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Cost of Treating Coronavirus Disease 2019 (COVID-19) Patients in Hospitals and Influencing Factors: A Systematic Literature Review

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ABSTRACT

Background: Increasing beds for COVID-19 patients is not a simple matter for hospitals because hospitals cannot directly increase the number of existing beds due to limited facilities, infrastructure, equipment, and resources. Careful calculations are needed in terms of preparing the room and treating COVID patients, especially the estimated costs needed to treat COVID patients in the hospital. This expenditure is important so that it can be an illustration of the hospital how much expenditure is needed. This study aimed to determine the number of costs incurred for treating COVID-19 patients in hospitals and the factors that influence these costs. **Methods:** This study was conducted by systematic literature review using the PRISMA statement conducted May-June 2021. An article search was conducted on Pubmed, Scopus, Proquest, and Google Scholar with the inclusion criteria, namely research related to the cost of treating COVID-19 patients in hospitals and the factors that influence the amount of these costs. **Results:** A systematic search obtained six articles. Studies vary greatly in study design and perspective included in the cost category. Estimated costs for COVID-19 care range from \$63/day to \$2,990/day. Factors that affect the cost of care include age, previous medical history, degree of infection or severity of COVID-19, length of stay, place of care, and need for a ventilator. **Conclusion:** There is a considerable economic burden associated with the incident of COVID-19. Several factors affect the cost of COVID-19, namely the length of the treatment period and the need for intensive rooms and ventilators.

1. Introduction

Coronavirus disease 2019 or better known as COVID-19, has spread widely throughout the world. On 11th March 2020, WHO declared COVID-19 to be the fifth pandemic after the flu pandemic in 1918. COVID-19 began with cases of pneumonia in the city of Wuhan, China, in late December 2019.¹ Indonesia confirmed a COVID-19 case on 2nd March 2020. Worldwide COVID-19 cases have reached 176,531,720, of which 3,826,181 have died. Currently, the number of COVID-19 in Indonesia has reached 2,156,465 people, and the number of patients

who have died is 58,024 people.²⁻³ Because cases of COVID-19 continue to increase daily, the Ministry of Health of the Republic of Indonesia issued a circular letter number HK 02.01/Menkes/11/2021 concerning increasing the capacity to care for COVID-19 patients in hospitals providing COVID-19 services. Currently, there are 2,979 hospitals throughout Indonesia, and 81,032 beds are prepared for COVID-19 patients, with an average national bed utilization rate of 64.83%. However, if you look specifically at big cities or per province, there are currently several areas where the

average bed utilization is 80 or even 88%. Therefore the Minister of Health is anticipating this by issuing a circular letter that requires all hospitals to increase their capacity. sleep for COVID-19 cases. For areas that enter the red zone, an increase in the number of beds is expected between 30-40%. The request for a circular letter applies to all hospitals, both central and regional government hospitals, private hospitals, as well as TNI-POLRI and ministry hospitals. Not only the usual wards but ICU wards are also expected to increase the number by 25%.⁴

Increasing beds for COVID-19 patients is not a simple matter for hospitals because hospitals cannot directly increase the number of existing beds due to limited facilities, infrastructure, equipment, and resources. The quickest step that can be taken by the hospital is to convert the treatment room, which is usually used for non-Covid patients to be converted into a COVID-19 treatment room and intensive room. Careful calculations are needed in terms of preparing the room and treating COVID patients, especially the estimated costs needed to treat COVID patients in the hospital. This expenditure is important so that it can be an illustration of how much the hospital needs to spend on treating one COVID-19 patient and the factors that influence the increase in financing for the COVID-19 patient so that the hospital can continue to run its operations from claims provided by the government.⁵ The cost of caring for COVID-19 patients is fully borne by the state through the Ministry of Health, where hospitals are treating COVID-19 patients and submitting claims following the instructions and technical claims issued by the Ministry of Health. The payment pattern for COVID-19 is based on the INACBGS (Indonesian Case Base Groups) given top-up according to the length of treatment calculated as cost per day. In order for the financing to be effective and efficient, claims submitted

