANC services. The need to shift the role of the health workforces is a vital factor that has a negative effect on women's attitude towards seeking MHCSs. Anxiety, dirty and poor environment of the health facilities, low quality of care, stigma, and risk minimization strategies are among other factors meant that pregnant women refrained from seeking ANC services.

CONCLUSION

Undoubtedly, COVID-19 related factors have decreased the possible usage of ANC services among rural communities in Bangladesh. Additional necessary health workforces are needed to be recruited urgently. A special wing for pregnant women in each health facility may be opened as a one-stop ANC service center for the COVID-19 period. Policymakers should take necessary actions to reduce anxiety among pregnant women and motivate them to use MHCSs for safe motherhood.

KEYWORDS

Bangladesh, Covid-19, Antenatal care, Qualitative study, Health facility.

INTRODUCTION

The world has fallen under an unprecedented burden in health care systems due to the Coronavirus Disease 2019 (COVID-19). The progress in maternal health care services (MHCSs) utilization is now under threat due to this unexpected pandemic. [1] COVID-19 has stuck both the supply and demand for MHCS. On one side, usage of MHCS has decreased with the pandemic; on the other side, health facilities prepared and reorganized their maternity care services to handle COVID-19 patients. [2]

Since the detection of COVID-19 first in China in December 2019, the virus has spread out rapidly worldwide. The virus hastily changed its patterns many times. The Delta pattern of the COVID-19, found first in India, has been moving swiftly to other countries. As of July 20, 2021, the Worldometer recorded more than 191,733,410 confirmed cases, 4113,054 deaths, and 174,585,511 recovered cases. [3] The latest pattern of COVID-19 called Omicron is now the main concern of the health professionals around the world.

In Bangladesh, the first three cases of COVID-19 were detected on March 08, 2020, and the first death on March 18, 2020. [2] As of July 20, 2021, Bangladesh has witnessed total death numbers of 18,325 people due to COVID-19. By this time, a total of 1128,889 cases have been confirmed, and 951,340 people have recovered. [4]

Bangladesh is one of the most vulnerable countries of the COVID-19 pandemic due to its poverty and flawed health care system. Lack of medical personnel, technicians, equipments, medicines, and affordability costs has placed the country at a higher risk of tackling the pandemic. The World Health Organization (WHO) Emergency Committee has announced that the transmission of COVID-19 could be reduced and discontinued by contract tracing, early detection, isolation, and prompt treatment. [5]

Irrespective of pregnancy status, women are at the same risk of transmission of COVID-19, but morbidity outcomes were found higher among pregnant women compared to non-pregnant women. [6,7] Although studies are yet to confirm the transmission of the virus from mother to fetus; however, pregnant women may be at higher risk of viral respiratory infections. Earlier, the Ebola outbreak in West Africa increased maternal mortality by 75%. [8] Therefore, researchers suspect that COVID-19 may increase maternal mortality for women's non-use of MHCSs. [9]

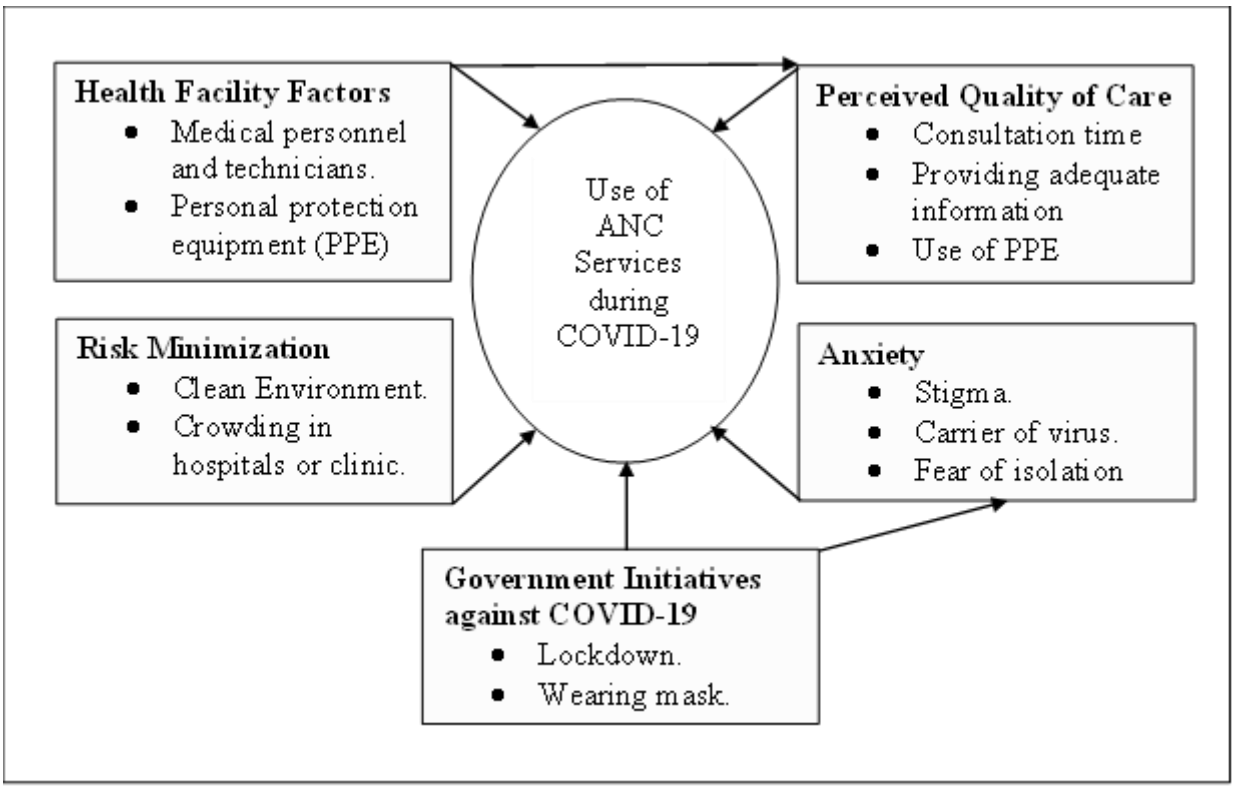
An estimated 295,000 women died in 2017 worldwide due to pregnancy and child-birth related complications. [10] The WHO recommends at least four antenatal care (ANC) visits to improve maternal and newborn health; because most of these births are avertable by early detection of complications by ANC. [11] A study on Ethiopian women added that ANC visits reduced by 39% to 52% due to COVID-19. [12]

The critical elements of ANC include screening, treatment of minor ailments, counseling, and immunization services. [13] ANC visits are essential for both maternal and fetal health. ANC visits help pregnant mothers providing information regarding proper nutrition, detect and treat danger signs, birth preparedness, and care for pregnancy complications. [9] Pre-eclampsia, eclampsia, anemia, diabetes, etc., may create severe complications and even death, which ANC can detect. [9]

Bangladesh is committed to ensure safe motherhood for each woman and aims to reduce the maternal mortality ratio to 121 deaths per 100,000 live births by 2022. [14] According to the latest Bangladesh Demographic and Health Survey 2017-18, 43% of the rural women visited for ANC at least four times which was 17% in 2004. [15] Studies from developing countries, including Bangladesh, reported that maternal age, parity, women's education, place of residence, religion, socioeconomic status, distance to health care facilities, road difficulties etc. are important determinants of ANC seeking. [15-17]

Pregnant women and mothers with newborns may experience various difficulties in using MHCS caused by lockdown and transportation problems during COVID-19 era. They may also be reluctant to go to health care facilities due to anxiety and fear of COVID-19. [9] This study aims to explore the effect of the COVID-19 pandemic on ANC seeking among the rural pregnant women of the South-Western part of Bangladesh using field survey data by adopting a conceptual framework developed by Hailemariam et al. [12] The conceptual framework has been shown in Figure I.

FIGURE I: CONCEPTUAL FRAMEWORK FOR ANTENATAL CARE DURING CORONAVIRUS.



METHODS

STUDY DESIGN

This study is exploratory, descriptive, and qualitative by nature. More specifically, the study aims to accumulate perception, opinion, and experiences of pregnant women regarding the impact of COVID-19 on seeking skilled ANC services. Such qualitative research helps the policy makers to understand social phenomena in a particular setting. [18]

RESEARCH SETTING

The research area is for rural settings of the Kushtia District, located in the South-Western part of Bangladesh. It lies between 23°42' and 24°12' north latitude and between 88°42' and 89°22' east longitudes. The total area of the district is 1621.15 km^2. The district consists of five sub-districts. The total population of the district is 2,018,000, representing about 1.4% of the country's total population. More than 75% of the people live in rural areas. [19]

Target Population and Sampling Technique

A total of ten villages was purposively selected taking two villages from each of the five sub-districts. Fifty pregnant women were selected randomly for ten focus group discussions (FGDs), taking five from each village. Finally, four women did not take part in the FGDs for different reasons. Finally, forty-six women participated in the FGDs. Data were collected during the period May 01, 2021, to July 20, 2021. Each of the FGDs was consisted of 4-5 women and took times as lowest at 90 minutes and highest at 120 minutes.

Data Collection Method

Data were collected directly by the main author from ten FGDs. The family planning workers (FPWs) are the main informants who identified the pregnant women during their field visits. The study women were selected by the FSWs. The FPWs randomly selected the pregnant women and fixed a date and time for FGDs. They also screened to ensure whether the participants were pregnant at least for the last three months. Before the scheduled date of the interview, the researchers supplied personal protection equipment for all FPWs and participants. Prior to start discussions, the author described the study objectives in detail, and a written consent was taken from all participants. The participants were affirmed that all information they would provide should be kept confidential and be used only for research purposes. To gather personal information of the

participants, a semi-structured questionnaire was developed which included respondents' current age, age at marriage, number of living children, education, participant's occupation, monthly family income, duration of pregnancy and times they visited health facilities for ANC services. The descriptive statements of the participants were recorded by a digital voice recorder. The language used for interviews was 'Bangla' –the national language of Bangladesh. While recording, a code was used to identify the respondent.

Data Processing and Analysis

Open Code 4.0 software was used thematically to analyze the data collected from the ten FGDs. All audio records and notes were then transcribed and translated from Bangla to English. Transcripts were checked carefully and comprehended to obtain a good grasp of the information provided by the participants.

Ethical Considerations

Ethical clearance for this study was obtained from the Institutional Review Board (IRB) of Islamic University (IU), Kushtia-7003, Bangladesh (IU/ACA/SCFRC-0009/2020-2021).

Methodological Rigor

The rigor of a qualitative study measures the extent to which privacy of the participants represents, and to what extent the participants maintain reliability in providing information. The criteria for ensuring rigor include credibility, transferability, dependability, and conformability. To ensure the credibility, we have checked the accuracy of transcribed data and confirmed whether the participants shared their experiences honestly. To enhance transferability, a detailed description of the research setting and selection criteria of the participants is represented. Methods used for data collection, analyzing procedure, and interpretations are also captured for dependability. For conformability, field notes, audio recordings, and coding were kept de-identified.

RESULTS

The age of the women ranges from 19 to 41 years. Eleven women had no formal education, twenty-five had some primary education, nineteen women had secondary education, and only one had higher education. Except one women, others were housewives. None of the participants visited four times for ANC checkup.

Perception towards COVID-19

Most of the participants had some knowledge about the danger of COVID-19. They believed that COVID-19 was like a viral fever at the initial stage of the pandemic. However, they are now more conscious of the pandemic.

"*…we thought it was like a simple fever and can be relieved taking only simple medicine. However, when a dead body of our neighbor come to our village from the town, the government authority did not allow us to see his face even for the last time. Then we understood that Corona is a dangerous infectious disease*." (FGD-3, Participant-3)

"*Corona affects only the urban people because of overcrowding. We, the rural people, are free of Corona. We did not see any COVID-19 patients in our village till today. So we do not wear masks. This is the first time I have used the mask…and feeling uneasy*." (FGD-8, Participant-4)

A participant reported that,
"*Before lockdown, I went to the town for regular checkup of ANC. I wanted to take shelter in my elder sister's rented house. My brother-in-law was a COVID-19 patient and he was in isolation. My sister advised me to go away to village for safety and to follow previous advice that my doctor prescribed for me earlier*." (FGD-1, Participant-4)

GOVERNMENT INITIATIVES AGAINST COVID-19

As a precaution, the Bangladesh Government has announced lockdown several times and also advised people to maintain social distancing and wearing mask compulsory while going outside of home for emergency.

"*My husband asked an easy bike (a battery-driven small vehicle) driver to go to the town for me. The driver demanded fare three times more than the usual, which is not affordable for us as my husband's income has been decreased in these days. Now my fortune is up to God*." (FGD-6, Participant-3)

"*I am not accustomed to using a mask. When I use a mask, I feel uneasy and cannot breathe freely. It seems that my breath comes off and going to die. It is not possible for me to wait for a long time wearing a mask in doctor's chamber*." (FGD-7, Participant-2)

"I do not like to go to town because of overcrowding. Moreover, free movement has been restricted by the authority. If I go to town, police may catch me and my husband. As evidence, I will not show my baby bump to others to prove that I am a pregnant woman. So all is up to God." (FGD-9, Participant-1)

Fear, Anxiety and Stigma

Several participants of the FGDs reported that they are worried about social distancing and social isolation following health facility visits.

"I went to a doctor due to influence of my husband. After coming back home, I noticed that my mother-in-law and sister-in-law do not come near to me, and even to my husband. When I asked them why they are doing such behave, my sister-in-law replied that I might be a carrier of Coronavirus." (FGD-10, Participant-4)

"…Hospitals and clinics are now hotspot areas. I heard that corona means death. Hence I have decided to endure my physical problem, but I would not go to the doctor to embrace premature death. My child (fetus) may also be affected by me." (FGD-4, Participant-2)

"If I be affected somehow, I would have to go for quarantine and live in an isolated room for many days. Who will then take care of my 3-years aged child at that time?" (FGD-2, Participant-1)

PERCEIVED QUALITY OF CARE DURING COVID-19

The pregnant women expressed their perception towards the quality of MHCSs, including ANC, during COVID-19.

"At that time of my first visit, doctor asked me about many issues. But when I went to him for the second time, I observed hurry in him. He quickly asked me some questions and prescribed some medicines. They did not checkup my blood pressure and weight. I know that the measurement of these two is very important for a pregnant mother. If they do like this, what would be the ultimate result to go for ANC checkup?" (FGD-2, Participant-5)

One of the participants shared that,

"My doctor advised me for an ultra-sonogram. Some other pregnant women were waiting there. I heard that the authority of the clinic asked a technician from other clinic. I had to wait there for more than two hours. I observed that the technician did not use gloves and even nor hand sanitizer. I also noticed that some facial masks and tissue papers were scattered away on the floor. …who knows… there may have Corona or other viruses hidden in those garbage which may be harmful." (FGD-1, Participant-3)

"In these days, doctors and nurses are busy with Corona affected patients. They do not have enough time to provide adequate services to the pregnant mothers. Thus, how much will I be benefited going to hospitals for ANC checkups if doctors do not provide treatment properly and carefully with adequate information?" (FGD-8, Participant-4)

Risk minimization

Many of the FGD participants perceived that health care facilities are now potential sources of COVID-19. Overcrowding and the unclean environment of the facilities may be the main reasons behind it.

"I heard that hospitals are not neat and clean. In this pandemic situation, it is important to clean floors, chairs, and other materials used for treatment. If I go there, I may be infected through contacting that materials, and my baby (fetus) may also be infected with the virus." (FGD-9, Participant-2)

"Different types of patients come to doctors. We are not sure who are and who are not COVID-19 patients. If once I come into contact with such a Corona patient, I may be affected. Hence, I have decided to take treatment from a local Kabiraj (herbal medicine practitioners) rather than hospitals." (FGD-1, Participant-3)

"I heard that Corona has changed its pattern. The present pattern is more dangerous than it was one year ago. Visitation to a health facility may bring more jeopardy than benefits to my unborn child and even to my family members. Thus, it is better to stay at home."
(FGD-3, Participant-5)

DISCUSSION

The perception towards the COVID-19 is found as somewhat mixed in the pregnant women of rural Bangladesh. While some women are quite afraid of the pandemic, others are a bit relaxed. Possibly, the lower educated women have little knowledge about the virus and danger. The fact is that, in Bangladesh, urban people have been more affected than those of rural areas. Moreover, rural women have little access to mass media – resulting in lower awareness among them regarding

COVID-19. A previous study reported that rural women of Bangladesh compared to their urban counterparts had significantly lower knowledge scores regarding COVID-19. [20]

Our study findings reveal that COVID-19 has largely disrupted health facility systems and provisions they generally offer to pregnant mothers for MHCSs use. This has been echoed by the voice of a woman who expressed her dissatisfaction regarding the time she needed for her adequate checkup. Plausibly, the lack of sufficient medical personnel, including doctors, nurses, and technicians, is a significant reason behind it. Moreover, a large number of medical staff are shifted to manage the COVID-19 patients. Our findings are consistent with those conducted elsewhere. [12,21]

Decreased household income, increased living costs, and transportation unavailability has made it difficult for rural women to seek skilled MHCSs, including ANC. Our findings corroborated those of a similar study on Ethiopian women. [12] Consistent with previous studies conducted in other developing countries [12,21,22] our study also shows that the government's restriction measures such as lockdown, obstruction of traffic, use of facial masks are vital factors to influencing pregnant women not to receive ANC services. These measures taken against COVID-19 are causing an unanticipated consequence on the utilization of skilled MHCSs. [12]

Anxiety and stigma are other important factors that prohibits women from using skilled MHCSs. This translates as that the rural community considers that a pregnant woman who visited a health facility during the pandemic period might have already been infected by COVID-19 and she may spread out the virus in the communities – resulting in inadequate use of MHCSs. These causes are also reported elsewhere. [12]

In general, the participants in this study stated that they would have to be careful to avoid COVID-19 by maintaining social distancing and following other rules of health safety. Although some of the participants do not agree to go to the health facilities for ANC services since they have no complicacy, some others stated that pregnancy is an important event and they need to take proper care for safe motherhood. The risky environment of the health facility, transportation problems, anxiety, and affordability costs are the most reported excuses to refrain from using ANC services.

STRENGTH AND LIMITATION

The study has several limitations and strengths. The study is entirely qualitative, and it was not possible to examine to what extent the factors influence the use of ANC services with a few participants. The strength is that, to our knowledge, this is the first ever qualitative study that explored the factors affecting ANC seeking among rural women in Bangladesh during the COVID-19 era.

CONCLUSION

The COVID-19 pandemic has had significantly negative effect on MHCSs use by the rural women of Bangladesh. The measures taken by the government against the COVID-19 pandemic have significantly decreased the usage of MHCSs. The need to shift the abruptly changing role of the health workforces in the health facilities is another factor that has a negative effect on women's attitude towards seeking MHCSs. Anxiety, low quality of care, dirty and poor environment of the health facilities, stigma, and risk minimization strategy are among other factors that refrained pregnant women from seeking ANC services. The negative impact of COVID-19 on women's attitude towards the usage of MHCSs may be minimized through providing health education by the FPWs since they have direct contact with married women in Bangladesh. Additional necessary health workforces are needed to be recruited urgently. A special wing for pregnant women in each health facility may be opened as a one-stop MHCSs center for the COVID-19 period. The policymakers should take necessary actions to reduce anxiety among pregnant women and encourage them to use MHCSs for safe motherhood.

References

1. Lu H, Stratton CW, Tang YW. Outbreak of pneumonia of unknown etiology in Wuhan China: the mystery and the miracle. J Med Virol. 2020;92(4):401-2.
2. Islam MT, Talukder AK, Badruzzaman M, Khan M. Health service facilities are positively linked with outcome of COVID-19 patients in majority of the countries: The global situation. J Adv Biotechnol Exp Ther. 2020;3(4):36-41.
3. Wordometer. Available: https://www.worldometers.info/coronavirus/ (Accessed 20/07/21)

4. Wordometer. Available: (https://www.worldometers.info/coronavirus/country/bangladesh/) (Accessed 20/07/21)
5. Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, Iosifidis C, Agha R. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). Inter J Surg. 2020;76:71-6.
6. Allotey, J., Stallings, E., Bonet, M., 2020. Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: living systematic review and meta-analysis. BMJ. 2020;370,m3320. DOI: 0.1136/bmj.m3320.
7. Brandt, J.S., Hill, J., Reddy, A., Sauer, M.V., Boyle, C., Anath, C.V., 2020. Epidemiology of coronavirus disease 2019 in pregnancy: risk factors and associations with adverse maternal and neonatal outcomes. Am J Obstet Gynecol. 224(4):e389.e1-e389.e9. DOI: 10.1016/j.ajog.2020.09.043.
8. Ribacke BKJ, Saulnier DD, Eriksson A, von Schreeb J. (2016) Effects of the West Africa Ebola Virus Disease on Health-Care Utilization – A Systematic Review. Front Public Health. 2016;4:222. DOI: 10.3389/fpubh.2016.00222
9. Tadesse E. Antenatal care service utilization of pregnant women attending antenatal care in public hospitals during the COVID-19 pandemic period. Int J Women's Health. 2020;12:1181-88. DOI: 10.2147/IJWH.S287534.
10. World Health Organization (WHO). Maternal Mortality. Geneva: Department of Reproductive Health and Research, Geneva: WHO, Switzerland; 2019.
11. World Health Organization (WHO). WHO recommendations on antenatal care for a positive pregnancy experience. Geneva: WHO, Switzerland; 2016
12. Hailemariam S, Agegnehu W, Derese M. Exploring COVID-19 related factors influencing antenatal care services uptake: a qualitative study among women in a rural community in Southwest Ethiopia. Journal of Primary Care & Community Health, 2021, 12: 1–8 . DOI: 10.1177/215013272199689
13. Akowuah JA, Agyei-Baffour P, Awunyo-Vitor D. Determinants of antenatal healthcare utilisation by pregnant women in third trimester in Peri-Urban Ghana. J Trop Med. 2018;2018:8. DOI: 10.1155/2018/1673517
14. Ministry of Health and Family Welfare (MOHFW) [Bangladesh]. 4th Health, Population and Nutrition Sector Programme (4th HPNSP) (January 2017-June 2022). Programme Implementation Plan (PIP), Dhaka: MOHFW, Bangladesh; 2017.
15. National Institute of Population Research and Training (NIPORT), and ICF. Bangladesh Demographic and Health Survey 2017-18. Dhaka, Bangladesh, and Rockville, Maryland, USA: NIPORT and ICF; 2020.
16. Tegegne TK, Chojenta C, GetachewT, Smith R, Loxton D. Antenatal care use in Ethiopia: a spatial and multilevel analysis BMC Pregnancy and Childbirth. 2019;19:399. DOI: 10.1186/s12884-019-2550-x.
17. Bhowmik KR, Das S, Islam MA. Modelling the number of antenatal care visits in Bangladesh to determine the risk factors for reduced antenatal care attendance. PLoS ONE. 2020;15(1): e0228215. DOI: 10.1371/journal.pone.0228215.
18. Pope N, Mays C. Reaching the parts other methods cannot reach: an introduction to qualitative methods in health and health services research. BMJ. 1995;311(6996):42–5
19. Bangladesh Bureau of Statistics (BBS). District Statistics 2011. Dhaka, BBS; 2013.
20. Anwar S, Araf Y, Newaz Khan A, Ullah MA, Hoque N, Sarkar B, Reshad RAI, Islam R, Ali N and Hosen MJ. Women's knowledge, attitude, and perceptions toward COVID-19 in lower-middle-income countries: a representative cross-sectional study in Bangladesh. Front Public Health. 2020;8:571689. DOI: 10.3389/fpubh.2020.571689.
21. Sarwer A, Javed B, Soto EB, Mashwani Z. Impact of the COVID-19 pandemic on maternal health services in Pakistan. Int J Health Plann Manage. 2020;35:1306-1310. DOI: 10.1002/ hpm.3048.
22. Ombere SO. Access to Maternal Health Services During the COVID-19 Pandemic: Experiences of indigent mothers and health care providers in Kilifi County, Kenya. Front Sociol. 2021;6:613042. DOI: 10.3389/fsoc.2021.613042.

