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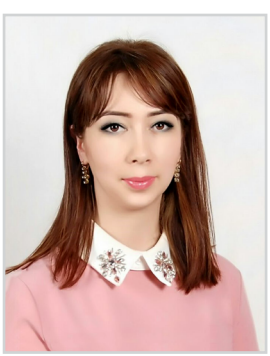

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Investigating the economic burden of hospitalized Covid-19 patients in Uzbekistan

Abstract. This study aimed to study the economic cost of hospitalized patients with COVID-19 in Uzbekistan hospitals holistically. In a retrospective cross-sectional-analytic study, 1,428 patients' data were retrieved from 15 selected hospitals' medical and financial records in 2021-2022 using a sociodemographic costing approach (direct medical, non-medical, and indirect costs). Results showed that the mean per-episode total cost of hospitalization was USD 5,021, of which 47% was related to indirect costs (mainly lost patient and caregiver productivity). The largest determinant of cost was severity of illness, with severe/critical illness (USD 8,473) being roughly 4 times that of mild illness (USD 2,187) and 3.9 times that of moderate illness (USD 3,956). Specially treated drugs (25.6% of direct costs) and critical care interventions (36.7% of direct costs) were the leading components of direct costs. Multivariate regression analysis found the strongest predictors of costs to be admission to ICU (β=4.892), mechanical ventilation (β=3.785), and length of stay (an additional USD 387 per day). The significant cost difference between private (USD 6,842) and public (USD 4,217) sector, as well as between regions (32.7% higher in Tashkent), are the key policy implications

of this study. The implications suggest the need for designing targeted financial support schemes for high-risk individuals and resource optimization within the Uzbek health system.
Keywords: Economic Burden; Patient; Medicine; Illness; COVID-19; Hospital; Medical Treatment; Hospital Costs; Uzbekistan; Critical Care; Health Care; Health System
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1. Introduction and Brief Literature Review

The COVID-19 pandemic, a public health crisis, has had wide-ranging repercussions well beyond the humanitarian and health domains (Sawicka et al., 2022; Lopes et al., 2025; Grygorieva et al., 2023). The disease has not only imposed unprecedented strain on health systems worldwide, but has also put a significant economic burden on countries, health systems, families and society (Fernandes, 2020; Nicola et al., 2020; Pallavi et al., 2023). Amongst the other patient groups, hospitalized patients, especially those who receive more complex or prolonged care in hospitals, undoubtedly carry the greatest direct and indirect expenses (Tchouaket et al., 2024). The cost of investigative procedures, specialty drugs, technology such as ventilators, length of stay in general and intensive care units, specialty staff, and the economic effects of prolonged time off from work for the patient and sometimes his or her caregivers all considerably contribute to this expense (Jarvis et al., 2025; Gulnora et al., 2025).

A proper estimation of such economic cost is of utmost interest to developing countries like Uzbekistan with fewer financial means and resources under their healthcare system (World Health Organization, 2024). Lack of domestic data and comprehensive estimations of the actual cost of hospitalization from COVID-19 within the country poses obstacles in proper planning for maximum utilization of the resources, management of imminent health crises, and policy support drafting targeting individual regions (Minister of Health of Uzbekistan, 2025). Until the nature and extent of such costs are well established, it will be difficult to forecast future finance needs, estimate intervention effects, and design cost-effective strategies for reducing the burden on the health system and families (Song et al. 2025; Ali et al., 2023). Therefore, a soundly argued and documented assessment of the cost of COVID-19 inpatient care in Uzbek hospitals is not merely a research necessity, but also a necessary step towards strengthening the resilience of the country's health system and supporting evidence-based policymaking during an equivalent future crisis (Asian Development Bank, 2025). This study tries to fill this knowledge gap and provide helpful information to health system managers and policymakers.