by the hospital collectively to the Director General of Health Services are copied to the Health BPJS (Social Security Administration Agency) for verification. The process of claiming health services for COVID-19 patients from the Ministry of Health takes a long time, with an average of 1 to 2 months. If an accident occurs *dispute*, then the time needed will be even longer. Late payment of claims for COVID-19 patient care costs will disrupt hospital operating costs, especially in private hospitals. So that the need for operational costs is not disrupted, the hospital must have a reserve fund to cover operational costs.⁶ This study aims to find out the financing of COVID-19 patients who are treated in hospitals both in the regular room and in the intensive care unit, along with the factors that affect the cost of this financing.

2. Methods

This study was conducted using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) protocol. A literature search was conducted on June 15th, 2021, in 4 online scientific databases, namely PubMed, Scopus, Proquest, and Google Scholar. The inclusion criteria used are articles related to the financing of COVID-19 patients who are hospitalized. The full text and articles in English are available. The exclusion criteria used were articles in foreign languages other than English, articles in the form of editorials, reviews, or letters to the editor. Search results from various online databases are compiled using the Endnote 9.2 software. If there are duplicate articles, they will be filtered and removed using the Endnote 9.2 application. All articles with full text were selected by looking at the inclusion and exclusion criteria. Articles that were selected and met the inclusion criteria were then included in data extraction.