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

CONVERGENCE OF COMORBIDITY AND COVID-19 INFECTION TO FATALITY: AN INVESTIGATION BASED ON HEALTH ASSESSMENT AND VACCINATION AMONG OLDER ADULTS IN KERALA, INDIA

Sindhu Joseph[1], Jijo Pulickiyil Ulahannan[2], Parvathy A J[3]

1. Department of Travel and Tourism Management GPM Government College, Kannur University, India
2. Department of Physics, Government College, Kannur University, India
3. Department of Computer Science, Vellore Institute of Technology, India

Correspondence: sjsindhu@gmail.com

ABSTRACT

OBJECTIVE

To investigate the impact of age, comorbidity, and vaccination in the fatality of older COVID-19 patients in the state of Kerala, India.

METHODS

A cross sectional study, adopting a mixed method approach was used and conducted among the older population in Kerala. To study the health profile of study participants 405 older people were surveyed and 102 people were interviewed in-depth at their households between June to November 2020. The results of the study were triangulated with elderly COVID-19 fatality data available from the citizen-science dashboards of the research team and Department of Health, Kerala. Vaccination data was retrieved from the Co-WIN government website (cowin.gov.in) to study its impact. The data was analyzed using the IBM SPSS version 22.0.

RESULTS

Age is a predictor of COVID-19 fatality. Diabetes, hypertension, CAD, CKD and COPD are the significant predictors of elderly COVID-19 fatality in Kerala. The current comorbidity profile of the total older population matches with the comorbidities of the COVID-19 elderly death cases. CFR and IFR have declined even when the CMR is high in the second wave of COVID-19 with more deaths. This is attributable to vaccination even though there exists a lesser chance for breakthrough infection.

CONCLUSIONS

Age and comorbidities can predict potential fatality among older COVID-19 patients. Timely and accurate health data and better knowledge of high-risk factors such as comorbidity can easily guide the healthcare system and authorities to efficient prevention and treatment methodologies. Knowledge on prevailing NCDs can drive early preparedness before it converges with an epidemic like the present zoonotic disease. Vaccination is an effective tool in preventing infection compared to the unvaccinated even though the chance for breakthrough infection is there, particularly, in people with comorbidities.

KEYWORDS

Comorbidity, Convergence, COVID-19 Mortality, Fatality, Older population, Vaccination.

INTRODUCTION

It is already acknowledged that health conditions deteriorate when age increases and ageing goes hand in hand with many behavioral issues and disabilities, contagious infections, lifestyle, and chronic diseases. Therefore, the impact of multi-morbidity on various aspects such as quality of life, functionality and risk of mortality becomes a matter of present discussions worldwide. In India, the elderly face NCDs' threats, including cancers, CVD (cardiovascular disease), respiratory diseases, and diabetes and one out of every two older people suffers from at least one chronic disease requiring life-long medication, particularly in urban areas [1].

Kerala's older population has increased by one million people every consecutive year since 1981 [2]. If this trend continues incessantly, it is expected to surpass the proportion of young and old people in between 2021 and 2031 [2]. In 2020, 4.8 million people of Kerala were above 60 years of age of which 15 percent of them were above 80 years, the fastest-growing group among the older population [3]. Kerala has higher hospitalization rates indicating higher morbidity levels [4]. The reported common ailments were paralysis, urinary problems, CVD and cancer in 2010 [5]; hypertension, diabetes mellitus, cataract and heart disease in 2011 [4]; CVD, diabetes, musculoskeletal, and respiratory disease in 2016 [6]; and diabetes, abdominal obesity, and hypertension in 2016-17 [7]. Based on these previous studies, it can be assumed that the significant prevalent diseases of older people in Kerala are hypertension, diabetes, CVD, cancer, and respiratory diseases.

THE COVID-19 FATALITY

Kerala reported the first COVID-19 case in India in January 2020 and was the first state that saw the first wave of the disease spread in the country. The spread of COVID-19 affected mostly older people. Patients with chronic comorbidities, including malignancy, CVD, diabetes, hypertension, kidney and respiratory disease are prone to the fatal outcome of COVID-19 infection [8–11]. Various studies [8–10] found that for CVD and hypertension, the use of renin-angiotensin system inhibitors may accelerate the susceptibility to SARS-CoV-2 infection.

Despite the long COVID-19 studies describing comorbidities and the poor clinical outcomes leading to fatality, the results are inconsistent. Throughout the COVID-19 outbreak, wide variations in CFR (Case Fatality Rate) and IFR (Infection Fatality Rate) estimates have been noted. There is a dearth of studies on COVID-19 and comorbidity while having timely data on the health profile of a population. Likewise, the study findings related to the health status, comorbidity profile, and the NCDs scenario of the older people over a decade in Kerala are also inconsistent [4–7] and there is no study on the impact of vaccination among the older population. In this context, this study is intended to fill the above knowledge gaps and plans to relate the comorbidity profile of the older people in Kerala in the COVID-19 scenario to the elderly mortality rate of COVID-19, which will help to identify the severity of risks. It is essential to draw a clear picture of the health status and morbidity levels of the older people amidst the pandemic to assess the possible implications of comorbidities and thereby frame geriatric treatment policies while it converges with infectious diseases.

This study is unique as it measured the comorbidity level of the older people, while the pandemic is ongoing with simultaneous assessment of the older people COVID-19 deaths due to the suspected comorbidity levels. Even though it is too early to assess the impact of vaccination, the study attempted to show its impact on COVID-19 mortality in the elderly.

METHODOLOGY

This study is based on a mixed methodology approach. The study used a concurrent timing strategy where both the quantitative and qualitative strands occurred during a single phase, from June 2020 to November 2020. Quantitative data was collected from 405 older people from 36 panchayats (village level council) of Kerala, adopting multi-stage sampling techniques, using a structured questionnaire. The study area was divided into three zones, South, Central and North Kerala. From each zone, three districts were selected at random. Four panchayats from each district were selected by drawing lots, making 36 panchayats of Kerala under study. From each selected panchayath, 11 households with older people were selected randomly.

The survey questionnaire included questions on socio-demographic profile and the disease profile of the elderly. The respondents were asked to mark appropriate responses against the names of different diseases they

have in a 5-point scale ranging from 'Always to Never'. The data was analyzed with the IBM SPSS version 22.0. The percentage of a particular disease is calculated exempting the 'never' and 'rarely' responses, therefore including 'always', 'frequently' and 'sometimes.'

Using a panchayat-wise list, received from Anganvadi and Asha workers (local health workers), older people above 60 years of age were selected randomly for the qualitative interview. The interviews were conducted at their households for about 30 - 45 minutes. An average of seven interviews per district were conducted and therefore 102 in-depth interviews were undertaken from all the fourteen districts of Kerala. They were asked about the present ailments. To further enrich the data, 12 interviews were conducted with Vayomithram (a public project for elderly care) district coordinators of 12 districts in Kerala.

Directorate Health Services (DHS) website (http://dhs.kerala.gov.in) gives updates about the COVID-19 spread. However, access to primary data is not complete and therefore, a multi-disciplinary team of experts compiled data through a citizen science initiative, managed by the researchers of this study [11]. A systematic analysis of the above mentioned two dashboards on CFR and comorbidities was done. The data was extracted from the death cases reported in Kerala with COVID-19 infection between January 2020 and September 20, 2021 (Fig. 1). Vaccination data was retrieved from the centralized C0-WIN portal in India (cowin.gov.in). To check and identify a consistent pattern in the association between age and COVID-19 mortality, an extensive review of the literature was carried out. The quantitative and qualitative strands were triangulated and integrated at the point of interpretation and drawn inferences from them.

The study is conducted in line with the guidelines of the ICSSR (Indian Council of Social Sciences) New Delhi, India under the ICSSR – IMPRESS scheme (F. No. IMPRESS/P1132/428/2018-19/ICSSR). The sanctioned study on geriatric health was carried out while the pandemic is ongoing, enabling the research team to simultaneously investigate older people COVID-19 deaths due to the suspected comorbidity levels. Before the qualitative and quantitative data collection, the participants were briefed about the study's purpose, and informed consent was obtained. COVID-19 protocol was adhered to while collecting the data.

Effective and safe vaccines are the pharmaceutical interventions to prevent this pandemic and different types of vaccines are getting acceptance. Over 90 per cent of the population in Kerala has been administered the first dose of the Covid-19 vaccine as of September 20, 2021, a target achieved within 247 days since beginning on January 16. The vaccination for the Age-Appropriate category (persons over 60 years of age, and persons between 45 and 59 years with comorbid conditions) started from March 1, 2021, onwards. Hence, we considered mortality data after April 1 for comparison with that of pre-vaccination data.

RESULTS

The socio-demographic profile (Table 1 Supplementary Data) shows that 55.3% were males, and 44.7% were females. Around 50.1% were in the 60-69 age category, followed by 31.6% in the 70-79 category(n=405).
Covid-19 Deaths in Kerala-Age wise

Figure 1 shows that age is a predictor of increased mortality rate. Till May 31, 2021, the number of COVID-19 deaths in Kerala were 8815, of which 6546 (73.24%) were elderly, where the majority (28.2%) belongs to the 60-69 age group (Fig.1). On September 20, 2021, the number of COVID-19 deaths in Kerala rose to 23683 (0.52% of the total infected), of which 17533 (74.03%) were elderly, where the majority is in the 70-79 age (27.0%) (Fig. 1).

COMORBIDITY OF ELDERLY PEOPLE IN KERALA

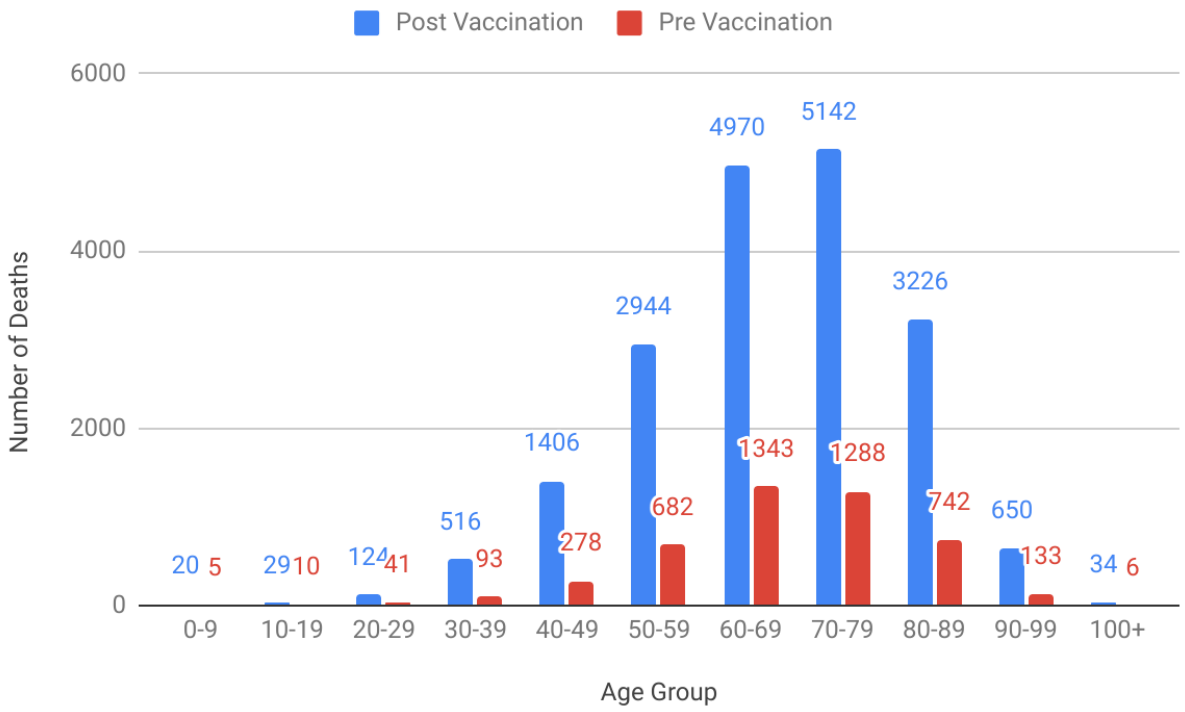
Table 1 shows that older people of Kerala suffer from Hypertension (59.3%), Diabetes (49.8%), Heart Disease (20.5%), Lungs Disease (13.4%), Cancer (5.9%), Rheumatic Disease (31.6%), Urinary Disease (20.7%) and Abdominal Disease (17.1%). Many of them have two or more diseases (comorbidities) (Table 2). Interviews with the elderly and Vayomithram coordinators also showed that most of them had lifestyle diseases like Hypertension, Diabetes, Heart Disease, Cancer, and Cholesterol (Table 2 supplementary data).

ELDERLY PEOPLE COVID-19 DEATHS AND COMORBIDITY

The study used the comorbidity data of the total death cases of COVID-19 as separate elderly comorbidity data is not available. As set out in the Death Audit report, which is available until March 2021, published by the Department of

Health, Kerala, out of the 4,621 people who died, 4,420 (95.65%) of them had comorbidities (Table 2 and Figure 2). Major comorbidities were diabetes (59.14%), hypertension (47.95%), CAD (25.84%), CKD (18.81%), COPD (11.32%) and only 4.35% had no comorbidities (Table 2 and Figure 2).

FIGURE 1. COVID-19 DEATHS IN KERALA-AGE WISE TILL SEPTEMBER 20, 2021



Source: DHS, Government of Kerala, COVID-19 Dashboard

TABLE 1. ELDERLY DISEASE PROFILE IN KERALA

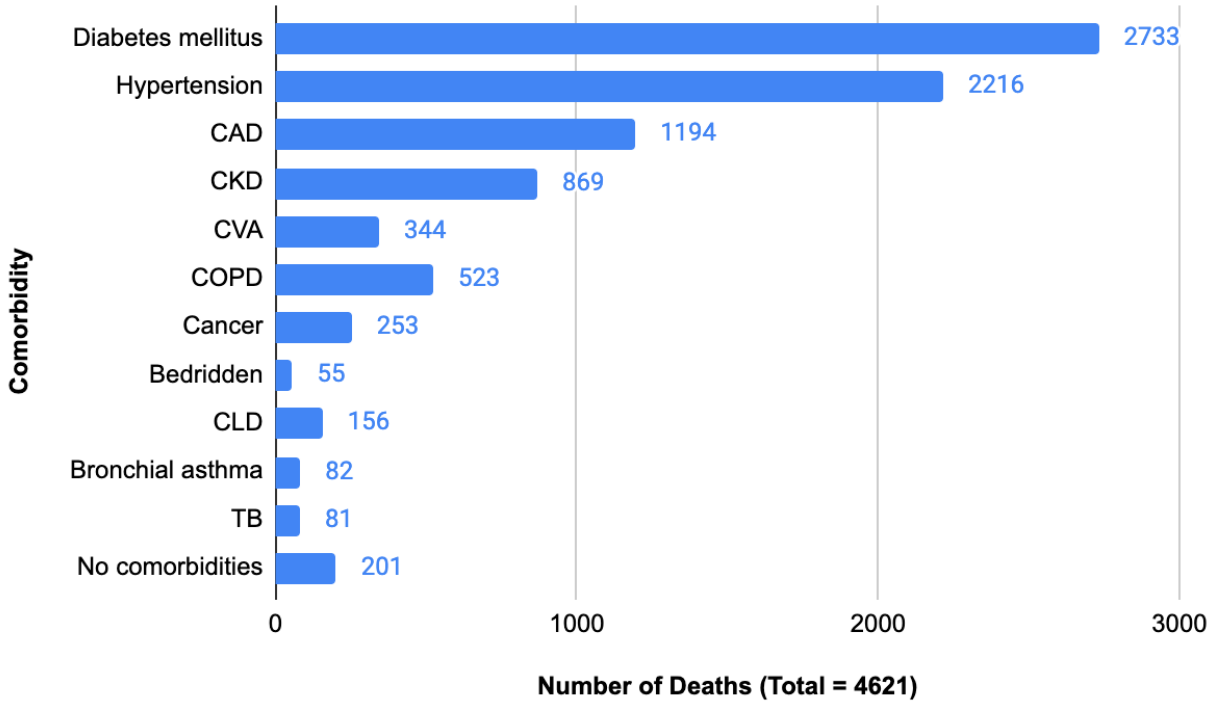
TYPE OF DISEASE	ALWAYS	FREQUENTLY	SOMETIMES	RARELY	NEVER
Diabetes	156 (38.5%)	37 (9.1%)	9 (2.2%)	6 (1.5%)	197 (48.6%)
Hypertension	145 (35.8%)	66 (16.3)	29 (7.2%)	19 (4.7%)	146 (36%)
Urinary Disease	24 (5.9%)	27 (6.7%)	33 (8.1%)	43 (10.6%)	278 (68.6%)
Lungs Disease	32 (7.9%)	8 (2%)	14 (3.5%)	25 (6.2%)	326 (80.5%)
Heart Disease	46 (11.4%)	18 (4.4%)	19 (4.7%)	9 (2.2%)	313 (77.3%)
Cancer	17 (4.2%)	4 (1%)	3 (0.7%)	3 (0.7%)	378 (93.3%)
Rheumatic Disease	57 (14.1%)	35 (8.6%)	36 (8.9%)	42 (10.4%)	235 (58%)
Abdominal Disease	25 (6.2%)	13 (3.2%)	31 (7.7%)	42 (10.4%)	294 (72.6%)

TABLE 2. TYPES OF COMORBIDITY PREVALENT IN FATALITY CASES OF COVID-19

COMORBIDITY	MONTHS (2020-21)								TOTAL
	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	
Diabetes mellitus	120	130	173	287	565	708	317	433	2733 (59.14%)
Hypertension	116	119	169	302	536	661	313	391	2216 (47.95%)
CAD	54	57	89	130	252	308	130	174	1194 (25.84%)
CKD	36	52	103	96	178	221	96	137	869 (18.81%)
CVA	17	22	20	33	80	101	36	35	344 (7.44%)
COPD	23	22	34	63	98	130	71	82	523 (11.32%)
Cancer	15	16	19	27	53	45	26	52	253 (5.48%)
Bedridden	5	16	3	5	3	11	6	6	55 (1.19%)
CLD	8	12	6	14	29	44	19	24	156 (3.38%)
Bronchial asthma	---	3	4	16	11	22	6	20	82 (1.77%)
TB	---	1	6	14	16	18	9	17	81 (1.75%)
No comorbidities	2	2	12	18	51	69	30	17	201 (4.35%)
Total deaths	**223**	**230**	**302**	**519**	**998**	**1258**	**585**	**701**	**4621**

Source: Death Audit Reports up to March 2021, DHS, Government of Kerala (Department of Health & Family Welfare, accessed on September 20, 2021)

FIGURE 2. TYPES OF COMORBIDITIES PREVALENT IN FATALITY CASES OF COVID-19



Source: Death Audit Reports up to March 2021, DHS, Government of Kerala (Department of Health & Family Welfare, accessed on September 20, 2021)

IMPACT OF VACCINATION

Total vaccinations given in Kerala (Covaxin and Covishield) is 2,38,07,401 (89.14% above 18 years and 67.08% of the total population) as on September 20, 2021, of which more than 96% of people aged over 45 years are vaccinated with a single dose. Though the vaccination was started only from March 1, 2021, a decline (2.44%) in elderly mortality has been noticed between the pre-vaccination and post-

vaccination period (Table 3 and Fig. 1) even when total mortality is high after the onset of second wave (from February onwards) while the average age of death remains static.

TABLE 3 IMPACT OF VACCINATION ON COVID-19 MORTALITY AMONG OLDER ADULTS

DEATHS	PRE-VACCINATION (JANUARY 30, 2020 - MARCH 31, 2021)	POST VACCINATION (APRIL 01, 2021 - SEPTEMBER 20, 2021)	OVERALL (JANUARY 30, 2020 - SEPTEMBER 20, 2021)
All age groups	4621	19062	23683
Older Adults	3512 (76.0%)	14022 (73.57%)	17535 (74.04%)
60-79 group	2531 (56.94%)	10112 (53.01%)	12744 (53.81%)

Source: https://dashboard.cowin.gov.in, accessed on September 19, 2021

The effect of this pandemic can be studied by using CFR, Crude Mortality Rate (CMR), and IFR [12]. CFR helps to recognize the disease severity, risks, and healthcare system quality. CFR and recovery rates are important indicators during epidemics and pandemics which will help clinicians in stratifying patients in terms of the extent of care required, and in turn, increase the possibilities of survival from the deadly pandemic [13]. The CFR of an ongoing pandemic is calculated using the formula:

$$CFR(\%) = \frac{Total\ number\ of\ deaths}{Number\ of\ deaths + Number\ of\ recoveries} \times 100\%$$

Since the data for the number of infected and recovered older people is not available, COVID-19 epidemiology data on total number of infections and recoveries have been used.

