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Original Article

The Financial Burden of COVID-19 Hospitalization: A Retrospective Economic Evaluation

Wahyu Gito Putro[1]

[1] Department of Community Medicine, Faculty of Medicine, Universitas Muhammadiyah Semarang, Jl. Kedungmundu Raya No.18, Semarang, 50273 Indonesia

ABSTRACT

Background: The COVID-19 pandemic continues to demonstrate dynamic fluctuations across global, regional, and local contexts. These ongoing variations have substantial public health and socioeconomic consequences worldwide. **Objective:** This study examines the financial and demographic effects of COVID-19 hospitalizations at South Tangerang General Hospital between 2021 and 2022. **Methods**: A retrospective economic analysis by comparing hospitalization data from 2021 and 2022. This study evaluated key parameters, including patient demographics, duration of hospitalization, treatment costs, and funding sources, identifying significant patterns across the study period. **Results**: This study revealed notable changes in patient demographics, with the predominant age group shifting from > 59 years (2021) to 19-59 years (2022; p=0.000). The percentage of females represented increased from 49.1% to 59.5% (p=0.033). Compared with 2021 admissions, hospital stays were significantly shorter, with most 2022 patients discharged within 1–5 days (p=0.000). The average treatment costs declined from $3,676 to $2,024 (p=0.000), primarily due to reduced nursing and medication expenses. Funding sources transitioned from near-total (99.6%) reliance on the national COVID-19 program in 2021 to 52.7% coverage by the *BPJS* health insurance in 2022 (p=0.000). **Conclusion**: This study revealed significant changes in COVID-19 hospitalization patterns, characterized by younger patient populations, shorter hospital stays, and lower treatment costs. The evolving financial model, which incorporates both insurance and government support, highlights the necessity of forward-looking financial strategies in healthcare systems to effectively manage future health crises. These findings underscore the adaptive capacity of the healthcare sector and the critical role of socioeconomic considerations in treatment outcomes.

KEYWORDS

Cost of illness, COVID-19, health economics, healthcare cost, direct cost

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CORRESPONDENCE

Wahyu Gito Putro, Department of Professional Medical Education, Faculty of Medicine, Universitas Muhammadiyah Semarang; wahyugitoputro@unimus.ac.id

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INTRODUCTION

Coronavirus disease 2019 (COVID-19) remains a significant global health concern. This novel infectious disease, first identified in Wuhan, China, in December 2019, is caused by a newly discovered coronavirus initially termed 2019 novel coronavirus (2019-nCoV) and was later designated severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses (ICTV) [1]. COVID-19 patients may present with diverse symptoms ranging from flu-like manifestations and severe respiratory distress to coagulation disorders and multiorgan failure [2]. Additionally, patients must adapt to substantial lifestyle changes, including relocation for isolation, remote work arrangements, job losses, and altered living conditions [3].

The pandemic continues to demonstrate fluctuating patterns globally. The WHO reported 200.2 million cases in 2021, a significant surge to 424.1 million in 2022, followed by a decline to 68 million in 2023. Southeast Asia ranks fourth among the six global regions, with the number of cases projected to reach 65 million by 2025 [4]. Persistent case numbers correlate with incomplete vaccination coverage hindering herd immunity development [5], compounded by sustained global population mobility [6]. Indonesia is a major contributor to Southeast Asia's fluctuating caseload, with 4,262,720 cases in 2021, which rose sharply to 6,719,815 in 2022 and further increased to 6,821,940 in 2023 [7]. Banten Province demonstrated similar volatility, with positivity rates fluctuating from 9% (2020) to 17.8% (2021) before declining to 8% in 2022, still exceeding the WHO's ≤5% target [8]. South Tangerang city leads Banten's eight regencies/municipalities in terms of the COVID-19 burden, with the number of cases peaking at 27,442 in 2021 after the initial 3,849 cases in 2020 and then decreasing to 3,817 in 2023 [9].