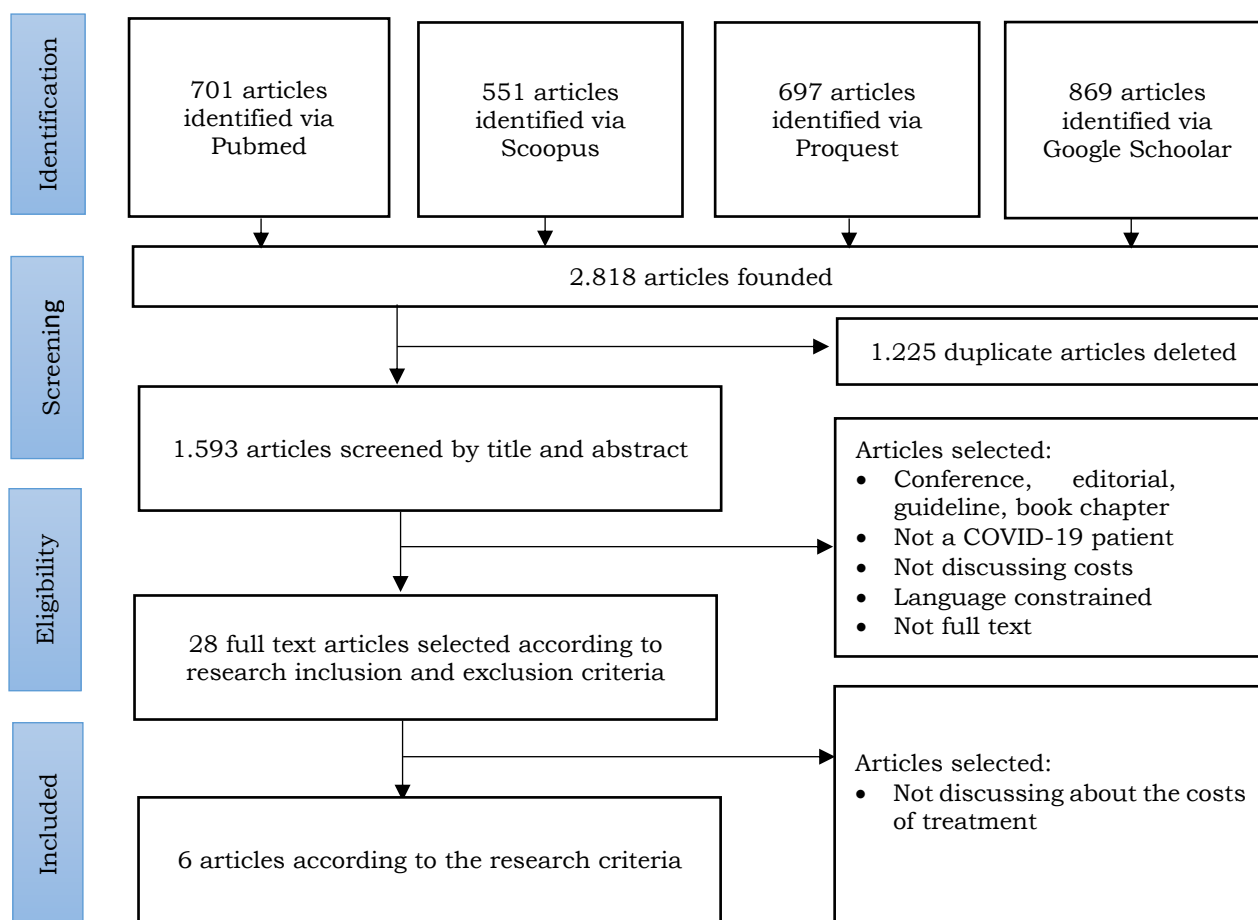


Figure 1. Research PRISMA diagram.

3. Results

Of the 6 studies that were reviewed, each was a 3 retrospective cohort study and a cross-sectional study. Articles were made in Indonesia, China, Kenya, Saudi Arabia, the United States, and the Philippines. Table 1 summarizes the methods and main findings of the 6 reviewed articles. One article represents one country in which the research was conducted. Studies from the United States include direct medical costs according to age group. Studies from Indonesia include the estimated cost based on the length of treatment without looking at other costs. A study from the Philippines lists the expenses for hospitalization of COVID-19 patients with details on which part of the

expenditure is found to be the largest according to the severity of the disease. In the Chinese study, the cost per case was calculated by considering whether the patient had a previous underlying disease or not, and the breakdown of costs was also linked to the details of where the greatest expenses were found. In Kenya itself, the research conducted included costs for hospitalization based on the mild severity of symptoms and based on home-based with details on which part of the largest expenditure is found.⁷⁻¹⁰ While most of the authors do not explicitly state the perspectives taken, and the authors conclude that most of the perspectives are taken from the health care system.

Table 1. Characteristics of articles that meet the inclusion criteria.

No	Research title	Researchers	Design study	Key results	Factor affecting
1	Cost estimate related to COVID-19 Treatment in Indonesia: What should be concerned? (2020) (Q3)	SP jati, Budiyono, RT Budiyanti, Suhartono, P Ginandjar, A Sritami, N Nandini.	Cross-sectional	Treatment 14 – 28 days: IDR 75.7 – 77.3 million/patient (\$5.318 - \$ 5.430)	Length of stay Treatment in ICU Ventilator use
2	Treatment of Coronavirus disease 2019 in Shandong, China: a cost and affordability analysis. (2020) (Q1)	Xue Zheng Li, Feng Jin, Jian-Guo Zhang, Yun-Feng Deng, Wei Shu.	Retrospective cohort	\$6,827 per treatment	Age, previous illness, disease severity
3	Examining unit cost for COVID-19 case management in Kenya. (2020) (Q1)	Edwine Barasa, Angela Kairu, Marybeth Miritim,	Cross-sectional	Mild-moderate cases: \$63/day. Severe case: \$124/day. Critical case: \$599/day.	Disease severity
4	Survival and estimation of direct medical cost of hospital COVID-19 patients in the Kingdom of Saudi Arabia. (2020) (Q2)	Anas AKhan, Yazed AlRuthia, Bander Balkhi, Sultan MA, Mhani Temsah, Saqer MA, Yousef MA	Retrospective cohort	Regular space: \$1,384/day Regular room+MV: \$1,948/day ICU: \$2,082/day ICU+MV: \$2,990/day	Treatment level and length of treatment
5	The potential health care costs and resource use associated with COVID-19 in the United States. (2020) (Q1)	Sarah MB, Marie CF, James AM, Kelly JO, Patrick TW, Sheryl SS, Bruce YL	Cross-sectional	Age appropriate: 0-17: \$11.367 18-44: \$13.132 45-64: \$15.943 65-84: \$14.859 >85: \$11.900	Degree of infection (severity of disease), age, treatment room.
6	Hospitalization expenditure of COVID-19 patients at the University of the Philippine General Hospital (UP-PGH) with PhilHealth Coverage. (2021) (Q4)	Scarlett Mia S, Tabunar, MD, MHA, Tamara Michelle P Mastered, MD	Retrospective Cohort	<i>Mild:</i> \$914.20 <i>Moderate:</i> \$2.976 <i>Severe:</i> \$6.930 <i>Critical:</i> \$16.340	Age, degree of disease,