Therefore, CFR=0.54%, IFR=0.52% ($IFR\ (\%) = \frac{Number\ of\ deaths\ from\ disease}{Total\ number\ of\ cases} \times 100\%$), CMR = 66.73% ($IFR\ (\%) = \frac{Number\ of\ deaths\ from\ the\ disease}{Total\ population} \times 100\%$), till September 20, 2021 (Table 4). Here CMR estimates the probability of any individual in a population dying from the disease [12] and IFR estimations give the proportion of fatality among all infected. Table 4 shows that CFR and IFR have declined even when the CMR is high in the second wave of COVID-19 with more deaths, which is attributable to vaccination.

TABLE 4. COVID-19 INDICATORS (CFR, CMR, IFR)

TYPE OF DATA	NO. OF INFECTED CASES	NO OF DEATHS	CFR %	CMR (X100000)	IFR %
DHS Dashboard *(as on 31 March 2021)*	1,124,584	4621	0.42	13.02	0.41
DHS Dashboard *(as on 20 September 2021)*	4,524,158	23683	0.54	66.73	0.52

Note: The 2021 Projected population of Kerala is 3,54,89,000 as per the report of National Commission on Population of India. The number of the elderly population is projected as 52,71,660.

DISCUSSION

The emergence of the COVID-19 disease has spread with surges and resurges. In this context, this paper is intended to associate older people's health scenario with COVID-19 comorbidity and fatality rates, using a concurrent mixed-method approach and to analyze the impact of vaccination.

Comorbidity profile of older population, age-wise COVID-19 death report, and the type of comorbidities of COVID-19 death cases in Kerala clearly show that the older

population has been adversely affected by the pandemic, which is consistent with the international studies [8,14–16]. Fatalities have been mostly reported from the 60-79 age category, which can be explained by using Kerala's socio-demographic profile (Table 1 supplementary data). It is to be noted that during the entire period of the pandemic from the first death to September 18, 2021, the median age of deaths remains static indicating that even after the second wave of COVID-19 infection with increased mortality rates, the association between the age and fatality remains. Here it is to be noted that the occupational structure of Kerala elderly (Work Participation Rate) has considerably increased as they continue as the major contributor to the household since 1983 by working in informal, low paying occupations in poor work environments [17]. This exposure to the outside environment during the pandemic might have led them to COVID-19 infection.

Despite these demographical factors, many older people are incapacitated due to attributable age-related diseases. This is consistent with the previous report [6] that, in the last two decades, the morbidity burden has grown faster than the rest of India wherein the Proportion of Ailing Population (PAP) in Kerala during 1995-96 was 109 against the national average of 55 which was increased to 251 in 2004, and to 308 in 2014, showing, an increase of 57 points in the overall morbidity rate against national average increase of just seven points during the 2004-2014 period. Existing evidence on the health profile suggests that Kerala has been going through a demographic transition with an unprecedented increase in the NCDs burden (Table 1). Qualitative data also validate this finding (Table 1 supplementary data). This is akin to the previous study results of Kerala over a decade [4,6,7].

This disease profile (Table 1) validates the comorbidity status of the older COVID-19 deaths (Table 2) where the most prevalent comorbidities were hypertension, diabetes, heart disease, COPD (Chronic Obstructive Pulmonary Disease) and CKD (Chronic Kidney Disease) where about 95% of the deceased had one or other comorbidities and the majority of them had multiple comorbidities. Many previous studies on COVID-19 have obtained the same results [12,18–21]. To be more specific, the major comorbidity found in Kerala's COVID-19 death cases is heart disease, followed by diabetes which are major predictors of COVID-19 fatality [22,23]. It is found that, for the total population in Kerala, the incidence of type 2 diabetes (T2DM) is 21.9% [24]. This can be attributable to risky health behaviors such as lack of exercise and an unhealthy diet which necessitates urgent implementation of healthy behavior policy initiative. Previous studies on Middle East Respiratory Syndrome (MERS-CoV) also found comorbidity leads to MERS-CoV infection [12,25]. Therefore, it can be assumed that a high proportion of older people with NCDs prevalence leading to multi-morbidities can be attributed to the increased older people fatality of COVID-19 in Kerala. Nevertheless, this study discards the findings that there is no significant relationship between COVID-19 infection and diabetes [21,22].

The outcome of convergence of NCDs and COVID-19 infection is serious and it is fatal when there is multi-morbidity. Multi-morbidity gives rise to multiple interactions between one condition and the treatment recommendations for another which necessitates simultaneous multiple drug use leading to complications. The susceptibility of the older people to COVID-19 is explained by immunosenescence where the innate immune cells' function is impaired when there is a decrease in the naïve T as well as B cells production, consequently leading to a situation where the innate immunity cannot fight the infection [26]. Another characteristic of ageing immunity is the CSSI (Chronic Subclinical Systemic Inflammation), which results in an elevation of inflammatory cytokines in serum due to the failure to resolve severe inflammation, which is a critical pathogenic mechanism in COVID-19, contribute to poor clinical outcome in older people [27]. This phenomenon called cytokine storm/ hypercytokinemia, associated impairment begins with the damage of the lungs' epithelial barrier. Subsequently, this initiates a cascade of tissue damage in other vital human organs, including the heart, kidneys, brain, and blood vessels, leading to Multiple Organ Dysfunction Syndrome (MODS), which may be even more fatal [28].

Studies report that most recovered patients experienced different manifestations even up to 30 days following diagnosis. Sequelae of COVID-19 may be manifested in a patient even if the virus is cleared and test shows negative. Once a person is tested positive for COVID-19, it is important to monitor the health status for at least 30 days, especially for elderly age groups with comorbidities. Here is the significance of the evaluation of elderly health profiles in predicting both COVID-19 fatality and post COVID syndrome as a clear understanding of these risk factors will help the healthcare system, particularly the clinicians, to identify and implement protocols to mitigate the fatal outcomes. Organized preventive and curative care for

infectious diseases and NCDs must be ensured for older people in the line of the Vayomithram project of Kerala, where free health check-ups and medicines are available in proximity, particularly when Kerala is undergoing demographic transition with largest proportion of elderly in India.

Since epidemiology has a holistic approach on wellness and maintenance, priority must be given to the complete vaccination of elderly as it has brought down the elderly mortality to 73.57 percent in the second wave from 76% in the first wave in Kerala (Figure1 and Table 4). Moreover, more than 90.2% of the infected and 78.21% of the deceased from June to August 2021 (post-vaccination period) were unvaccinated [29]. However, In August 2021, the death rate was 78.21% among the non-vaccinated, 12.47% among those with one dose vaccinated and 5.12% among the fully vaccinated, indicating that vaccinated people also may get infected, termed as breakthrough infections, but chances of worsening the symptoms leading to severe disease is relatively very less when compared to non-vaccinated individuals.

Ageing is inevitable, and often, the promotional and preventative aspects of geriatric care are neglected with a notion that it is 'unavoidable' and 'genetically determined' neglecting the impact of healthier lifestyle to decrease healthcare expenditure [30]. To ensure geriatric care, there must be an attitudinal change and subsequent efforts from the policymakers to ensure 'quality ageing.' Furthermore, the public healthcare system should ensure documentation of incidents and causes of death to estimate 'excess deaths' occurring during outbreaks, when it becomes difficult to estimate the CFR. Weekly/ monthly death counts can be collated with trends over the years to ascertain whether it is significantly higher than the expected count. This estimation can provide information about the potential burden of mortality and fatality, associated with the infection, directly or indirectly [31].

The study findings on older people's comorbidity level and their subsequent mortality, determine the etiology of COVID-19 and therefore, prevention strategies can be implemented to avoid further spread and increased fatalities. Moreover, the study findings l adds to the existing knowledge realm on the spectrum of comorbidities among the older people and its converged impact on the phase of epidemics spread. Future studies can be undertaken to assess the impact of vaccination after vaccinating the total older population in Kerala.

The study has its limitations. First, this study was carried out among the older people in Kerala, and therefore, the results may not be suitable in an international context. Second, getting authentic and correct primary data in calculating CFR of the elderly was a limitation. Third, there may be underestimations, hidden cases, and asymptomatic or mild symptomatic cases affecting the actual COVID- 19 data. Fourth, there will be vulnerable segments of the population who keep themselves away from COVID-19 testing and hesitate to undergo treatment. Finally, the COVID-19 infection might have influenced the responses of study participants.

CONCLUSION

It is found that older patients with chronic diseases are more susceptible to COVID-19 infection. Knowledge of these risk factors and the present health profile of the older population in Kerala necessitate a more focused approach to introduce a spectrum of interventions to protect the lives of the older people when there is a convergence of epidemics and NCDs. The study emphasizes the need for having timely and accurate health data of a population, which can easily guide the healthcare system and authorities to more efficient prevention and treatment methodologies in health care emergencies.

Reference:

1. Rajan SI. Population Aging, Health and Social Security in India [Internet]. CREI; 2007. Report No.: 3. Available from: https://www.econ.osaka-cu.ac.jp/CREI/discussion/2006/CREI_DP003.pdf
2. Press Trust of India. Kerala population ageing fast: survey. Business Standard [Internet]. 2014 Sep 18 [cited 2021 May 19]; Available from: https://www.business-standard.com/article/pti-stories/kerala-population-ageing-fast-survey-114091800463_1.html
3. Kerala State Planning Board. Economic Review 2017 [Internet]. 2018 Jan [cited 2021 May 19]. Available from: https://spb.kerala.gov.in/economic-review/ER2017/web_e/index.php
4. Alam M, James KS, Giridhar G, Sathyanarayana KM, Kumar S, Raju SS, et al. Building a knowledge base on population aging in India: Report on the Status of Elderly in Select States of India [Internet]. United Nations Population Fund; 2013. Available from: https://ideas.repec.org/p/ess/wpaper/id5209.html

5. Sandhya RS. Sociological analysis of the Problems of the oldest old (A study conducted in Kerala). International Research Journal of Social Sciences. 2010;3(1):57–79.
6. Karan A, Srivastava S, Chakraborty A, Matela H. Key indicators of health and morbidity: Kerala 2014. Delhi: Public Health Foundation of India; 2016 Apr.
7. Madore A, Rosenberg J, Dreisbach T, Weintraub R. Positive Outlier: Health Outcomes in Kerala, India over Time | The Global Health Delivery Project [Internet]. Boston, MA: Harvard Business Publishing; 2018. Available from: https://www.globalhealthdelivery.org/files/ghd/files/ghd-042_kerala_as_a_positive_outlier_2018_09_05.pdf
8. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet. 2020 Mar;395(10229):1054–62.
9. Fang L, Karakiulakis G, Roth M. Are patients with hypertension and diabetes mellitus at increased risk for COVID-19 infection? The Lancet Respiratory Medicine. 2020 Apr;8(4):e21.
10. Pal R, Bhansali A. COVID-19, diabetes mellitus and ACE2: The conundrum. Diabetes Res Clin Pract. 2020 Apr;162:108132.
11. Ulahannan JP, Narayanan N, Thalhath N, Prabhakaran P, Chaliyeduth S, Suresh SP, et al. A citizen science initiative for open data and visualization of COVID-19 outbreak in Kerala, India. J Am Med Inform Assoc. 2020 Nov 5;00(0):1–8. https://doi.org/10.5281/zenodo.3818096
12. Roser M, Ritchie H, Ortiz-Ospina E, Hasell J. Coronavirus Pandemic (COVID-19). Our World in Data [Internet]. 2020; Available from: https://ourworldindata.org/coronavirus
13. Khafaie MA, Rahim F. Cross-Country Comparison of Case Fatality Rates of COVID-19/SARS-COV-2. Osong Public Health Res Perspect. 2020 Apr;11(2):74–80.
14. Yanez ND, Weiss NS, Romand JA, Treggiari MM. COVID-19 mortality risk for older men and women. BMC Public Health. 2020 Dec 1;20(1):1742.
15. Wang L, He W, Yu X, Hu D, Bao M, Liu H, et al. Coronavirus disease 2019 in elderly patients: Characteristics and prognostic factors based on 4-week follow-up. J Infect. 2020 Jun 1;80(6):639–45.
16. Kang SJ, Jung SI. Age-related morbidity and mortality among patients with COVID-19. Infect Chemother. 2020 Jun;52(2):154–64.
17. Tripathi T. Insights into the condition of elderly in India. Econ Polit Wkly. 2015 Jun 5;55(23):7–8.
18. Guan W-J, Liang W-H, Zhao Y, Liang H-R, Chen Z-S, Li Y-M, et al. Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis. Eur Respir J. 2020 May 14;55(5):2000547.
19. Onder G, Rezza G, Brusaferro S. Case-Fatality Rate and Characteristics of Patients Dying in Relation to COVID-19 in Italy [Internet]. Vol. 323, JAMA - Journal of the American Medical Association. American Medical Association; 2020. p. 1775–6. Available from: https://www.who.int/docs/default-
20. Sanyaolu A, Okorie C, Marinkovic A, Patidar R, Younis K, Desai P, et al. Comorbidity and its Impact on Patients with COVID-19. SN Comprehensive Clinical Medicine. 2020 Aug;2(8):1069–76.
21. Yang X, Yu Y, Xu J, Shu H, Xia J 'an, Liu H, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. The Lancet Respiratory Medicine. 2020 May;8(5):475–81.
22. Li J, Guo T, Dong D, Zhang X, Chen X, Feng Y, et al. Defining heart disease risk for death in COVID-19 infection. QJM: An International Journal of Medicine [Internet]. 2020 Aug 13; Available from: https://academic.oup.com/qjmed/advance-article/doi/10.1093/qjmed/hcaa246/5892264
23. Guo W, Li M, Dong Y, Zhou H, Zhang Z, Tian C, et al. Diabetes is a risk factor for the progression and prognosis of COVID-19. Diabetes Metab Res Rev [Internet]. 2020 Oct 1;36(7). Available from: http://dx.doi.org/10.1002/dmrr.3319
24. Vijayakumar G, Manghat S, Vijayakumar R, Simon L, Scaria LM, Vijayakumar A, et al. Incidence of type 2 diabetes mellitus and prediabetes in Kerala, India: results from a 10-year prospective cohort. BMC Public Health. 2019 Jan 31;19(1):140.
25. Badawi A, Ryoo SG. Prevalence of comorbidities in the Middle East respiratory syndrome coronavirus (MERS-CoV): a systematic review and meta-analysis. Int J Infect Dis [Internet]. 2016; Available from: https://www.sciencedirect.com/science/article/pii/S1201971216311006

26. Castle SC. Clinical relevance of age-related immune dysfunction. Clin Infect Dis. 2000;31(2):578–85.

27. Bonafè M, Prattichizzo F, Giuliani A, Storci G, Sabbatinelli J, Olivieri F. Inflamm-aging: Why older men are the most susceptible to SARS-CoV-2 complicated outcomes. Cytokine Growth Factor Rev. 2020 Jun 1;53:33–7.

28. Bhaskar S, Sinha A, Banach M, Mittoo S, Weissert R, Kass JS, et al. Cytokine Storm in COVID-19-Immunopathological Mechanisms, Clinical Considerations, and Therapeutic Approaches: The REPROGRAM Consortium Position Paper. Front Immunol. 2020 Jul 10;11:1648.

29. Daily Bulletins [Internet]. Directorate of Health Services. 2021 [cited 2021 Sep 20]. Available from: https://dhs.kerala.gov.in/

30. Prabhu P, Singh FMA. Nutrition the Geriatric Population. In: Geriatric Care. Cochin: Brookdale Foundation; 2002. p. 56–65.

31. Centers for Disease Control and Prevention. Excess deaths associated with COVID-19: Provisional Death Counts for Coronavirus Disease (COVID-19) [Internet]. National Center for Health Statistics. 2020 [cited 2020 Dec 29]. Available from: https://www.cdc.gov/nchs/nvss/vsrr/covid19/excess_deaths.htm

SUPPLEMENTARY TABLE 1. SOCIO-DEMOGRAPHIC VARIABLES

VARIABLE	CATEGORY	FREQUENCY	PERCENT
GENDER	Female	181	44.7
	Male	224	55.3
AGE	60-69	203	50.1
	70-79	128	31.6
	80-89	60	14.8
	Above 90	9	2.2
MARITAL STATUS	Married	314	77.5
	Not Married	11	2.7
	Partner Died	75	18.5
	Divorced	3	0.7
EDUCATION	No formal Education	74	18.3
	School	267	65.9
	College/University	53	13.1
	No response	4	1
MONTHLY INCOME	No income	125	25.9
	Less than INR 10,000	228	56.3
	INR 10,000-20,000	37	9.1
	INR 21,000-30,000	20	4.9
	Above INR 30,000	5	1.2
SOURCE OF INCOME	Job	18	4.4
	Pension	211	52.1
	Income from assets	29	7.2
	Business	35	8.6
	Income from agriculture	49	12.1
	Income from other sources	15	3.7

SUPPLEMENTARY TABLE 2. ELDERLY DISEASE PROFILE IN KERALA

ATTRIBUTE	RESPONSES (DISTRICT-PARTICIPANT ID, GENDER, AGE)
Disease	..I have Diabetes for the past 35 years, severe joint pain, back pain... (Palakkad, F, 70-75) …there are number of diseases in this age…headache, back pain, blood pressure, disk problem, cholesterol (Pathanamthitta, F, 60-65) I am taking medicines for blood pressure regularly…. (Pathanamthitta, M, 60-65) ….I had a block in my heart, for which cardiac surgery was done. Check-up is done every three months. Then I had prostate cancer… follow up visits once in six months. I am a diabetic patient too... (Thrissur, M, 65-70) …angioplasty was done ….taking medicines for blood pressure twice a day." (Kozhikode, F, 70-75) "I am a cardiac patient, using a pacemaker…. (Palakkad, F, 70-75) "Taking medicines for thyroid, sugar, BP daily… (Thiruvananthapuram, F, 65-70) "My current health problems are Asthma, Cholesterol, Sugar, blood pressure, thyroid, Cardiac diseases…… (Kollam, F, 70-75) I have cancer, BP, Heart problem, doing chemotherapy (Malappuram, M, 70-75)

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

AWARENESS OF JORDANIAN SURGICAL PATIENTS ABOUT COVID 19 DURING PEAK OF EPIDEMIC AT JUH

Abdelkarim S. Aloweidi, Sami Abu Halaweh, Mahmoud M. Al-Mustafa, Islam Massad, Ibraheem Qudaisat, Ahmad El-share, Mohammad Rwaidi, Mohammad Yousef, Mazin Al-Nouti, Isam Bsisu, Mohammad Aqel*

Anesthesia and Intensive Care Department, School of Medicine, the University of Jordan, Amman, Jordan

Correspondence: Abdelkarim S. Aloweidi, akaloweidi@hotmail.com

ABSTRACT

Around the first COVID-19 epidemic in Jordan, we aimed to explore awareness of COVID-19 (knowledge and attitudes) disease, treatment options, and preventive measures among patients who were admitted to Jordan University Hospital (JUH) and planned to undergo elective surgery over a period of 3 months in 2020.

This prospective cross-sectional article uses a questionnaire based survey which was provided to and was answered by patients themselves, then collected data was migrated to computer software and analyzed. The sample resulted in 292 patients. More than 95% were aware of the disease and and given age, educational levels and gender, we found no significant differences in knowledge and awareness of COVID-19 and protective and preventive measures. More than 60% of those surveyed were aware of COVID-19 serious complications and risk factors for developing them. Around 28% of patients who were admitted had significant anxiety from having COVID-19. The media appears to largely influence and spread some misconceptions about COVID-19 transmission and claimed therapies.

KEYWORDS

COVID-19, awareness, surgical patients.

INTRODUCTION

Since the beginning of 2020 the Corona virus is continuing in spreading from the Far East reaching the whole world and causing major impacts in every single country in the world. [11] Located in the Middle East, Jordan, with a population reaching 10 million people and 117 working hospitals, [12,13] the story of the COVID-19 pandemic began in March 2020 when the diagnosis of the first case of COVID-19 infection occurred. [1] This caused a strict series of governmental actions ending in major lockdown and activation of national defense law which prohibited the majority of citizens going outside of their homes for most of the time with the exception for some including patients going to hospitals to receive healthcare and treatment. [2, 3,7] From August 2020 the wearing of a facemask in public became mandatory in the law. [6] Those actions delayed the outbreak and prevented hospitals being crowded with infected patients. [14, 15] In the beginning, special hospitals were assigned to treat COVID-19 positive patients, [8] but by October 2020, when numbers of positive cases started to increase, many hospitals participated in treating CVOID-

19 infected patients. The University of Jordan Hospital (JUH) is one of the three largest hospitals in the country and it offered health services for infected and non-infected patients.

The peak of the pandemic in Jordan began at the beginning of October 2020, when cases started to rise above 1,000 daily reaching near 8,000 daily by November. This large rise in numbers goes hand in hand with increased numbers of critical cases and deaths. [10, 11]

The Jordanian population is considered to be one with high literacy rates reaching 98% in 2018, [4] and 67% of the population has access to internet. [5] An abundance of information and the continuous official and non-official health related awareness and information on web-based platforms announced daily news about the Corona virus, COVID-19 disease, and emerging updates about risks, challenges and possible solutions to the global pandemic. [16, 17]

Daily news set out that it made it a risky journey to the hospital for patients who needed to undergo elective surgeries. Considering the situation of home lockdown, exposure to the high flow of information and misinformation about the diseases and there spread; the community's anxiety increased and their fears grew higher. A recent study undertaken with over 5,200 participant in Jordan demonstrated that approximately four out of every ten participant's experienced quarantine-related anxiety. [9]

Many papers have been published worldwide exploring levels of awareness among different groups from different populations In Saudi Arabia two studies were conducted where both of them found that people from higher socioeconomic classes have more knowledge about the COVID-19 pandemic, but there's varying results among the two genders. [19, 20] While in India a study [21] showed that men have a better knowledge about the pandemic.

