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Variation and Predictors of COVID-19 Mortality in Hospitalized Cases in West Sumatra Province, Indonesia: A Retrospective Observational Study

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Abstract

During 2020, the year of the COVID-19 pandemic, different Indonesian provinces had different numbers of COVID-19 infections and fatalities, particularly in West Sumatra Province. This study aimed to investigate the variation of confirmed COVID-19 cases and determine predictors of mortality in hospitalized patients across districts in West Sumatra Province. A retrospective observational study was conducted during the COVID-19 pandemic. From March 2020 to June 2021, 46,005 confirmed cases were collected in the province, of which 42,308 were hospitalized and analyzed. Confirmed cases and deaths were compared by geographic location using spatial analysis. The risk predictors of death were estimated using logistic regression. COVID-19 incidence and mortality varied across cities/districts, with less than 1,000 confirmed cases appearing to be the lowest number. A distinct pattern was visible nonetheless when the incidence density of confirmed cases and deaths was higher. Acute respiratory distress syndrome during the COVID-19 treatment had a higher risk of death (OR = 75.2, 95% CI: 25.6–250). The most significant predictors of death in terms of comorbidity were pneumonia, followed by cancer, chronic obstructive pulmonary disease, diabetes, cardiac disease, and hypertension.

Keywords: comorbidity, COVID-19, pandemic, prevention, risk factor

Introduction

SARS-CoV-2 spread rapidly from its origin in Wuhan, China, to many countries worldwide since its emergence in December 2019. It resulted in a global pandemic within three months only, as the World Health Organization announced the coronavirus disease 2019 (COVID-19) pandemic in March 2020.[1] The total confirmed cases shortly reached 213,050,725 cases, including 4,448,352 deaths, as of August 26, 2021.[2]

Indonesia is no exception to the COVID-19 pandemic, reaching a total of 765,350 confirmed cases with 22,734 deaths as of December 28, 2020.[3] A five-fold increase of confirmed cases and deaths due to COVID-19 occurred eight months later, to 4,008,166 cases and 128,252 deaths as reported on August 28, 2021.[3] Furthermore, the pandemic curve seemed to be lifted significantly from June to August 2021 due to the massive spread of the delta variant of COVID-19 in the country.[4]

Two months after the pandemic outbreak in India from January 2021 to May 2021,[5] Indonesia was named the new epicenter of the pandemic in Asia and contributed the highest number of cases globally during June 12–18, 2021, surpassing the United Kingdom, Brazil, India, and the United States.[6] The COVID-19 cases and death numbers vary across provinces in Indonesia. The highest numbers were reported in Java and Bali, two islands where most of the population live. However, the ongoing number of cases and deaths reported in other provinces could not be disregarded in this developing country with a decentralized government.[7,8] The variation in the number of cases and deaths across cities/districts or provinces may reflect the local government's response in following the national policy on pandemic control. It differs according to their coordination and decision-making capacity, which may decelerate the national agenda to address this pandemic.[9]

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The COVID-19-related deaths in developing countries are critical, even though the numbers are likely an underestimate of actual deaths.[10,11] From a public health perspective, deaths due to a novel virus reflect the severity of the disease in the community, the population at risk, the readiness of the health system, and the quality of health care.[12] Fewer studies on COVID-19 mortality in low and middle-income country (LMIC) settings have been published, discussing factors associated with COVID-19 mortality, analyzing one-month COVID-19 cases in Iran,[13] population-level indicators in Africa,[14] mortality in children,[15] and demographic and clinical factors of the COVID-19-related deaths in Jakarta, Indonesia.[16]

However, previous studies did not include a large cohort of hospitalized patients of COVID-19 in their analysis since the beginning of the pandemic, and none of those studies revealed whether COVID-19 mortality indicators varied across areas in the LMIC settings. To direct the medical interventions and public health policy during the COVID-19 pandemic, it was essential to assess mortality rates and predictors of death among hospitalized cases. The necessity to adequately manage resources and save lives was the driving force behind the haste.[17,18]

This study presents a different insight into COVID-19 mortality for a one-year period of the pandemic and contributes to filling the gap in the existing literature concerning COVID-19-related deaths in LMIC. This study aimed to investigate the variation of confirmed COVID-19 cases and determine predictors of mortality in hospitalized patients across cities/districts in West Sumatra Province, Indonesia. This study emphasizes the importance of understanding comprehensive mortality patterns and risk factors to serve public health strategies in responding to and controlling pandemics.

