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RESEARCH ARTICLE

PRODUCTIVITY LOSS LINKED TO NON-COMMUNICALE DISEASES ACROSS SOCIO-DEMOGRAPHIC PROFILES: EVIDENCE FROM SEDENTARY OCCUPATION EMPLOYEES DURING COVID-19

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ABSTRACT

BACKGROUND:

The COVID-19 pandemic has significantly transformed work dynamics, leading to a notable shift towards remote work, particularly for those in sedentary roles. This change has been linked to a heightened risk of Non-Communicable Diseases (NCDs), many of which stem from lifestyle-related factors. Such health challenges can adversely affect productivity in the workplace, causing both absenteeism and presenteeism.

AIM:

This study examines the costs of presenteeism and absenteeism related to non-communicable diseases (NCDs) across socio-demographic variables.

METHODS:

Using stratified and purposive sampling, a cross-sectional study was conducted with 426 employees in sedentary occupations in the Delhi-NCR region. Productivity losses from presenteeism and absenteeism were assessed using the WHO HPQ Questionnaire. Additionally, the General Linear Model (GLM) was utilised to analyse the relationship between loss productive time (LPT) costs associated with presenteeism and absenteeism across disease categories and socio-demographic factors.

RESULTS:

Employees diagnosed with 'NCDs Category I', 'NCDs Category II', and those with 'comorbid' conditions were estimated to lose between 40 and 48 workdays each year. Absenteeism accounts for a greater portion of productivity losses than presenteeism in all disease categories. Comorbidities contribute to the most significant losses, with costs surpassing those associated with CDs by INR 51.78 thousand (932.04 AUD) for presenteeism and INR 226.47 thousand (4,076.46 AUD) for absenteeism. Additionally, every extra year of education corresponds to an increase of INR 4.96 thousand (89.28 AUD) in costs related to LPT due to presenteeism and a reduction of INR 15.68 thousand (282.24 AUD) in absenteeism-related LPT costs.

CONCLUSION:

The research indicates that NCDs, particularly in the presence of comorbid conditions, have a substantial effect on workplace productivity. Notably, individuals with higher levels of education and Income exhibit elevated presenteeism

costs, which may be attributed to the influence of remote work arrangements. Conversely, absenteeism rates appear to be lower among highly educated employees in similar settings.

KEYWORDS

productivity loss, absenteeism, presenteeism, sedentary occupation, COVID-19, NCDs

INTRODUCTION

The COVID-19 pandemic, which emerged in early 2020, led to a dramatic shift in the work culture. It forced people into a lifestyle of lockdown, making most people undertake remote work during this time. However, this transition towards a work-from-home culture came with limitations, including limited social interaction and more sedentary time at work. Employees of a sedentary occupation are usually identified for spending six hours or more sitting, with limited movement or standing time of two hours or less in total working hours [1]. Prolonged sedentary postures raise the risk of NCDs, with studies showing increased health issues like MSD, diabetes, hypertension, and mental illness among remote workers during COVID-19 [2, 3, 4].