Health components are considered directly, and estimates of indirect costs vary between studies. For estimates of direct costs, most studies include costs

related to inpatient hospital care, physician services, medications, and diagnostic laboratory tests

Table 2. Components of direct health costs for COVID-19.

No	Researchers	Inpatients	Doctor service	Drug	Other therapy	Lab	Other supporting examination	Transportation	PPE
1	Jati et al	√							
2	Li, et al	√		√	√	√	√	√	
3	Barasa, et al			√	√	√	√		√
4	Khan, et al	√	√	√	√	√	√	√	
5	Bartsch et al	√							
6	Tabuñar, et al	√	√	√		√	√	√	

In several studies reviewed, the components of health costs are attached in various versions. Research by Bartasch et al. in the United States included direct medical costs according to the degree of disease.⁸ Most of them list the cost as the cost of daily hospitalization, both regular hospitalization, and intensive care. Some studies include costs that are more specific to the cost of PPE used by health workers, such as the study by Barasa et al. in Kenya⁹ (Table 2).

The costs of COVID-19 patients who are hospitalized in the research reviewed are written in average costs, and these costs are converted from the currency of the country concerned to the national currency, namely USD. Two articles perform calculations based on claims paid by the government. But there are those who include charity funds/donations, as in a study by Tabuñar in the Philippines.¹¹ The amount of maintenance costs incurred varies. Based on several reviewed studies, it is known that the lowest estimated cost per day for treating COVID-19 patients comes from Kenya, with mild-moderate cases of \$63/day, severe cases of \$124/day, and critical cases of \$599/day. In Saudi Arabia, the cost of treating COVID-19 cases ranges from \$1,384/day to \$2,990/day, depending on the type of treatment room. Tabuñar, in his research, stated that the estimated daily cost of treating COVID-19 cases ranged from \$914.20 to \$16,340. In Indonesia alone, treatment for COVID-19 costs an average of \$5,318 - \$5,430 for 14-28 days of treatment. In China, treating COVID-19 patients costs \$6,827 per treatment. Bartsch, in a study in the

United States, found that the average estimated cost of treating COVID-19 patients was \$ 11,367 to \$ 15,943 during treatment. (Table 1).

Research by Tabuñar et al., the top three sources of costs and expenses for charity/donation patients are pharmacy (18.06%), use of personal protective equipment (PPE) (17.42%), and laboratories (16.82%) which are almost parallel to patients without guarantees (personal payments), namely laboratories (19.02%), pharmacies (15.01%), use of PPE (12.99%). Payments for doctors' professional fees recorded the highest coverage for both patient classifications, 37.81% for charity wards and 35.66% for private wards.¹¹ In Li et al.'s study in China, the largest financing was in prescribing drugs (45.1%) and other therapies (29.2%), with lab tests as the third order (19.0%).¹⁰ This is different from the study by Barasa et al. in Kenya, where the largest expenses related to treating COVID-19 patients were differentiated based on the degree of illness. For patients with mild-moderate symptoms, the biggest expenditure was on the use of PPE (51.7%), payment of health staff (17.71%), and facilities and infrastructure (28.31%). For severe symptoms, the biggest funding is for medicines (35.03%), use of PPE (28.10%), and facilities and infrastructure (14.48%). For patients with critical conditions, it is more focused on financing health staff (46.19%), use of PPE (32.04%), and medicines (9.48%).⁹