Method

This retrospective observational study was conducted in collaboration with the West Sumatra Provincial Health Office and the Faculty of Public Health, Universitas Andalas. Data recorded by the West Sumatra Provincial Health Office through the Epidemiological Surveillance System for Viral Respiratory Diseases were analyzed. The study population of confirmed cases of COVID-19 admitted to the hospital from the beginning of the pandemic on March 2020 to June 7, 2021, as confirmed by laboratory tests of the real-time PCR (RT-PCR) assay for SARS CoV-2.

Data collection involved the entire provincial government health authority network, from primary health care (PHC) in each subdistrict, across cities/district health offices, public and private hospitals, and laboratories to the provincial health office. The RT-PCR results from the laboratories were delivered to and verified by the city and district health offices to ensure whether the confirmed case was registered as residents of their respective cities and districts. Demographic, contact records, symptoms, and clinical data were recorded by 279 PHCs for self-quarantined cases and by hospitals for hospitalized cases. These data were then recorded by the respective city and district health offices and forwarded to the provincial health offices to be compiled and reported to the Indonesian Ministry of Health for the national database.

A total of 46,005 confirmed cases from March 2020 to June 7, 2021, were collected in West Sumatra Province, from which 42,308 cases were hospitalized and analyzed in this study. A total of 3,697 cases were excluded from the analysis of this study for several reasons, including having died in a private or public isolation center, an unknown place of death, and still being hospitalized at the time of analysis (Figure 1).

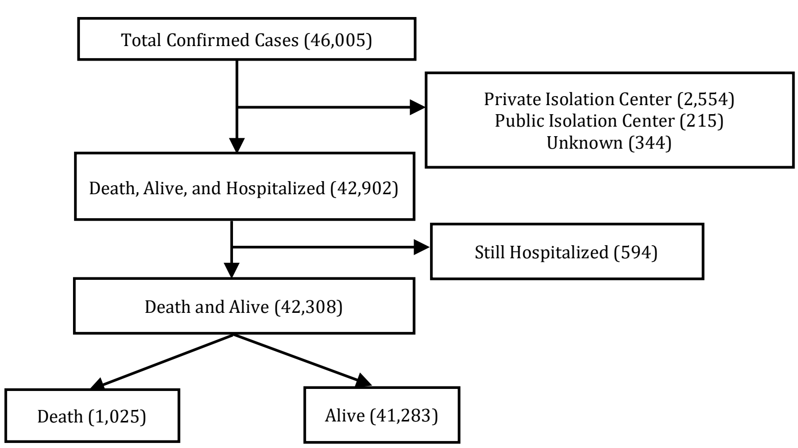

Figure 1. Study Flowchart of the Number of Cases

Treatment outcomes were categorized as patients alive (discharged alive) and deceased (dead). For analysis purposes, only one episode of hospitalization for patients discharged and then readmitted within the study period was considered. The discharged alive is defined as confirmed COVID-19 cases who recovered from the disease, as evidenced by negative COVID-19 RT-PCR laboratory results; no symptoms for three consecutive days; met discharge criteria based on comprehensive medical assessment including radiology and blood tests; and approved by a physician.[19] Deceased is defined as discharge due to the death of a patient with COVID-19.

