

FACTORS ASSOCIATED WITH PROLONGED LENGTH OF STAY IN PATIENTS WITH CONCURRENT RESPIRATORY AND GASTROINTESTINAL DISORDERS

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ABSTRACT

Objective: To identify the clinical predictors of extended hospitalization among adult patients admitted with concurrent respiratory and gastrointestinal illnesses at a tertiary care hospital in Pakistan.

Methods: This analytical cross-sectional study was conducted in the Department of Pulmonology at a tertiary care teaching hospital in Pakistan from August 2025 to January 2026. A total of 385 patients aged 18–70 years with coexisting respiratory and gastrointestinal illnesses were enrolled using a non-probability consecutive sampling technique. Demographic, clinical, laboratory, and hospitalization-related data were collected using a structured proforma. Respiratory illnesses included pneumonia, acute exacerbation of chronic obstructive pulmonary disease (COPD), acute bronchitis, and asthma exacerbation, whereas gastrointestinal manifestations included diarrhea, vomiting, abdominal pain, and dehydration. Extended hospitalization was defined as a hospital stay exceeding six days. Data were analyzed using SPSS version 26.0.

Results: Prolonged hospitalization occurred in 97 (25.2%) patients. Pneumonia (41.8%) and acute exacerbation of COPD (31.7%) were the predominant respiratory diagnoses, while diarrhea (61.8%) and vomiting (48.3%) were the most common gastrointestinal manifestations. Multivariable analysis identified age above 60 years, diabetes mellitus, oxygen saturation below 92%, moderate-to-severe dehydration, oxygen therapy requirement, and ICU admission as independent predictors of extended hospitalization.

Conclusion: Prolonged hospitalization was common among adults with concurrent respiratory and gastrointestinal illnesses and was primarily associated with markers of respiratory compromise and systemic illness severity. Early identification of high-risk patients may improve outcomes and optimize healthcare resource utilization.

Keywords: Respiratory illness, gastrointestinal illness, prolonged hospitalization, pneumonia, COPD, dehydration.

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INTRODUCTION

Respiratory and gastrointestinal illnesses are two of the highest burdens of hospital admissions globally and continue to cause a heavy burden on healthcare systems worldwide, especially in low- and middle-income settings. It has been observed that respiratory illnesses like community-acquired pneumonia, acute exacerbation of chronic obstructive pulmonary disease (COPD), acute bronchitis, and asthma are more often associated with gastrointestinal signs and symptoms, which include diarrhea, vomiting, abdominal pain, and dehydration. Joint presence of those conditions usually leads to more physiologic stress, higher disease severity, and delayed resolution of symptoms compared to isolated illness (1, 2).

Lower respiratory tract infections remain one of the leading causes of morbidity and mortality, especially in adults, where they represent millions of hospitalizations each year worldwide. Likewise, acute gastrointestinal illnesses remain a leading cause of healthcare utilization and hospitalization in all age groups. Epidemiological studies from Europe, North America, and Asia have shown that respiratory infections are frequently associated with gastrointestinal symptoms as a primary sequela of translocation (systemic inflammation), direct effects as an adverse effect of treatment, or pathogen involvement. The presence of these conditions has previously been linked to increased healthcare expenditure, longer length of stay, and worse clinical outcomes (3, 4).

These diseases come with a heavy burden, especially in Pakistan, where respiratory infections are still one of the leading causes of medical admissions in tertiary care units. Community-acquired pneumonia (CAP) and acute exacerbations of chronic obstructive pulmonary disease (AECOPD) account for a large part of admissions to pulmonology and internal medicine wards, especially during seasonal peaks. Similarly, acute gastroenteritis and dehydration remain a common cause for hospitalisation in adults and the elderly. The prevalence of smoking, air pollution, crowding, poor sanitation, and late care-seeking behaviour may aggravate the co-existence and severity of respiratory and gastrointestinal diseases in the local population (5, 6).

