

# IDENTIFYING POTENTIALLY MODIFIABLE FACTORS TO REDUCE HOSPITAL READMISSIONS IN A TERTIARY CARE HOSPITAL IN SRI LANKA

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## ABSTRACT

Identifying potentially modifiable factors associated with hospital readmissions would lead to reduction of the burden on healthcare expenditure and improvement of quality of life of patients.

A cross-sectional descriptive study was carried out on medical inpatients of University Medical Unit, National Hospital of Sri Lanka. Among the 425 participants, 178 (41.9%) had at least one prior admission over the preceding year. Participants with readmissions were significantly older than those with single admissions. The onset of illness/time since diagnosis, number of chronic illnesses, number of long-term medications, compliance with medications, compliance with follow-up, availability of family support, depression, anxiety, stress and alcohol use were associated with readmissions, whereas the location of follow-up, living arrangement and level of activity was not. A significant proportion of the study population had readmissions. Interventions aiming to reduce pill burden and to improve compliance with medications and follow-up are suggested, and further studies are recommended to assess their impact.

Where appropriate, patients should be directed to local hospitals/clinics for follow-up. Early identification of depression, anxiety and stress among patients and assessing each patient's alcohol intake, and making recommendations for them to obtain necessary help would be beneficial.

## KEYWORDS

readmissions, modifiable factors, developing countries

## INTRODUCTION

Healthcare systems worldwide experience a significant burden due to readmissions of medical inpatients. Various studies conducted in different healthcare settings show varying readmission rates, depending on the methodology, the time frame used in defining readmissions, and the age groups of patients studied. For example, a cohort study of discharge data of five consecutive years from twenty-one

tertiary-care hospitals (eight in USA, five in UK, four in Australia, four in continental Europe) investigating rates and reasons of readmissions to the same hospital with specific disease conditions, showed a 10.6% readmission rate within 30 days of discharge.[1] A retrospective observational study performed at a large district general hospital in London, showed a readmission rate of 4.34% within 14 days of discharge from a medical ward.[2] A cross-sectional study using the 2008 Belgian Hospital

Discharge Dataset (which includes data for all inpatients in acute hospitals in Belgium) of one calendar year, showed a 10.3% readmission rate within 30 days of discharge.[3] Another study, done in the internal medicine department of a tertiary teaching hospital in Brisbane, Australia, on inpatients aged 50 years or more, with a previous hospitalization six months preceding the index admission, showed a readmission rate of 38.7% within six months of discharge.[4]

Readmissions of medical inpatients incur a remarkable burden to healthcare costs, and bear a significant impact on the welfare of patients.[5] It is also indicative of the quality of care provided to patients.[6]

Various studies conducted in developed countries have looked into potential risk factors for readmissions of medical patients.[1-9] Some of these studies have predominantly included elderly populations,[7,8,9] and some have included patients with specific disease conditions only.[1] These studies, including a systematic review,[9] have identified various socio-demographic factors and disease-related factors as reasons for hospital readmissions.

The factors leading to hospital readmissions among medical patients in Sri Lanka (and other developing countries) could be different to those of patients in developed countries due to differences in socio-economic background, and due to variations in disease patterns. There is a paucity of studies providing data on readmission rates or factors associated with readmissions among medical patients in developing countries, and there are no studies on such done in Sri Lanka.

Identifying these factors is useful to modify any potentially modifiable factors and reduce the burden on the already-strained healthcare system, which is functioning with resource limitations and constraints. Also, including the younger patient population in the study is important to minimize the impact on the economy by preventing hospital readmissions of the productive workforce of the country.

## METHODS

A cross sectional descriptive study was carried out in April-May, 2022 with participation of consenting (informed

written consent) medical inpatients admitted consecutively to University Medical Unit, National Hospital of Sri Lanka (NHSL).

Data was collected using an interviewer administered data proforma and self-administered 'Depression, Anxiety and Stress Scale - 21 Items' (DASS-21).[10]

The interviewer administered data proforma consisted of four sections: demographic data, admission data, disease factors and psychosocial factors. The section on admission data was designed to collect information on previous hospital admissions over the preceding year. This was filled by interviewing the patient and referring to medical records (e.g. clinic book, diagnosis cards). All readmissions were included, regardless of whether they were related to the index presentation or not.

The Self-administered DASS-21 scale has been validated for the Sri Lankan population. [11,12] The Sinhala and Tamil translations are available and have previously been used in Sri Lankan studies.[13] The participants were allowed to fill it in their preferred language.