Patient characteristics and severity variables during the course of the disease covered in this study were sex (categorized as male and female), age (in years), employment status (categorized as employed, unemployed, and unknown), and pregnancy (for females). Closed contact was defined as a person with a record of face-to-face contact within a one-meter distance for at least 15 minutes, or having direct physical contact such as shaking and holding hands, or providing direct medical treatment or care without appropriate and standard personal protective equipment or other situations indicating contact based on risk assessment by local epidemiologists, with probable or confirmed cases within two days before to 14 days after symptom onset for symptomatic cases and within two days before to 14 days after the date of the swab examination for asymptomatic case.[19]

Contact records with a suspect of COVID-19 were defined as similar records of contact with a suspect case (a person with one of three criteria: having acute infection of the respiratory tract and having travel history to a place with local transmission in 14 days prior to the infection; showing at least one acute infection of respiratory tract signs or symptoms and having contact with a probable or confirmed case in 14 days prior to the onset of signs or symptoms; and having severe infection of the respiratory tract or severe pneumonia, needing medical treatment in hospital, and no other cause based on convincing clinical features.[19] Travel history was defined as domestic or international travel history within the last 14 days before the onset of signs or symptoms. In addition, vaccination status was categorized as fully vaccinated if receiving two doses of the COVID-19 vaccine, not fully vaccinated if receiving only one dose, and unvaccinated. Symptoms (anosmia, cough, fever, dyspnea, diarrhea) and comorbidities (hypertension, diabetes, heart disease, cancer, asthma, and chronic obstructive pulmonary disease (COPD)) during hospitalization were defined as diagnoses included in the medical record. Severe conditions were critical complications requiring close monitoring and prompt medical intervention in the course of the disease during hospitalization (pneumonia and acute respiratory distress syndrome (ARDS)).

The QGIS (desktop version 3.38.1-Grenoble) for cartography was employed to obtain variations and patterns of confirmed COVID-19 cases and deaths. The QGIS was open-source software available under the terms of the GNU General Public License, Copyright (C) 1989, 1991 Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA (https://www.qgis.org). The number of confirmed cases, incidence density of confirmed cases per 10,000, the number of deaths per 100,000, and case fatality ratio (CFR) of confirmed cases (in percentage) were compared by geographic location using spatial analysis, respectively. The CFR of confirmed cases was calculated as the number of deaths divided by the total number of confirmed cases. Incidence density was estimated as the number of confirmed cases divided by the number of permanent resident population.

Variables assessed were sex, age, employment, closed contact, contact records with the suspect, travel history, vaccination status, symptomatic status, comorbidity, and number of comorbidities. For categorical variables, descriptive statistics contained proportions; for continuous variables, they included medians and interquartile ranges (IQRs). A Pearson's Chi-square was utilized to evaluate a relationship between two categorical variables. Medians of two independent samples were compared using the Wilcoxon rank sum test, and the independence of a 2x2 contingency table was tested using Fisher's exact test.

The determined risk factors were calculated using bivariable and multivariable logistic regression models, and the results were reported as an odds ratio (OR) with a 95% confidential interval (CI). In the multivariable models, every independent variable in the bivariable analysis with a p-value of <0.10 was included. The Akaike Information Criterion was used to guide the final model selection. All analyses were performed using R software (version 4.1.1) and R Studio software (version 1.4.1717). R Studio is an open-source user interface for R software. The R software and RStudio are available under the GNU Affero General Public License v3. The AGPL v3 is an open-source license.

Results

Morbidity and Mortality Variation

This study found variations in COVID-19 incidence and death across cities/districts in the West Sumatra Province (Figure 2). The highest number of confirmed cases, over 5,000, was found in Kota Padang, the capital city and the most populous city in the province, with a total case of 20,794 and the incidence density of confirmed cases (more than 240 per 10,000 population). Moreover, the spatial analysis showed several cities and districts: Pariaman, Kepulawan Mentawai, Sawahlunto, and Solok Selatan, which seemed to have the lowest number of confirmed cases (less than 1,000). However, there was a higher incidence density of confirmed cases.