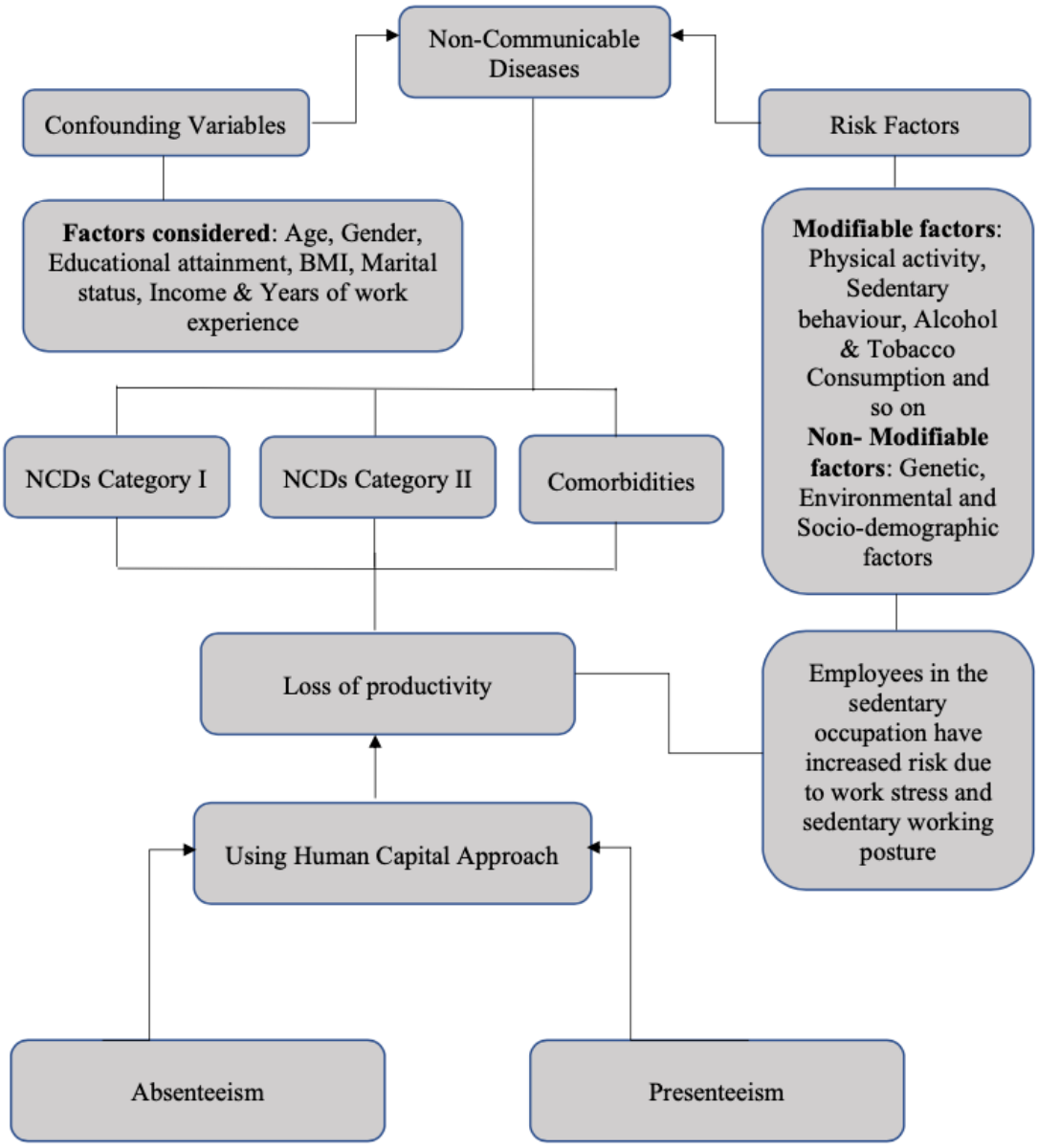
Socio-demographic variables such as Age, Gender, Educational Attainment, BMI, Income, Years of Work Experience, and Marital Status have also been identified by the literature to influence the prevalence of NCDs apart from sedentary behaviour [5, 6, 7, 8, 9, 10, 11, 12]. However, the evidence regarding their impacts is still mixed and inconclusive, highlighting a grey area in understanding their role in influencing NCDs among employees engaged in sedentary occupations.

The prevalence of ill health in the form of 'NCDs' or 'Communicable Diseases (CDs)' can significantly reduce productivity at work, posing economic challenges for both employees and employers. Presenteeism and absenteeism approaches are commonly used to quantify productivity loss in individuals with ill health at work [13, 14]. Absenteeism is used when a person does not show up at work, whereas presenteeism refers to the situation when the person, despite being ill, shows up for work.

Researchers have attempted to estimate the impact of illnesses on the productivity of individuals by using both absenteeism and presenteeism approaches [13, 15, 16, 17]. However, in the Indian context, limited literature is available examining productivity loss due to NCDs using an empirical research design [18, 19].