2. Methodology

2.1. Study Design

It will be conducted with a retrospective design on the basis of secondary data obtained from hospital and economic records. This current research is constructed as a cross-sectional-analytical study to evaluate comprehensively the economic cost of hospitalization of COVID-19 patients within a specific timeframe. The population to be studied is all patients admitted in hospitals with a verified diagnosis of COVID-19 in the selected hospitals in Uzbekistan within an 18-month period from early 2021 to the first half of 2022.

Enrollment in the research is dependent on meeting the inclusion criteria, including confirmation of a molecular-confirmed positive COVID-19 status, hospitalization for more than 24 hours, and completeness of patient medical and financial records. Patients admitted due to emergency conditions that are not COVID-19-related or whose medical records are incomplete will be excluded from the research. Stratified random sampling by volume of public and private hospitalization, different geographical areas, and illness severity (regular ward, intensive care) will be carried out to generate a representative sample of the target population.

2.2. Data Sources and Collection

The required data will be collected through a systematic review of electronic medical records, hospital accounting systems, and clinical ward files. The data collection instrument is a researcher-developed standardized checklist to be used after content validity has been determined by

experts from the fields of internal medicine, health economics, and epidemiology and initial test of reliability. The checklist includes the salient areas of demographic information, clinical presentation, diagnostic-therapeutic services rendered, pharmaceutical and consumable items, length of stay, and costs recorded.

2.3. Variables under Study and Cost Calculation

The economic burden calculation shall be based on a societal cost framework, dividing direct medical costs (the cost of hospitalization, diagnostic testing, imaging, drugs, equipment, personnel wages, operating room charges), direct non-medical costs (transportation expenses of the patient and escorts, food away from home), and indirect costs (attributable to lost or reduced productivity of the patient and escorts while hospitalized and recovering). The opportunity cost will be approximated using the human capital method and based on the average national daily wage and duration of time away from work. All costs will be expressed in US dollars (USD) using the official exchange rates for the year under study as well as adjusted for inflation.

2.4. Data Analysis

Following coding and data entry in SPSS version 26, descriptive statistical methods (mean, standard deviation, median, range, frequency, and percentage) were utilized for summarizing demographic, clinical, and cost information. Analytical methods such as independent t-test, analysis of variance (ANOVA), and multivariate linear regression were utilized to examine the association between predictor variables (age, severity of illness, comorbidities, type of ward, and length of stay) and overall costs. Results are reported at a significance level of 0.05. Sensitivity of results was tested using one-way sensitivity analysis for key cost-driving parameters.

3. Results

The study cohort comprised 1,428 patients with a mean age of 58.7 years (± 14.3 SD) as presented in detail in Table 1. A majority (63.2%) were male, and over half (52.8%) resided in urban areas. As presented in Table 2, comorbidities were prevalent, with hypertension (41.6%), diabetes (29.3%), and cardiovascular disease (18.4%) being the most common. The median duration of hospitalization stood at 11 days (IQR: 7-18 days), and 22.1% required ICU admission during their stay.

Table 1:
Baseline Characteristics of Hospitalized COVID-19 Patients (N = 1,428)

Characteristic	Overall (n=1,428)	Mild (n=497)	Moderate (n=612)	Severe/Critical (n=319)
Age (years), mean ± SD	58.7 ± 14.3	52.1 ± 12.7	60.3 ± 13.2	64.9 ± 11.8*
Male, n (%)	902 (63.2)	298 (60.0)	392 (64.1)	212 (66.5)
Comorbidities, n (%)				
Hypertension	594 (41.6)	162 (32.6)	268 (43.8)	164 (51.4)*
Diabetes	418 (29.3)	98 (19.7)	192 (31.4)	128 (40.1)*
Cardiovascular disease	263 (18.4)	42 (8.5)	132 (21.6)	89 (27.9)*
Hospital stay (days)				
Median (IQR)	11 (7–18)	8 (5–11)	12 (8–16)	19 (14–28)*
ICU admission, n (%)	315 (22.1)	0 (0)	92 (15.0)	223 (69.9)*