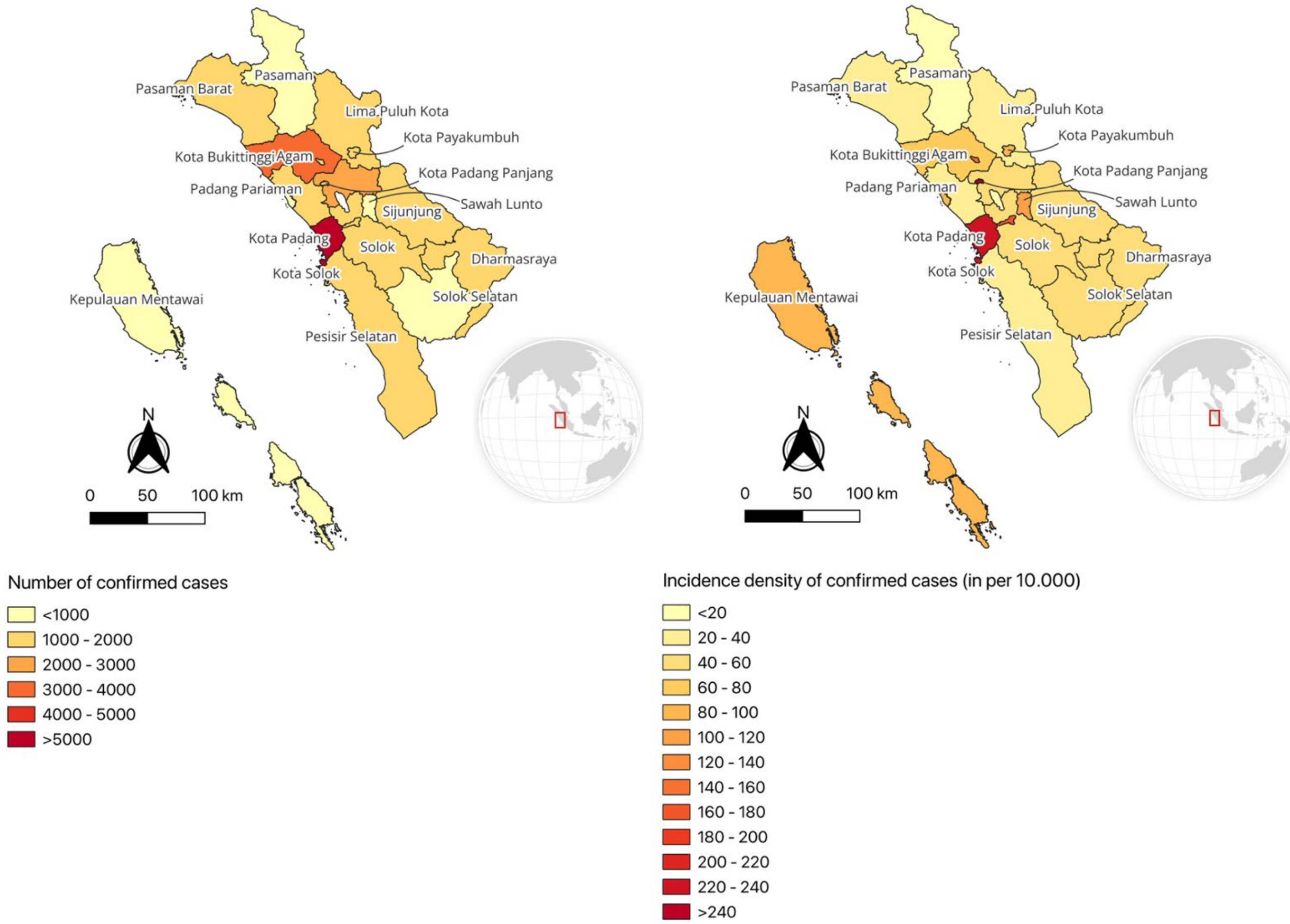

Figure 2. Number of Confirmed Cases and Incidence Density of Confirmed Cases

A different pattern was revealed by the results of spatial analysis for deaths (Figure 3). This study found that 1,025 (2.4%) of the cases analyzed had died. The highest mortality rate was found in Kota Padang (45 to 50 deaths per 100,000 population), followed by Solok, Pariaman, and Sijunjung. Nevertheless, the highest CFR was found in Pasaman and Pasaman Barat (5.1 to 6%), followed by Pariaman, Solok, and Sawahlunto.