Given this scenario, the current study examines the presenteeism and absenteeism costs related to NCDs across socio-demographic variables. The conceptual framework highlighted in Figure 1 has been adopted to undertake this study.

FIGURE 1: CONCEPTUAL FRAMEWORK OF THE STUDY



Given the extensive nature of non-communicable diseases (NCDs), this study focuses on those affecting physical health. The NCDs have been categorised based on their comorbid characteristics. The categories used in this study are as follows:

1. NCDs Category I: Hypertension, Diabetes or CVD.
2. NCDs Category II: Respiratory Diseases, Musculoskeletal Diseases, Digestive Issues, Kidney Issues, Cancer or Reproductive Health Issues.
3. Comorbidities: Presence of more than one NCD.
4. Communicable Diseases: COVID-19, Flu, Cold, Dengue or Fever.

METHODOLOGY

STUDY DESIGN:

A cross-sectional study was conducted involving 426 employees in sedentary occupations within the Delhi-NCR region. Utilising a combination of stratified and purposive sampling, data were collected from Delhi and Gurgaon based on workforce estimates [20] to mitigate selection bias. The stratified random sampling technique divided the regions into

distinct zones, with at least 30 samples collected from each stratum. Purposive sampling was implemented to ensure equitable representation across gender and age categories.

PARTICIPANTS:

The research targeted a sample size of 385 participants and successfully reached out to 432 employees. Ultimately, 426 completed the survey, resulting in a high response rate of 98.61%. The survey was conducted between November 2021 and April 2022 during the third wave of COVID-19. The sample size for this study was based on a rule of thumb [21] and an online sample size calculator, suggesting 370-400 responses for populations of 5,000 to 100,000 at a 95% confidence level with a ±5% margin of error. As there was no specific data for sedentary occupations, the study used the tertiary sector workforce in Delhi-NCR as a proxy.

The study targeted salaried individuals aged 18 to 64 in sedentary occupations in Delhi-NCR with at least one year of experience. Those diagnosed with, or self-reporting, any health issue at the time of the survey or within the preceding one month were included, irrespective of whether medical consultation or treatment had been sought. Individuals without any diagnosed or self-reported health issues within the past month were excluded from the study.

The responses were primarily collected through field interviews. However, due to the COVID- 19 third wave, the study faced challenges in collecting data in person. The telephonic interview method was adopted only for those cases.

Before conducting field interviews, the study received approval from the 'Research Conduct and Ethics Committee' of CHRIST University, Bengaluru, Karnataka, India (*CU: RCEC/00374/11/21 dated: 21 November 2021*). Participants were informed about the study's nature and purpose, and informed consent was obtained. Participants were assured of their voluntary involvement, the right to withdraw at any time, and the confidentiality of their information, which was used only for research purposes.

QUESTIONNAIRE:

A questionnaire consisting of three sections and a total of 39 questions was prepared for the survey, focusing on a one-month recall period to minimise 'recall biasedness'. The first section collected socio-demographic data (Question 1-13; Question 29-32), the second addressed health issues (Question 14-28), and the third assessed productivity loss due to illness (Question 33-39).

The economic burden of disease was assessed, covering both direct costs (medical and non-medical expenses) and indirect costs related to productivity loss, following the framework proposed in previous literature [22]. Indirect costs were estimated using the human capital approach based on average earnings.

Both presenteeism and absenteeism were measured using the Health and Work Performance Questionnaire (HPQ) by WHO [23]. Before data collection, field experts evaluated the questionnaire for face and content validity.

STATISTICAL ANALYSIS:

The study's analysis was performed using IBM SPSS software for data evaluation and interpretation. To summarise the surveyed data, basic descriptive analysis tools were applied, and the results were presented as mean scores using tabular representations.

Using the Kolmogorov-Smirnov test and Kaiser-Meyer-Olkin (KMO) tests, the normality assumption and sample adequacy of the surveyed data were tested.