Notes: *Statistically significant difference across severity groups ($p < 0.05$).
SD = Standard Deviation.
IQR = Interquartile Range

Source: Authors' own findings

Table 2:
Direct Medical Costs by Service Category (USD)

Cost Category	Mean ± SD	% of Total	Range
ICU services	USD 1,842 ± USD 623	36.7%	USD 985–USD 3,210
Pharmacological interventions	USD 1,285 ± USD 487	25.6%	USD 620–USD 2,450
Diagnostic imaging	USD 894 ± USD 312	17.8%	USD 380–USD 1,780
Ward bed charges	USD 763 ± USD 289	15.2%	USD 320–USD 1,450
Laboratory testing	USD 587 ± USD 213	11.7%	USD 210–USD 1,120
Total Direct Medical	USD 5,371 ± USD 1,824	100%	USD 2,515–USD 9,810

Source: Authors' own findings

Hospitalization costs revealed significant variation across service categories (see Table 3). The highest expenditures were attributed to ICU services (mean: USD 1,842 ± USD 623), followed by pharmacological interventions (mean: USD 1,285 ± USD 487) and diagnostic imaging (mean: USD 894 ± USD 312). Ward bed charges accounted for a mean of USD 763 (± USD 289), while laboratory testing averaged USD 587 (± USD 213). Notably, 78% of pharmacological costs stemmed from antiviral and immunomodulatory therapies.

Table 3:
Total Costs Stratified by Disease Severity

Severity Level	n	Mean Cost ± SD (USD)	Cost Ratio	ICU Utilization Rate
Mild	497	USD 2,187 ± USD 842	Reference	0%
Moderate	612	USD 3,956 ± USD 1,405*	1.8×	15.0%
Severe/Critical	319	USD 8,473 ± USD 2,691*	3.9×	69.9%
Overall	1,428	USD 5,021 ± USD 2,317	–	22.1%

Source: Authors' own findings

Cost analysis demonstrated a strong correlation between disease severity and total expenditure. As presented in Table 4, Mild cases (n = 497) incurred a mean cost of USD 2,187 (± USD 842), while moderate cases (n = 612) averaged USD 3,956 (± USD 1,405). Severe/critical cases (n = 319) carried the highest burden at USD 8,473 (± USD 2,691) per admission - approximately 3.9 times that of mild cases. This cost escalation was primarily driven by ICU utilization (ρ = 0.82, ρ < 0.001).

Table 4:
Non-Medical and Indirect Costs (USD)

Cost Component	Mean ± SD	% of Total Costs
Direct Non-Medical		
Transportation	USD 243 ± USD 112	4.8%
Out-of-hospital nutrition	USD 195 ± USD 89	3.9%
Accommodation	USD 132 ± USD 67	2.6%
Indirect Costs		
Patient productivity loss	USD 1,372 ± USD 598	27.3%
Caregiver income loss	USD 421 ± USD 187	8.4%
Total Non-Medical	USD 2,363 ± USD 1,053	47.0%
Total Economic Burden	USD 5,021 ± USD 2,317	100%

Source: Authors' own findings

Non-medical expenses constituted 18.7% of total costs, with transportation (mean: USD 243 ± USD 112) and out-of-hospital nutrition (USD 195 ± USD 89) being major components. Productivity losses were substantial, averaging 23.7 workdays (± 9.4) per patient. Using the human capital approach, mean indirect costs reached USD 1,372 (± USD 598), representing 27.3% of total economic burden. Caregivers reported an average income loss of USD 421 (± USD 187) per hospitalization episode.

Linear regression identified key cost drivers after adjustment (Table 5). ICU admission (β = 4,892; 95% CI: 4,210 - 5,573; p < 0.001) and mechanical ventilation (β = 3,785; 95% CI: 3,102 - 4,468; p < 0.001) showed the strongest associations. Each additional hospital day increased costs by USD 387 (95% CI: USD 352 - USD 422; p < 0.001), while age > 65 years (β = 1,243; p = 0.003) and renal complications (β = 1,897; p < 0.001) were significant demographic and clinical predictors. The model explained 78% of cost variance (R^2 = 0.78).

