Original Research Article

Two years of COVID-19 mortality in a government hospital in the capital of Bangladesh: a retrospective study

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ABSTRACT

Background: Bangladesh experienced multiple waves of COVID-19 infection. A comprehensive understanding of mortality patterns within government healthcare facilities is essential for evidence-based healthcare planning and resource allocation in resource-constrained settings. This study systematically examines two years of COVID-19-associated mortality data from a major tertiary government hospital in Dhaka, Bangladesh.
Methods: A retrospective observational analysis was conducted examining 693 laboratory-confirmed COVID-19-related deaths occurring between 2020 and 2022. Patient demographic characteristics, pre-existing comorbidities, intensive care unit (ICU) utilization, length of hospital stay (LOS), vaccination status, and temporal mortality trends were systematically examined. Multivariable logistic regression modelling was employed to assess independent predictors of prolonged LOS and ICU admission.
Results: The median age of the deceased was 66 years, and 65% were male. Most (78%) were aged 60 years or older. Diabetes (55%) and hypertension (51%) were the most common comorbidities. Of all deaths, 35% occurred after ICU admission and 65% outside the ICU. Hypertension increased the likelihood of ICU admission (OR 1.43), while chronic kidney disease (CKD) decreased it (OR 0.50). No significant predictors of prolonged LOS were identified, and model performance was poor (AUC≈0.50). Only five deaths occurred among vaccinated individuals.
Conclusions: COVID-19 mortality at this government hospital primarily affected older males with metabolic comorbidities. ICU use varied by wave, reflecting changes in resource availability and triage. Hypertension and CKD influenced ICU admission but not survival duration. Enhancing critical-care capacity and clinical data systems is essential for future pandemic preparedness.

Keywords: COVID-19, Mortality, Intensive care unit, Comorbidities, Length of hospital stay, Vaccination status

INTRODUCTION

Coronavirus disease 2019 (COVID-19), a disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has led to significant global morbidity and mortality since late December, 2019. Sustained pressure and multiple waves of epidemics have exposed stretched health systems to persistent risk in many low- and middle-income countries, where the health system remains poorly equipped.[1,2] While progress in clinical management and

vaccination has decreased mortality in many contexts, COVID-19 continued to account for substantial hospital deaths during consecutive waves. During 2020-2022, Bangladesh, with one of the highest population densities in the world faced several waves of COVID-19. Dhaka, as the capital, had a high proportion of cases and deaths associated with its urban density and ongoing transmission.[3] Government hospitals were major referral centers for the severe and critical cases during the pandemic. In many such centers, ICU capacity was limited, treatment guidelines were changing and resources were variable. Knowledge of mortality patterns in these situations is important for assessing health system performance and preparedness for future public health emergencies. Proved to be a strong predictor of the COVID-19 death, advanced age and male gender have been found in large observational studies and meta-analyses.[4,5] Baseline comorbid conditions, such as diabetes mellitus, hypertension, cardiovascular disease and CKDs were also reported to relate with the risk of severe disease or mortality.[2] These are common conditions in South Asian populations, such as Bangladesh, where the burden of NCDs has increased significantly over the past few decades. This situation may lead to increased population level risk of severe COVID-19 outcomes. Supporting this is the proposition that national level surveillance data are only able to describe broad trends, whereas hospital-based mortality analysis results in a more granular understanding of patient demographics, healthcare use and clinical courses. Analysis of this last figure, ICU use amongst fatal cases is especially informative given it reflects both the severity of disease and hospital capacity, including triage at the time of surge demand. Work from high-income contexts has shown substantial heterogeneity in rates of ICU admission and outcomes over pandemic waves, reflecting modifications to clinical practice and resource availability.[6] Similar longitudinal data from government hospitals in South Asia are sparse. LOS in the hospital before death is a second outcome of interest that may also shed light on disease process, and healthcare delivery. Short LOS might be due to rapid clinical deterioration or late presentation, whereas long LOS may indicate prolonged organ support, complications/lack of response.[7] Nevertheless, few publications in low-resource settings have explored predictors of LOS for those who died due to COVID-19. COVID-19 vaccination has been demonstrated to significantly decrease severe disease, ICU admission, and mortality in real-world data.[8] However, deaths in vaccinated individuals remain rare and require investigation to allow for comparison of vaccine impact on hospital-based mortality particularly early in vaccine rollout. There is however a paucity of longitudinal hospital-level studies from Bangladesh reporting COVID-19 mortality across waves with detailed analysis of comorbidities, ICU use and trends over time. Filling this gap is essential to improving preparedness in critical care and informing subsequent pandemic response. Hence this study planned to explore 2 years COVID-19 related mortality in Dhaka's one of the largest tertiary government hospitals; where it highlighted demographic distribution, various comorbidity profile, temporal trajectory of deaths based on age and sex and impact on ICU use and LOS along with its predictors among different clinical outcomes.