We conducted this survey in the peak period between October and December 2020 to explore awareness of patients planned to undergo elective surgery under general and regional anesthesia in JUH. To our knowledge, no similar studies were conducted in the same period for the same exact purpose.

Face masks and social distancing remain the best methods to prevent infection. [18]

METHODS

STUDY DESIGN:

This research was designed to be a prospective cross-sectional survey by conducting a questionnaire survey tht was answered directly by our sample of patients. Ethical clearance was granted by the University of Jordan's Hospital IRB (number 10/2020/22589) prior to conducting the survey. Written and verbal consent was obtained from the sample patients directly in order for them to participate in this study. All patients' identities are hidden and kept anonymous for the sake of privacy and safety. This study was conducted in JUH in the period between October and December 2020.

STUDY POPULATION, SAMPLE, AND DATA COLLECTION:

Over a period of 3 months in 2020 we collected data from a sample of 292 randomly selected subjects from the population of patients undergoing elective surgeries at JUH. The total invited population of patients was about 1,500 cases during the study period. Data was obtained through a pre-designed questionnaire. The questionnaire was designed by the authors in the light of previous similar articles and was checked and validated by medical doctor colleagues with any necessary questionaire adjustment and optimization occuring before conducting the study. The survey/questionnaire was conducted in the Arabic language, which is the mother tongue of the population.

INCLUSION CRITERIA:

Adult patients: males and females, admitted to JUHwith planned elective surgical treatment under anesthesia - regardless of diagnosis and type of anesthesia.

EXCLUSION CRITERIA:

Patients aged below 18 years, patients undergoing non-elective surgeries and patients who are not eligible to consent.

The questionnaire is comprised of 27 Questions among 3 fields in addition to the patient profile. The first field was about general knowledge of COVID-19 disease;, the second about anxiety from this disease; and lastly knowledge of prevention from COVID-19. Questions included open ended and multiple choice types of questions.

Participantsin the sample were compared between among three variables; Gender (Male and Female), Age (<20 years, 20-40 years, 40-60 years, > 60 years), and educational level (Primary school, High school, Diploma, Bachelor, Masters, PhD).

TABLE 1: QUESTIONNAIRE USED IN THE STUDY

NAME: AGE: GENDER: MALE FEMALE OCCUPATION:

Educational degree: below. High school. Diploma. Bachelor. Masters. PhD

1. Are you aware of COVID19?
2. What is the cause of COVID 19?
   Ø Bacteria. Ø Virus. Ø Other.
3. Can COVID 19 be transmitted?
   Ø Yes ø No.
4. How many times did you undergo the COVID19 swab?
5. Have you been diagnosed +ve COVID19?
6. If yes what treatment did u had?
   ø Paracetamol, ø choloroquine, ø others
7. Have you ever took prophylactic meds to protect u from corona virus?
8. Have you ever contacted a +ve patient?
   ø Family, ø friend, ø during travel, ø In hospital, ø never
9. Have you ever been isolated?
   ø Hotel, ø home, ø hospital, ø never
10. If yes, why have you been isolated?
    ø Travel, ø contact isolation. Ø Diagnosed.
11. Dou you feel stressed due to corona?
12. Have you had isolated yourself due to stress/anxiety?
13. Have you had postponed your surgery due to stress/anxiety?
14. Have you had quit your job or took a long leave off due to stress/anxiety?
15. Were you affected medically due to the general lockdown and had medical complications?
16. Are all COVID19 patients symptomatic?
17. What is the most common symptom?
    ø Fever. Ø Diarrhea. Ø Runny nose. Ø Cough. Ø Arthralgia. ø Fatigue.
18. Is it important to get knowledge about COVID19?
19. Who are most at risk of getting infected?
    ø Elderly. Ø Who works with animals. Ø Healthcare workers. Ø Police. Ø Everybody is at high risk. Ø I don't know.
20. Who are most at risk from COVID19 morbidity?
    ø Healthcare workers. Ø Elderly. Ø Children. Ø Pregnant women. Ø Police.
21. How is it transmitted?
    ø Bloodborne. Ø Airborne. Ø Respiratory droplets. Ø Touch. Ø Animals. Ø I don't know
22. What are the complications?
    ø Sepsis, ø respiratory failure. Ø Pneumonia, ø CVA/MI. ø I don't know
23. Are there any effective treatment?
    ø Yes. Ø No.
24. Is there any vaccine?
    ø Yes. Ø No.
25. Do you think wearing protection is important?
    ø Yes. Ø No. ø I don't know. Ø Doesn't matter.
26. What is the most important protection mode?
    ø Mask. Ø Gloves. Ø Distancing. Ø Avoid raw food.
27. Are you at a higher risk for getting COVID19 due to surgery and anesthesia?
    ø Yes. Ø No.

PRIMARY OBJECTIVES:

- We aimed to study awareness (attitudes and knowledge) levels of this population regarding COVID-19 disease.
- To measuring anxiety and stress levels amongst the study population.
- To assess particpant knowledge of protection methods.

DATA COLLECTION AND STATISTICAL ANALYSIS:

Data collection was made via a printed questionnaire answered directly by the patients themselves., Then Microsoft Excel (2007) software was used for data entry, and later data was migrated to SPSS software (version 25) (SPSS Inc, Chicago, Illinois). Descriptive data was obtained. Chi-square test was performed to compare percentages for categorical variables. A P value < 0.05 was considered statistically significant.

RESULTS

SAMPLE CHARACTERISTICS

Our sample contained 292 patients. The sample was grouped according to 3 variables; Gender: 123(42%) males, 169 (58%) females; Age: with an average of = 43.3 years (SD±14.9); the participant sample is predominantly middle aged; and Educational level: 62% had university level education. More results details are shown in Table 2

TABLE 2: ANXIETY AND STRESS FROM COVID-19

QUESTION	ANSWER	%	N
Do you feel anxious from getting COVID disease?	too much	28%	83
	just a little	37%	107
	not at all	19%	56
	I don't care about it	16%	46
Have you isolated yourself fearing COVID?	yes	27%	80
	no	73%	212
Have you taken a long work leave due to fear?	yes	7%	21
	no	93%	271
Have you changed your living place due to fear?	yes	3%	8
	no	97%	284
Have you delayed your surgery due to fear?	yes	15%	43
	no	85%	249

AWARENESS AND KNOWLEDGE ABOUT COVID-19

Overall, 95.5% of the participants in the sample are aware about COVID-19, despite that the highest awareness percentage among the groups was in the young population (93% in younger than 20 years of age). The least awareness percentage among all subgroups was 69% in subjects with primary education level. 92% of the sample knew COVID-19 was contagious, and 87.8 % knew it's caused by a virus; with 95% of subjects being aware of respiratory route transmission.

87% of the subjects think it's important to seek knowledge about COVID-19 and to follow up with updates.

In regards to symptomology of COVID-19, only 16% of the sample thinks that all infected patients have active symptoms of the disease, while the remainder of 84% thought not all positive patients necessarily have active symptoms. 70% of participants think that fever is the most common symptom and 27% thinks respiratory tract symptoms only (without fever) are most common, while the rest think GI symptoms is most common.

Regarding risk of infection, 41% of the subjects think the elderly are at higher risk of getting the infection. 36% of subjects thought everybody in the community has equal risk of transmission, while only 10% of participants thought that healthcare workers are at higher risk.

Although 61% believed that COVID-19 is self-limiting and doesn't need specific treatment, there appeared a good level of awareness regarding progression of the disease in some patients. Among a list of COVID-19 complications; 84% of the subjects thought respiratory failure is the most serious complication and 67% of the subjects think the elderly are at most risk developing serious complication from all infected patients. On the other hand, 7% of the sample believed COVID-19 doesn't cause any serious complication of infection. Our participants were aware of risk factors leading to complications of COVID-19 as 70-83% thought smoking, malignancy and diabetes are major risk factors. 60% thought that obesity, and 42% thought that Hypertension, as a major risk factor. 90% thought that pregnancy and abnormal lipid profiles are not risk factors for developing serious complications.

Interestingly, 54% of the participant sample thought that the Jordanian population has a lower risk of getting COVID-19 and its complications in comparison compared with other populations including European nations. This result is similar (between 40-64%) among different variables subgroups of age, gender and educational levels.

KNOWLEDGE AND FOLLOWING PROTECTIVE MEASURES

38% of our participants have had a nasal-swab for RT-PCR testing, 7% of them have been diagnosed COVID-19 positive (3% of the sample).

Of our participants, 38% believes that antibiotics, and 30% that nebulizers, are effective for prophylaxis against COVID-19. Only 2% of the whole sample size have actually took some form of herbal supplement or pharmacological agent as a prophylaxis against COVID-19.

Only 6% of particpiants have been quarantined, all of them were due to travel, and only 2% has been in physical contact with an infected patient during last 3 months prior to survey.

Around 81% of our subjects believe there's no treatment for COVID-19, with 78% believing there is no vaccine developed to protect against the disease, and 40% believed that infection provides immunity against re-infection.

Despite that, 90% of participants considered PPE important and vital for protection from COVID-19 transmission, with a variety of responses in deciding which is the most important PPE; 37% consider face masks the most important and 32% went with physical distancing.

ANXIETY AND STRESS DUE TO COVID-19

We asked the surevyed patients 5 questions to assess their anxiety and fear due to COVID-19 in general; only 21% had isolated themselves from their friends and families due fear of getting the infection, 28% described their fear as too much, while 35% claimed that they aren't really stressed about COVID-19. Details of these results are shown in Table 3.

TABLE 3: ANXIETY AND STRESS FROM COVID-19

QUESTION	ANSWER	%	N
Do you feel anxious from getting COVID disease?	too much	28%	83
	just a little	37%	107
	not at all	19%	56
	I don't care about it	16%	46
Have you isolated yourself fearing COVID?	yes	27%	80
	no	73%	212
Have you taken a long work leave due to fear?	yes	7%	21
	no	93%	271
Have you changed your living place due to fear?	yes	3%	8
	no	97%	284
Have you delayed your surgery due to fear?	yes	15%	43
	no	85%	249

3% of the whole sample has changed their residency location due to anxiety and fear and about 7% of respondents have taken a long leave from work (more than one month) to minimize risk of infection.

About 15% of participants have previously rescheduled their planned surgical operation due to fear of getting the infection while they were in the hospital.

DISCUSSION

This paper targeted surgical patients admitted to Jordan university hospital during the major lockdown in Jordan, and the first peak of COVID-19 cases. Those patients were planned to undergo different surgical procedures electively and were admitted one day prior to surgery.

Our sample of randomly selected 292 patients (out of a 1500 population) was predominantly middle aged. All subjects were literate, with majority having educational level higher than secondary school. That was reflected by the high percentage of awareness about basic features of COVID-19 being viral contagious through respiratory route, with their agreement on importance of general population seeking further knowledge about this disease. This knowledge might be motivated by fear of infection due to the fact that those patients were free of COVID-19 going to a hospital (for other reasons) where there's a risk of contacting an infected individual.

Majority of subjects' beliefs about percentage of asymptomatic population is consistent with different worldwide reports displaying variable percentage of asymptomatic COVID-19 infected individuals ranging between 50-80 % [24, 25]. Adding to that majority of our sample also is aware of most common symptom caused by COVID-19 is fever. [26] In same page also; majority recognized the true at higher risk of complications being elderly and risk factors of developing life-threatening disease as obesity, DM, smoking and malignancy. [27]

As in every large event, or this time, a pandemic, lots of misguiding news and rumors circulate in the media; of them one claimed that Mediterranean and Middle Eastern population are genetically more resistant to COVID-19 than European population, and another claimed that traditional foods as Mansaf in Jordan and Mulukhiyah in Egypt protect from COVID-19, that is clearly reflected on our subjects beliefs where 54% thought Jordanians are less likely to be infected, and interestingly this result is similar among different groups of age, and education.

Despite large and wide trials of finding a specific cure for COVID-19, none till this moment succeeded, and main lines of treatment are preventive and supportive. [28 – 30] At the time of implementing this survey there was no vaccine yet approved, as first vaccine was approved by the FDA in the US was on December 11, 2020. [31] And that is reflected on our subjects' beliefs and knowledge of those facts.

Undergoing PCR testing or being under quarantine doesn't seem to affect awareness or beliefs of the patients. Again, social media and news affect misconception of the population; as around 40% of the sample belief that nebulizers and / or antibiotics helps in preventing or treating COVID-19. [28 -30]

There's no clear preference of social distancing or wearing a face mask over one another, but both of them remain best methods of protection from COVID-19 transmission, [18] and that's reflected on our samples' beliefs where majority split (around one third each) supporting each of these two methods of protection.

Relatively a small percentage of subjects have previously re-scheduled their surgical operation date due to fear of COVID-19, and that is surely caused by different factors; most importantly the underlying disease or condition urging the patient to go to hospital and undergo surgical treatment, despite 37% claiming mild anxiety and 28% claiming too much fear from getting infected with COVID-19.

Changing residency location or taking work-leaves is not easy, especially in the difficult economical situations in Jordan, so the small percentage (less than 8%) of patients changing their residency state or taking a long work leave is biased and not conclusive.

CONCLUSION

Patients from this study undergoing surgical procedures seem to be well aware and knowledgeable about the COVID-19 situation and with general information. They also are well aware of transmission methods, risk factors and main lines of protection from transmission. Media, news and rumors seem to largely affect popular beliefs and cause basic misconceptions regarding treatment options, and

that opens a door for financial exploitation of the population to target them towards specific pharmacological or non-pharmacological claimed "therapies".

CONFLICT OF INTERESTS:

All authors declare no conflict of interests.

FUNDING:

No funding of any form has been received.

ABBREVIATIONS

JUH: Jordan University Hospital
DM: Diabetes Mellitus
COVID-19: Corona Virus Disease
PPE: Protective Personal Equipments

References:

1. JT. Jordan confirms First case of Coronavirus. The Jordan Times. Mar 02,2020. Available at https://www.jordantimes.com/news/local/jordan-confirms-first-case-coronavirus
2. Maram Kayed. Schools suspended, borders closed, gatherings banned as gov't responds to continued coronavirus spread. The Jordan Times. Mar 14,2020. Available at https://www.jordantimes.com/news/local/schools-suspended-borders-closed-gatherings-banned-govt-responds-continued-coronavirus
3. Suleiman Al-Khalidi. Jordan's monarch announces state of emergency to combat coronavirus. Reuters. March 17, 2020. Available at https://www.reuters.com/article/us-health-coronavirus-jordan-idUSKBN2141FA
4. Jordan. UNESCO UIS. Available at http://uis.unesco.org/en/country/jo . Accessed in March 2021.
5. The World Bank. Available at https://data.worldbank.org/indicator/IT.NET.USER.ZS?locations=JO . Accessed in March 2021.
6. JT. Circular issued for mandatory face mask use. The Jordan Times. Aug 13,2020. Available at: http://www.jordantimes.com/news/local/circular-issued-mandatory-face-mask-use .
7. COVID-19-related legislation in the Hashemite Kingdom of Jordan. Dentons. April 21, 2020. Available at: https://www.dentons.com/en/insights/articles/2020/april/21/covid-19-related-legislation-in-the-hashemite-kingdom-of-jordan .
8. Bahaa Al Deen Al Nawas. Five hospitals designated for quarantine, Covid-19 testing. The Jordan Times. Mar 08,2020. Available at: https://jordantimes.com/news/local/five-hospitals-designated-quarantine-covid-19-testing .
9. Massad I; Al-Taher R; et, al. The impact of the COVID-19 pandemic on mental health: early quar-antine-related anxiety and its correlates among Jordanians. East Mediterr Health J. 2020;26(10):1165–1172. https://doi.org/10.26719/emhj.20.115
10. COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University. Available at: https://github.com/CSSEGISandData/COVID-19 . Visited at March 2021.
11. Joint Statement by ILO, FAO, IFAD and WHO. Impact of COVID-19 on people's livelihoods, their health and our food systems. The World Health Organization. 13 October 2020. Available at: https://www.who.int/news/item/13-10-2020-impact-of-covid-19-on-people%27s-livelihoods-their-health-and-our-food-systems
12. The Official Site of the Jordanian e-Government. Available at: https://portal.jordan.gov.jo/wps/portal?lang=en . Visited at March 2021.
13. The Official Site of Department of Statistics. Jordanian ministry of planning and international cooperation. Available at: http://dosweb.dos.gov.jo/ar . Visited at March 2021.
14. Maram Kayed. Jordan's extraordinary measures to contain COVID-19 spread draw int'l accolades. The Jordan Times. Apr 02,2020. Available at: http://jordantimes.com/news/local/jordans-extraordinary-measures-contain-covid-19-spread-draw-intl-accolades .
15. Ali Younes. How Jordan is flattening its COVID-19 curve. Aljazeera. 22 Apr 2020. Available at: https://www.aljazeera.com/news/2020/4/22/how-jordan-is-flattening-its-covid-19-curve .
16. In crisis: Jordan battles COVID-19 and misinformation. Reliefweb. United Nations office for the coordination of humanitarian affairs. 20 Apr 2020. Available at: https://reliefweb.int/report/jordan/crisis-jordan-battles-covid-19-and-misinformation .

17. Ministry of Health, the official website of the Jordanian Ministry of Health Coronavirus disease. Jordanian ministry of health. Available at: https://corona.moh.gov.jo/en . Visited at March 2021.
18. Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis, Derek K Chu, MD , Prof Elie A Akl, MD, Stephanie Duda, MSc , Karla Solo, MSc, Sally Yaacoub, MPH, Prof Holger J Schünemann, MD.
19. Al-Hanawi MK, A. K. (2020). Knowledge, Attitude and Practice Toward COVID-19 Among the Public in the Kingdom of Saudi Arabia: A Cross-Sectional Study. Front. Public Health, 10. doi: 10.3389/fpubh.2020.00217
20. Hadil Alahdal, F. B. (2020). An analytical study on the awareness, attitude and practice during theCOVID-19 pandemic in Riyadh, Saudi Arabia. Journal of Infection & Public Health, 7. doi:10.1016/j.jiph.2020.06.015
21. Singh, A. K. (2020). COVID-19: Assessment of knowledge and awareness in Indian society. Journal of public affairs, 9. doi:10.1002/pa.2354.
22. Hamilton M. A. Rating Scale For Depression. Journal of Neurology, Neurosurgery & Psychiatry 1960;23:56-62.
23. American Psychiatric Association Diagnostic and statistical manual of mental disorders: 5th Edn. Washington, DC: (2013).
24. Yanes-Lane M, Winters N, Fregonese F, Bastos M, Perlman-Arrow S, Campbell JR, et al. (2020) Proportion of asymptomatic infection among COVID-19 positive persons and their transmission potential: A systematic review and meta-analysis. PLoS ONE 15(11): e0241536. https://doi.org/10.1371/journal.pone.0241536 .
25. Petersen I, Phillips A. Three Quarters of People with SARS-CoV-2 Infection are Asymptomatic: Analysis of English Household Survey Data. Clin Epidemiol. 2020; 12:1039-1043. https://doi.org/10.2147/CLEP.S276825 .
26. Coronavirus disease (COVID-19) Q&A. The World Health Organization. Available at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19#:~:text=symptoms . Visited at March 2021
27. Coronavirus disease (COVID-19). The World Health Organization. Available at: https://www.who.int/health-topics/coronavirus#tab=tab_1 . Visited at March 2021.
28. Bhimraj A, Morgan RL, Shumaker AH, et al. Infectious Diseases Society of America Guidelines on the Treatment and Management of Patients with COVID-19. Infectious Diseases Society of America 2021; Version 4.2.0. Available at https://www.idsociety.org/practice-guideline/covid-19-guideline-treatment-and-management/ .
29. Interim Clinical Guidance for Management of Patients with Confirmed Coronavirus Disease (COVID-19). CDC. Available at :https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-guidance-management-patients.html . visited in March 2021.
30. Kim, Arthur. And others. (2021). Coronavirus disease 2019 (COVID-19): Management in hospitalized adults. UpToDate. Retrieved Feb 26, 2021from: https://www.uptodate.com/contents/coronavirus-disease-2019-covid-19-management-in-hospitalized-adults .
31. Comirnaty and Pfizer-BioNTech COVID-19 Vaccine. US Food and Drug Administration. Available at: https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/pfizer-biontech-covid-19-vaccine . Visited at March 2021.

ACHSM Asia-Pacific Journal of Health Management

RESEARCH ARTICLE

PUBLIC AWARENESS AND PERSONAL HYGIENIC PRACTICES OF RURAL PEOPLE IN THE COVID-19 SITUATION

Prodip Kumar Baral[1], Umme Habiba[2], Md. Emdadul Islam[2], S. M. Woahid Murad[3,4]

1. Department of Pharmacy, Noakhali Science and Technology University, Noakhali, Bangladesh
2. Institute of Information Sciences, Noakhali Science and Technology University, Noakhali, Bangladesh
3. Department of Economics, Noakhali Science and Technology University, Noakhali, Bangladesh
4. School of Accounting, Economics and Finance, Curtin University, Perth, Australia

Correspondence: w.murad@nstu.edu.bd

ABSTRACT

BACKGROUND

The study attempted to understand rural Bangladesh's health information, awareness level, and preventive measures in the Coronavirus disease -19 (COVID-19) pandemic.

METHODS

A cross-sectional survey by face-to-face interview was conducted with rural people from 14 June 2020 to 13 August 2020. An ordered logistic regression model was employed for data analysis. A total of 3,007 people (Female = 55.97%; Male = 44.03%) participated in the survey who met the inclusion criteria.

RESULTS

The demography of respondents revealed that a significant portion of villagers were within the ages 21-30 (26.80%), had primary education (23.88%), unemployed (31.73%), and middle class (56.17%). The most common and influential used media to know about the Coronavirus disease were electronic media and relative/family/friend/neighbors. Change of demography created a spectacular difference in public awareness level and hygiene practice. Female, illiterate, poor, and age above 60 were comparatively less aware of seven essential facts about the disease. There was no mentionable difference in personal hygienic practices due to sex. But particpants who were aged 51-60 years, graduates or postgraduates, unmarried, government or non-government employees and middle class exhibitedthe best hygiene practice over other features. Invariably, the education level of rural people had a positive effect on awareness and preventive measures.