To estimate scores for presenteeism and absenteeism, the study followed the WHO's guidelines for content and scoring [24]. Additionally, it adopted an established methodology to calculate the annual cost of 'Lost Productive Time (LPT)' resulting from presenteeism and absenteeism [25]. The study also employed the General Linear Model (GLM) to analyse the relationship between the cost of LPT related to presenteeism and absenteeism across disease categories and socio-demographic variables. The following econometric model was used:

$$Y_i = f(Dis_i, Gen_i, Age_i, Edn_i, BMI_i, Inc_i, Work\_Exp_i, Mar\_Stat_i)$$

$$Y_i = \beta_1 + \beta_2 Dis_i + \beta_3 Gen_i + \beta_4 Age_i + \beta_5 Edn_i + \beta_6 BMI_i + \beta_7 Inc_i + \beta_8 Work\_Exp_i + \beta_9 Mar\_Stat_i + \varepsilon_i$$

where,

Y_i represents dependent variables from different models:

Model I: Cost of LPT due to Presenteeism

Model II: Cost of LPT due to Absenteeism

Dis_i = The disease category of i[th] respondent. With the 'Communicable Disease' category as the reference category

Gen_i = Gender of the i[th] respondent. With the 'Male' category as the reference category

Age_i = Age of the i[th] respondent. With the '45 years and above' category as the reference category

Edu_i = Years of formal education of the i[th] respondent. With the 'Post-Graduation and above' category as the reference category

BMI_i = Body Mass Index of the i[th] respondent. With the 'Obesity Class II and above' category as the reference category

Inc_i = Income of the i[th] respondent. With the 'Income quintile V' category as the reference category

$Work\_Exp_i$ = Years of work experience of the i[th] respondent. With the 'Less than 5 years' category acting as the reference category

Mar_Stat_i = Marital status of the i[th] respondent. With the 'Married' category as the reference category

β_1 *to* β_9 are the parameters of the estimates.

ε_i = Residual term.

RESULTS

Table 1 presents the socio-economic characteristics of the sample population. The mean age of the sample group is 36.30, with a majority (39.7%) aged between 25 and 34, with a slight male predominance (58.0%). The average Body Mass Index (BMI) was recorded at 24.90 (σ = 3.95), with 52.3% of participants classified as having normal weight. Most respondents were married (68.1%) and held an undergraduate degree (93.2%). The mean monthly Income was INR 60,962.91 (1,097.33 AUD), and the average work experience was approximately 12 years. Respondents were selected from nine zones in the Delhi-NCR region, contributing 7.7% to 13.8% each to the total sample.

Descriptive statistics on absenteeism and presenteeism among sedentary employees are highlighted in Table 2. A higher score of absenteeism represents a higher amount of lost productivity, whereas a higher score of presenteeism represents a lower amount of lost performance [25]. Absolute absenteeism showed a range where some employees worked up to 60 hours overtime while others missed up to 135 hours a month, resulting in an average absenteeism of 23.98 hours, approximately equivalent to one workday. The relative absenteeism rate averaged 0.11, indicating a low level of absenteeism in the sample. In absolute presenteeism, measured from 0 (complete lack of performance) to 100 (full performance), scores ranged from 40 to 100, with an average of 80.63%, reflecting generally high job performance.

TABLE 1: SOCIO-DEMOGRAPHIC PROFILE OF THE RESPONDENTS'

Variables	Frequency (n)	Percentage (%)
Gender		
Male	247	58.00
Female	179	42.00
Age		
Less than 25 years	51	12.00