Patients with respiratory and gastrointestinal simultaneous illnesses show dehydration, electrolyte disturbance, malnutrition, decreased oral intake, and higher metabolic demands, which can delay recovery and increase length of hospital stay. A longer stay in the hospital leads to higher treatment costs, risk of acquiring illnesses within the establishment, increased healthcare resource utilization, and reduced patient

outcomes (7). Although these conditions are most commonly seen together in routine clinical practice, little evidence is available about predictors of prolonged hospitalization, especially from Pakistan. Recognizing clinical variables related to prolonged hospitalisation may allow the stratification of those at highest risk right from their admission, optimise resource utilisation in healthcare systems, and direct focused interventions towards ameliorating these outcomes.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional observational analysis was conducted at the Department of Pulmonology and Gastroenterology & Hepatology, Jinnah Sindh Medical University (JSMU) / Jinnah Postgraduate Medical Centre (JPMC), Karachi, a tertiary care teaching hospital in Pakistan, from August 2025 to January 2026 to determine clinical and laboratory predictors of prolonged hospital stay of adult patients with concomitant respiratory and gastrointestinal illness. The study site is a tertiary care referral centre catering to the urban, semi-urban, and rural population and has a high load of respiratory and infective diseases (all year round).

Sample Size Estimation

The sample size for estimation of a single population proportion was calculated using the WHO sample size calculator. Assuming a 50% rate of prolonged hospital stay among patients with concurrent respiratory and gastrointestinal illnesses (8), a confidence level of 95%, and an absolute precision of 5%) was calculated to be 385. All eligible patients seen during the study period were included in the final analysis to reduce potential bias and increase the accuracy of estimates when dealing with incomplete records or missing values.

Study Population

We included all patients of either gender between the ages of 18 and 70 years were included with concomitant respiratory and gastrointestinal illness during the study period. Types of respiratory illnesses in this study are community-acquired pneumonia, acute exacerbation of chronic obstructive pulmonary disease (COPD), acute bronchitis, asthma exacerbation, lower respiratory tract infections, and other clinically diagnosed respiratory symptoms with hospitalization. Gastrointestinal illnesses consisted of cases with acute gastroenteritis; vomiting, diarrhea, abdominal pain, nausea, dehydration, and other acute

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gastrointestinal manifestations coinciding with respiratory disease.

Patients were excluded if they had chronic respiratory disease requiring long-term oxygen therapy, chronic liver disease, inflammatory bowel disease, gastrointestinal malignancy, any immunosuppressive disorder as a cause of PaD (eg, diabetes mellitus), end-stage renal disease, or insufficient clinical records. Participants who met the inclusion criteria were consecutively enrolled using a non-probability consecutive sampling technique after obtaining written informed consent.

Data Collection Procedure

Demographic, clinical, laboratory, and hospitalization-related information were extracted using a structured study proforma by the principal investigator and trained research staff following enrollment, together with demographic details.

Facultative demographic variables at baseline included age, focality of disease, domicile, smoking status, body mass index (BMI), nutrition (poor-nutritive state), and the existence of pathogen controversy and coalma have adequately identified comorbidity are tissue diabetes mellitus, hypertension, ischemic heart disease chronic kidney disease.

Clinical variables assessed at admission included the duration of symptoms before presentation, fever, cough and/or sputum production, dyspnea/wheezing, O₂ saturation <90%, diarrhea and vomiting (yes/no), abdominal pain (presence), signs of dehydration, as well as additional needs for supplemental O₂. Data were also available on prior admissions to the hospital and recent antibiotic use.

The laboratory investigations included complete blood count, serum electrolytes, renal function tests, C-reactive protein levels, and blood glucose measurements in addition to any further investigations that were considered clinically appropriate (per the decision of the treating physician). Where appropriate, radiological data (infiltrates, consolidations, hyperinflation, or pleural effusion on chest radiographs) were documented.

The variables related to hospitalization were the requirement of oxygen therapy, non-invasive ventilation, mechanical ventilation, admission to the intensive care unit (ICU), intravenous fluid administration, duration of respiratory support, and total length of stay in hospital.

Outcome Measures

The study's primary outcome was prolonged hospitalization, defined as an admission duration longer than the 75th percentile of each patient cohort.

Secondary outcomes included admission to an ICU, need for ventilatory support, and hospital-acquired complications while in the hospital, as well as in-hospital mortality.