METHODS

A retrospective observational study was conducted covering deaths recorded between January 2020 and December 2022. A total of 693 consecutive COVID-19-related deaths were included using complete enumeration. The study was conducted at Kurmitola General Hospital, a large tertiary government hospital in Dhaka. The study population included all in-hospital deaths with laboratory-confirmed COVID-19.

Inclusion and exclusion criteria

RT-PCR confirmed COVID-19 deaths, complete hospital records, were included and suspected but unconfirmed COVID-19 deaths were excluded.

Data collection

Data fields included: age, sex, comorbidities [diabetes, hypertension, CKD, Ischemic heart disease (IHD), asthma, COPD (Chronic obstructive pulmonary disease)], ICU admission status, LOS, death date, vaccination status. The dataset contained no missing demographic variables except for one patient with unknown sex.

Statistical analysis

Descriptive statistics were used for demographics and comorbidities. Temporal trends were analysed via epidemiological week-based aggregation. Comparisons between ICU and non-ICU deaths used χ^2 or Fisher's exact tests, with false-discovery-rate (FDR) correction for multiple comparisons. Logistic regression models assessed predictors of prolonged LOS (>7 days), ICU admission among fatal cases. Model discrimination was evaluated using receiver operating characteristic (ROC) curves. Analyses were based entirely on the dataset provided.

RESULTS

A total of 693 deaths were reviewed. Median age was 66 years (IQR 58-73), ranging from 14 to 103 years. Males accounted for 65% of deaths. Approximately 78% of fatalities occurred in patients aged ≥60 years, with the highest proportions in the 60-69 and 70-79 age groups.

Comorbidity burden was high diabetes mellitus: 55%, hypertension: 51%, CKD: 22%, IHD: 9%, asthma: 4%, COPD: 2%, multiple comorbidities frequently co-occurred.

Median LOS was 7 days (IQR 3-11). CKD and COPD patients demonstrated shorter survival trends, though regression modelling revealed no significant predictors of

prolonged LOS (AUC≈0.50), indicating limited predictive value of demographic and comorbidity data alone.

Only 5 deaths were documented among vaccinated individuals. Their LOS appeared longer (median 16 days), but extreme variability and small sample size rendered comparative analysis unreliable.

Three distinct waves were observed: First wave: peak week beginning 23 November 2020 (23 deaths). Second wave: peak week beginning 19 April 2021 (19 deaths). Third wave: peak week beginning 9 August 2021 (22 deaths). These peaks aligned with recognized national surges documented during the pandemic.

Table 1: Demographic characteristics of COVID-19 deaths, (n=693).

Variables	N	Percentage (%)
Age (in years)		
Median (IQR)	66 (58-73)	-
Range	14-103	-
≥60	541	78.0
Gender		
Male	454	65
Female	238	34.5
Unknown	1	0.5

Table 2: Distribution of comorbidities among deceased patients, (n=693).

Comorbidity	N	Percentage (%)
Diabetes mellitus	382	55
Hypertension	355	51
CKD	149	22
IHD	63	9
Asthma	29	4
COPD	15	2

Table 3: LOS.

Variables	Value
Median LOS (in days)	7
IQR (Q1-Q3)	3-11
Minimum	0
Maximum	376

Of all deaths, 239 (35%) occurred after ICU admission, while 447 (65%) occurred in non-ICU wards.