Anonymously collected data was entered onto a spreadsheet and analyzed using IBM SPSS statistical software. Descriptive statistics were outlined with frequencies, percentages and mean with standard deviation. Significance of categorical variables were analyzed using chi-square test.

Ethical approval was obtained from the Ethics Review Committee of National Hospital of Sri Lanka. (Ref: AAJ/ETH/COM/2022/JANUARY)

## RESULTS

The ages of participants ranged from 21 to 95 years. Majority of participants were male (59.5%). Approximately three-quarters (76.9%) of the participants resided in Colombo district, where the National Hospital of Sri Lanka is located. The demographic characteristics of the sample are further illustrated in table 1.

TABLE 1 DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE (N=425)

| Category                                  | Number / Mean $\pm$ SD        | Percentage % |
|---|-------------------------------|--------------|
| Age (in years)                            | 60.7 $\pm$ 16.9 (range 21-95) |              |
| <b>Gender</b>                             |                               |              |
| Male                                      | 253                           | 59.5         |
| Female                                    | 172                           | 40.5         |
| <b>Area of residence (district)</b>       |                               |              |
| Within Colombo                            | 327                           | 76.9         |
| Outside Colombo                           | 98                            | 23.1         |
| <b>Level of education</b>                 |                               |              |
| Not schooled                              | 34                            | 8.0          |
| Passed fifth grade                        | 149                           | 35.1         |
| Passed GCE (O/L)                          | 198                           | 46.6         |
| Passed GCE (A/L)                          | 37                            | 8.7          |
| Undergraduate degree                      | 5                             | 1.2          |
| Postgraduate degree                       | 2                             | 0.5          |
| <b>Occupation</b>                         |                               |              |
| Unemployed                                | 89                            | 20.9         |
| Day-wage worker                           | 68                            | 16.0         |
| Monthly-salary earner (private sector)    | 73                            | 17.2         |
| Monthly-salary earner (government sector) | 21                            | 4.9          |
| Private business owner                    | 174                           | 40.9         |
| <b>Monthly family income (LKR)</b>        |                               |              |
| <50,000                                   | 88                            | 20.7         |
| 50,001-100,000                            | 178                           | 41.9         |
| 100,001-150,000                           | 147                           | 34.6         |

|                           |     |      |
|---------------------------|-----|------|
| >150,000                  | 12  | 2.8  |
| <b>Marital status</b>     |     |      |
| Single                    | 39  | 9.2  |
| Married                   | 316 | 74.4 |
| Divorced                  | 48  | 11.3 |
| Widowed                   | 22  | 5.2  |
| <b>Number of children</b> |     |      |
| None                      | 58  | 13.6 |
| 1                         | 86  | 20.2 |
| 2                         | 201 | 47.3 |
| 3                         | 57  | 13.4 |
| 4 or more                 | 23  | 5.4  |

**TABLE 2 NUMBER OF PREVIOUS ADMISSIONS IN PARTICIPANTS (N=425)**

| Number of previous admissions (within 1 year) | Number of participants | Percentage % |
|---|------------------------|--------------|
| 0   | 247                    | 58.1         |
| 1   | 35                     | 8.2          |
| 2   | 48                     | 11.3         |
| 3   | 44                     | 10.4         |
| 4 or more                                     | 51                     | 12.0         |

Among the 425 participants, 178 (41.9%) had at least one previous admission over the preceding year. The number of previous admissions in study participants are summarized in table 2.

Age category of the participant showed a statistically significant association with readmissions ( $p < 0.01$ ). None of the other demographic factors studied (gender, district of

residence, level of education, occupation category, monthly family income, marital status and number of children) had a significant association with readmissions, when tested with Chi-square test. This is summarized in Table 3.