Ethical Considerations

The study was conducted after obtaining approval from the Institutional Ethical Review Committee of the Institute where it was conducted. Before enrollment, written (paper and electronic) informed consent was obtained from all participants or their legally authorized representatives. Study participation was voluntary, and study participants were assigned a unique identification number to maintain anonymity; access to study records is restricted to members of the research team only. All procedures were performed in accordance with the ethical standards of the Declaration of Helsinki for biomedical research involving human subjects.

Statistical Analysis

Data were entered and cleaned, and analysed with the Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA). A Shapiro–Wilk test is used for testing the normality of continuous variables.

Continuous variables (age, oxygen saturation, laboratory parameters, and hospital stay) were expressed as mean $\pm$ SD or median with IQR according to the data distribution. The categorical variables sex, smoking status, type of respiratory illness, dehydration status, oxygen requirement, and intensive care unit admission were expressed as frequencies and percentages.

Where appropriate, the Chi-square test or Fisher's exact test was used to compare patients with prolonged versus non-prolonged hospital stay for categorical variables, and the independent samples t-test or Mann–Whitney U test to compare continuous variables.

All variables with a univariable analysis p-value of < 0.20 and clinically-important variables were entered into a multivariable logistic regression to identify independent predictors of prolonged hospitalization. Results were presented as adjusted odds ratios (aORs) with 95% confidence intervals (95% CIs). All two-sided p-values < 0.05 were considered statistically significant in the analysis.

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RESULTS

Patients with prolonged hospitalization were significantly older than those discharged within six days (54.3 ± 14.8 vs. 45.2 ± 14.7 years, $p < 0.001$). A higher proportion of patients with extended hospital stay were aged more than 60 years (27.8% vs. 16.0%, $p = 0.008$). Comorbid conditions, particularly diabetes mellitus and hypertension, were significantly more common among patients who experienced prolonged hospitalization (46.4% vs. 25.7%, $p < 0.001$ and 47.4% vs. 31.6%, $p = 0.006$, respectively). Markers of disease severity at presentation, including oxygen saturation below 92%, moderate to severe dehydration, and the requirement for oxygen therapy, were also significantly more frequent among patients with extended hospital stay (all $p < 0.001$). Furthermore, patients with prolonged hospitalization had substantially higher rates of intensive care unit admission compared with those discharged earlier (36.1% vs. 6.6%, $p < 0.001$). No significant differences were observed with respect to sex or place of residence between the two groups (Table 1).

Table 1. Baseline demographic and clinical characteristics according to duration of hospital stay (n = 385)

Baseline & Clinical Parameters	Overall (n=385)	Hospital Stay ≤6 Days (n=288)	Hospital Stay >6 Days (n=97)	p-value
Age (years), Mean ± SD	47.6 ± 15.1	45.2 ± 14.7	54.3 ± 14.8	<0.001
Age group (years)				0.008
18–30	82 (21.3)	68 (23.6)	14 (14.4)	
31–45	109 (28.3)	86 (29.9)	23 (23.7)	
46–60	121 (31.4)	88 (30.6)	33 (34.0)	
>60	73 (19.0)	46 (16.0)	27 (27.8)	
Male gender	221 (57.4)	160 (55.6)	61 (62.9)	0.221
Urban residence	225 (58.4)	171 (59.4)	54 (55.7)	0.537
Current smoker	148 (38.4)	98 (34.0)	50 (51.5)	0.003
Diabetes mellitus	119 (30.9)	74 (25.7)	45 (46.4)	<0.001
Hypertension	137 (35.6)	91 (31.6)	46 (47.4)	0.006

Fever	323 (83.9)	237 (82.3)	86 (88.7)	0.154
Oxygen saturation <92%	131 (34.0)	74 (25.7)	57 (58.8)	<0.001
Moderate/severe dehydration	102 (26.5)	56 (19.4)	46 (47.4)	<0.001
Oxygen therapy required	148 (38.4)	86 (29.9)	62 (63.9)	<0.001
ICU admission	54 (14.0)	19 (6.6)	35 (36.1)	<0.001

Data are presented as mean ± standard deviation (SD) for continuous variables and frequency (percentage) for categorical variables. Continuous variables were compared using the independent samples t-test, whereas categorical variables were compared using the Chi-square test or Fisher's exact test as appropriate.