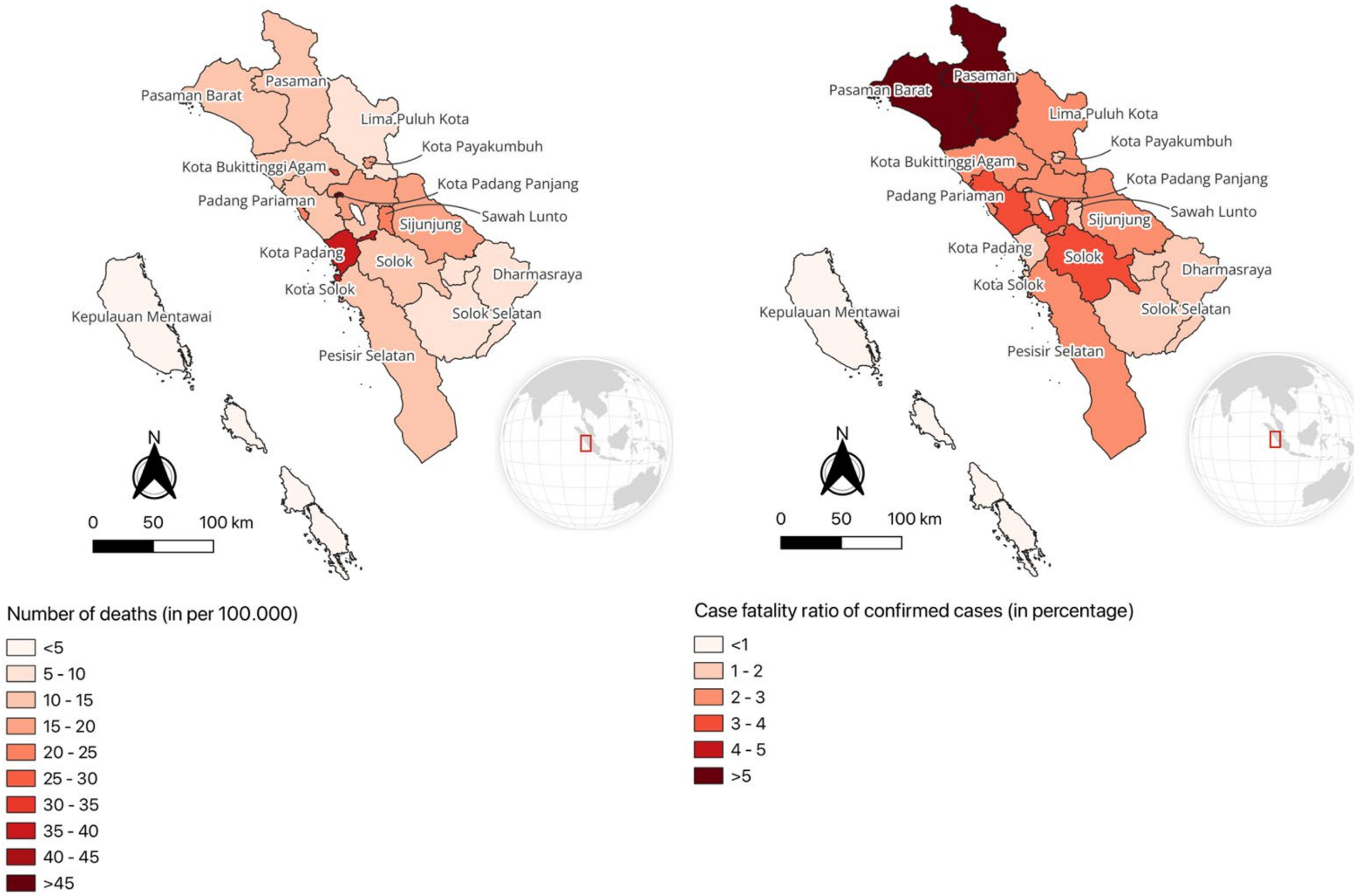

Figure 3. Number of Deaths and Case Fatality Ratio of Confirmed Cases

Demographic, Symptoms, and Clinical Features

Demographics, symptoms, and clinical feature distribution are shown in Table 1. This study analyzed data from 42,308 COVID-19 patients. Of the number of patients, 55% were females, although women were less likely to die from the disease compared to men, having a higher mortality rate. Pregnant women had a lower rate of illness and a reduced death rate compared to other groups. Most patients exhibited symptoms such as fever and cough. Employment status affected outcomes, in which employed individuals showed higher survival rates than those unemployed.