The pandemic has imposed substantial direct and indirect costs on patients, families, healthcare systems, and society. These costs vary significantly according to socioeconomic status, age, disease severity, and the presence of comorbidities [10]. A United States study estimated direct treatment costs for symptomatic COVID-19 patients at approximately $3,045 per infection [11], whereas indirect costs, including productivity losses, reduced purchasing power, and supply chain disruptions, have had profound economic impacts globally [12]. The macroeconomic consequences of the pandemic are staggering. Global Trade Analysis Project modeling estimates worldwide economic impacts of USD 5.8 trillion (6.4% of global GDP) for 3-month containment scenarios and USD 8.8 trillion (9.7% of GDP) for 6-month scenarios [13]. Asian Development Bank projections indicate Southeast Asian losses reaching USD 238 billion, potentially exceeding USD 350 billion in severe scenarios, with ASEAN GDP growth projected at just 1.0% [14].

Nationally, Indonesia's economic losses reached USD 83 million (8.8% of GDP), with average monthly COVID-19 expenditures of USD 226 per case, comprising diagnostic (USD 36), preventive (USD 58), medical (USD 37 for treatment and USD 57 for post-COVID-19 care), and nonmedical (USD 30) costs [15]. Banten Province experienced the deepest economic contraction in Java, at 4.44% in 2021 [16], whereas South Tangerang city recorded a 1.02% constant-price GRDP contraction in 2020, equivalent to 37.6 million USD in economic losses [17].

A comprehensive evaluation of the direct (medical/nonmedical) and indirect costs of COVID-19 provides critical insights for policymakers and health administrators to develop more effective resource allocation and expenditure control strategies, particularly during the postpandemic pandemic period, with ongoing case fluctuations. Despite numerous COVID-19 studies, few have specifically examined economic burdens, presented standardized monetary valuations, or focused on smaller administrative units. This study addresses these gaps through a comparative analysis of the two-year economic burdens borne by COVID-19 patients and municipal governments in South Tangerang city.

MATERIALS AND METHODS

Study design

This study employed a descriptive quantitative design with retrospective analysis to examine the patient characteristics and economic burdens of COVID-19 patients from 2021–2022 without

intervention. Using medical records and billing data from South Tangerang General Hospital, we analyzed numerical data on 1) age distribution (adolescents 10–18; adults 19–59; elderly ≥60), 2) sex (male/female), 3) length of stay (1–5 days: short; 6–10: moderate; >10: long), 4) payment methods (National program of COVID-19 or JKN-BPJS), and 5) direct medical costs (treatment, laboratory, physician fees, nursing care, room charges). Variables were measured via the following: 1) ordinal for age and hospitalization duration [18], 2) nominal for sex and payment methods [19], and 3) ratio converted to ordinal (via median split) for cost analysis [20].

Population and sampling

The study population comprised all COVID-19 inpatients (234 in 2021 and 220 in 2022) at the South Tangerang General Hospital. Total sampling was applied, utilizing complete medical and billing records without exclusion criteria [21].

Data collection

Secondary data were extracted from hospital medical records and billing documents (2021–2022) through 1) data editing for completeness, 2) coding (e.g., 1=male, 2=female), 3) computerized processing, 4) quality verification, and 5) tabular presentation [22–24].

Statistical analysis

This study employs a frequency distribution for descriptive analysis of patient characteristics [24] and assesses the cost of illness for financial burden by calculating medical costs from hospital and patient perspectives [25]. In addition, for comparative analysis, this study used the Mann–Whitney U test for ordinal variables (age, length of stay) [26], the chi-square test for nominal variables (sex, payment method) [27], and cost comparisons via median categorization (high/low expenditure) due to a nonnormal distribution [28].

Ethical considerations

This study was approved by the Ethics Committee for Medical and Health Research at Universitas Gadjah Mada. The document in question is an acceptance letter with reference code KE/FK/1319/EC/2023.