Variables	Frequency (n)	Percentage (%)
25 years <35 years	169	39.70
35 years <45 years	122	28.60
45 years and above	84	19.70
Mean (S.D; C.V#)*	36.30 (10.00; 27.54)	
BMI		
Underweight (0-18.5)	11	2.60
Normal weight (18.5-24.9)	223	52.30
Pre-obesity (25-29.9)	149	35.00
Obesity class I (30-34.9)	36	8.50
Obesity class II and above	7	1.60
Mean (S.D; C.V#)*	24.90 (3.95; 15.86)	
Educational attainment		
High-School	29	6.80
Undergraduate	207	48.60
Post-graduate and above	190	44.60
Marital status		
Unmarried	136	31.90
Married	290	68.10
Income**		
Income Quintile I	85	19.95
Income Quintile II	85	19.95
Income Quintile III	85	19.95
Income Quintile IV	85	19.95
Income Quintile V	86	20.20
Mean (S.D; C.V#)*	60,962.91## (46,511.92##; 76.29)	
Years of work experience		
Less than 5 years	106	24.88
5 years – 11 years	106	24.88
11 years – 18 years	107	25.12
18 years and above	107	25.12
Mean (S.D; C.V#)*	11.78 (9.30; 78.94)	
Region		
North Delhi	59	13.80
South Delhi	55	12.90
Central Delhi	52	12.20
East Delhi	34	8.00
West Delhi	38	8.90
North Gurgaon	55	12.90
South Gurgaon	52	12.20
East Gurgaon	48	11.30
West Gurgaon	33	7.70

*S.D=Standard Deviation; #C.V=Coefficient of Variation; ##Measured in Indian Rupees

TABLE 2: DESCRIPTIVE STATISTICS ON PRODUCTIVITY MEASURES

Variables	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation (%)
Absenteeism					
Relative	-0.33	0.52	0.11	0.14	127.27
Absolute	-60.00	135.00	23.98	30.48	78.67
Presenteeism					
Relative	0.60	1.80	1.02	0.21	20.58
Absolute	40.00	100.00	80.63	12.53	15.54
Productivity Loss	0.33	1.88	0.90	0.25	27.78

TABLE 3: MEAN SCORES OF ANNUAL LPT DUE TO PRESENTEEISM AND ABSENTEEISM

Disease Categories	LPT of Presenteeism			LPT of Absenteeism		
	In Hours	*In days*	*In Work Days*	*In Hours*	*In Days*	*In Work Days*
NCDs Category I	325.55	13.56	40.69	374.71	15.61	46.84
NCDs Category II	342.86	14.29	42.86	324.84	13.54	40.61
Comorbidities	342.97	14.29	42.87	381.35	15.89	47.67
CDS	**234.36**	**9.77**	**29.30**	**315.11**	**13.13**	**39.39**

TABLE 4: GLM RESULTS FOR ESTIMATION OF THE ANNUAL COST OF LPT DUE TO PRESENTEEISM (000'S)

Variables	β	Standard Error	Confidence Interval		Sig.
			Lower	Upper	
Intercept	148.50**	59.76	30.96	266.04	0.01
Diseases (#Ref. CDs)					
NCDs Category I	51.93***	4.76	30.46	73.39	0.00
NCDs Category II	20.29**	1.92	-0.49	41.07	0.04
Comorbidities	51.78***	4.33	28.23	75.32	0.00
Gender (#Ref. Male)	-3.07	8.02	-18.85	12.71	0.70
Years of education	4.96*	2.79	-0.53	10.45	0.07
Age (#Ref. 45 years and above)					
Less than 25 years	-0.43	27.12	-53.78	52.92	0.98
25 years – 35 years	2.90	23.39	-43.11	48.91	0.90
35 years – 45 years	-7.11	15.94	-38.46	24.23	0.65
Income (#Ref. Income Quintile V)					
Income quintile I	-239.56***	14.48	-268.03	-211.08	0.00
Income quintile II	-159.34***	13.21	-185.33	-133.36	0.00
Income quintile III	-123.07***	12.79	-148.22	-97.93	0.00
Income quintile IV	-86.10***	12.36	-110.41	-61.79	0.00
Years of work experience (#Ref. Less than 5 years)					
5 years - 11 years	7.03	13.96	-20.43	34.49	0.61
11 years - 18 years	15.49	22.77	-29.30	60.27	0.49
18 years and above	-1.33	25.93	-52.33	49.67	0.95
BMI	-0.43	1.04	-2.47	1.62	0.68
Insurance (#Ref. People having insurance)	-8.23	8.33	-24.61	8.16	0.32
Marital status (#Ref. Married)	18.34	12.80	-6.84	43.52	0.15
R-Square	0.589				
F-Statistic (df1, df2)	196.61*** (346,3)				