Based on several studies that have been conducted, it can be concluded that there are several influencing factors that cost financing the treatment of COVID-19 patients. According to Jati et al., in general,

the cost of caring for COVID-19 patients is influenced by the length of stay, and the need for intensive rooms and ventilators, with a cost range of \$5,318 - \$5,430 for 14-28 days of treatment. Intensive room use is also associated with the severity of the disease, which is also associated with high costs of treatment.⁷ This is also almost similar to research by Khan et al. in Saudi Arabia, where the level and length of treatment affect the cost of treating COVID-19. The need for better inpatient rooms accompanied by mechanical ventilators has also increased costs for treating COVID-19 patients. This can be seen by comparing the cost of care per day spent during COVID-19 care ranging from \$1,384/day to \$2,990/day.¹² Li et al., in their research, said that age and previous illness also affect the level of financing. Increasing age affects COVID-19 financing ($p=0.002$). Previous medical history also greatly influenced financing for COVID-19 management ($p<0.001$)¹⁰

4. Discussion

An understanding of the structure of spending during the treatment of COVID-19 patients is needed to estimate the estimated economic burden related to the government budget. In its journey, systematic review This study is expected to be able to estimate the costs incurred to treat COVID-19 patients in various degrees of severity, namely without symptoms, with mild symptoms, with moderate-severe symptoms, and critical conditions, patients who do not use respirators and patients who use respirators in intensive care units. This estimate can be used by hospitals for planning and allocating funds by implementing cost-effectiveness as the opening of new treatment rooms and management interventions for COVID-19 patients.

Several studies show that the COVID-19 pandemic has placed an additional economic burden on health services due to the loss of a number of potential benefits from actions that were commonly carried out before the pandemic. One of its forms is the postponement of various elective procedures, such as hip and knee joint replacements, during the COVID-

19 pandemic.¹³ In addition, overall, there were cancellations of up to 43% of elective surgical procedures and 40% of procedures in primary care clinics.^{14,15} The cost of health services during the COVID-19 pandemic showed very high figures, both in low, lower-middle, and upper-middle-income countries. A modeling study shows that the economic value needed to respond to this pandemic is US\$ 52.45 billion at a per capita cost of around US\$ 8.6. The main components that must be financed are human resources, commodities, and the place of service itself.¹⁶ Most COVID patients are asymptomatic or develop mild to moderate symptoms. In several studies from Asia, Europe, and the United States that only about 15% develop severe symptoms, and about 5% enter a critical condition and must be treated in the intensive care unit because they use mechanical ventilation and have complications.¹⁷

Funding also varies in each country with the same goal, even though the allocation is slightly different. Research by Tabuñar et al., the top three sources of costs and expenses for charitable patients are pharmacies, use of personal protective equipment (PPE), and laboratories.¹¹ In the study of Li et al. in China, the largest funding lies in prescribing drugs (45.1%) and other therapies (29.2%), with lab tests as the third order (19.0%).¹⁰ Steep hospital bills have been reported during the early part of the pandemic reaching up to millions of pesos (~> USD 20,000) when admitted to private hospitals in urban areas. The main cost drivers for moderate cases typical of private hospitals are pharmaceutical products, room rates, and laboratory tests, including blood tests, x-rays, and COVID test kits.¹⁷ This is different from the study by Barasa et al. in Kenya, where the largest expenses related to treating COVID-19 patients were differentiated based on the degree of illness.⁹ For patients with mild-moderate symptoms, the biggest expenditure was on the use of PPE (51.7%), payment of health staff (17.71%), and facilities and infrastructure (28.31%). For severe symptoms, the biggest funding is for medicines (35.03%), use of PPE (28.10%), and facilities and infrastructure (14.48%).