CONCLUSIONS

Overall, the government and policymakers must identify vulnerable groups whose awareness and hygienic practices are not at the optimum level. Afterward, the government and related organizations should take necessary measures immediately to protect these groups from COVID-19 threats until the complete immunization.

KEYWORDS

COVID-19; awareness; health information; ordered logit; rural people

INTRODUCTION

Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), a zoonotic infectious virus, is the causative organism of the 21st-century pandemic. [1, 2] It was a novel coronavirus, and the infection pattern was entirely hypothetical from the beginning of the outbreak in December 2019. Therefore, better preventive and curative measures were obscure. [3,4] As the enveloped RNA virus mainly spreads human-to-human through respiratory droplets, the World Health Organization and other national and international health authorities provided guidelines to enforce standard personal hygiene practice to prevent the contagious virus from community transmission. [1, 5, 6] They suggested maintaining public distancing, using face masks, regular hand sanitization, and a healthy diet. The general attitudes towards these hygiene measures relied on their knowledge and awareness development. [7] The people who live below the margins of literacy, economy, and adequate information sources were considered vulnerable to prevent the disease. [8,9]

Bangladesh is the South Asian eighth-most populated country with 162 million, and 62.60% live in rural areas [10]. Therefore, the virus transmission control at the community level was challenging for government. When the entire world was preparing to prevent the virus, Bangladesh faced difficulties with one of the world's dense populations. Furthermore, a lower-middle-income economy is a barrier to maintaining social distancing, sanitization facilities, temporary quarantine sites and healthcare facilities at a local level. [11,10]

The country experienced two waves of infection with a death toll of 13,282 until 16 June 2021, and virologists have warned of a chance of a third wave by the Indian SARS-CoV-2 variant. [12,13] During that time, low-income rural areas suffered from a scarcity of food, treatment, and medication during the multiphase lockdown and partial lockdown. [14] In addition, the private sector's jobholder, day laborers, fishermen, vehicle drivers, small employee industry and cottage industry employees have lost their jobs. This led to psychological disturbances such as fear, anxiety, and depression. [15]

Public knowledge, awareness levels, attitudes, and cultural norms have been considered as crucial indicators for an individual's perspective of disease prevention from the very beginning of the pandemic. [16] Based on these indicators, the rural people of Bangladesh are behind the urban people. [10, 11] Additionally, the knowledge level of rural men, women, and adolescents about different infectious diseases and chronic diseases was deficient compared to the urban community. [17-19] Some recent studies have found that the Indonesian, Nepalese and Pakistani communities had an excellent experience and a positive approach regarding the COVID-19 pandemic. However, it was reported half of those populations did not understand the quarantine concept and the distance between people to be kept up to limit the transmission. [20-22] Like these communities of the three nations, most of the rural Bangladeshi people are also not aware about pandemic.

The present study was aimed at demonstrating the health information sources, people's awareness level, and the extent of hygienic procedures people maintain to combat the COVID-19 grim circumstance in rural Bangladesh. To our knowledge no previous investigations on Bangladesh's perspectives about the rural people's awareness and preventive measures are still to be conducted.

METHODS

DATA COLLECTION

This study relies on a database generated from a cross-sectional survey. It was conducted in the rural areas of all divisions of Bangladesh from 14 June 2020 to 13 August 2020. The random invited participants needed to meet the following inclusion criteria: age ≥18 years, psychologically healthy, not temporally visiting rural areas, excluding the standard gender ratio of the 2011 Bangladesh census. A structured questionnaire was developed considering previous related empirical studies. [23,20,24] Surevys were in the Bengali language for the convenience of both interviewers and interviewees. The questionnaire was finalized after pretesting and checking its reliability using Cronbach (1951). [25] The Cronbach's alpha for the sources of awareness of COVID-19 was 0.7520, while the Cronbach's alpha for the awareness level regarding the COVID-19 diseases and the practices of health guidelines during the COVID-19 pandemic were 0.9176 and 0.9202, respectively.

To ease data entry, we created a Google form along with the questionnaire in a printed format, As most rural dwellers neither use smartphones or access to the internet, [26,10] we hired and trained 16 young interviewers who had their university graduation and had a smartphone. In addition,

we verified their performance by a pilot study on this survey and personal safety measures were ensured before inaugurating the interviewers' field surveys. The questionnaires mainly comprised two parts: the first part involved participants' sociodemographic characteristics. The second part covered questions regarding awareness levels and hygiene techniques that combine the variables for combating COVID-19. [45,46] The first section consisted of multiple-choice questions and the second section was based on responses on a 5-point Likert scale. This survey's actual sample size was 3,007, justified at a 5% significance level and a 2% margin of error.

ECONOMETRIC TOOLS FOR DATA ANALYSIS

Stata 16 was used for the data analysis. The Ordered Logit (ologit) model was employed to estimate the likelihood of awareness and practice of hygiene in daily life in terms of each sociodemographic category, specifically, sex, age, level of education, and marital status, occupation, and socioeconomic status. [27] Since all independent variables considered in this study were categorical variables, we estimated the odds ratio for each category of the independent variables keeping the first category as a benchmark. The Odds vary from zero to positive infinity. If odds exceed 1, the likelihood of *success* is greater than the possibility of failure.

RESULTS

RESPONDENTS' DEMOGRAPHIC INFORMATION

This study was conducted in rural Bangladesh and tried to determine the level of awareness and hygienic practices the surveyed people maintained regarding COVID-19, which were subsequently evaluated with their demographic characteristics. The sociodemographic aspects, including sex, age, education level, socioeconomic status, marital status, and occupation, are worthy of mentioning independent variables in the reverse of awareness and hygiene measures. Table 1 reports the demographic characteristics of the respondents. Out of 3,007 respondents, males and females were 55.97% and 44.03%, respectively. The most significant number of respondents were within the age range of 21-30 (26.80%). Among the respondents, 36.88% of people were impoverished. In terms of education, about 20% were illiterate, and 23.88% had only primary education. Finally, it was found that only 15.6% of people are directly affiliated with farming, although diversity in occupation was noteworthy.

TABLE 1: DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS IN RURAL BANGLADESH ($n = 3007$)

DEMOGRAPHY	CATEGORY	PERCENTAGE	DEMOGRAPHY	CATEGORY	PERCENTAGE
Sex	Male	55.97	Education	Illiterate/only can sign	19.72
	Female	44.03		Primary education	23.88
Age	Less than 21	17.03		SSC level	20.15
	21-30	26.8		HSC level	12.87
	31-40	20.65		Graduate	15.43
	41-50	18.09		Post-graduate	7.95
	51-60	10.81	Marital status	Married	61.02
	above 60	6.62		Unmarried	33.12
Residence (Division)	Dhaka	1.76		Widows	4.82
	Chittagong	9.78		Divorced	0.73
	Barisal	33.89		Others	0.3
	Khulna	9.44	Occupation	Unemployed	31.73
	Mymensingh	2.06		Farmer	15.6
	Rajshahi	1		Housewife	25.17
	Rangpur	28.9		Self-employed	5.52
	Sylhet	13.17		Local Businessman	8.05
Socio-economic status	Poor class	36.88		Non-government worker	5.65
	Middle class	56.17		Government worker	5.19
	Rich class	6.95		Others	3.09

SSC - Secondary School Certificate; HSC - Higher Secondary School Certificate

SOURCES OF AWARENESS OF THE COVID-19 BY DEMOGRAPHIC CHARACTERISTICS

Table 2 illustrates the percent contribution of information sources for getting awareness of COVID-19 within five levels of agreements (Strongly disagree, Disagree, Neutral, Agree, Strongly agree). Over 40% of participants agreed on relative/family/friend/neighbors' contribution source; more than that, nearly one-fourth strongly agreed on that source. Furthermore, the agree and strongly agree levels on electronic media information sources were 38.78% and 34.62%, respectively. The contributions of print media, social media, workplace, and doctors and other healthcare service providers strongly disagreed with each most significant percentage. Interestingly, the awareness development role of social media didn't show any notable difference among the five levels, where each level was around 20%.

TABLE 2: CONTRIBUTION OF DIFFERENT SOURCES OF AWARENESS ABOUT COVID-19 IN RURAL BANGLADESH (IN PERCENTAGE)

SOURCES	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
Electronic media (Television, Radio, Internet)	3.86	8.48	14.27	38.78	34.62
Print media (Magazines, Newspapers, Flyers, Newsletters)	24.84	20.05	17.99	23.74	13.37
Social media (Facebook, YouTube, Twitter, Instagram, Blog)	22.18	18.89	20.98	22.31	15.63
Workplace (Peers, Colleagues)	29.83	20.65	27.97	17.23	4.32
Doctors and other healthcare service providers)	31.56	19.52	24.54	19.69	4.69
Relatives/ family members/ friends/ neighbors	11.27	5.85	12.5	43.23	27.14

AWARENESS LEVEL OF RURAL PEOPLE ABOUT COVID-19 DISEASE

The study investigated the extent of the eight COVID-19 related information sources that people know vital for awareness and attitude development. The knowledge source was used as indicators to determine the awareness. Table 3 correlates among demographic features on the five levels of awareness (Nothing, Little, Fair, Good, Excellent) through an ordered logit model. The chi-square values of all estimated variables were significant at the level of 1%, which confirmed the ologit models' fitness in data analysis.

In all categories, the odds ratio for females was less than 1. This indicated the female knowledge level about the pandemic was lower than males in every case, nevertheless, literacy on respiratory complications was moderately significant with signs and symptoms and self-isolation were minimally substantial for women. On the other hand, depending on information, age showed diversity in health awareness. Surprisingly, in most cases, the values of the age range 21-30 and above 60 were relatively smaller than the others. The age group 21-30 had highly significant values on the knowledge about the respiratory complications, the extent of severity, and the transmission through tiny respiratory droplets. Whereas the age groups above 60 had a highly compelling value for respiratory droplet knowledge. Furthermore, age levels, such as for the 41-50 age goup, also found highly significant health literacy values on self-isolation and preventive measures. As the level of education increased, this study revealed the improvement of health literacy in all cases. Most of the odd's ratios were highly significant.

Compared to married individuals, unmarried people showed a little better result except for the extent of severity. On the contrary, divorced individuals and widows/widowers were less likely to be aware of the COVID-19 since the odds ratios were highly significant in most cases and less than 1. Furthermore, we found a heterogeneous level of awareness across different occupations. In contrast with unemployed respondents, the awareness levels of non-government and government employees were significant. In the case of self-isolation and preventive measures, most occupations had considerable knowledge. Moreover, in terms of socioeconomic status, the middle class had highly effective health literacy relative to the poor respondents. Analogously, the middle class's odds ratios were larger and statistically significant than the rich class except for the presence of mild symptomatic or asymptomatic infection and the spread of disease via asymptomatic patients.

TABLE 3: AWARENESS LEVEL OF RURAL PEOPLE OF BANGLADESH REGARDING THE COVID-19 DISEASES BY SOCIODEMOGRAPHIC FEATURES ($n = 3007$)

Variable	Respiratory complications	Extent of severity	Common Signs and symptoms	Transmission through small respiratory droplets	Presence of mild symptomatic or asymptomatic infection	The spread of infection via asymptomatic patients	Containment of outbreaks keeping Self-isolation	Common preventive measures
Sex (Male → Ref)								
Female	0.800**	0.915	0.844*	0.869	0.901	0.871	0.846*	0.891
Age (< 21 → Ref)								
21-30	0.648***	0.673***	0.807*	0.651***	0.917	0.845	0.816	0.770**
31-40	0.866	0.902	0.859	0.712**	1.065	0.857	1.312*	1.270
41-50	0.926	1.103	1.112	0.801	0.923	0.777*	1.925***	1.874***
51-60	0.785	0.858	0.908	0.666**	0.848	0.759	1.370*	1.274
above 60	0.867	0.850	0.618**	0.457***	0.700*	0.636**	1.118	1.189
Education (Illiterate → Ref)								
Primary education	1.161	1.575***	1.126	1.261**	1.371***	1.312**	1.246**	1.262**
SSC level	1.531***	2.141***	1.291**	1.303**	1.387***	1.384***	1.382***	1.519***
HSC level	1.984***	3.264***	1.936***	1.594***	1.764***	1.818***	1.754***	1.899***
Graduate	2.940***	4.116***	3.062***	3.390***	3.847***	4.361***	3.065***	3.212***
Post-graduate	3.397***	4.435***	3.416***	4.022***	4.932***	5.093***	3.116***	3.452***
Marital status (Married → Ref)								
Unmarried	1.230*	0.858	1.032	1.163	1.038	1.172	1.035	1.142
Widows	0.719*	0.666**	0.868	0.644**	0.777	0.815	0.662**	0.751*
Divorced	0.283***	0.206***	0.299***	0.252***	0.381**	0.317***	0.233***	0.321***
Others	0.671	1.358	1.132	0.700	0.907	0.509	0.586	0.646
Occupation (Unemployed → Ref)								
Farmer	1.084	0.845	0.915	1.112	0.866	0.905	0.890	0.948
Housewife	1.283*	1.056	1.035	1.128	0.778*	0.906	1.109	1.160
Self-employed	1.147	1.511**	1.333*	1.307	1.077	1.020	1.763***	1.629***
Local Businessman	1.394**	1.014	1.481**	1.533***	1.110	1.083	1.531***	1.506**
Non-government employee	2.049***	1.169	1.564**	1.653***	1.447**	1.349*	1.456**	1.589**
Government employee	1.478**	1.117	1.414*	1.667***	1.439**	1.524**	1.651***	1.536**
Others	0.791	0.878	1.403*	1.295	0.582**	0.608**	1.019	2.004***
Socioeconomic status (Poor class → Ref)								
Middle class	1.366***	1.337***	1.311***	1.619***	1.469***	1.654***	1.412***	1.460***
Rich class	1.198	1.195	0.954	1.318*	1.682***	2.198***	0.946	0.969
/cut1	-2.523	-2.209	-3.303	-2.452	-1.286	-1.125	-2.630	-2.281
/cut2	-0.966	-0.584	-1.245	-0.343	0.070	0.362	-0.792	-0.676
/cut3	0.837	0.712	0.580	1.034	1.485	1.650	0.738	0.610
/cut4	2.208	2.258	2.159	2.571	2.984	3.119	2.160	2.002
χ^2	319.33***	348.38***	335.55***	470.21***	537.70***	647.26***	334.97***	337.95***

Note: *, **, and *** indicate 10%, 5% and 1% significance level, respectively

TABLE 4: THE PRACTICES OF HEALTH GUIDELINE DURING THE COVID-19 PANDEMIC BY SOCIODEMOGRAPHIC FEATURES IN RURAL BANGLADESH ($n = 3007$)

Variable	Proper handwashing while coming back from outside	Use of mask when going outside	Sanitation in sudden sneezing at a public place	Proper handwashing before eating food	Maintenance of social distance	Abstain from touching eye, nose, and mouth	Eating more fruits and vegetables than ever before
Sex (Male → Ref)							
Female	1.005	1.018	1.097	1.027	1.131	1.133	1.066
Age (< 21 → Ref)							
21-30	0.722**	0.589***	0.923	0.682***	0.790*	0.810*	0.715***
31-40	0.780	0.545***	0.713**	0.728**	0.718**	0.783*	0.684**
41-50	0.814	0.588***	0.742*	1.054	0.727**	0.790	0.744*
51-60	1.027	0.937	0.907	1.047	0.898	0.957	1.286
above 60	1.152	0.828	0.606***	0.996	0.722*	0.897	0.984
Education (Illiterate → Ref)							
Primary education	1.287**	1.591***	1.263**	1.415**	1.244**	1.144	0.864
SSC level	1.439***	1.513***	1.565***	1.001	1.161	1.166	0.815*
HSC level	2.281***	2.302***	2.312***	1.327**	1.528***	1.633***	1.243
Graduate	4.095***	5.292***	4.606***	3.565***	3.066***	3.187***	2.499***
Post-graduate	4.104***	4.887***	5.225***	3.241***	3.186***	3.218***	2.528***
Marital status (Married → Ref)							
Unmarried	1.238*	1.117	1.145	1.223	1.384***	1.491***	1.463***
Widows	0.625***	0.562***	0.734*	0.704**	0.559***	0.672**	0.883
Divorced	0.438**	0.397***	0.541	0.383**	0.409**	0.391**	0.410**
Others	1.751	0.888	0.789	0.844	0.571	0.316**	0.526
Occupation (Unemployed → Ref)							
Farmer	0.833	0.849	0.679***	0.933	1.050	1.088	1.461***
Housewife	0.968	0.927	0.589***	1.081	0.841	0.871	1.171
Self-employed	0.737*	0.765	0.727*	0.936	0.893	0.842	0.958
Local Businessman	1.266	1.466**	0.986	1.728***	1.110	1.354**	1.408**
Non-government employee	1.685***	1.725***	1.160	2.046***	1.985***	1.616***	1.990***
Government employee	1.876***	1.968***	1.158	2.100***	1.996***	1.543**	2.111***
Others	0.602**	0.499***	0.489***	1.105	0.543***	0.351***	0.659
Socioeconomic status (Poor class → Ref)							
Middle class	1.317***	1.438***	1.651***	1.210**	1.662***	1.624***	1.632***
Rich class	0.856	0.969	1.627***	0.700**	1.422**	1.441**	1.434**
/cut1	-2.986	-2.479	-1.426	-2.597	-1.933	-1.339	-1.431
/cut2	-1.462	-0.696	-0.120	-1.108	-0.438	0.172	-0.472
/cut3	0.686	0.730	1.300	0.264	1.055	1.362	0.929
/cut4	1.670	1.807	2.533	1.307	2.197	2.647	2.240
χ^2	439.42***	586.40***	764.55***	335.38***	533.21***	512.09***	406.60***

Note: *, **, and *** indicate 10%, 5% and 1% significance level, respectively

PRACTICES OF PERSONAL HYGIENIC PROCEDURES OF RURAL PEOPLE DUE TO COVID-19

Table 4 illustrates the seven health-related daily practices and the odds ratio on the five levels of hygiene practice (Never, Rarely, Sometimes, Often, Always) among the aforesaid demographic features obtained from ordered logistic regressions. The first category of each demographic variable was considered as a reference. The seven questions covering the essential personal hygiene practices were (i) proper handwashing while coming back home, (ii) use of a mask when going outside of the house, (iii) sanitation in sudden sneezing at a public place, (iv) proper handwashing before eating food, (v) maintenance of social distance, (vi) abstain from touching eye, nose, and mouth, (vii) eating more fruits and vegetables than ever before.

In all cases, the female odds ratio against the male was not a statistically significant event at a 1% significance level. It implies that practices of personal hygiene did not significantly vary among different sexes. The age groups' significant odds ratio from 21 and above were less than the reference age group (odds ratio < 1). It implied that people aged 21 and above were less likely to practice hygienic procedures than the younger respondents.

Like awareness level, we found a significant positive effect of education level on the likelihood of the sanitizing level. Moreover, people who had tertiary education, were more likely to practice hygienic procedures. In marital status, unmarried and married respondents practiced sanitary measures more frequently than widows/widowers, divorced respondents.

The government and non-government employees continued hygiene practice regularly than other categories of occupation. However, sanitation in sudden sneezing in public places was statistically significant, and substantially, the odds values were more prominent for farmers, homemakers, and self-employed, respectively, than unemployed people. Moreover, farmers' odds of eating more fruits and vegetables than ever before were also 1.461 times larger. In terms of socioeconomic status, almost all odds value of the middle class and the rich class was greater than 1. Surprisingly, the middle class practiced health safety measures more steadily compared to the affluent class.

DISCUSSION

This study was conducted to determine rural people's information-seeking behavior, such as sources of information they used for getting COVID-19 related health information, awareness levels, and preventive measures they practiced during the COVID-19 pandemic. The most reported sources of information for people in rural areas were electronic media, relatives, and other interpersonal sources. Most young villagers also stated that they first knew about this Coronavirus from social media platforms. An early paper set out that primarily rural people get information from television and radio followed by public speaking with neighbors, friends, and relatives [28]. That is mainly because of insufficient print media supply and have no information center in the rural area in Bangladesh. Similarly, another recent study also confirmed that it was not easy for rural people to access and understand official website news (e.g., the World Health Organization, Ministry of Health), official pages of social media, newspapers, and video broadcasts through electronic sources due to their poor media knowledge and language gaps. [29-31]

Moreover, the study of Abdelhafiz et al. (2020) found similar findings where senior citizens of Egypt obtained information from social media (66.9%) and the internet (58.3%). [23] Similarly, another investigation found that the north-central Nigerians had enough knowledge (99.5%) of COVID-19, and where 55.7% of them achieved information primarily through the internet and social media, and television [32]. In their study, Karim et al. (2020) also mentioned that using the internet positively correlates with good knowledge in demographic characteristics such as gender, higher education, living in a town/urban area, and good financial condition. [33]

This study also found that females' knowledge level was lower than males in every case. The age groups, such as those above 60 years, had a highly significant value for respiratory droplet knowledge. Furthermore, age levels, such as 41-50 years, also found highly significant health awareness values in self-isolation and preventive measures. Remarkably, the odds ratio for the awareness level from SSC to the postgraduate education level was highly effective. Furthermore, some other investigations similarly observed that more than half of the participants in Bangladesh declared "had a good understanding" about COVID-19, and in the case of their age and education

levels, theknowledge and prevention practices of COVID-19 had a notable impact. [34-37] Previous studies have also found that the COVID-19 related knowledge was significantly lower among the people with less education, which led to a poor attitude and practice to prevent the disease. [23,38-41] Another paper by Rahman et al. (2021) showed that urban people comparatively had sufficient knowledge, attitudes, and practices (KAP) than rural citizens [34]. The authors further stated that this might be mainly because of adequate education, have enough flexibility of internet access, communication procedures, and health facilities that influenced the respondents' level of KAP. Similarly, Islam et al. (2021) conducted investigations on Bangladeshi citizens, and findings showed that approximately 89.80% of the residents in Bangladeshi expressed knowing about the COVID-19 and its preventive measures, which had many differences that of our study because this study only covered rural dwellers [8]. However, the difference might be that there are more higher education facilities in the urban areas than the rural area.