Patients with prolonged hospitalization had significantly higher frequencies of pneumonia (54.6% vs. 38.2%, $p = 0.002$), diarrhea (72.2% vs. 57.6%, $p = 0.006$), vomiting (60.8% vs. 44.8%, $p = 0.006$), moderate-to-severe dehydration (54.6% vs. 29.5%, $p < 0.001$), and abdominal pain (46.4% vs. 30.2%, $p = 0.006$) compared with patients discharged within six days. In contrast, the frequencies of acute exacerbation of COPD, acute bronchitis, and asthma exacerbation were comparable between the two groups ($p > 0.05$). These findings suggest that pneumonia and more severe gastrointestinal involvement were important contributors to extended hospitalization among patients with concurrent respiratory and gastrointestinal illnesses. (Figure 1).

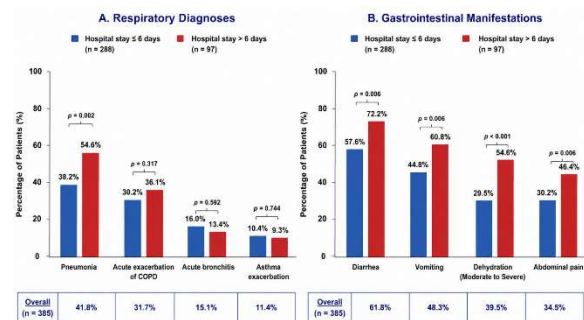


Figure 1. Distribution of respiratory diagnoses and gastrointestinal manifestations among study participants (n = 385).

Patients with prolonged hospitalization experienced significantly worse clinical outcomes compared with those discharged within six days. Rates of ICU admission (36.1% vs. 6.6%), non-invasive ventilation

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(30.9% vs. 5.9%), mechanical ventilation (18.6% vs. 2.1%), vasopressor requirement (20.6% vs. 2.8%), hospital-acquired infections (17.5% vs. 1.7%), and acute kidney injury (19.6% vs. 4.2%) were all significantly higher among patients with extended hospitalization (all $p < 0.001$). Similarly, in-hospital mortality was markedly increased in patients with prolonged hospital stay (9.3% vs. 1.0%, $p < 0.001$), indicating a strong association between longer hospitalization and adverse clinical outcomes (Table 2).

Table 2. Clinical outcomes according to duration of hospital stay (n = 385)

Clinical Outcome	Overall n (%)	Hospital Stay ≤6 Days n (%)	Hospital Stay >6 Days n (%)	p-value
ICU admission	54 (14.0)	19 (6.6)	35 (36.1)	<0.001
Non-invasive ventilation	47 (12.2)	17 (5.9)	30 (30.9)	<0.001
Mechanical ventilation	24 (6.2)	6 (2.1)	18 (18.6)	<0.001
Vasopressor requirement	28 (7.3)	8 (2.8)	20 (20.6)	<0.001
Hospital-acquired infection	22 (5.7)	5 (1.7)	17 (17.5)	<0.001
Acute kidney injury	31 (8.1)	12 (4.2)	19 (19.6)	<0.001
In-hospital mortality	12 (3.1)	3 (1.0)	9 (9.3)	<0.001

Data are presented as frequency (percentage). Categorical variables were compared using the Chi-square test or Fisher's exact test, as appropriate. Bold p-values indicate statistical significance ($p < 0.05$).

Patients with prolonged hospitalization demonstrated significantly greater physiological and inflammatory disturbances at presentation, including lower oxygen saturation ($89.8 \pm 4.7\%$ vs. $94.1 \pm 3.5\%$), higher white blood cell counts (15.2 ± 5.8 vs. $11.8 \pm 4.2 \times 10^9/L$), and markedly elevated C-reactive protein levels [39 (20–68) vs. 14 (8–28) mg/L] compared with patients discharged within six days (all $p < 0.001$). Additionally, these patients had higher serum creatinine levels (1.48 ± 0.57 vs. 1.02 ± 0.31 mg/dL) and lower serum sodium

concentrations (133.1 ± 4.8 vs. 136.9 ± 3.4 mmol/L), reflecting a greater burden of systemic inflammation, dehydration, and organ dysfunction associated with extended hospitalization (Table 3).