RESULTS

Characteristics of patients diagnosed with COVID-19

Table 1 presents a comprehensive analysis of patient characteristics categorized by age, sex, length of hospitalization, and payment method, comparing data between 2021 and 2022. A striking demographic shift is evident, with the dominant age group transitioning from patients over 60 years (54.7%) in 2021 to the 19–59 years age group (56.4%) in 2022. Gender distribution analysis revealed a significant increase in female patients, from 50.4% in 2021 to 59.5% in 2022.

The duration of hospitalization (length of stay) has dramatically changed: in 2021, nearly all patients (97.9%) were hospitalized for more than 10 days, whereas in 2022, the majority (66.8%) experienced shorter stays of 1–5 days. Payment methods also demonstrated significant adjustments, with a sharp decline in National COVID-19 Program utilization from 99.6% in 2021 to 47.3% in 2022, contrasted with a substantial increase in Indonesian National Health Insurance *(BPJS)* usage from 0.4% to 52.7%. These trends highlight the evolving patient demographics and healthcare financing patterns during the study period.

These differences were statistically supported by the chi-square and Mann–Whitney U test results. For age, the alternative hypothesis (Ha) was accepted, with a p value (0.000) < α (0.05), indicating significant differences between 2021 and 2022 COVID-19 patients. Similarly, gender analysis revealed Ha acceptance ($p=0.033 < \alpha=0.05$), confirming significant interannual differences. Length of stay also demonstrated Ha acceptance ($p=0.000 < \alpha=0.05$), revealing significant variations in hospitalization duration. Finally, the payment method analysis yielded Ha acceptance ($p=0.000 < \alpha=0.05$), establishing significant differences between the two years.

Table 1. Characteristics of patients diagnosed with COVID-19 (2021–2022)

Patient's Characteristics	2021		2022		p-value
	(N= 234)	%	(N= 220)	%	
Age					
10–18 years old (adolescent)	5	2,1	18	8,1	0,000***
19–59 years old (adult)	101	43,2	124	56,4	
≥ 60 years old (elderly)	128	54,7	78	35,5	
Gender					
Male	119	50,9	89	40,5	0,033**
Female	115	49,1	131	59,5	
Length of Stay					
1 – 5 days	2	0,9	147	66,8	0,000***
6 – 10 days	3	1,2	42	19,1	
>10 days	229	97,9	31	14,1	
Payment Method					
National Program of COVID-19	233	99,6	104	47,3	0,000***
Indonesian National Health Insurance (JKN-BPJS)	1	0,4	116	52,7	

Remarks: The data is normally distributed, with significant p-values (p<0.05) and highly significant p-values (p<0.01).

Direct costs of COVID-19-diagnosed patients

Table 2 provides a detailed breakdown of the direct cost components, including expenses related to medications, laboratory services, medical support, physician procedures, nursing care, inpatient room charges, and mortuary services, along with their minimum, maximum, and average values in USD. In 2021, nursing care emerged as the component with the highest expenditure, with an average of USD 318, indicating that it constituted the most substantial cost burden during patient treatment. Pharmaceutical costs ranked second, at an average of USD 268, reflecting the significant pharmacological requirements for COVID-19 management. The inpatient room charges are followed at USD 142, and physician procedures are followed at USD 77. Laboratory services averaged USD 47, and medical support costs stood at USD 22. The lowest expenditure was recorded for mortuary services, at an average of USD 3, which is applicable only in cases of mortality. Conversely, the 2022 data revealed reductions across nearly all cost components compared with those in 2021. Although nursing care remained the highest expense, its average decreased substantially to USD 89. The medication costs decreased from USD 268 to USD 75. Laboratory expenses were the third highest at USD 56, followed by physician procedures (USD 13) and inpatient rooms (USD 12). Medical support costs declined to USD 8 on average, with mortuary services showing zero average cost, indicating that no such charges were incurred.