In preventive measures among Bangladesh's rural people, none of the female odds ratios were statistically significant. Therefore, sex was not an essential determinant of hygienic procedures. These findings confirmed that the respondents, including all demographic levels, usually maintained and practiced preventive measures to combat COVID-19. For example, the graduate and postgraduate education levels saw a higher attitude towards practicing hygienic processes than the other education groups. Additionally, the government and non-government employees always try to keep in maximum practice level, and the odds ratios for the two occupations are almost highly significant in all cases. The national and international welfare organizations have provided guidelines to enhance the daily food list with fruits, vegetables, and whole-grain foods from the very beginning. Adjustment of daily protein needs is an essential preventive action to combat COVID-19. [42] Yet, the people's knowledge and awareness of food and nutrition are deficient, and the access to economic resources of rural Bangladesh is limited. Rahman et al. (2021) found their respondents had a low level of adequate knowledge of COVID-19 (i.e., 70.8%, and preventative practices were 73.8%). [34]

Additionally, rural residents had an exceptionally high risk of COVID-19 than urban people. Ferdous et al. (2020) found that 48.3% of participants in Bangladesh had comprehensive knowledge, and 55.1% of residents, especially females, frequently practice COVID-19 prevention than did males. [36] In contrast, our findings revealed that male respondents were more conscious of maintaining hygienic procedures. In these health difficulties, particularly with a contagious disease outbreak, such as COVID-19 that causes millions of deaths, public well-being, and social measures and vaccines are the most powerful tool to save lives. [43] Therefore, inadequacy of a proven vaccine or medicine, several precautions, and preventive measures have been adopted worldwide to limit the transmission of COVID-19. [8] Unfortunately, in some areas, with word of mouth, rumors start raising distrust about vaccines and people fail to believe in the vaccination. However, these types of findings may be useful for public health policymakers and health workers to identify target populations for health-related knowledge development and disease prevention. [44]

The rural people of Bangladesh are neither entirely incompetent nor so much fit for this pandemic situation. The direction in rural pandemic prevention relies on segregating vulnerable groups of people like old, illiterate, unwealthy by focusing on the criterion. Though it is an arduous approach, it should highlight vulnerable groups whose awareness and hygienic practices are not at the optimum level. Therefore, the government and development agencies should immediately take necessary measures to protect rural people from COVID-19 threats until complete immunization can be achieved.

DECLARATIONS

Ethics approval and consent to participate

Before the study was initiated, the present research achieved ethical consideration from the Noakhali Science and Technology University (reference no# 27/2020).

Consent for publication

Patient consent for publication is not required.

Availability of data and material

Upon request in the future, we confirm that all the pertinent information will be disclosed for further use.

Competing interests

There are no competing interests.

Funding

We did not receive any financial assistance from any agency—all the costs associated with preparing the article bear by authors solely.

Authors' contributions

WM, PKB, UH, and MEI conceptualized and designed the study. Data collections were done by UH, PKB, and MEI. WM, PKB, and UH analyzed the data, and PKB wrote the first draft, and WM, UH wrote the final draft. All authors contributed to the critical reviews. All authors examined the entire manuscript and approved it for submission.

Acknowledgments

We would like to thank all survey respondents conducted among Bangladesh's rural dwellers for their cooperation.

References

1. Baral PK, Nuruzzaman M, Uddin MS, Ferdous M, Chowdhury IH, Smrity SZ. Severe acute respiratory coronavirus-2 invasion of the central nervous system: a host-virus deadlock. Acta virologica. 2021;65(2):115-126.
2. Wertheim JO. A Glimpse Into the Origins of Genetic Diversity in the Severe Acute Respiratory Syndrome Coronavirus 2. Clinical Infectious Diseases. 2020;71(15):721–722.
3. Cheng ZJ, Shan J. 2019 Novel coronavirus: where we are and what we know. Infection. 2020;48(2):155-163.
4. Riou J, Althaus CL. Pattern of early human-to-human transmission of Wuhan 2019 novel coronavirus (2019-nCoV), December 2019 to January 2020. Eurosurveillance. 2020;25(4):2000058.
5. Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, et al. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). International journal of surgery. 2020;76:71-76.
6. World Health Organization. Responding to community spread of COVID-19: interim guidance, 7 March 2020. World Health Organization. (2020, 7 March). https://apps.who.int/iris/handle/10665/331421
7. Azlan AA, Hamzah MR, Sern TJ, Ayub SH, Mohamad E. Public knowledge, attitudes and practices towards COVID-19: A cross-sectional study in Malaysia. Plos one. 2020;15(5):e0233668.
8. slam SDU, Mondal PK, Ojong N, Bodrud-Doza M, Siddique MAB, Hossain M, et al. Water, sanitation, hygiene and waste disposal practices as COVID-19 response strategy: insights from Bangladesh. Environment, development and sustainability. 2021;1-22.
9. Salman M, Mustafa ZU, Asif N, Zaidi HA, Hussain K, Shehzadi N, et al. Knowledge, attitude and preventive practices related to COVID-19: a cross-sectional study in two Pakistani university populations. Drugs & Therapy Perspectives. 2020;36:319-325.
10. South Asian Network on Economic Modeling. SANEM-Action Aid Bangladesh Webinar on Gender and Youth Inclusiveness in Technology in Bangladesh. 2020. https://sanemnet.org/sanem-netizen-forum-on-covid-19-pandemic-2-june-2020-2/
11. Seven days in medicine: 8-14 Jan 2020. BMJ. 2020. https://www.bmj.com/content/bmj/368/bmj.m132.full.pdf
12. Ministry of Health and Family Welfare. Coronavirus COVID-19 Dashboard. Directorate General of Health Services (DGHS). Government of the People's Republic of Bangladesh. 2021. https://dghs.gov.bd/index.php/en/home
13. Experts: Indian variant, gatherings could spark third wave in June. Dhaka Tribune. (2021, 9 May). https://www.dhakatribune.com/health/coronavirus/2021/05/09/experts-indian-variant-gatherings-could-spark-3rd-wave-in-june
14. Shammi M, Bodrud-Doza M, Islam ARMT, Rahman MM. Strategic assessment of COVID-19 pandemic in Bangladesh: comparative lockdown scenario analysis, public perception, and management for sustainability. Environment, Development and Sustainability. 2021;23(4):6148-6191.
15. Bodrud-Doza M, Shammi M, Bahlman L, Islam ARM, Rahman MM. Psychosocial and socioeconomic crisis in Bangladesh due to COVID-19 pandemic: a perception-based assessment. Frontiers in Public Health. 2020;8:341.
16. Larson EL, Ferng YH, McLoughlin JW, Wang S, Morse SS. Effect of intensive education on knowledge, attitudes, and practices regarding upper respiratory infections among urban Latinos. Nursing Research. 2009;58(3):150-157.
17. Gani MS, Chowdhury AMR, Nyström L. Urban–rural and socioeconomic variations in the knowledge of STIs and AIDS among Bangladeshi adolescents. Asia Pac J Public Health. 2014;26(2):182-195.
18. Islam FMA, Chakrabarti R, Dirani M, Islam MT, Ormsby G, Wahab M, et al. Knowledge, attitudes and practice of diabetes in rural Bangladesh: the Bangladesh

population based diabetes and eye study (BPDES). PLoS One. 2014;9(10):e110368.

19. Hossain M, Mani KK, Sidik SM, Shahar HK, Islam R. Knowledge and awareness about STDs among women in Bangladesh. BMC Public Health. 2014;14(1):1-7.
20. Afzal MS, Khan A, Qureshi UUR, Saleem S, Saqib MAN, Shabbir RMK, et al. Community-based assessment of knowledge, attitude, practices and risk factors regarding COVID-19 among Pakistanis residents during a recent outbreak: a cross-sectional survey. Journal of Community Health. 2021;46(3):476-486.
21. Sari DK, Amelia R, Dharmajaya R, Sari LM, Fitri NK. Positive correlation between general public knowledge and attitudes regarding COVID-19 outbreak 1 month after first cases reported in Indonesia. J Community Health. 2021;46(1):182-189.
22. Singh DR, Sunuwar DR, Karki K, Ghimire S, Shrestha N. Knowledge and perception towards universal safety precautions during early phase of the COVID-19 outbreak in Nepal. J Community Health. 2020;45:1116-1122.
23. Abdelhafiz AS, Mohammed Z, Ibrahim ME, Ziady HH, Alorabi M, Ayyad M, et al. Knowledge, perceptions, and attitude of Egyptians towards the novel coronavirus disease (COVID-19). Journal of Community Health. 2020;45(5):881-890.
24. Alahdal H, Basingab F, Alotaibi R. An analytical study on the awareness, attitude and practice during the COVID-19 pandemic in Riyadh, Saudi Arabia. Journal of Infection and Public Health. 2020;13(10):1446-1452.
25. Cronbach LJ. Coefficient alpha and the internal structure of tests. Psychometrika. 1951;16(3):297–334.
26. BRAC Institute of Governance and Development. Digital Literacy in Bangladesh. BRAC 2020. https://bigd.bracu.ac.bd/news/54-pc-bangladeshi-rural-families-lack-internet-access-survey/
27. Grilli L, Rampichini C. Ordered logit model. Encyclopedia of quality of life and well-being research. 2014;4510-4513. Springer.
28. Uddin MJ, Mezbah-ul-Islam M. The flow of, and access to, information in Bangladesh: A village level case study. The International Information & Library Review. 2012;44(4):224-232.
29. Islam MN, Zaman A, Sarker S. Beliefs About COVID-19 of Elderly Residents in Rural Bangladesh. Asia Pacific Journal of Public Health. 2020;32(8):527-528.
30. Laato S, Islam AN, Islam MN, Whelan E. What drives unverified information sharing and cyberchondria during the COVID-19 pandemic?. European Journal of Information Systems. 2020;29(3):288-305.
31. World Health Organization. Addressing myths and rumours. World Health Organization (2020, 17 April). https://www.who.int/bangladesh/emergencies/coronavirus-disease-(covid-19)-update/addressing-myths-and-rumours
32. Reuben RC, Danladi MM, Saleh DA, Ejembi PE. Knowledge, attitudes and practices towards COVID-19: an epidemiological survey in North-Central Nigeria. Journal of community health. 2021;46(3):457-470.
33. Karim A, Akter M, Mazid A, Pulock OS, Aziz TT, Hayee S, et al. Knowledge and attitude towards COVID-19 in Bangladesh: population-level estimation and a comparison. Nature. 2020;5(4):536-544.
34. Rahman M, Karamehic-Muratovic A, Amrin M, Chowdhury AH, Mondol M, Haque U, et al. COVID-19 Epidemic in Bangladesh among Rural and Urban Residents: An Online Cross-Sectional Survey of Knowledge, Attitudes, and Practices. Epidemiologia. 2021;2(1):1-13.
35. Hossain I, Mullick AR, Khan MH, Ahmad SA, Rahman MS, Aktaruzzaman MM. Epidemiology of Coronavirus Disease: Past, Present, Future Prospects and Its Journey Towards Bangladesh. Epidemiology. 2020;25(06):2518-2529
36. Ferdous MZ, Islam MS, Sikder MT, Mosaddek ASM, Zegarra-Valdivia JA, Gozal D. Knowledge, attitude, and practice regarding COVID-19 outbreak in Bangladesh: An online-based cross-sectional study. PloS one. 2020;15(10):e0239254.
37. Paul A, Sikdar D, Hossain MM, Amin MR, Deeba F, Mahanta J, et al. Knowledge, attitudes, and practices toward the novel coronavirus among Bangladeshis: Implications for mitigation measures. PloS one. 2020;15(9):e0238492.
38. Al-Mohrej OA, Al-Shirian SD, Al-Otaibi SK, Tamim HM, Masuadi EM, Fakhoury HM. Is the Saudi public aware of Middle East respiratory syndrome?. Journal of infection and public health. 2016;9(3):259-266.
39. Gudi SK, Chhabra M, Undela K, Venkataraman R, Mateti UV, Tiwari KK, et al. Knowledge and beliefs towards universal safety precautions during the coronavirus disease (COVID-19) pandemic among the

Indian public: a web-based cross-sectional survey. Drugs & Therapy Perspectives. 2020;36(9):413-420.

40. Wolf MS, Serper M, Opsasnick L, O'Conor RM, Curtis L, Benavente JY, et al. Awareness, attitudes, and actions related to COVID-19 among adults with chronic conditions at the onset of the US outbreak: a cross-sectional survey. Annals of internal medicine. 2020;173(2):100-109.
41. Zhong BL, Luo W, Li HM, Zhang QQ, Liu XG, Li WT, et al. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. International Journal of Biological Sciences. 2020;16(10):1745.
42. de Faria Coelho-Ravagnani C, Corgosinho FC, Sanches FLFZ, Prado CMM, Laviano A, Mota JF. Dietary recommendations during the COVID-19 pandemic. Nutrition Reviews. 2021;79(4):382-393.
43. World Health Organization (WHO). COVID-19 vaccines, Coronavirus disease (COVID-19). World Health Organization 2021. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/covid-19-vaccines
44. Alyousefi TA, Abdul-Ghani R, Mahdy MA, Al-Eryani SM, Al-Mekhlafi AM, Raja YA, et al. A household-based survey of knowledge, attitudes and practices towards dengue fever among local urban communities in Taiz Governorate, Yemen. BMC infectious diseases. 2016;16(1):1-9.
45. Singh, Ashish Kumar, Bharti Agrawal, Anukriti Sharma, Prayas Sharma, et al. COVID-19: Assessment of knowledge and awareness in Indian society. Journal of Public Affairs. 2020; 20(4): e2354.
46. Siddiqui, A. A., Alshammary, F., Amin, J., Rathore, H. A., Hassan, I., Ilyas, M., Alam, M. K., et al. Knowledge and practice regarding prevention of COVID-19 among the Saudi Arabian population. Work. 2020; 66(4):767-775.

ACHSM Asia-Pacific Journal of Health Management

REVIEW ARTICLE

ETHICAL CONFLICTS AMONG THE LEADING MEDICAL AND HEALTHCARE LEADERS

Dr. Bindu Roy[1], Anuj Kumar[2], Dr. Arya Kumar[3], Dr. Kavitha R Gowda[4]

1. Department of Commerce, D.A.V Centenary College, Faridabad, Haryana, India
2. Department of Management, Apeejay School of Management, Dwarka, Delhi, India
3. KIIT School of Social, Financial & Human Sciences, Kalinga Institute of Industrial Technology (Deemed to be University), Bhubaneswar, India
4. School of Business and Management, Christ (Deemed to be University), Bangalore, Karnataka, India

Correspondence: Anuj Kumar, anujsmooth@gmail.com

ABSTRACT

Today, the whole world is fighting the pandemic of COVID-19. In these circumstances, the medical professionals and Doctors are being viewed as the frontline warriors who are risking their lives for the sake of helping, caring, and curing these patients. However, in these difficult times, there are few medical professionals and health care providers who are taking advantage of this situation and milking distressed and distraught patients at will. A conflict between professional and personal ethical values makes them depressed and puzzled. It is tough for them to maintain a good image of their profession and business. The objectives of this study are to review the ethical conflict amid the ongoing Covid pandemic and post-Covid pandemic (vaccination period) in the context of medical professionals and health care providers. The paper is designed based on a literature review. Almost fifty-two research papers, articles, survey reports, and newspapers were studied in the context of ethics in business/profession. After reviewing moral distress is ongoing and post-pandemic period, the researchers have tried to present the medical professionals and health care providers' critical situation to give priority to their professional ethics or personal interest.

KEYWORDS

ethical conflicts, medical professionals, healthcare providers, COVID-19, leadership

INTRODUCTION

Ethics is the discipline dealing with what is good and evil and with moral duty and obligation. It explains guidelines for checking and administrating while framing the right decision. It is essential for medical field's success, just like safety while flying in an airplane. In both cases, if the prerequisites are not in place to ensure trust in the product or services provided, consumers will not utilize the product or service. In the case of the medical field, the public trusts the medical profession to regulate its own practices. Medical professionals are the most respected among the various professionals across a wide variety of occupations. This paper focuses on medical professionals and health care providers. By the term medical professionals, we imply those professionals who have the qualification of the medical field such as doctors, nurses, pathologists, etc. and the term health care providers includes all the stakeholders who are directly and indirectly involved with the medical

profession such as hospital authorities, medicine companies, medical transportation providers, medical equipment suppliers, and other supporting staff. Today, the whole world is fighting with the pandemic, and COVID-19 has claimed many lives to date, more than the world wars put together, and it is yet to stop. In these circumstances, the medical professionals are being viewed as the frontline warriors who are risking their lives for the sake of helping, caring, and curing these patients.

RATIONALE OF THE STUDY

During COVID-19, medical professionals and health care workers have been subjected to immense pressure and conflicts that has not been previously experienced by them. This has led to immense psychological and physiological stress which has made health care providers act differently than they would do so normally. Few medical practitioners and health care workers took this as an opportunity to make money and hence, resorted to unfair practices [1, 2, 3]. [4, 5, 6]. However, the majority of healthcare providers were affected mentally leading to deterioration in their mental well-being [7]. In fact, the role of psychiatrists and counsellors has increased and their importance felt. It is not just the persons from the medical fraternity who have shown evidence of mental disorder and confusion, but the lockdown associated with Covid 19 have also rendered many people, especially elderly and children, mentally traumatized [8]. Healthcare workers have to constantly keep themselves updated as to the situation globally which was very fluid [9]. These situations were very unique to even the most experienced of the medical practitioners and hence, study in this field needs to be undertaken so that appropriate measures, techniques and guidelines may be formulated for the well-being of both the medical fraternity and society.

OBJECTIVES

The objective of this study was to review any ethical conflict amid the ongoing COVID -19 pandemic period and in the vaccination period in the context of medical professionals and health care providers.

RESEARCH METHODOLOGY

The present study is a traditional narrative review based study in which the Scopus database, Google Scholar and Google are used to get valuable insights in the context of research objective. The review methodology was to identify a few studies that can describe the problem of interest. No predetermined research question or specified search strategy is applied for this methodology. The Scopus database, Google Scholar and Google were searched to retrieve journal articles, review articles, reports and news releases to review any arising conflicts amongst medical professionals and health care providers especially during the period of ongoing COVID-19 pandemic from 2020 to 2021. More than 30 articles are for review to fulfill the objective of the study. The research methodology is totally based on previously available literature on this topic. After review findings that moral distress is ongoing, the researchers have tried to present the medical professionals and health care providers' critical situations to give priority support to their professional ethics or personal interests.

.

ETHICS IN THE MEDICAL PROFESSION AND BUSINESS

The medical profession is about giving primary preference to serve patients rather than to earn money, but in actual practice, few medical practitioners have become materialistic in their approach. With the increased use of internet and development of various apps. Many medical customers are using these apps to obtain medical services since authenticity of these apps and related guidelines/prescriptions provided are from unknown sources they can't be realistically relied upon. [1] In the recent years, extreme competition between pharmaceutical companies have led to extreme pressure placed on their manpower and also on their sales partners., This combined with the greed to earn more have created grounds for a few to indulge in unethical practices which can or can't be harmful to life.[2]

EXISTING CIRCUMSTANCES OF HEALTH CARE PROVIDERS AND MEDICAL PROFESSIONALS

The deadly coronavirus is spreading all around the globe, and because of this, general wards and special wards are being quickly converted into isolation wards for the patients who are affected by the virus, and the medical professionals stepped in to serve these patients and thus, they are considered as an essential resource for every nation. Good health is necessary for them so that they can help their country. [3] The doctors, nurses, and other healthcare providers were under extraordinary stress related to the high risk of infection, stigmatization,

understaffing, and uncertainty. Comprehensive support was a high priority during the outbreaks and afterward. [4] [5] The frontline healthcare providers treating patients with COVID-19 also have more significant risks of mental health problems, such as anxiety, depression, insomnia, and stress. [6] [7] In this high-risk emergency situations, the doctor must compete for various duties like a duty to patients, commitment to protect himself from undue risk of harm, the duty to his family, duty to colleagues whose workloads and risk of injury will increase in his absence and commitment to society which make a great deal of pressure on him.

Figure 1 presents the various factors that create conflicting circumstances for medical professionals and health care providers.