Unvaccinated individuals accounted for the majority of both cases and deaths, while those fully vaccinated experienced significantly fewer cases and fatalities. Diabetes was more common among the dead than in survivors, with a greater likelihood of hypertension. Higher mortality was linked to pneumonia, cancer, and heart disorders. The prevalence of COPD and asthma was low. ARDS was rare but had a notable impact on mortality.

Mortality Predictors

Multivariable analysis showed that men had a higher risk of death compared with women (OR = 1.52, 95% CI: 1.33 to 1.73). The study revealed that among those who develop ARDS during COVID-19 treatment, the risk of death is higher (OR = 75.2, 95% CI: 25.6–250). The most significant predictors of death in terms of comorbidity were pneumonia, followed by cancer, COPD, diabetes, cardiac disease, and hypertension. A COVID-19 case with pneumonia had a 16.2 times higher risk of death than without pneumonia (95% CI: 10.2-25.1). The adjusted ORs for other comorbidities are described in Table 2.

Table 1. Demographics, Symptomatic Characteristics, and Comorbidities of COVID-19 in West Sumatra Province, Indonesia

Characteristic	N = 42,308[1]	Alive, N = 41,283[2]	Death, N = 1,025[2]	p-value[3]
Sex				**<0.001**
Female	23,373 (55%)	22,911 (55.5%)	462 (45.1%)	
Male	18,935 (45%)	18,372 (44.5%)	563 (54.9%)	
Pregnant women	335 (0.8%)	331/41,283(0.8%)	4/1,025(0.4%)	0.14
Median IQR age (years)	36 (24, 51)	35 (24, 50)	61 (54, 70)	**<0.001**
Age interval (years)				
0-10	2,072 (4.9%)	2,067 (5.0%)	5 (0.5%)	
10-19	4,782 (11%)	4,781 (11.6%)	1 (0.1%)	
20-29	8,730 (21%)	8,719 (21.1%)	11 (1.1%)	
30-39	8,269 (20%)	8,232 (19.9%)	37 (3.6%)	
40-49	6,733 (16%)	6,617 (16.0%)	116 (11.3%)	
50-69	6,810 (16%)	6,540 (15.8%)	270 (26.3%)	
60-69	3,416 (8.1%)	3,096 (7.5%)	320 (31.2%)	
70-79	1,126 (2.7%)	940 (2.3%)	186 (18.1%)	
80-89	335 (0.8%)	264 (0.6%)	71 (6.9%)	
90-110	35 (<0.1%)	27 (0.1%)	8 (0.8%)	
Age group				**<0.001**
Infants (1-2 years)	569 (1.3%)	566 (1.4%)	3 (0.3%)	
Children (3-16 years)	4,498 (11%)	4,495 (10.9%)	3 (0.3%)	
Young Adults (17-39 years)	18,786 (44%)	18,738 (45.4%)	48 (4.7%)	
Middle-aged Adults (40-59 years)	13,543 (32%)	13,157 (31.9%)	386 (37.7%)	
Elderly (>59 years)	4,912 (12%)	4,327 (10.5%)	585 (57.1%)	
Employment status				**<0.001**
Employed	38,040 (90%)	37,156 (90.0%)	884 (86.2%)	
Unemployed	1,618 (3.8%)	1,563 (3.8%)	55 (5.4%)	
Unknown	2,650 (6.3%)	2,564 (6.2%)	86 (8.4%)	
Closed contact	21,447 (51%)	21,293/41,283(51.6%)	154/1,025(15.0%)	**<0.001**
Contact record with suspect	7,031 (17%)	6,507/41,283(15.8%)	524/1,025(51.1%)	**<0.001**
Travel history	1,713 (4.0%)	1,668/41,283(4.0%)	45/1,025(4.4%)	0.6
Vaccination status				**0.001**