Table 3. Laboratory and physiological parameters according to duration of hospital stay (n = 385)

Parameter	Hospital Stay ≤6 Days	Hospital Stay >6 Days	p-value
Oxygen saturation (%), Mean ± SD	94.1 ± 3.5	89.8 ± 4.7	<0.001
White blood cell count ($\times 10^9/L$), Mean ± SD	11.8 ± 4.2	15.2 ± 5.8	<0.001
C-reactive protein (mg/L), Median (IQR)	14 (8–28)	39 (20–68)	<0.001
Serum sodium (mmol/L), Mean ± SD	136.9 ± 3.4	133.1 ± 4.8	<0.001
Serum creatinine (mg/dL), Mean ± SD	1.02 ± 0.31	1.48 ± 0.57	<0.001

On multivariable logistic regression analysis, ICU admission emerged as the strongest independent predictor of prolonged hospitalization (aOR 4.53, 95% CI 2.32–8.84, $p < 0.001$), followed by oxygen saturation below 92% at presentation (aOR 3.27, 95% CI 1.89–5.66, $p < 0.001$) and moderate to severe dehydration (aOR 2.91, 95% CI 1.66–5.08, $p < 0.001$). Patients requiring oxygen therapy had nearly three-fold higher odds of extended hospitalization (aOR 2.74, 95% CI 1.54–4.86, $p = 0.001$), while diabetes mellitus (aOR 2.21, 95% CI 1.24–3.95, $p = 0.007$) and age above 60 years (aOR 1.94, 95% CI 1.03–3.67, $p = 0.041$) were also independently associated with prolonged hospital stay. (Table 4).

Table 4. Multivariable logistic regression analysis identifying independent predictors of prolonged hospitalization among patients with concurrent respiratory and gastrointestinal illnesses (n = 385)

Variables	Frequency n (%)	Adjusted Odds Ratio (aOR)	95% CI	p-value
Malnutrition	106 (27.5)	2.48	1.42 – 4.34	0.001

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Oxygen saturation <92%	131 (34.0)	3.27	1.89 – 5.66	<0.0 01
Moderate/severe dehydration	102 (26.5)	2.91	1.66 – 5.08	<0.0 01
Oxygen therapy requirement	148 (38.4)	2.74	1.54 – 4.86	0.001
PICU admission	54 (14.0)	4.53	2.32 – 8.84	<0.0 01
Age <1 year	106 (27.5)	1.56	0.89 – 2.73	0.118
Male gender	221 (57.4)	1.14	0.68 – 1.92	0.617

Multivariable logistic regression analysis was performed with prolonged hospitalization as the dependent variable, defined as a hospital stay exceeding six days. Variables with a p-value <0.20 on univariable analysis and clinically relevant covariates were included in the final model. Bold p-values indicate statistical significance (p<0.05).

DISCUSSION

This study was performed to find out the clinical predictors of lengthy hospital stay in adults presenting with concurrent respiratory and gastrointestinal illness. The main results from the study indicated that 25.2% of patients were diagnosed with a prolonged hospitalization, while pneumonia and acute exacerbation of COPD occurred in 41.8% and 31.7%, respectively. Regarding gastrointestinal manifestations, 61.8% reported diarrhea and 48.3% vomiting. Older age, diabetes mellitus (DM), hypoxemia at presentation, moderate to severe dehydration at presentation, requirement for oxygen therapy, and ICU admission were independently associated with prolonged hospitalization. These findings highlight the interplay between respiratory compromise and GI severity in determining outcomes and healthcare resource use.