FIGURE 1- VARIOUS FACTORS CREATING CONFLICT CIRCUMSTANCES FOR MEDICAL PROFESSIONALS AND HEALTH CARE PROVIDERS

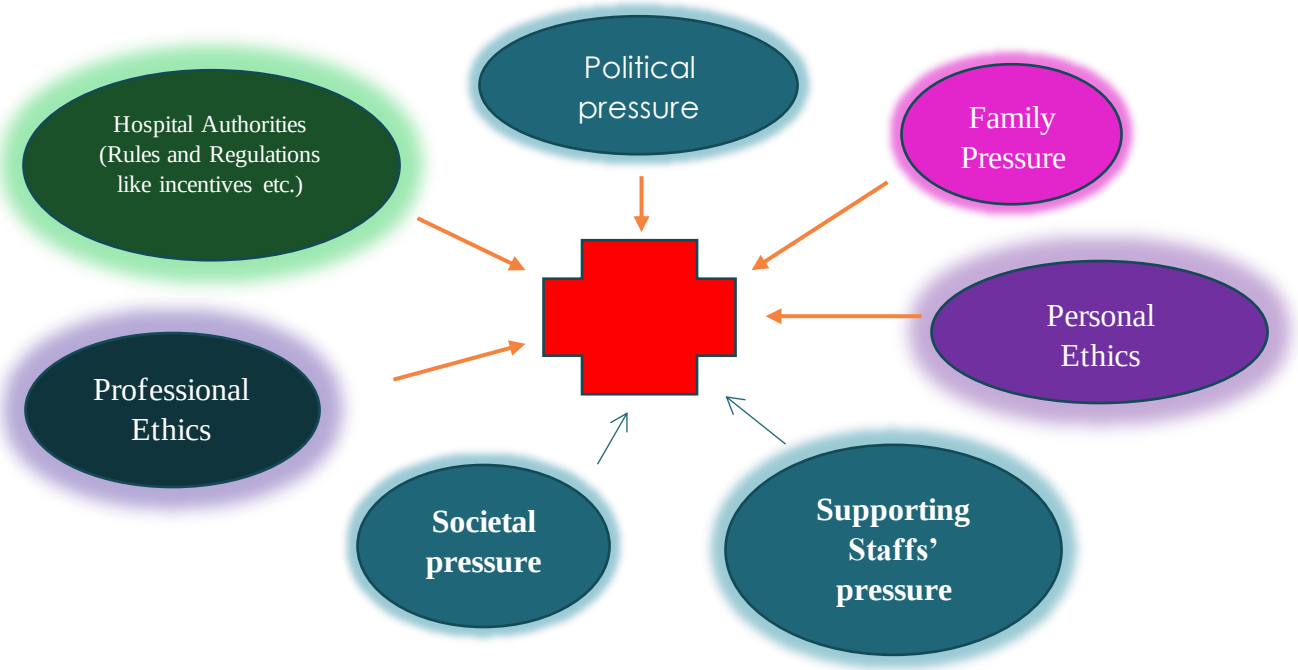


TABLE 1 (AUTHORS' OWN) ETHICAL CONFLICTS IDENTIFIED DURING PANDEMIC PERIOD

Author(s) publication details	Ethical conflict amid a COVID-19 pandemic	Findings
[8]	Communication of attractive vs. actual information to the public	The conflicting situation, in this case, is that sometimes they are unable to deliver essential information, which is anti to their professional ethics, but due to problems, they must ignore it
[9] [10]	Conflict of actual availability of precautionary resources	Front line health care providers are not getting sufficient resources; this creates conflict among them either they should blow the whistle in this regard or should keep quiet

[9]	To meet the acute need of medical services with limited resources and restricted norms	In this circumstance, where resources to check the virus presence is limited, conflict arises for methodology with which services must be provided, treatment of virus-infected and non-virus-infected patients at the same place, and questioning regarding mere lockdown is the solution to this drastic problem
[11] [12]	Conflict in delivering health care services to non-Covid chronic patients amid a pandemic	Patients who are not suffering from corona instead but may have other serious diseases (such as HIV, TB) are not able to access treatment as the authorities are majorly concerned for coronavirus affected people
[9]	Conflict of hiding the professional identity	The medical professionals and health care providers who are working in hospitals are criticized as they may create problematic situations for their landlords and surroundings.
[13]	Ethical conflict during the treatment of COVID-19 patients in isolation:	In the field of medical professionals, physical touch and personal care provided by the doctors is essential and non-replaceable medicine for any patients who help them in fighting against any significant disease, and in the case of coronavirus, this vital touch and feel lacking. This leads to conflict among medical professionals of not treating their patients properly because of isolation requirements
[14] [10]	Moral distress due to working with uncertain and unproven therapies	In such conditions, where exact medication is not available, and everyone is just trying to address issues and trying methods. When their methods become a failure, this leads to mental stress and loss of confidence among medical professionals and health care providers; this situation leads to the creation of mental conflict of not knowing the exact treatment method
[15] [10]	Duty to care vs. the right of protection	The conflicting situation is that where hospitals are unable to provide proper safety kits and other requirements to their staff, hospitals are not serving people, whereas hospitals are working as multiplayer in those cases. The America Medical Association said that they must ensure patient safety as well as their own
[10]	Ethical stress for dignity in the death of patients	The conflicting situation is that family members are not allowed to do post-death rituals properly. Also, the patient is kept in isolation. Thus, that patient lives in isolation before death, and even that dead body is not allowed to see my family members.
[16]	Conflict in priority of testing of a celebrity or average person	There arises a battle in front of medical professionals and health care providers who must be given priority for testing. It should be an

		ordinary person or a celebrity who might have infected a significant lot of people.
[17]	Conflict at the time of availability of vaccine	After the arrival of the vaccine, they will have to allocate those limited vaccines to individuals based on some pre-fixed benchmarks.

ETHICAL CONFLICT AMID ONGOING PANDEMIC IN MEDICAL PROFESSIONALS AND IN HEALTH CARE PROVIDERS

Table 1 shows various reviews about ethical conflict among medical professionals and health care providers during the pandemic period as found through this literature review.

ETHICAL CONFLICT AND COVID-19 PANDEMIC

Table 1that COVID-19 had presented a big dilemma to the medical fraternity. The first dilemma is to choose between individual patient health and public health. The second dilemma was how to maintain a balance in justifying and delivering treatment to Covid and non-Covid patients. There is also a third quandary which needs to be mentioned and that is patient's health versus self-health and health of a person's families. COVID-19 also has brought about big shortfalls in logistics, medical equipment and medicines that medical community has had to cope with across the globe. Constructive communication was required during this period. The biggest question that medical professionals faced during this pandemic was about who to save and when to take that call for help or assistance. During COVID-19, even dignity with death was rare and privileged. COVID-19 has also affected the importance of personal and public privacy.

ETHICAL CONFLICT AMID VACCINATION PERIOD IN MEDICAL PROFESSIONALS AND IN HEALTH CARE PROVIDERS

The WHO draft on the landscape of COVID-19 candidate vaccines, 2020 by World Health Organization, [27] "As of 17 November 2020, the WHO reports 48 vaccines undergoing clinical trials and 164 candidates in preclinical evaluation." Many studies have been conducted on this deadly virus, and it has been found that overcoming coronavirus disease is just a start towards an unknown journey from a health perspective. [18] The significant issue during the vaccination period is building and retaining trust among the public by providing them the transparent and correct information, equal distribution of resources among all demographical and economic profiles. [19]

Table 2 sets out the conflicts that are arising in the vaccination period for medical professionals and health care providers:

TABLE 2 (AUTHORS' OWN) ETHICAL CONFLICT IDENTIFIED IN VACCINATION PERIOD

Ethical conflict amid vaccination period	Findings	Authors' publication support
(i)Setting framework for vaccination priority order for distribution among population	As the resources are scarce for fighting this deadly virus and therefore on ethical grounds, these resources may be allocated by taking into consideration four pillars namely, maximum derived benefits from these limited resources, equality, spreading instrumental values, and prioritizing the neediest ones. Sometimes, due to situational circumstances, they cannot help themselves to maintain ethical values of professionalism due to personals.	[20], [21] [22], [23], [24] [25]
(ii) Delivering the correct information or working for the personal benefits	On the landscape of COVID-19 candidate vaccines, two dosages are required for the vaccination schedule for any person. But clear and transparent communication for vaccination is not being followed. Few misleading information issues regarding multiple	[26], [27] [28]

	dosages, the inefficiency of vaccines, and its side effects promoted through social media are unethically enhancing costs to people and leading to wastage of vaccines with no use.	
(iii) Equality with limited supply and storage of resources	The role of medical professionals and health care providers is vital to follow ethical norms regarding equality during the implementation of the vaccination process. The vaccination process must follow a first cum first serve basis by avoiding the economic, personal cultural, etc. backgrounds of individuals.	[29], [16] [27]
(iv) Recordkeeping and Privacy of Information	Medical professionals are required to maintain proper records of people to identify those categories of populations which are vaccinated once and groups/classes which are still not vaccinated. Due to some doubt and lacking trust in healthcare providers, individuals generally hesitate to share their personal data regarding the safety of their private information.	[30], [17]

ETHICAL CONFLICT IDENTIFIED IN VACCINATION PERIODS

This COVID-19 pandemic has shone light on various managerial and planning tools which need to be used to fight COVID-19 as the best possible way considering limited resources (vaccines, manpower, centres and logistics.). Who, when, where and how are the questions which need to be answered at each step towards dealing with COVID-19 patients and towards the process of vaccinating the public. Data management and privacy regarding vaccination also needs to be structured in such a way that along with effective communication, all confusion and fear that populations and communities may have can be addressed and settled.

CONCLUSION

The ongoing COVID-19 pandemic has reduced opportunity for health workers to play a vital role in relieving sufferings of communities and populations. As stated by Dr Tedros Adhanom Ghebreyesus, WHO Director-General. "No country, hospital or clinic can keep its patients safe unless it keeps its health workers safe." (WHO News 17 September 2020) The COVID-19 pandemic not only affects the physical and medical well-being of an individual, but it also significantly impacts the mental health of healthcare workers (HCWs) and as well as the public [40]. These issues are due to an imbalance in effectively handling various factors such as professional ethics, personal ethics, and pressure on hospital administration and supporting staff, hype from social media, political and societal pressure. These factors thereby create conflicting circumstances for medical professionals and health care providers who are in the frontline of this crisis. Healthcare providers, namely doctors, nurses, technicians and others are not experienced regarding this new pandemic, and hence unable to address the major ethical issues immediately. Key impact factors such as prioritization of patients in view of limited resources, selection related to individual patient health needs, self-health, family's health and public health, require balance in justifying and delivering treatment to Covid and non-Covid patients. Issues involved relate to coping with the big shortfall in logistics, medical equipment and medicines. A range of responses are required such as setting frameworks for vaccination, equality among the public entitled to vaccination as well as dealing with limited supply and storage of resources and record keeping and maintenance of privacy. Such ethical issues are a cause for severe moral distress among healthcare providers. Urgent attention needs to be taken to monitor community member's mood, sleep and other mental health issues to understand mediating factors.

This study identifies the need to educate society about the various stress and pressures that healthcare leaders experience. This ultimately leads to creation of conflict due to various factors that surround medical professionals and healthcare providers. This pandemic is new experience to

everyone therefore, medical professionals and healthcare providers should have safe working conditions, should be trained to handle such situations, and should be provided special remuneration, rewards and moral support. Proper counselling also needs to be provided to support health professional's mental health. This study aims at opening doors for other research work based on these dilemma and constraints so that a proper roadmap can be framed to benefit both the medical professionals along with healthcare providers and the public. This study also identifies the need for future research to study effective communication needed to ensure the bond between the public and the health care providers becomes stronger and is without any prejudice.

References:

1. ANI, "Families allege medical negligence after 5 COVID patients die at Hisar hospital," 2021.
2. L. Leo, "DCGI pulls up Glenmark for false claims, overpricing of covid-19 drug FabiFlu," New Delhi, 2020.
3. R. Nagarkoti, "Punjab: Private hospital booked for cheating Covid patients," TNN, Mohali, 2021.
4. D. Mohanty, "Odisha Police arrest drug company MD for selling fake, overpriced Covid medicine," The Hindustan Times, Odisha, 2021.
5. P. Singhal, "Overcharging for Covid treatment: Panchkula private hospitals to return Rs 20 lakh, most refunds processed, say authorities," The Indian Express, Punchkula, 2021.
6. "DCGI asks manufacturers to take steps to prevent black-marketing, overpricing of COVID-19 drugs," Press Trust of India, New Delhi, 2020.
7. P. Pujari, P. Pujari and A. Kumar, " Impact of COVID-19 on the Mental Health of Healthcare Workers: Predisposing factors, prevalence and supportive strategies," Asia Pacific Journal of Health Management, vol. 16, no. 4, pp. 260-265, 2021.
8. A. Kumar and N. Ayedee, "Life under COVID-19 lockdown: an experience of old age people in India," Working with Older People, Vols. Vol. ahead-of-print, no. No. ahead-of-print., pp. https://doi.org/10.1108/WWOP-06-2020-0027, 2022.
9. S. Lloyd, S. M. Walker and A. Goswami, " Health information: Applications and challenges in the COVID-19 pandemic.," Asia Pacific Journal of Health Management, vol. 15, no. 3, p. 23–28, 2020.
10. D. KA, "Ethical Challenges of Medicine and Health on the Internet: A Review," J. Med Internet Res, vol. 3, no. 2, p. 23, 2001.
11. R. Ganesan and R. Thambusamy, "Ethics in Business: A Case Study of a Pharmaceutical Company.," The European Journal of Social & Behavioural Sciences, vol. 28, pp. 3143-3149, 2020.
12. D. Chang, H. Xu, A. Rebaza, L. Sharma and C. Dela Cruz, "Protecting health-care workers from subclinical coronavirus infection," Lancet Respir Med., vol. 8, p. 13, 2020.
13. S. Lee, W. Kang, A. Cho, T. Kim and J. Park, "Psychological impact of the 2015 MERS outbreak on hospital workers and quarantined hemodialysis patients," Compr Psychiatry, vol. 87, p. 123–27, 2018.
14. R. Maunder, J. Hunter and L. Vincent, "The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital.," CMAJ, vol. 168, p. 1245–1251, 2003.
15. L. Qian, L. Dan, E. H. Joan, G. Qiaohong, Q. W. Xiao, L. Shuo, X. Z. Lin, J. Y. Liu and B. X. Yang, "The experiences of health-care providers during the COVID-19 crisis in China: a qualitative study," The Lancet Global Health, vol. 8, no. 6, pp. 790-798, 2020.
16. S. Liu, L. Yang and C. Zhang, "Online mental health services in China during the COVID-19 outbreak," Lancet Psychiatry, vol. 7, p. 17–18, 2020.
17. A. N. M. Yusof, M. Z. Muuti, L. A. Ariffin and M. K. M. Tan, "Sharing Information on COVID-19: the ethical challenges in the Malaysian setting," Asian Bioethics Review, vol. 12, no. 3, pp. 1-13, 2020.
18. Hebbar, P. &. Sudha, A. &. Dsouza, V. &. Chilgod and L. &. A. Adhip., "Healthcare Delivery in India amid the COVID-19 Pandemic: Challenges and Opportunities.," Indian Journal of Medical Ethics, pp. 01-04, 2020.
19. G. V., "Clinical ethics during the COVID-19 pandemic: Missing the trees for the forest..," Indian J Med Ethics, vol. 5, no. 3, pp. 182-187, 2020.
20. H. Lau, V. Khosrawipour, P. Kocbach, A. Mikolajczyk, J. Schubert and J. Bania, "The positive impact of lockdown in Wuhan on containing the COVID-19 outbreak in China.," J Travel Med, 2020.
21. Z. Wang and K. Tang, "Combating COVID-19: health equity matters," Nat Med, p. 1, 2020.
22. G. Yang, B. Nelson, R. Murphy, H. Choset, H. Christensen and S. Collins, "Combating COVID-19—The role of robotics in managing public health and infectious

diseases.," Science Robotics, vol. 5, no. 40, p. 5589, 2020.

23. S. Hasan, C. Kow and H. Merchant, "Is it worth the wait? Should Chloroquine or Hydroxychloroquine be allowed for immediate use in COVID-19?," Br J Pharm, vol. 5, no. 1, p. 745, 2020.
24. H. D. K and M. Goldrich, "Physician obligation in disaster preparedness and response," Camb Q Healthc Ethics, vol. 15, no. 4, p. 417–31, 2006.
25. J. E. Ezekiel, P. Govind, R. U. J.D., T. Beatriz, P. Michael, G. Aaron, Z. Cathy, B. Connor, S. Maxwell and P. P. James, "Fair Allocation of Scarce Medical Resources in the Time of COVID-19.," The new England Journal of Medicine, 2020.
26. World Health Organization, "A Global Framework to Ensure Equitable and Fair Allocation of COVID-19 Products and Potential implications for COVID-19 Vaccines.," 18 June 2020.
27. WHO, "DRAFT landscape of COVID-19 candidate vaccines," Dec, 2020.
28. Gemelli Against COVID-19 Post-Acute Care Study Group, "Post-COVID-19 global health strategies: the need for an interdisciplinary approach," Aging Clin Exp Res, pp. 1613-1620, Aug 2020.
29. P. B. Beth, R. R. José and M. L. Grace, "Scientific and Ethical Principles Underlying Recommendations From the Advisory Committee on Immunization Practices for COVID-19 Vaccination Implementation.," JAMA, vol. 324, no. 20, pp. 2025-2026, 2020.
30. G. Persad, A. Wertheimer and E. Emanuel, "Principles for allocation of scarce medical interventions," The Lancet Global Health, vol. 373, pp. 423-431, 2009.
31. G. Persad, M. Peek and E. Emanuel, "Fairly Prioritizing Groups for Access to COVID-19 Vaccines," JAMA, vol. 324, no. 16, p. 1601–1602, 2020.
32. L. Biddison, K. Berkowitz and B. Courtney, "Ethical considerations: care of the critically ill and injured during pandemics and disasters," CHEST consensus statement, pp. 145S-155S., 2014.
33. S. Rosenbaum, R. Bayer and R. Bernheim, "Ethical considerations for decision making regarding allocation of mechanical ventilators during a severe influenza pandemic or other public health emergency," Atlanta: Centers for Disease Control and Prevention, 2011.
34. H. Zucker, K. Adler and D. Berens, "Ventilator allocation guidelines," Albany: New York State Department of Health Task Force on Life and the Law, Nov. 2015.
35. M. Christian, C. Sprung and M. King, "Triage: care of the critically ill and injured during pandemics and disasters," CHEST consensus statement, pp. 61S-74S., 2014.
36. E. W. Dward, W. Robert, J. Frenck, R. F. Ann, K. Nicholas, A. Judith, G. Alejandra, L. Stephen, N. Kathleen, J. M. Mark and B. Ruth, "Safety and immunogenicity of tworna-based COVID-19 vaccine candidates.," New England Journal of Medicine, 2020.
37. WHO, "Draft landscape of COVID-19 candidate vaccines," 2020.
38. T. Burk, "Vaccine misinformation and social media.," The Lancet Digital Health, vol. 1, no. 6, p. 258–259, 2019.
39. S. Harald, O. G. Lawrence and A. W. Michelle, "Is it lawful and ethical to prioritize racial minorities for COVID-19 vaccines?," Jama, vol. 324, no. 20, pp. 2023-2024, 2020.
40. D. Calina, T. Hartung, A. O. Docea, D. A. Spandidos, A. M. Egorov, M. I. Shtilman and A. Tsatsakis, "COVID-19 vaccines: ethical framework concerning human challenge studies," DARU Journal of Pharmaceutical Sciences, 2020.
41. P. Sofia, i. N. Vasilik, G. Timoleon, G. G. Vassilis, P. Eleni and i. K. Paraskev, "Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis," Brain, Behavior and Immunity, vol. 92, p. 245, 2021.

ACHSM Asia-Pacific Journal of Health Management

REVIEW ARTICLE

ROLE OF SOCIAL DISTANCING, HAND HYGIENE AND WEARING MASK IN CONTROLLING COVID-19 PANDEMIC: A REVIEW

Santosh Kumar Swain[1], MNAMS; Pragnya Paramita Jena, MD [2]; Somadatta Das, MA[3]*

1. Department of Otorhinolaryngology, IMS and SUM hospital, Siksha "O" Anusandhan University, K8, Kalinganagar, Bhubaneswar-751003, Odisha, India.
2. Department of Microbiology, IMS and SUM hospital, Siksha "O" Anusandhan University, K8, Kalinganagar, Bhubaneswar-751003, Odisha, India.
3. Central Research Laboratory, IMS and SUM hospital, Siksha "O" Anusandhan University, K8, Kalinganagar, Bhubaneswar-751003, Odisha, India.

Correspondence: Santosh Kumar Swain, santoshvoltaire@yahoo.co.in

ABSTRACT

BACKGROUND:

Coronavirus disease 2019 (COVID-19) continues to spread all over world and is outpacing the resources and capacity of health care systems. This rapidly spreading COVID-19 infection is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and has been challenging the medical community and keeping the whole world in great threat to an unprecedented degree.

OBJECTIVES:

The objective of this review article is to describe details of social distancing, hand hygiene and wearing face masks including there role in controlling the current COVID-19 pandemic.

METHOD:

We conducted an electronic search of Google Scholar, Scopus, Medline and PubMed databases for articles between June to September 2021.

RESULTS:

The novel SARS-CoV-2 virus is transmitted from person to person by respiratory droplets or contact with an infected person. There are no established medications and vaccine available until now to restrain the transmission of the COVID-19 infection. Currently, social distancing, hand hygiene and wearing a mask are key steps to lower the transmission of the SARS-CoV-2 virus in COVID-19 pandemic. As this infection is highly contagious via a respiratory pathway through coughing, sneezing and contact with an infected surface, the spread can be reduced by the proper practice of social distancing, hand hygiene or frequent hand washing and wearing mask. These universal precautions should be done as COVID-19 patients may be asymptomatic.

CONCLUSION:

Social distancing, hand washing and wearing face masks are cheap and widely acceptable methods for the prevention of the COVID-19 infection. The goal of this review paper is to discuss social distancing, hand hygiene and face mask information, including its role in managing the current COVID-19 pandemic

KEYWORDS

COVID-19 pandemic; Social distancing; Hand hygiene; Wearing mask.

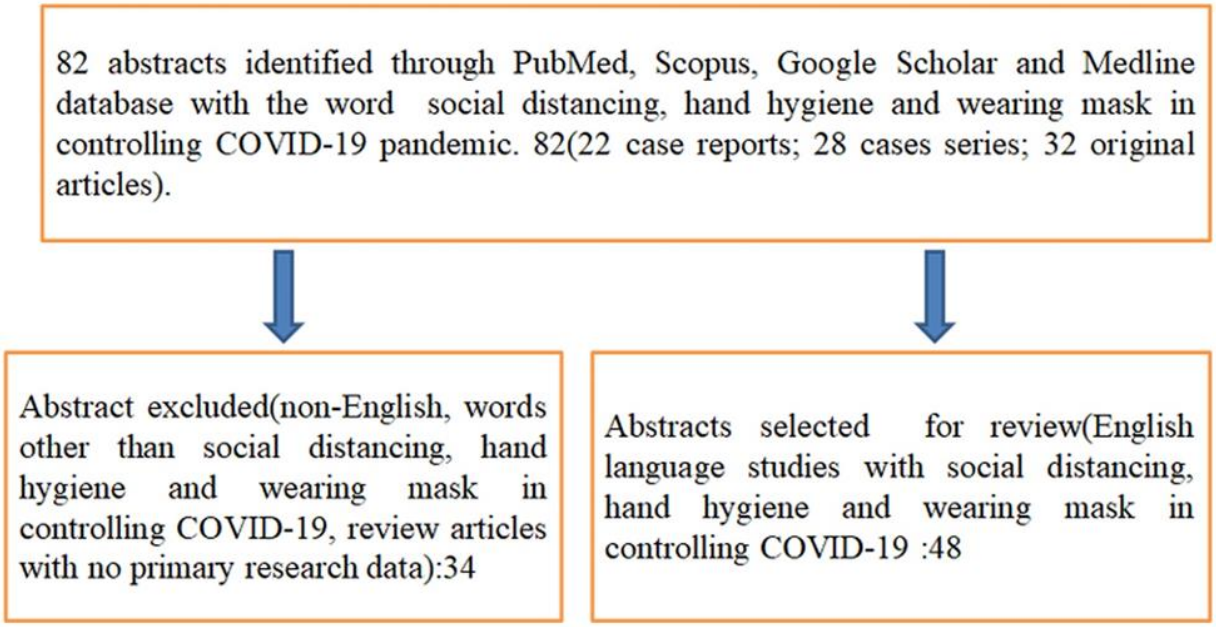
INTRODUCTION

COVID-19 infection refers to an outbreak of the acute respiratory infection caused by a novel coronavirus, called severe acute respiratory syndrome coronavirus 2(SARS-CoV-2). [1] This infection was first started at Wuhan, Hubei Province of China and it has rapidly spread throughout the world. [2] COVID-19 infections have a dramatic impact on the health care systems even in the developed countries of the world. Vaccines and curative medicines against COVID-19 infections are not available to date. As there is no effective vaccine, the only choice to prevent this infection is to break the transmission link. In this context, public health actions are vital steps to reduce the transmission of the virus. Social distancing, hand hygiene and wearing masks are less expensive and widely acceptable preventive measures for both individual protection and pandemic prevention of the COVID-19 infections. [3] However, it is very difficult to maintain these three norms for effective compliance. In one study, it was found that most important recommendation of prevention of the COVID-19 infections by use of the face mask which protect from the coughing, sneezing from the infected persons along with hand washing and social distancing. [4] Maintaining the appropriate distance from people, avoiding the touching of the eyes, nose and mouth are also important advisories for presentation of COVID-19 infections. There are not many studies or literature regarding the role of social distancing, hand washing and wearing masks in the COVID-19 pandemic. This review article focuses on the importance of social distancing, hand washing and use of face masks during current COVID-19 pandemic.