Fully vaccinated	182 (0.4%)	181 (0.4%)	1 (0.1%)	
Not fully vaccinated	415 (1.0%)	394 (1.0%)	21 (2.0%)	
Unvaccinated	41,711 (99%)	40,708 (98.6%)	1,003 (97.9%)	
Symptomatic status				**<0.001**
Asymptomatic	2,734 (6.5%)	2,716 (6.6%)	18 (1.8%)	
Symptomatic	38,601 (91%)	37,653 (91.2%)	948 (92.5%)	
Unknown	973 (2.3%)	914 (2.2%)	59 (5.8%)	
The number of symptomatic				**<0.001**
0	37,019 (87%)	36,287 (87.9%)	732 (71.4%)	
1	3,053 (7.2%)	2,918 (7.1%)	135 (13.2%)	
2	1,904 (4.5%)	1,793 (4.3%)	111 (10.8%)	
>2	332 (0.8%)	285 (0.7%)	47 (4.6%)	
Anosmia	886 (2.1%)	883/41,283(2.1%)	3/1,025(0.3%)	**<0.001**
Cough	2,918 (6.9%)	2,752/41,283(6.7%)	166/1,025(16.2%)	**<0.001**
Fever	3,571 (8.4%)	3,373/41,283(8.2%)	198/1,025(19.3%)	**<0.001**
Dyspnea	431 (1.0%)	302/41,283(0.7%)	129/1,025(12.6%)	**<0.001**
Diarrhea	62 (0.1%)	60/41,283(0.1%)	2/1,025(0.2%)	0.7
Comorbidity	4,981 (12%)	4,304/41,283(10.4%)	677/1,025(66.0%)	**<0.001**
The number of comorbidities				
0	39,002 (92%)	38,486 (93.2%)	516 (50.3%)	
1	2,639 (6.2%)	2,274 (5.5%)	365 (35.6%)	
2	598 (1.4%)	474 (1.1%)	124 (12.1%)	
>2	69 (0.2%)	49 (0.1%)	20 (2.0%)	
Hypertension	1,455 (3.4%)	1,261/41,283(3.1%)	194/1,025(18.9%)	**<0.001**
Diabetes	1,288 (3.0%)	1,039/41,283(2.5%)	249/1,025(24.3%)	**<0.001**
Cardiac Diseases	563 (1.3%)	477/41,283(1.2%)	86/1,025(8.4%)	**<0.001**
Cancer	236 (0.6%)	170/41,283(0.4%)	66/1,025(6.4%)	**<0.001**
Pneumonia	111 (0.3%)	76/41,283(0.2%)	35/1,025(3.4%)	**<0.001**
Asthma	313 (0.7%)	299/41,283(0.7%)	14/1,025(1.4%)	**0.018**
COPD	59 (0.1%)	43/41,283(0.1%)	16/1,025(1.6%)	**<0.001**
ARDS	20 (<0.1%)	5/41,283(0.0%)	15/1,025(1.5%)	**<0.001**

[1]n (%); Median interquartile ranges (IQR)

[2]n (%); n/N (%); Median interquartile ranges (IQR)

[3]Pearson's Chi-square test; Wilcoxon rank sum test; Fisher's exact test

Notes: IQR = Median interquartile ranges, COPD = Chronic Obstructive Pulmonary Disease, ARDS = Acute Respiratory Distress Syndrome.

Table 2. Comorbidity Predictors of COVID-19 Mortality in West Sumatra Province, Indonesia

	Crude OR[1]	95% CI[1]	p-value	Adjusted OR[1]	95% CI[1]	p-value
Sex						
Female	—	—		—	—	
Male	1.52	1.34, 1.72	<0.001	1.52	1.33, 1.73	<0.001
Hypertension						
No	—	—		—	—	
Yes	7.41	6.26, 8.73	<0.001	3.39	2.78, 4.11	<0.001
Diabetes						
No	—	—		—	—	
Yes	12.4	10.6, 14.5	<0.001	7.31	6.10, 8.72	<0.001
Cardiac Diseases						
No	—	—		—	—	
Yes	7.83	6.14, 9.89	<0.001	3.40	2.57, 4.45	<0.001
Cancer						
No	—	—		—	—	
Yes	16.6	12.4, 22.2	<0.001	11.7	8.33, 16.2	<0.001
Pneumonia						
No	—	—		—	—	
Yes	19.2	12.6, 28.5	<0.001	16.2	10.2, 25.1	<0.001
COPD						
No	—	—		—	—	
Yes	15.2	8.29, 26.5	<0.001	9.24	4.65, 17.4	<0.001
ARDS						
No	—	—		—	—	
Yes	123	47.4, 378	<0.001	75.2	25.6, 250	<0.001