For patients with critical conditions, it is more focused on financing health staff (46.19%), use of PPE (32.04%), and medicines (9.48%). From this, it can be seen that the biggest need is related to contact issues with patients, both paying for PPE and paying for health staff in handling COVID-19. Therefore, to minimize the costs required, education for self-isolation at home will cut these costs. However, not all asymptomatic patients with mild to moderate symptoms are eligible for self-isolation at home, and some still require hospitalization because they are at high risk (e.g., have co-morbidities) or their home environment is not suitable for self-isolation. This includes individuals living on low incomes in less affluent residential areas. However, the use of self-reporting with mobile technologies, for example, could minimize healthcare worker-patient interactions and substantially reduce staff and PPE costs even for these hospitalized patients. Furthermore, lower cadres of health workers can also be used to monitor patients in central isolation. Other adaptations could target cost drivers such as length of stay and discharge protocols, with patients being discharged as soon as their symptoms progress from severe to mild/moderate. This will also reduce costs that are influenced by the length of stay, as mentioned in several studies reviewed.^{7,9,11}

Various factors also influence spending on health services for COVID-19 patients. Findings in Korea show that the things that influence spending on medical services from an individual patient perspective are age, insurance coverage, level of service in the ICU, CT scan results, and drug use (lopinavir/ritonavir and hydroxychloroquine)¹⁸, plus the patient's comorbid disease status.¹⁰ Various studies show that the severity of the disease related to the care that must be given is one of the main predictors of an increase in the cost of medical services in COVID-19 patients.^{7-13, 17,18} The main expenditure is in the form of drugs,⁹ and doctor services. In addition to drugs, laboratory diagnosis, radiology, bedside, and therapeutic treatment also affect this, taking into account existing comorbid conditions.¹⁰ The use of complete personal

protective equipment accompanied by the use of experimental drugs and the lack of standard management guidelines also played a role in increasing the cost of health services for COVID-19 patients, especially at the start of the pandemic.¹¹ In general, these findings are in line with data that demographic factors, payment methods, hospital characteristics, use of health services, comorbidities suffered¹⁹, and disease complications associated with higher health care costs.²⁰

The age of the patient with a history of previous illness has a strong relationship with an increase in financing. Age is associated with high morbidity, especially in elderly patients. However, in contrast to other studies, older COVID-19 patients tend to require lower costs due to a higher fatality rate.^{8-11,17}

As a response to the increase in COVID-19 cases, the government asked hospitals to open more rooms for the treatment of COVID-19 patients, so hospitals need data on estimated cost usage in managing COVID-19 patients to be able to plan and allocate resources effectively and efficiently according to the financial capacity of the hospital.⁵ The limitation of this study is that the method of calculating the cost of each research is different, so generalizing the data is quite difficult. In addition, the total cost calculation is also not uniform, where there are studies that include charity or donations in the cost calculation.

5. Conclusion

There is a considerable economic burden associated with the incident of COVID-19. Several factors affect the cost of COVID-19, namely the length of the treatment period and the need for intensive rooms and ventilators.

6. References

1. Handayani D, Hadi DR, Isbaniah F, Burhan E, Agustin H. Corona Virus Disease 2019. *J Respir Indonesia*. 2020; 40(2):119-29.
2. Task Force for Handling COVID-19. COVID-19 distribution map. <https://covid19.go.id/peta->