METHODS

We conducted an electronic search of Google Scholar, Scopus, Medline and PubMed databases for articles. The search terms in the data base included social distancing, hand hygiene, wearing face masks and COVID-19 pandemic. The abstracts of the published articles were identified manually from these citations. We started by searching the Scopus, PubMed, Medline, and Google Scholar databases online. A search strategy using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines was developed. This search strategy recognized the abstracts of published articles, while other research articles were discovered manually from the citations. Observational studies, comparative studies, case series, and case reports were evaluated for eligibility. There were a total number of 82 articles (32 original articles, 28 case series, 22 case reports) (Figure 1). This review examines the importance of social distancing, hand hygiene and wearing a face mask in controlling the current COVID-19 pandemic. This review article presents a baseline from where further studies can be designed regarding these universal precautions for controlling this dreaded pandemic as there are not many studies or reviews in medical literature.

FIGURE 1: FLOW CHART OF METHODS FOR LITERATURE SEARCH



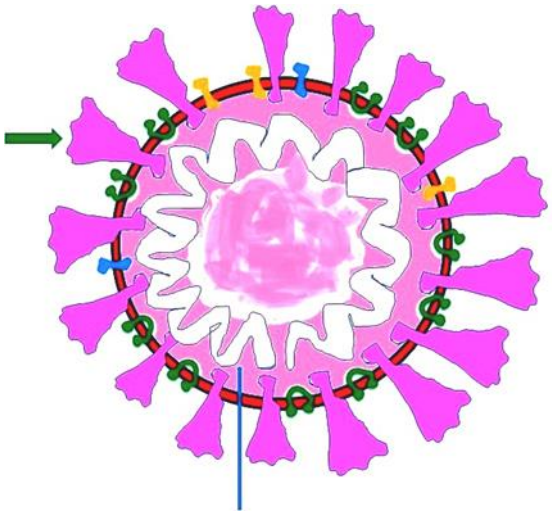
EPIDEMIOLOGY

COVID-19 infection is a highly contagious disease of the respiratory tract. The first patient of the COVID-19 infection was reported in Wuhan, Hubei Province, China in late December 2019. [5] COVID-19 infections continue to spread and currently are affecting more than 200 countries and territories across the world. By February 27, 2020, more than 82,000 COVID-19 positive patients and more than 2,800 deaths were documented of which approximately 95% of the positive cases and 97% of deaths were in China. [6] By March 26th, 2020, there were 46,2684 positive cases of COVID-19 infection were reported in 199 countries. [7] By 20th July 2020, total of 14,348,858 persons were infected and 603,691 had died because of the COVID-19 infections in 213 countries. [8] While more than 30 countries showed highest level of response, the COVID-19 infection continues to spread in different parts of the world. [9] Strict lockdown leads to jeopardising people's livelihoods with vulnerability of the population or family going into poverty. The poverty may push towards the death of people because of the vulnerability to other diseases. Lockdowns can be relaxed with strictness with lifestyle actions such as social distancing, frequent hand washing and wearing face masks. As there is high vulnerability of the COVID-19 infection in the community, hand hygiene, use of face mask and social distancing are repeatedly emphasized for whole populations. [10] Most countries are now strictly following social distancing, hand washing and wearing face mask protocols. Adapting to these universal precautions, there is slow decline of SARS-CoV-2 viral transmission in current life-threatening situations. Due to the fear of second waves of the COVID-19 pandemic, social distancing, hand washing and wearing face masks are now greatest priorities to minimize the morbidity and mortality due to COVID-19 infection.

COVID-19 VIRUS

The causative microbiological agent for COVID-19 infection was identified as a novel corona virus which was known as acute respiratory syndrome corona virus 2(SARS-CoV-2) and this disease is called as corona virus disease 2019 (COVID-19) by World Health Organization (WHO). [11] SARS-CoV-2 (Fig 2) was earlier known as 2019-nCoV, positive-sense, single stranded RNA virus with diameter of 60 to 140 nm11. SARS-CoV-2 is included in the genus of beta corona virus. [12] So far, this is the seventh member of the corona virus family which can infect human being. The incubation period of SARS-CoV-2 ranges from 1 to 14 days with a median of 5-6 days. Although a recent study reports that the incubation period may extend to 24 days, [13] a longer incubation period has implications in quarantine policies and prevention of the spread of the disease. Respiratory droplets are primarily responsible for transmission of the infection. However, blood and stool can also cause transmission of the SARS-CoV-2 virus, so raises questions regarding the mode of transmission of the infection. [14]

FIGURE 2: STRUCTURE OF THE COVID-19 VIRUS (GREEN ARROW IS SPIKE PROTEIN OVER LIPID MEMBRANE, BLUE ARROW INDICATES RNA).



TRANSMISSION OF THE INFECTION

SARS-CoV-2 spreads by air-borne transmission, respiratory droplets and contaminated surfaces. [15] There are four patterns of the transmission of the COVID-19 infections, and these include community transmission, nosocomial transmission, household transmission and transmission of the infection in a closed environment. [16] Prevention of the viral transmission from human to human is the most challenging step in current COVID-19 pandemic. The rapid spread of the COVID-19 infection is mainly due to asymptomatic cases and travelling of the cases with or without symptoms. Certain surgical procedure like tracheostomy which is considered as aerosol generating procedures and high risk for exposing the aerosols from the air way to the health care professionals or others. [17,18] The common clinical symptoms of the COVID-19 patients are cough, fever, fatigue and dyspnea. There are some patients those are asymptomatic and considered as silent carriers in this pandemic. There are also symptoms like anosmia and taste alterations are two important features are associated with this patient. Therefore, health care workers should be aware about these symptoms and so can prevent from transmission to them and other patients. The procedures which deal with nose, nasopharynx, oral cavity, larynx and trachea which produces respiratory droplets, leads to transmission of the infections. After declaration of the COVID-19 infection as a pandemic by the WHO on 11 March 2020, most countries declared preparedness against COVID-19 such as lock-down, social distancing, hand washing and wearing face mask. Frequent hand washing, wearing masks and social distancing are the proven approach to slow the exponential spread of the SARS-CoV-2 in current threat situation of the COVID-19 pandemic. [19]

SOCIAL DISTANCING

Social distancing is also called as physical distancing which is about keeping a safe distance between people. Social distancing is an important public health measure which reduces social interaction between people based on touch or physical proximity.[20] The virus mainly spreads during breathing, coughing, talking or sneezing through droplet contamination. To stop the spread of COVID-19, the person should avoid close contact with anyone who does not live with them. Social distancing is a critical measure for the slowing the rapidly spreading COVID-19 pandemic. Social distancing should be maintained by at least six feet from one person to other. Social distancing should be practiced rigorously for minimizing the spread of the COVID-19 infection. It is safe to avoid crowded places and social gathering for maintain proper social distancing as it is difficult to maintain six feet distance from other person. However, a high compliance is required for getting maximum impact which may not be easily achievable. Even at the time of lockdown, person to person contacts in supermarkets or medical care, many citizens were not obeyed properly. As several people are moving constantly, the SARS-CoV-2 can be easily picked up when social distancing is not rigorously practiced. This makes the virus back into the home and workplace and lead to community spread of the virus easily. Individuals more than 70 years of age should strictly practice social distancing meaning they must maintain a two-meter distance from other persons and avoid gatherings or congregations. [21] This social distancing measure is targeted to decrease the contacts by 50% at the workplace and reduce other contacts by 75%. [22] All individuals must practice social distancing to prevent the transmission of the viral infections from human to human. Non-essential use of the public transport should be avoided and the arrangement to work from the home. Person should use remote technology to keep in touch with family and friends, so that small and large gatherings can be avoided. Online services and telephone should be utilized for contacting health care professionals and other essential services. [23] The power of social distancing should be properly understood by the public and health care professionals. The power of the social distancing is given in (Table 1). [24]

TABLE 1: POWER OF THE SOCIAL DISTANCING AND RATE OF COVID-19 INFECTION

NOW	5 DAYS	30DAYS
1 person	2.5 persons are infected	406 persons are infected
50% LESS EXPOSURE	**5 DAYS**	**30DAYS**
1 person	1.25 persons are infected	15 persons are infected

75% LESS EXPOSURE	5 DAYS	30DAYS
1 person	1 person is infected	3 persons are infected

HAND HYGIENE

Hand hygiene is an important element for prevention of the transmission of the viral infection. The literature showed that frequent hand washing would minimize the risk of viral transmission by 55%. [25] Appropriate hand washing can break the transmission cycle of the virus and reduce the risk of infection between 6% to 44%. [26] The behaviors of hand hygiene in COVID-19 pandemic reflect the global issue and its presentation. There should be feedback for monitoring hand hygiene and this should be monitored properly. However, there are still some inadequacies. In line withthe WHO recommendation, hand washing should be done thoroughly, including for inter-digital web spaces, wrists and finger nails for at least 20 seconds with soap and water. Frequent hand washing causes prolonged exposure to water and chemical or physical agents which lead to several pathophysiologic changes with epidermal barrier disruption of the hand. Hand hygiene products are available in different types such as bar or liquid soaps, synthetic detergents, antiseptic hand washes and alcohol-based hand sanitizers (ABHSs). These work by penetrating into the viral membrane to denature and coagulate the proteins, disruption of the cellular metabolism and enhances the lyses' of the viral particles. [27] For health care workers, hands must be washed before and after encountering patients with the use of ABHS and antiseptics with antiviral activity. [28] Each formulation is usually effective against COVID-19 infection but these may alter the skin barrier integrity and functional aspect, leading to the chance of the hand dermatitis. The alteration in the skin of the hand due to excessive hand washing may cause dryness of the skin and even contact dermatitis. Wet work and synthetic detergents are often contributors in causing hand dermatitis because of the inclusion of the preservative, surfactant and fragrance allergens. A mixture of the chemical and physical irritants e.g., detergents and hot water leads to release of pro-inflammatory cytokines from keratinocytes which instigate the disruption of the skin barriers of the hands. The documented irritants are detergents, iodophors, chlorhexidine, triclosan and alcohol-based products. Methods for avoiding hand dermatitis include devoid of common allergens and use of moisturizers. Individuals with recalcitrant hand dermatitis should be properly evaluated and treated by a dermatologist. These manifestations of the skin can be managed by applying moisturizer immediately after hand washing. The proper technique of rinsing of the hands should be done gently to prevent physical irritation of the skin. Regular skin hydration is the key point for preventing the dermatitis on the hand as a consequence of the frequent hand washing. These hydrating products should be applied liberally, several times per day, specifically after washing hand. In case of person with highly sensitive skin which easily develop dermatitis, short course of topical corticosteroids can be used to minimize the signs and symptoms of the inflammations of the skin. Those are wearing protective gloves; it is recommended to wash the hands and use moisturizers whenever gloves are removed. Awareness about adverse effects for hand washing should be promoted such as to avoiding excessive hand washing, prolonged surgical scrubbing and prolonged use of gloves. [29]

WEARING MASK

Face mask use by the general population for preventing the spread of the COVID-19 infection is controversial, though increasingly recommended. Mass uses of face masks for healthy individuals in the community were not recommended by the WHO to prevent the SARS-CoV-2 virus in its interim guidance of April 6, 2020. [30] Public Health England (PHE) had not recommended same as WHO, but Centers for Disease Control and Presentation (CDC) advised for wearing cloth masks in public places. [31] After this, several countries accepted mass mask use in public spaces. Mass use of the face mask is useful for the daily workers those cannot stay at home. As daily workers return to work, mass use of the face mask might be helpful to reduce the transmission of the SARS-CoV-2 virus. The exact pathophysiology of the COVID-19 is still unclear, and the droplet and contact transmission are thought to be important route. Wearing face mask is a simple method to prevent the transmission of the virus which reduces the spread of the disease. [32] Use of face mask prohibits pathogens from entering into the respiratory airway which will cut the droplet transmission route directly. Face masks will purify the air entering into lungs by filtration of inspiratory

air. Currently, few western countries oppose mask wearing by general community members, however, the experience from China and South Korea showed that use of face masks are a effective protective measure. There are several types of the masks available such as medical or homemade masks for general public and N95 masks for the health care workers. N95 masks can filter 95% or tinier 0.3µm particles. Use of N95 masks and surgical masks can separately block 91% and 68% pathogens respectively. [25] Cloth masks usually filter viral particles at the time of coughing with 50 to 100% filtration efficiency of surgical masks. [33] Properly fitted face masks play an important role for prevention of the infection in youth persons. One study showed that approximately 32.47% of the primary school children used properly fitted masks. [34] Mass mask wearing is helpful to control the source of the infection and considered as low-cost adjunct in relation to the social distancing and hand washing in COVID-19 pandemic. So, the mass mask wearing is a symbol of social solidarity during the global response to the COVID-19 pandemic. More than 100 countries, including India, have guidelines for people to wear face mask when they leave their home as preventive measures against COVID-19 infection. Several countries like Japan, Singapore and Hong Kong adopted the mandatory use of the face mask at initial phases of the COVID-19 outbreak, resulting in low mortality rates. Thus, wearing face masks in public space will stop the spread of the virus. Such preventive measures are helpful to reduce the spread of the infection in a large population. So, use of the face mask in the public space is an important health measure and now wearing face mask is called a new normal after COVID-19 pandemic.

CONCLUSION

Currently there is a challenge to break the chain of the human transmission of COVID-19 infection. There should be continuous monitoring, tracing of the COVID-19 patients and strict adherance to the universal precautions for preventing such a dreaded pandemic. Social distancing, hand washing and wearing face masks are inexpensive and widely acceptable options for theprevention of the COVID-19 infection. These should be strict and effective ways for controlling this current COVID-19 pandemic. Social distancing, hand hygiene and wearing face masks contributed not only to preventing current COVID-19 infections but also help to reduce further waves of the COVID-19 infection and other respiratory infections.

References

1. Swain SK, Agrawal R. Mastoid surgery: a high-risk aerosol generating surgical procedure in COVID-19 pandemic. International Journal of Otorhinolaryngological and Head and Neck Surgery 2020;6(10):1941.
2. Remuzzi A, Remuzzi G. COVID-19 and Italy: what next? Lancet 2020; 395:1225-1228.
3. Swain SK, Behera IC. Managing pediatric otorhinolaryngology patients in coronavirus disease-19 pandemic-A real challenge to the clinicians. Indian J Child Health 2020;7(9):357-362.
4. Di Gennaro F, Pizzol D, Marotta C, Antunes M, Racalbuto V, Veronese N, et al. Coronavirus diseases (COVID-19) current status and future perspectives: a narrative review. International journal of environmental research and public health 2020;17(8):2690.
5. Swain SK, Acharya S, Sahajan N. Otorhinolaryngological manifestations in COVID-19 infections: An early indicator for isolating the positive cases. J Sci Soc 2020; 47:63-68.
6. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019(COVID-19) outbreak in China: summary of a report of 72314 cases from the Chinese Center for Disease Control and Prevention. JAMA 2020; 323:1239-1242.
7. Coronavirus disease 2019 (COVID-19) Situation Report –66. World Health Organization. March 26, 2020 https://www.who.int/docs/defaultsource/ coronaviruse/situation-reports/20200326-sitrep-66-covid- 19.pdf?sfvrsn=81b94e61_2 March 27,2020.
8. WHO. Situation report – 182. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200720-covid-19-sitrep-182.pdf?sfvrsn=60aabc5c_2. Accessed 21 July 2020.
9. WHO. Rolling updates on coronavirus disease (COVID-19) https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen. Accessed 15 July 2020.
10. McIntosh K, Hirsch MS, Bloom A. Coronavirus disease 2019 (COVID-19): pidemiology, virology, and prevention. Lancet Infect Dis 2020; 1:2019-2020.

11. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med 2020; 382(8):727-733.
12. He F, Deng Y, Li W. Coronavirus disease 2019: What we know? Journal of medical virology 2020; 92(7):719-725.
13. Bai Y, Yao L, Wei T, Tian F, Jin DY, Chen L, Wang M. Presumed asymptomatic carrier transmission of COVID-19. JAMA 2020;323(14):1406-1407.
14. Zhang W, Du RH, Li B, Zheng XS, Yang XL, Hu B, et al. Molecular and serological investigation of 2019-nCoV infected patients: implication of multiple shedding routes. Emerging Microbes & Infections 2020;9(1):386-389.
15. Jones NR, Qureshi ZU, Temple RJ, Larwood JP, Greenhalgh T, Bourouiba L. Two metres or one: what is the evidence for physical distancing in covid-19?. BMJ 2020 Aug 25;370.
16. Xie Y, Wang Z, Liao H, Marley G, Wu D, Tang W. Epidemiologic, clinical, and laboratory findings of the COVID-19 in the current pandemic: systematic review and meta-analysis. BMC infectious Diseases 2020;20(1):1-2.
17. Zhejiang University School of Medicine: Handbook of COVID-19 Pre-vention and Treatment, 18/03/2020.2.
18. Swain SK, Das S, Padhy RN. Performing tracheostomy in intensive care unit-A challenge during COVID-19 pandemic. Siriraj Medical Journal 2020;72(5):436-442.
19. Ma QX, Shan H, Zhang HL, Li GM, Yang RM, Chen JM. Potential utilities of mask-wearing and instant hand hygiene for fighting SARS-CoV-2. J Med Virol 2020; 31:10.1002/jmv.25805. doi: 10.1002/jmv.25805. Epub ahead of print. PMID: 32232986; PMCID: PMC7228401.
20. Mishra M, Majumdar P. Social Distancing During COVID-19: Will it Change the Indian Society? Journal of Health Management 2020;22(2):224-235.
21. Tom Inglesby answers your COVID-19 questions, [Internet]. [cited 2020 Mar 29]. Available from: https://html5-player.libsyn.com/embed/episode/id/13526585/height/90/theme/custom/thumbnail/yes/direction/forward/render-playlist/no/ custom-color/ea5329/.
22. Ferguson NM, Laydon D, Nedjati-Gilani G, Imai N, Ainslie K, Baguelin M. vol. 20. 2020. (Impact of Non-pharmaceutical Interventions (NPIs) to Reduce COVID- 19 Mortality and Healthcare Demand)
23. Guidance on social distancing for everyone in the UK. https://www.gov.uk/government/publications/covid-19-guidance-on-social-distancing-and-for-vulnerable-people/guidance-on-social-distancing-for-everyone-in-the-uk-and-protecting-older-people-and-vulnerable-adults [Internet], GOV.UK. [cited 2020 Mar 22].
24. Nicola M, O'Neill N, Sohrabi C, Khan M, Agha M, Agha R. Evidence based management guideline for the COVID-19 pandemic - Review article. Int J Surg 2020; 77:206-16.
25. Je_erson T, Del Mar CB, Dooley L, Ferroni E, A Al-Ansary L, A Bawazeer, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses: Systematic review. BMJ 2009; 339: 3675.
26. Rabie T, Curtis V. Handwashing and risk of respiratory infections: A quantitative systematic review. Trop Med Int Health 2006;11:258-267.
27. Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. J Hosp Infect 2020;104(3):246-251.
28. World Health Organization. WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge: Clean Care Is Safer Care. World Health Organization; 2009.
29. Gasparini G, Carmisciano L, Giberti I,Murgioni F, Parodi A,Gallo R. ''HEALTHY HANDS''. A pilot study for the prevention of chronic hand eczema in healthcare workers of an Italian University Hospital. [Epub ahead of print]. G Ital Dermatol Venereol. 2019. https://doi.org/10.23736/S0392-0488.19.06220-5. Accessed June 12, 2019.
30. WHO. Advice on the use of masks in the context of COVID-19: interim guidance, April 6, 2020. https://www.who.int/publications-detail/ advice-on-the-use-of-masks-in-the-community-during-home-care-andin- healthcare-settings-in-the-context-of-the-novel-coronavirus-(2019-ncov)-outbreak (accessed April 15, 2020).
31. US Centers for Disease Control and Prevention. Recommendation regarding the use of cloth face coverings, especially in areas of significant community-based transmission. April 3, 2020. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover.html (accessed April 15, 2020).

32. Feng S, Shen C, Xia N, Song W, Fan M, Cowling BJ. Rational use of face masks in the COVID-19 pandemic. Lancet Respir Med 2020; 8(5):434-436.

33. Dugdale CM, Walensky RP. Filtration Efficiency, Effectiveness, and Availability of N95 Face Masks for COVID-19 Prevention. JAMA Intern Med Published online August 11, 2020. doi:10.1001/jamainternmed.2020.4218

34. Chen X, Ran L, Liu Q, Hu Q, Du X , Tan X. Hand Hygiene, Mask-Wearing Behaviors and Its Associated Factors during the COVID-19 Epidemic: A Cross-Sectional Study among Primary School Students in Wuhan, China. Int J Environ Res Public Health 2020; 17(8):2893