*Significant at 10% level. **Significant at 5% level. ***Significant at 1% level. Values are represented in INR (000's). Values can be converted to AUD by multiplying to 0.018 (avg. exchange rate in 2021)

TABLE 5: GLM RESULTS FOR ESTIMATION OF THE ANNUAL COST OF LPT DUE TO ABSENTEEISM (000'S)

Variables	β	Standard Error	Confidence Interval		Sig.
			Lower	Upper	
Intercept	314.82**	134.14	78.06	605.58	0.01
Diseases (#Ref. CDs)					
NCDs Category I	93.58*	59.07	-22.56	209.72	0.09
NCDs Category II	213.38***	67.44	80.77	345.98	0.00
Comorbidities	226.47***	71.52	85.85	367.10	0.00
Gender (#Ref. Male)	84.32	58.06	-29.84	198.49	0.14
Years of education	-15.68**	6.24	-27.96	-3.40	0.01
Age (#Ref. 45 years and above)					
Less than 25 years	9.00	59.57	-108.14	126.14	0.88
25 years – 35 years	14.40	50.24	-84.38	113.19	0.77
35 years – 45 years	-17.02	34.08	-84.04	49.99	0.61
Income (#Ref. Income Quintile V)					
Income quintile I	-55.18	53.01	-159.43	49.06	0.29
Income quintile II	-36.04	54.90	-143.99	71.91	0.51
Income quintile III	-25.48	53.21	-130.12	79.15	0.63
Income quintile IV	-19.08	52.59	-122.48	84.32	0.71
Years of work experience (#Ref. Less than 5 years)					
5 years - 11 years	25.90	32.54	-38.07	89.88	0.42
11 years - 18 years	22.43	48.46	-72.85	117.71	0.64
18 years and above	-2.79	56.66	-114.21	108.62	0.96
BMI	-2.05	2.38	-6.73	2.62	0.38
Insurance (#Ref. People having insurance)	26.01	19.42	-12.18	64.19	0.18
Marital status (#Ref. Married)	-4.76	29.81	-63.38	53.87	0.87
R-Square	0.213				
F-Statistic (df1, df2)	29.19*** (370, 6)				

*Significant at 10% level. **Significant at 5% level. ***Significant at 1% level. Values are represented in INR (000's). Values can be converted to AUD by multiplying to 0.018 (avg. exchange rate in 2021).

The data in Table 3 reflect the extent of productive time lost due to presenteeism and absenteeism. The absolute scores for both presenteeism and absenteeism were utilised to assess the total productive time lost. For employees diagnosed with 'NCDs Category I,' 'NCDs Category II,' and 'comorbidities,' the estimated range of workdays lost due to these determinants was between 40 and 48 days per year. While there is no significant difference in the productive time lost between presenteeism and absenteeism, the findings indicate that employees are more likely to miss work days due to absenteeism across all disease categories rather than working while unwell. This postulate that employees prefer to take time off when they are ill instead of attending work despite being sick.

Table 4 showcases the results of the GLM model examining the relationship between the annual average cost of LPT due to presenteeism with the categories of diseases and the confounding variables. All disease categories were statistically significant, with 'comorbidities' and 'NCDs Category I' leading to the highest productivity losses due to presenteeism, at INR 51.78 thousand (932.04 AUD) and INR 51.93 thousand (934.74 AUD), respectively.

Education and Income were identified as significant confounding variables influencing the cost of LPT due to presenteeism. An increase of one year in educational attainment corresponds to an increase in LPT costs of INR 4.96 thousand (89.28 AUD). This indicates that employees with higher education, who are also likely to have higher incomes, may experience greater productivity loss, possibly due to a reluctance to take sick leave while ill. The income-related sensitivity of productivity loss is evident; higher-income employees tend to favour presenteeism to protect their earnings. In contrast, lower-income employees reported considerably lower LPT costs, with 'Income Quintile I' and 'Income Quintile II' showing reductions of INR 236.56 thousand (4,258.08 AUD) and INR 159.34 thousand (2,868.12 AUD), respectively, compared to 'Income Quintile V'.