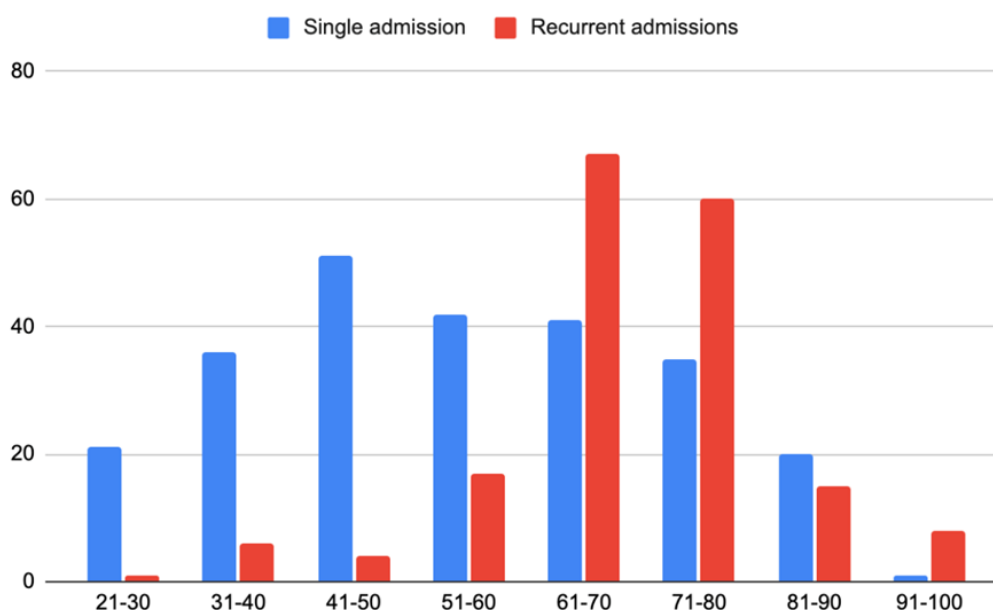
The age distribution of participants with single admissions and readmissions is illustrated in figure 1.

**TABLE 3 ANALYSIS OF ASSOCIATION BETWEEN DEMOGRAPHIC FACTORS AND READMISSIONS**

| Variables                                 | Single admission | Readmissions | Chi-square value (p value) |
|---|------------------|--------------|----------------------------|
| <b>Age category</b>                       |                  |              |                            |
| < 25 years                                | 12               | 1            | 72.5 (< 0.01)              |
| 25-50 years                               | 96               | 10           |                            |
| 51-75 years                               | 103              | 127          |                            |
| >75 years                                 | 36               | 40           |                            |
| <b>Gender</b>                             |                  |              |                            |
| Male                                      | 149              | 104          | 0.15 (0.69)                |
| Female                                    | 98               | 74           |                            |
| <b>Area of residence (district)</b>       |                  |              |                            |
| Within Colombo                            | 188              | 139          | 0.23 (0.63)                |
| Outside Colombo                           | 59               | 39           |                            |
| <b>Level of education</b>                 |                  |              |                            |
| Not schooled                              | 17               | 17           | 3.01 (0.56)                |
| Passed fifth grade                        | 82               | 67           |                            |
| Passed GCE (O/L)                          | 120              | 78           |                            |
| Passed GCE (A/L)                          | 22               | 15           |                            |
| Undergraduate degree                      | 4                | 1            |                            |
| Postgraduate degree                       | 2                | 0            |                            |
| <b>Occupation</b>                         |                  |              |                            |
| Unemployed                                | 53               | 36           | 3.98 (0.41)                |
| Day-wage worker                           | 44               | 24           |                            |
| Monthly-salary earner (private sector)    | 46               | 27           |                            |
| Monthly-salary earner (government sector) | 12               | 9            |                            |

|                                    |     |     |             |
|------------------------------------|-----|-----|-------------|
| Private business owner             | 92  | 82  |             |
| <b>Monthly family income (LKR)</b> |     |     |             |
| <50,000                            | 52  | 36  | 3.14 (0.37) |
| 50,001-100,000                     | 104 | 74  |             |
| 100,001-150,000                    | 87  | 60  |             |
| >150,000                           | 4   | 8   |             |
| <b>Marital status</b>              |     |     |             |
| Single                             | 23  | 16  | 1.66 (0.65) |
| Married                            | 186 | 130 |             |
| Divorced                           | 24  | 24  |             |
| Widowed                            | 14  | 8   |             |
| <b>Number of children</b>          |     |     |             |
| None                               | 35  | 23  | 2.12 (0.71) |
| 1                                  | 52  | 34  |             |
| 2                                  | 119 | 82  |             |
| 3                                  | 30  | 27  |             |
| 4 or more                          | 11  | 12  |             |

FIGURE 1 DISTRIBUTION OF AGE FOR SINGLE ADMISSIONS (BLUE) AND READMISSIONS (RED)



The mean age of participants with single admissions was 54.58 years (SD 17.47), and that of those with readmissions was 69.12 years (SD 11.83). There's a statistically significant difference between these two means, when tested with t-test ( $p < 0.01$ ).

When considering disease-related factors, the onset of illness/time since diagnosis, number of chronic illnesses, number of long-term medications, compliance with medications and compliance with follow-up were associated with readmissions ( $p < 0.01$ ). Interestingly,

location of follow-up was not associated with readmissions. Analysis of association between disease factors and readmissions using Chi square test is summarized in table 4.