Table 2. Direct costs of COVID-19-diagnosed patients (2021–2022)

Costs payment	2021			2022			p-value
	Min (USD)	Max (USD)	Mean (USD)	Min (USD)	Max (USD)	Mean (USD)	
Medications	2	1.438	268	0	554	75	0,000***
Laboratory services	2	487	47	5	174	56	
Medical support	8	494	22	7	37	8	
Physician procedures	3	551	77	5	48	13	
Nursing care	10	1.999	318	10	1.615	89	
Inpatient room charges	15	428	142	8	107	12	
mortuary services	0	133	3	0	0	0	
Total costs	**69**	**3.676**	**879**	**61**	**2.024**	**253**	

Remarks: The data is normally distributed, with significant p-values (p<0.05) and highly significant p-values (p<0.01).

DISCUSSIONS

Advanced age is a significant risk factor for severe COVID-19 outcomes, although numerous studies have inadequately addressed age-dependent disease dynamics [29]. This investigation revealed a statistically significant demographic transition, with the predominant patient cohort shifting from elderly individuals (2021) to working-age adults (2022). These findings align with Peng et al.'s [30] documentation of age-related epidemiological transitions and reflect Indonesia's national case trends, where there were 418,534 elderly cases in 2021 [31] compared with 4,994,752 adult cases in 2022 [32].

The observed age-specific case transition between 2021 and 2022 appears to be influenced by behavioral and biological factors. A German study [33] associated a higher incidence among working-age populations with greater community exposure, whereas age-related immunosenescence explained the elevated vulnerability in those aged ≥50 years. Moscow-based studies [34] further substantiate these patterns, demonstrating that infection rates in younger cohorts correlate strongly with mobility patterns rather than comorbidities.

This study reveals evolving gender disparities, with female cases increasing from 50.4% (2021) to 59.5% (2022). These findings corroborate Anchocea et al.'s [35] reports of sex-based differential susceptibility and mirror European data showing a 63% female predominance among 417 cases [36]. The heightened olfactory/gustatory dysfunction in females [37] may partially explain this disparity, although the underlying biological mechanisms require further investigation. Notably, women's pandemic vulnerability stems from two factors: (1) overrepresentation in caregiving roles and frontline health occupations and (2) systemic gender inequities in healthcare access and policy representation [38]. These results contrast with Indonesian Ministry of Health reports [32] and studies demonstrating a 2.4-fold higher mortality risk in males [39], a reduced likelihood of ICU admission in females [40], and a greater prevalence of COVID-19-exacerbating comorbidities in males [41].

Hospital length of stay (LOS) showed a marked transformation, transitioning from prolonged admissions (2021) to abbreviated care periods (2022). This aligns with Australian findings [42] of improved clinical protocols but diverges from Aceh's observations of extended LOS among elderly males [43]. Multivariate analyses identify comorbidity burden, smoking status, disease severity, BMI, and laboratory markers as key LOS determinants [44]. The financing paradigm shifted substantially from exclusive National COVID-19 Program coverage (99.6% in 2021) to hybrid Indonesian National Health Insurance (*BPJS Kesehatan*) (52.7% in 2022). This mirrors global trends where emergency funding mechanisms [45] gradually transitioned to sustainable structures, as evidenced by the African Union [46] and Chinese [47] pandemic responses.

A comprehensive cost evaluation revealed that nursing care was the principal expenditure (USD 318 average, 2021), followed by pharmaceuticals (USD 268). By 2022, average costs declined significantly (USD 253 vs. USD 879 in 2021), which is consistent with Singaporean trends [48]. Comparative analyses position Indonesia's per-patient costs (USD 3,676 in 2021; USD 2,024 in 2022) between Southeast Asian peers (Thailand: USD 2,860 [49]; Philippines: USD 1,041–4,156)[50]) and developed nations (US: USD 13,072 [51]; China: USD 3,328 [52]. The financial burden equating to 10.07 times greater than Indonesia's average monthly wage (USD 350) [53] underscores the urgent need for 1) strengthened health system financing preparedness, 2) gender-responsive pandemic policies, and 3) cost-containment strategies for prolonged hospitalizations.