Age and sex distributions were similar between groups. Comorbidity prevalence differed modestly: DM (ICU 60% vs non-ICU 52%), HTN (57% vs 48%), CKD (16% vs 24%). After FDR correction, none of these differences reached statistical significance.
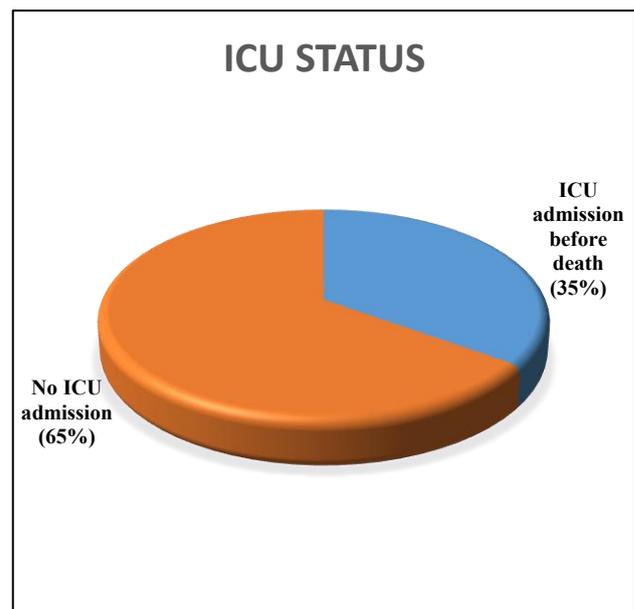
Table 4: LOS according to vaccination status.

Vaccination status	Deaths	Median LOS (days)	Mean±SD	IQR	Range
Unvaccinated	556	6	32.7±59.7	1-31	0-376
Vaccinated	5	16	95.8±125.3	14-159	2-288
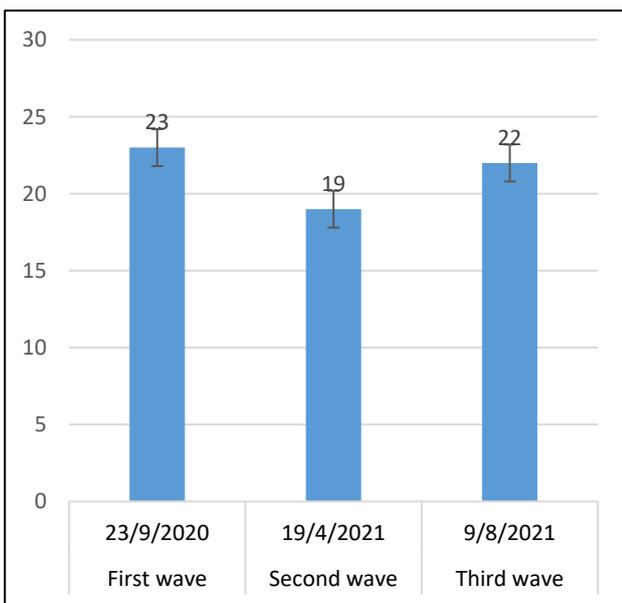
Figure 1: Weekly peak COVID-19 deaths during the study period.

Figure 2: ICU utilization among fatal COVID-19 cases.

Table 5: Comparison of ICU vs non-ICU deaths by comorbidity.

Comorbidity	ICU deaths, N (%)	Non-ICU deaths, N (%)
Diabetes mellitus	144 (60)	232 (52)
Hypertension	136 (57)	214 (48)
CKD	38 (16)	107 (24)

Table 6: Predictors of ICU admission among fatal cases.

Predictors	Odds ratio
Hypertension	1.43
CKD	0.50

Logistic regression revealed: hypertension: OR 1.43 (significant), CKD-OR 0.50 (significant negative predictor). age, sex, DM, IHD, asthma, COPD: not significant, model discrimination modest (AUC=0.63).