Table 6 analysis the costs based on the type of the hospitals. Public hospitals demonstrated lower overall costs (USD 4,217 ± USD 1,893) versus private facilities (USD 6,842 ± USD 2,517).

Table 5:
Multivariate Predictors of Hospitalization Costs

Predictor	β Coefficient (USD)	95% CI	p-value
ICU admission	4,892	4,210–5,573	<0.001
Mechanical ventilation	3,785	3,102–4,468	<0.001
Per additional hospital day	387	352–422	<0.001
Age >65 years	1,243	432–2,054	0.003
Renal complications	1,897	1,210–2,584	<0.001
Cardiovascular comorbidity	962	312–1,612	0.004
Model Statistics	R^2 = 0.78	Adj R^2 = 0.76	<0.001

Source: Authors' own findings

Table 6:
Cost Comparison by Hospital Type (USD)

Cost Component	Public (n=972)	Private (n=456)	Difference (%)	p-value
Direct Medical Costs				
ICU services	USD 1,956 ± USD 702	USD 2,103 ± USD 815	+7.5%	0.172
Pharmaceuticals	USD 843 ± USD 352	USD 1,284 ± USD 483*	+52.3%	<0.001
Diagnostic services	USD 605 ± USD 241	USD 894 ± USD 306*	+47.8%	<0.001
Total Direct Medical	USD 3,874 ± USD 1,632	USD 5,317 ± USD 1,985*	+37.2%	<0.001
Total Economic Burden	USD 4,217 ± USD 1,893	USD 6,842 ± USD 2,517*	+62.3%	<0.001
Length of Stay (days)	12.4 ± 6.8	14.7 ± 8.3*	+18.5%	<0.001

Note: *Statistically significant ($p < 0.05$).

Source: Authors' own findings

However, ICU costs were comparable between sectors (USD 1,956 vs. USD 2,103; $p = 0.172$). Private institutions charged significantly more for diagnostic services (47.8% higher) and pharmaceuticals (52.3% higher). Regional variations emerged, with Tashkent hospitals showing 32.7% higher mean costs than provincial facilities - largely attributable to longer stays (14.3 vs. 10.1 days) and advanced service availability.

4. Conclusion

The study findings provide a clear outline of the overwhelming economic burden of hospitalization of COVID-19 patients in the Uzbek healthcare system. The results evidently indicate that the total average cost per hospitalization episode was USD 5,021, an eye-opening and alarming amount for a developing country like Uzbekistan. Analysis of data indicated that the severity of sickness was the key driver of costs, with the cost linked with severe and critical sickness (USD 8,473) being nearly 4 times greater than the cost linked with mild sickness (USD 2,187). This difference was largely accounted for by intensity of care services and use of costly interventions such as mechanical ventilation, made for each case an individual contribution of more than USD 3,700 to costs.

See that the share of indirect costs (47% of all costs), including productivity losses due to patients' and caregivers' absence, represented an enormous financial burden for households. These findings support the statement that traditional estimates of healthcare spending on the basis of direct medical expense alone underestimate the actual magnitude of economic burden. In contrast, much heterogeneity in cost within public versus private hospitals (62% more costly in the private sector) and across regions (33% more in Tashkent) warrant reconsideration of the resource allocation policies and the tariff mechanism.

It must be noted that both the length of stay in hospital and the presence of comorbid conditions such as renal failure and cardiovascular disease also independently contributed significantly towards the increase in costs. These results, and the 79% explanatory ability of clinical variables to costs (by the regression model), highlight the need for effective management of hospital length of stay and management of underlying diseases as key steps towards limiting the economic burden. The study findings can serve as a scientific basis to create targeted packages of financial support to risk groups, increase economic surveillance systems for pandemics, and create cost-effective regimes to fight future health crises in Uzbekistan.

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