- sebaran, Published on 15th June 2021. Retrieved 15th June 2021.
3. Indonesian CNN. 4 countries that have experienced a surge in COVID-19, Including Indonesia. <https://www.cnnindonesia.com/internasional/20210619105743-106-656555/4-negara-yang-alami-lonjakan-covid-19-termasuk-indonesia>, Published on 19th June 2021. Retrieved 15th June 2021.
 4. Republic of Indonesia Ministry of Health. COVID-19 patients surging, Ministry of Health asks every hospital to add bed supplies. <https://www.kemkes.go.id/article/view/21012300003/pasien-covid-19-melonjak-kementerian-kesehatan-Minta-Every-rs-add-peravailable-place-tidur.html>, Published on 22nd January, 2021. Retrieved June 15th 2021.
 5. Admin PERSI. COVID-19 Cases Spike, Ministry of Health Releases Circular Letter for Hospitals concerning Converting Beds and ICUs, Published on 25th January 2021. Accessed on 10th June 2021.
 6. Admin PERSI. This is how hospitals submit claims for COVID-19 treatment, patients are free of charge and charged to BNPB. <https://persi.or.id/inilah-cara-rs-ajukan-klaim-perawatan-covid-19-pasien-bebas-biaya-dan-dibebankan-pada-bnpb/>, Published on 4th June 2021. Retrieved 10th June 2021.
 7. Sutopo PJ, Rani TB, Ginandjar P, Sariatmi A, Nandini N. Cost estimates related to COVID-19 treatment in Indonesia: What should be concerned? In: Warsito B, Sudarno S, Putranto TT, editors. E3S Web of Conferences. Semarang: E3S Web of Conferences; 2020; 12012.
 8. Bartsch SM, Ferguson MC, McKinnell JA, O'shea KJ, Wedlock PT, et al. The potential health care costs and resource use associated with COVID-19 in the United States: A simulation estimate of the direct medical costs and health care resource use associated with COVID-19 infections in the United States. *Health Aff.* 2020; 39(6): 927–35.
 9. Barasa E, Kairu A, Maritim M, Were V, Akech S, et al. Examining unit costs for COVID-19 case management in Kenya. *BMJ Globe Heal.* 2021; 6(4): e004159.
 10. Li X-Z, Jin F, Zhang J-G, Deng Y-F, Shu W, et al. Treatment of coronavirus disease 2019 in Shandong, China: a cost and affordability analysis. *Infect Dis Poverty.* 2020; 9(1): 1–8.
 11. Tabuñar SM, Dominated TM. Hospitalization expenditure of COVID-19 patients at the University of the Philippines-Philippines General Hospital (UP-PGH) with PhilHealth Coverage. *Act Med Philipp.* 2021; 55(2).
 12. Khan AA, AlRuthia Y, Balkhi B, Alghadeer SM, Temsah M-H, et al. Survival and estimation of direct medical costs of hospitalized COVID-19 patients in the Kingdom of Saudi Arabia. *Int J Environ Res Public Health.* 2020; 17(20): 7458.
 13. Carroll NW, Smith DG. Financial implications of the Covid-19 epidemic for hospitals: A case study. *J Health Care Finance.* 2020.
 14. Hübner M, Zingg T, Martin D, Eckert P, Demartines N. Surgery for non-COVID-19 patients during the pandemic. *PLoS One.* 2020; 15(10): e0241331.
 15. Rubin R. COVID-19's crushing effects on medical practices, some of which might not survive. *JAMA.* 2020;324(4):321–3.
 16. Edejer TT-T, Hanssen O, Mirelman A, Verboom P, Lolong G, et al. Projected healthcare resource needs for an effective response to COVID-19 in 73 low-income and middle-income countries: a modeling study. *Lancet Glob Heal.* 2020; 8(11): e1372–9.
 17. Jordan RE, Adab P, Cheng KK. COVID-19: risk factors for severe disease and death. *BMJ.* 2020; 368: m1198.

18. Jang SY, Seon J-Y, Yoon S-J, Park S-Y, Lee SH, et al. Comorbidities and factors determining medical expenses and length of stay for admitted COVID-19 patients in Korea. *Risk Manag Healthc Policy*. 2021; 14.
19. Thavorn K, Maxwell CJ, Gruneir A, Bronskill SE, Bai Y, et al. Effect of socio-demographic factors on the association between multimorbidity and healthcare costs: a population-based, retrospective cohort study. *BMJ Open*. 2017; 7(10): e017264.
20. Chaikledkaew U, Pongchareonsuk P, Chaiyakunapruk N, Ongphiphadhanakul B. Factors affecting healthcare costs and hospitalizations among diabetic patients in Thai public hospitals. *Value Heal*. 2008; 11: S69-74.