DISCUSSION

The present 2-year (2020-21) retrospective study on 693 COVID-19 related deaths presents information regarding mortality patterns in response to the epidemic at one of the largest government hospitals in Dhaka. Advanced age, male sex and chronic non-communicable diseases were the most important risk factors reported in the findings, which also portrayed the shifting trends in ICU use and mortality by pandemic waves in a resource-limited setting. Mortality was highly concentrated among elderly aged patients, with 78% of the patients ≥60 years and a median age of 66. This age profile matches other reports from China, Europe and South Asia where higher age is the strongest predictor of COVID-19 mortality.[4,5,9] Domination of male mortality (65%) is also consistent with global experience and explains sex-related differences in immunity, comorbidity load, and health seeking behaviour.[10,11] Similar male preponderance is observed in hospital-based studies from India and Pakistan, indicating a regional trend in South Asia. Comorbidity was common among fatal cases. Diabetes mellitus (55%) and hypertension (51%) were the most prevalent co-morbidities observed, followed by CKD (22%). These fractions are similar to those in national and regional studies, indicative that Bangladesh has a high background burden of metabolic disease.[2,3] Diabetes and hypertension have remained strongly correlated to severe COVID-19 and mortality, probably because of chronic inflammation, endothelial dysfunction/immune response deficiency.[12] The lower contribution of asthma (4%) and COPD (2%) is consistent with past evidence of a less than expected role for chronic respiratory diseases in COVID-19 mortality.[5] The duration of hospital stay prior to death can inform disease course and quality of care. In the present study, median LOS was 7 days, consistent with publications from other low- and middle-income countries.[7] Patients with CKD-COPD had a shorter LOS, indicating more rapid progression or delayed presentation.

In contrast, by regression analyses there were no predictors of prolonged LOS and the model performance was low (AUC≈0.50). This finding indeed implies that demographic and comorbidity-related factors are not enough to elucidate the duration of survival, justifying the laboratory indicators, radiological severity and treatment-related variables for the simple prognostic model.[13] Vaccination status among the fatal cases was stark. Only 5 deaths occurred in vaccinated persons, emphasizing the high level of protection against COVID-19 granted by vaccines at the population level. While vaccinated patients did have a higher median LOS (16 vs. 6 days), the very small sample size and wide range make it too difficult to interpret. This observation is also consistent with that reported elsewhere, in which post-vaccination deaths are infrequent and often occur among the elderly or those who are immunosuppressed.[8,14] Temporal distribution showed three obvious waves of mortality, which were at peaks in November 2020, April 2021 and August 2021. These peaks closely match those of national epidemic waves based on surveillance data in Bangladesh.[15] This alignment would support the accuracy of hospital level mortality data as a measure of broader transmission patterns and re-emphasize the repeated pressure faced by government hospitals during waves. Patterning of ICU use can give valuable information about the health system capacity and triage. Only 35% of deaths were after ICU admission, hence, almost 2 in every three patients died without having been in an ICU. This percentage is lower than has been observed in high-income contexts where ICU access among fatal cases was much higher in the early months of the pandemic.[6,16] Such practice might be due to limited availability of ICU, delayed referral and triage decisions. Comparisons of ICU deaths and non-ICU death revealed small differences to comorbidity constellation. Diabetes hypertension was more frequent in ICU deaths (60% 57%, respectively) while CKD was higher among non-ICU death (24%). This could be explained by the results of logistic regression analysis, with hypertension raising the risk of ICU admission (OR=1.43), but CKD lowering it (OR=0.50). Analyses from other areas found that patients with advanced CKD were less likely to be treated in the ICU because of poor prognosis or marginal anticipated benefit.[6] Conclusions This study has highlighted disproportionate disease burden due to COVID-19 for older people with metabolic comorbidities in Bangladesh and illustrates changes in ICU utilization over the waves under resource constraints. The experience that LOS/survival duration cannot be predicted by simple models indicates the necessity of new clinical data systems with better integration of laboratory and severity indices. Building critical care capacity, triage criteria and incorporation of real-time clinical predictors are important to consider in future pandemic planning in similar low-resource settings.

CONCLUSION

This two-year study revealed that COVID-19 death in a tertiary national hospital in Dhaka was chiefly observed

among the elderly patients with male predominance with an overwhelming proportion of diabetes and hypertension. A majority of deaths occurred outside the ICU, likely due to insufficient critical care resources and dynamic triage with pandemic wave evolution. Hypertension was associated with an increased chance of ICU admission, while CKD with decreased ICU access. Responsive demographic and comorbidity factors performed poorly in predicting duration of survival. Increasing ICU capacity, enhancing clinical data platforms, and integrating severity-based decision-making is imperative in preparedness for future public health crises.

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