Psychosocial factors associated with readmissions include, availability of family support, depression, anxiety, stress ( $p < 0.01$ ), and alcohol use ( $p < 0.05$ ). Living arrangement and level of activity was not associated with readmissions. Analysis of these factors with Chi-square test is summarized in table 5.

**TABLE 4 ANALYSIS OF ASSOCIATION BETWEEN DISEASE FACTORS AND READMISSIONS**

| Variables                                     | Single admission | Readmissions | Chi-square value (p value) |
|---|------------------|--------------|----------------------------|
| <b>Onset of illness/ Time since diagnosis</b> |                  |              |                            |
| ≤1 year                                       | 162              | 17           | 133.25 (<0.01)             |
| >1 year                                       | 85               | 161          |                            |
| <b>Number of chronic illnesses</b>            |                  |              |                            |
| None  | 131              | 1            | 165.40 (<0.01)             |
| 1   | 29               | 16           |                            |
| 2   | 48               | 44           |                            |
| 3   | 26               | 64           |                            |
| 4 or more                                     | 13               | 53           |                            |
| <b>Number of long-term medications</b>        |                  |              |                            |
| None  | 131              | 1            | 142.64 (<0.01)             |
| 1   | 7                | 7            |                            |
| 2   | 16               | 11           |                            |
| 3   | 32               | 36           |                            |
| 4 or more                                     | 61               | 123          |                            |
| <b>Compliance with medications</b>            |                  |              |                            |
| Poor  | 1                | 12           | 121.53 (<0.01)             |

|                                  |     |     |               |
|----------------------------------|-----|-----|---------------|
| Fair                             | 3   | 53  |               |
| Average                          | 18  | 82  |               |
| Good                             | 95  | 30  |               |
| Not applicable                   | 130 | 1   |               |
| <b>Follow up (location)</b>      |     |     |               |
| NHSL                             | 84  | 138 | 1.69 (0.43)   |
| Local hospital                   | 25  | 33  |               |
| Private sector                   | 7   | 6   |               |
| Not applicable                   | 131 | 1   |               |
| <b>Compliance with follow up</b> |     |     |               |
| Poor                             | 1   | 11  | 80.93 (<0.01) |
| Fair                             | 5   | 33  |               |
| Average                          | 20  | 90  |               |
| Good                             | 90  | 43  |               |
| Not applicable                   | 131 | 1   |               |

**TABLE 5 ANALYSIS OF ASSOCIATION BETWEEN PSYCHOSOCIAL FACTORS AND READMISSIONS**

| Variables                          | Single admission | Readmissions | Chi-square value (p value) |
|------------------------------------|------------------|--------------|----------------------------|
| <b>Living arrangement</b>          |                  |              |                            |
| Lives with family/ extended family | 193              | 143          | 2.08 (0.56)                |
| Lives alone (home/ accommodation)  | 45               | 25           |                            |
| Lives in a nursing home            | 3                | 3            |                            |
| Lives on the street                | 6                | 7            |                            |
| <b>Level of activity</b>           |                  |              |                            |
| Fully independent                  | 229              | 157          | 2.57 (0.28)                |

|                                       |     |     |                |
|---------------------------------------|-----|-----|----------------|
| Dependent for instrumental ADL        | 15  | 18  |                |
| Dependent for all ADL                 | 3   | 3   |                |
| <b>Availability of family support</b> |     |     |                |
| Available                             | 179 | 78  | 35.52 (<0.01)  |
| Not available                         | 68  | 100 |                |
| <b>Alcohol use</b>                    |     |     |                |
| None                                  | 96  | 73  | 7.33 (0.03)    |
| Drinks in moderation*                 | 133 | 79  |                |
| Heavy use**                           | 18  | 26  |                |
| <b>Depression</b>                     |     |     |                |
| Normal                                | 238 | 81  | 147.18 (<0.01) |
| Mild                                  | 7   | 96  |                |
| Moderate                              | 2   | 1   |                |
| <b>Anxiety</b>                        |     |     |                |
| Normal                                | 210 | 47  | 157.56(<0.01)  |
| Mild                                  | 34  | 80  |                |
| Moderate                              | 3   | 51  |                |
| <b>Stress</b>                         |     |     |                |
| Normal                                | 207 | 49  | 143.22 (<0.01) |
| Mild                                  | 35  | 81  |                |
| Moderate                              | 5   | 48  |                |

\*2 drinks or less in a day for men or 1 drink or less in a day for women on days when alcohol is consumed, or 14 drinks or less per week for men or 7 drinks or less per week for women

\*\* more than 2 drinks in a day for men or more than 1 drink in a day for women on days when alcohol is consumed, or more than 14 drinks per week for men or more than 7 drinks per week for women [14]

## DISCUSSION

This is the first Sri Lankan study exploring the factors associated with hospital readmissions in medical inpatients. It showed a significant proportion (41.9%) of the sample

had at least one previous admission over the preceding year. Studies done elsewhere in the world have used varying time frames (14 days,[2] 30 days, [1,3] 6 months[4] etc) for defining readmissions and therefore the

readmission rates cannot be compared across these studies.