All disease categories emerged as significant predictors in the GLM model used to examine the annual cost of LPT due to absenteeism (Table 5). Employees with comorbidities experienced the highest productivity losses, with absenteeism costs exceeding those related to CDs by INR 226.47 thousand (4,076.46 AUD), followed by INR 213.38 thousand (3,840.84 AUD) for NCDs Category II and INR 93.58 thousand (1,684.44 AUD) for NCDs Category I. The findings indicate that individuals with any NCDs are more likely to take sick leave than their peers with CDs. Furthermore, a negative association was found between years of education and LPT costs, suggesting that higher educational attainment is associated with reduced productivity losses from absenteeism.

DISCUSSION

Current research has demonstrated that NCDs can result in considerable presenteeism and absenteeism, leading to a loss of between 40.61 and 47.67 work days. The co-occurrence of one or more NCDs led to 42.87 and 47.67 workdays lost due to presenteeism and absenteeism, respectively.

A similar observation regarding absenteeism was noted, as the seven NCDs examined in the study resulted in a loss of workdays ranging from 6.65 to 37.32 [26]. The variation in average lost days stemmed from differences in estimating productivity loss, with their study utilising prevalence-based secondary data compared to the incidence-based primary data of the current study. Notably, days lost increased from 6.62 to 16.26 with multiple NCDs. The study also revealed a 2.5-fold increase in the number of workdays lost due to functional limitations for individuals with comorbid conditions compared to those with one NCD.

Similarly, according to study by Found et al., individuals with multiple chronic diseases had a 36% higher presenteeism rate and 61% higher absenteeism rate compared to those with a single NCD [27]. However, this study diverges from current research by also considering mental health issues while examining NCDs.

The present study further revealed higher presenteeism costs for 'NCDs Category I' compared to 'NCDs Category II,' while absenteeism costs were greater for 'NCDs Category II'.

These results are in line with previous research that presents mixed evidence on productivity loss related to NCDs. An assessment of productivity losses due to absenteeism and presenteeism linked to chronic diseases was conducted among 1.3 million employees [28]. The findings indicated significant productivity losses for 'NCDs Category II', with asthma [INR 23,652 (425.74 AUD)], back pain [INR 17,766 (319.79 AUD)], and cancer [INR 86,454 (1,556.17 AUD)] exceeding those of 'NCDs Category I', which included CVD [INR 17,712 (318.82 AUD)] and diabetes [INR 17,496 (314.93 AUD)]. Notably, the productivity loss associated with arthritis [INR 9,882 (177.88 AUD)] was lower than that of 'NCDs Category I'.

These findings are in contrast with previous studies on productivity loss from absenteeism across seven NCDs [26, 27]. The study found that employees with arthritis, lung disease, and cancer experienced greater productivity losses than those with 'NCDs Category I'.

Similarly, previous research has shown that musculoskeletal and respiratory diseases, along with kidney and digestive disorders, impact absenteeism rates more significantly than cardiovascular diseases and diabetes [27]. However, only chronic respiratory diseases were observed to have a significantly higher effect on presenteeism rate than other NCDs.

Overall, 'NCDs Category II', such as MSD, respiratory diseases and cancer, lead to a high productivity loss in the form of absenteeism and presenteeism. Results further suggest that employees with MSD or arthritis experience higher absenteeism and reduced productivity due to pain and physical limitations affecting their job performance.

The present study's findings also indicate a positive correlation between educational attainment and presenteeism costs while concurrently demonstrating a negative correlation with absenteeism costs. This unexpected finding may result from the pandemic's remote work culture, which enabled more employees to work while unwell [29]. With most employees working from home irrespective of their formal education, the latter predicted a conflicting result regarding presenteeism. Despite this plausible explanation, studies conducted before the COVID-19 pandemic recorded supporting evidence. Study conducted by Found et al. among people diagnosed with chronic illnesses estimated an average presenteeism score of 1.8 days for individuals lacking formal education, in contrast to higher scores for individuals with formal education [27].