Pneumonia and COPD exacerbation were the most common forms of respiratory disease in our cohort. Similar observations have been reported from Pakistan, where community-acquired pneumonia is still among the three most common causes of adult respiratory admissions (9, 10). A study in Quetta, amongst 293 hospitalized adults with community-

acquired pneumonia, documented a mean patient age of ~56 years, and it showed that there is a high burden of significant comorbid disease in the admitted patients (11). Worldwide, pneumonia and exacerbations of COPD represent a major component of respiratory admissions, with seasonal variations in hospitalisation rates in older adults from European countries as well as North America (12, 13). Pneumonia hospitalized patients with a diagnosis of pneumonia and co-existing underlying COPD have consistently been shown to be more likely to require ICU admission and remain in hospital longer than non-COPD controls (14). The higher proportion of exacerbations we observed with COPD is likely to be a reflection of the high prevalence of tobacco smoking, biomass fuel exposure, and air pollution in Pakistan.

One of our study findings was a very high association between hypoxemia and prolonged stay. Multivariable analyses demonstrated that odds of prolonged hospital stay (length > 3 days) were more than threefold greater in patients presenting with oxygen saturation 60 years (aOR 1.94, 95% CI 1.03-3.67). This observation is in keeping with the international literature, which demonstrates that older individuals hospitalised for pneumonia have a worse prognosis (15). Long-term mortality was observed in 45.7% of older adults as compared with 31.4% of younger patients (p <0.001), corroborating the detrimental effect of age on disease outcomes during a multinational cohort study of adult community-acquired pneumonia (16). A Pakistani study showed similar findings and observed that adults ≥ 56 years old had much higher odds of developing pneumonia compared to the younger group (17). This association may be attributed to the lower physiological reserve, impaired immunity, and more common comorbid illnesses.

Diabetes mellitus was also a notable predictor of longer hospitalization, with diabetic patients having more than double the odds of prolonged stay (aOR 2.21, 95% CI 1.24–3.95). The results are in line with previous observations by Pakistani and international studies conducted on hospitalized pneumonia patients and demonstrated a strong association between diabetes, severe disease, and adverse outcomes (18, 19). Studies from across the world have also found that diabetes is an important risk factor associated with mortality and extended hospitalization by respiratory infections stemming from immune dysfunction and impaired resolution of inflammation (20).

In the current study, the need for oxygen therapy and ICU admission were among the strongest predictors of prolonged hospitalization. ICU admission was found to be the strongest predictor identified in our analysis, with aOR 4.53 (95% CI 2.32–8.84) for prolonged

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hospitalization. Similar results were found in Karachi, so that out of 371 patients with COPD exacerbations requiring hospitalization, the vast majority (352) suffered from no or mild exacerbation, only 19 (5.1%) had a severe condition and intensive care, and therefore a longer hospital stay; mortality was also higher in these cases compared to all other classes. International studies also confirm; however, due to high disease severity and increased risk for complications, those needing mechanical ventilation or ICU support are often hospitalized longer (21).

We also observed an important increase in adverse clinical outcomes among patients with prolonged hospitalization. Compared with patients discharged within six days, those staying longer had a higher proportion of ICU admission (36.1% vs 6.6%), mechanical ventilation (18.6% vs 2.1%), acute kidney injury (19.6% vs 4.2%), and in-hospital mortality (9.3% vs 1.0%, respectively). These results corroborate previous reports that prolonged hospitalization is both a marker and a sequela of severe systemic illness, as well as multiple organ involvement (22, 23).

This study has some limitations. First, it was performed at a single tertiary care referral center, which may limit the applicability of results to other healthcare environments. Secondly, the cross-sectional design was limited to prove a cause-and-effect relationship between established predictors and long hospital stay. Third, microbiological confirmation of infectious aetiologies was not available for every patient. Ultimately, differences in discharge practices and institutional protocols might also affect the duration of hospital stay.

CONCLUSION

Adult patients admitted with respiratory and GI illness were found to have a protracted hospital course in one of four hospitalized patients. The independent predictors of a prolonged hospital stay were found to be older age, presence of diabetes mellitus and hypoxemia at presentation, moderate-to-severe dehydration, requirement of oxygen therapy, and ICU admission. To improve and optimize their management process, these high-risk patients should be identified early so that timely interventions can be made to reduce the burden of prolonged hospitalization in tertiary care settings and probably also enhance resource allocation.

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