In this study, age was the only demographic factor that showed a statistically significant association with readmissions ( $p < 0.01$ ). None of the other demographic factors studied (gender, district of residence, level of education, occupation category, monthly family income, marital status and number of children) showed a significant association.

Participants with readmissions were significantly older than those with single admissions, as seen in other studies in the literature.[3]

Among the disease-related factors studied, the onset of illness/time since diagnosis, number of chronic illnesses, number of long-term medications, compliance with medications and compliance with follow-up were associated with readmissions ( $p < 0.01$ ), whereas the location of follow-up was not associated. Among these factors, the number of long-term medications, compliance with medications and compliance with follow-up are potentially modifiable.

Interventions aiming to reduce pill burden and to improve compliance with medications and follow-up are suggested based on these results. Studies in other countries have demonstrated that medication review interventions are useful in reducing readmissions. [15,16] Some of these interventions can be adapted to the Sri Lankan setup, and further studies are recommended to assess their impact.

Where appropriate, patients should be directed to local hospitals/clinics for follow-up, as the location of follow-up has no association with readmissions.

When considering psychosocial factors, availability of family support, depression, anxiety, stress ( $p < 0.01$ ), and alcohol use ( $p < 0.05$ ) were significantly associated with readmissions, whereas living arrangement and level of activity was not associated. Among these factors, depression, anxiety, stress and alcohol use are potentially amenable to interventions.

Early identification of depression, anxiety and stress among patients and assessing each patient's alcohol intake, and directing them to obtain necessary help is recommended based on these results.

There is a paucity of studies on factors associated with hospital readmissions, and even the studies available in the literature have predominantly looked into readmissions in elderly populations [7,8,9], or in patients with specific disease categories (e.g. heart failure, atrial fibrillation, myocardial infarction)[1]. Therefore, comparison of the results would be futile as the patient populations studied are different. Furthermore, the time frame used in defining readmissions is different in each study, as mentioned earlier.

The DASS-21 scale is designed to measure the emotional states of depression, anxiety and stress over the preceding week. Therefore, the scores recorded by participants may not be indicative of their emotional states throughout the preceding year.

Furthermore, this study does not include readmissions of the study population of patients to other hospitals in Sri Lanka. This is a limitation of this study. Therefore, a further national level study including other hospitals outside Colombo district would be beneficial. Also, exploring other modifiable factors (such as smoking habits, diet and exercise) would be beneficial.

## CONCLUSIONS

This study showed a significant proportion (41.9%) of medical inpatients of the university medical unit of the largest tertiary care hospital in Sri Lanka, had at least one previous admission over the preceding year.

It also identified important disease-related and socio-demographic factors associated with these readmissions, some of which are potentially modifiable and amenable to interventions.

Implementing interventions to modify these factors may reduce hospital readmissions, leading to reduction of burden on the healthcare system and improvement of quality of life of patients. Further interventional studies are recommended to assess the impact of such interventions on reducing readmissions.

Also, further national level studies are recommended to conduct multivariate analysis; to determine adjusted odds ratios of factors associated with hospital readmissions, using logistic regression.

## ABBREVIATIONS

ADL- Activities of Daily Living

GCE (A/L) - General Certificate of Education (Advanced Level)

GCE (O/L) - General Certificate of Education (Ordinary Level)

LKR - Sri Lankan Rupee

NHSL- National Hospital of Sri Lanka  
Declarations

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Ethics Review Committee of National Hospital of Sri Lanka. (Ref: AAJ/ETH/COM/2022/JANUARY). Informed written consent was obtained from all participants. (For illiterate participants, informed consent was obtained from the legal representative of the participant). All methods were carried out in accordance with relevant guidelines and regulations in the Helsinki declaration.

## CONSENT FOR PUBLICATION

Not applicable. Manuscript does not contain any individual person's data.

## AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

## COMPETING INTERESTS

None

## FUNDING

None

## AUTHORS' CONTRIBUTIONS

The author confirms sole responsibility for study conception and design, data collection, analysis, interpretation of results, and manuscript preparation.

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