The findings demonstrate that the direct cost burden of COVID-19 extends beyond the healthcare sector, significantly impacting public and private sector operations. These financial pressures create systemic challenges in all economic domains. Furthermore, socioeconomic consequences disproportionately affect vulnerable populations, exacerbating existing health and economic disparities with far-reaching implications for human welfare. This study is subject to several methodological constraints, including the exclusion of indirect and intangible cost components and reliance on descriptive and comparative analytical approaches. In addition, future research should build upon these findings by incorporating multidimensional cost analyses, advanced econometric modeling, and longitudinal impact assessments to establish a more robust evidence base for formulating pandemic-responsive policies.

Public health implications

The demographic transition from elderly to working-age populations requiring COVID-19 hospitalization represents a fundamental shift requiring targeted public health interventions for economically active individuals while maintaining protective measures for elderly populations. Healthcare systems must recalibrate resource allocation strategies to address the evolving patient profile, particularly increased female representation and shortened hospitalization periods, alongside the transition from exclusive government COVID-19 program funding to hybrid insurance coverage models that demand strengthened health insurance frameworks capable of managing fluctuating case volumes. Acknowledgments The substantial reduction in direct medical costs from USD 879 to USD 253 per patient demonstrates improved clinical efficiency. However, the financial burden remains approximately ten times greater than the average Indonesian monthly wage, indicating persistent economic vulnerability that necessitates increased nursing workforce capacity, specialized training programs, and the integration of sex-disaggregated data collection into routine surveillance systems to inform evidence-based policy decisions addressing gender-specific vulnerability patterns and community exposure risks.

Limitations

This study presents methodological constraints that limit generalizability, including the exclusion of indirect costs, such as productivity losses, and intangible costs, including quality of life deterioration, which constitute significant components of the total economic impact. The single-center retrospective design restricts external validity across different healthcare settings and introduces potential information bias, whereas the two-year temporal scope may not capture longer-term economic implications or seasonal variations in the burden of COVID-19. The absence of control groups limits the ability to attribute the observed changes specifically to COVID-19 rather than the broader evolution of the healthcare system. The conversion of costs to USD using exchange rates at a single time point may not accurately reflect the purchasing power parity or temporal currency fluctuations that affect actual economic burden assessment. Predetermined cost classifications may not capture the full spectrum of healthcare expenditures or account for potential cost shifting between healthcare providers, government programs, and out-of-pocket payments.

CONCLUSIONS

Analysis of COVID-19 direct costs and patient characteristics from 2021–2022 highlighted significant changes in healthcare spending, demographics, and financing. Healthcare costs decreased dramatically, with total expenditures decreasing from an average of USD 879 in 2021 to USD 253 in 2022, driven by reduced nursing care and medication. Patient demographics are shifting, with the dominant age group changing from > 59 years in 2021 to 19–59 years in 2022, and the percentage of female patients increasing from 49.1% to 59.5%. The hospital length of stay is also shorter, with most patients in 2022 staying for 1–5 days compared with longer lengths of stay in 2021. Financing methods are evolving, with reliance on the National COVID-19 program decreasing from 99.6% in 2021 to 47.3% in 2022, while *BPJS* Health rose to 52.7%. These trends underscore the adaptability of the healthcare system to the changing dynamics of the pandemic and emphasize the need for increased financial preparedness to address future health crises sustainably.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

AUTHOR CONTRIBUTIONS

Conceptualization, methodology, software, validation, formal analysis, investigation, data curation, writing - original draft, writing - review & editing, visualization, supervision: WGP.

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DECLARATION OF ARTIFICIAL INTELLIGENCE USE

We hereby confirm that no artificial intelligence (AI) tools or methodologies were utilized at any stage of this study, including during data collection, analysis, visualization, or manuscript preparation. All work presented in this study was conducted manually by the authors without the assistance of AI-based tools or systems.

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