However, prior research assessing productivity loss in individuals with NCDs before the pandemic reported contrasting findings [30]. All education categories were observed to incur a lower presenteeism score than the education category of no education. In addition, the study provided corroborative evidence to suggest a negative correlation between absenteeism and educational attainment, implying that the likelihood of absenteeism decreases as years of education increase.

The current study highlights decreased absenteeism scores with increased years of educational attainment. However, it is imperative to note that the current study was conducted in a work-from-home culture and may significantly impact the results. Employees working from home were reluctant to take sick leave even when unwell, irrespective of their educational background. Nevertheless, employees in higher education categories had higher opportunity costs of taking sick leaves due to their well-paying jobs, leading to a plausible explanation.

Studies conducted before the COVID-19 pandemic provided similar observations [27, 31]. Employees without a university degree reported 0.12 times higher absenteeism than those with one [31]. These studies emphasised the importance that individuals with a university degree hold by considering them irreplaceable at work, resulting in a lower absenteeism rate. They further highlighted a positive correlation between health and education level, leading to a lower likelihood of them incurring physical or mental illness and lower absenteeism.

The study has also yielded other significant findings, indicating a robust and positive relationship between presenteeism and absenteeism costs across the income categories. However, it should be noted that the estimates of presenteeism and absenteeism costs are sensitive to Income, as the latter is utilised to derive the former estimates. This sensitivity may

have led to a positive association between the variables. However, the study fails to provide conclusive remarks due to the absence of interactive analysis between the variables.

Findings from previous research highlight that individuals in the wealthiest quintile (Q5) were 1.29 times more likely to experience presenteeism than those in the lowest quintile (Q1) [30]. The study also found some contradictory evidence regarding absenteeism, as individuals in Q5 were 0.92 times less likely to experience absenteeism than those in Q1. However, the results for absenteeism were not statistically significant to draw any conclusive comparisons with the present study.

In contrast to the current study's findings, earlier findings highlighted lower-income quintiles exhibiting higher mean presenteeism and absenteeism scores (28.2 and 3.1, respectively) compared to their high-income counterparts [31]. The study suggests that reduced flexibility in taking sick leave and increased job insecurity among low-income individuals may lead to these higher rates. However, a lack of detailed data on absenteeism and presenteeism costs across income categories hinders a thorough comparison with the main study.

The study failed to provide conclusive remarks on Gender, Age, Work Experience, Marital Status, Insurance and BMI due to statistical insignificance. Despite this limitation, this study's findings are important due to the increased significance in the discourse on understanding the economic burden of lifestyle diseases in multiple spheres.

LIMITATIONS:

The study was conducted during the third wave of the COVID-19 pandemic, which may have affected the findings. It specifically examines the NCDs related to physical health, excluding the productivity loss associated with mental health issues. Additionally, the results primarily rely on employee income information, meaning that the outcomes derived using the human capital approach could have limitations based on the quality and accuracy of the respondents' data.

CONCLUSION

This study highlights significant productivity losses attributable to NCDs, particularly among employees afflicted with multiple health conditions. The analysis found that higher levels of education and Income were correlated with increased costs associated with presenteeism, a phenomenon potentially influenced by the rise of remote work during the pandemic.

The findings further suggest that the shift to remote work may have lowered absenteeism, particularly among highly educated employees who face higher opportunity costs for missing work. Although the results are mostly consistent with previous studies, variations in productivity loss estimates among different disease categories and differences in methodologies emphasise the challenges involved in examining productivity loss. Additionally, the research did not identify definitive associations with variables such as gender, age, work experience, marital status, insurance coverage, and BMI. This suggests that more research can be undertaken to understand how socio-demographic variables and NCDs affect workplace productivity.

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