Notes: OR = odds ratio, CI = confidence interval, COPD = Chronic Obstructive Pulmonary Disease, ARDS = Acute Respiratory Distress Syndrome.

Discussion

West Sumatra Province, Indonesia, is located on the West Coast of Sumatra Island and inhabited by more than five million people across cities/districts. Several cities/districts in the province have been identified as having the highest level of COVID-19 risk by the Indonesian Ministry of Health. A total of 85,130 confirmed cases and 1,930 total deaths were reported as of June 2021.[20] A significant increase of new cases and deaths were notified in June and July 2021 in the province, a similar pattern to the national level. Specifically, in the number of deaths, a three-fold increase occurred from 524 deaths in December 2020 to 1,941 deaths reported in August 2021.[20]

The epidemiological details of 42,308 hospitalized COVID-19 cases representing a cohort of cases from one year since the start of the pandemic reported in 19 cities and districts in West Sumatra Province, Indonesia (Table 1). Given that 2.4% of the instances resulted in death, a 2.8% CFR of COVID-19 was recorded nationally as of June 7, 2021 (52,879 deaths of 1,911,358 confirmed cases). By 2.16% of confirmed deaths in the same period, the ratio was greater than the global situation. This study's findings about CFR might be overestimated, especially in the early stages of the pandemic when contact tracing and testing were less likely to be carried out successfully and when reporting cases and fatalities was delayed. In addition, access to testing capacity was still uneven and could also occur due to different response capacities between cities and districts.[21,22]

Comparing the variation in the number of deaths and CFR by cities/districts would provide worthwhile insight to evaluate the severity of the disease among those hospitalized.[17] This study found that the COVID-19 morbidity and mortality patterns differ across cities/districts in the West Sumatra Province. The highest number of confirmed cases and deaths was reported in Kota Padang, the capital city of West Sumatra Province. However, the city was detected as having a lower CFR compared to other districts with a lower number of cases and deaths.

This variation might reflect the difference in terms of capacity between local governments at the city/district level and the central government in terms of case detection and providing quality health care. The higher number of cases and lower CFR in Kota Padang could be explained since Padang is the capital city of the province, where health capacity is better than in other districts. The population wealth indicators are higher in the city, leading to higher awareness of the people towards the pandemic and its preventive measures, including seeking care behaviors.

This study revealed that the median age of confirmed cases was 36 years, and most of them were females. However, this study discovered that the median age of the deceased was 61 years and that the risk of death increased with age. This finding was in line with infection susceptibility and the higher prevalence of comorbidities among older adults, hampering the body's response against the infection.[23] Besides, the proportion of deaths among males was significantly higher than that among females. This result is consistent with the possibility of different immune responses between male and female individuals, leading to different impacts on inflammation.[24]

The low-level coverage of COVID-19 vaccination was found during the study period in the West Sumatra Province, as greater than 95% of cases (both discharge alive and death) remained unvaccinated, while the vaccination coverage (fully vaccinated) at the national level was reported at 7.2% by June 27, 2021. Nevertheless, the proportion of vaccinated among the deceased was significantly lower than that of the survivors. Fever and cough were the most frequent symptoms reported in the West Sumatra Province, similar to Jakarta.[16]

This study revealed evidence that COVID-19 cases developing ARDS during the course of the disease had a higher risk of death compared to those without ARDS. ARDS was found to be one of the major causes of COVID-19-related deaths. However, the pathophysiology of ARDS in COVID-19 was relatively more established compared to the initial period of the COVID-19 pandemic. A systematic review found that the highest specific mortality from COVID-19-associated ARDS was identified by studies in China, Poland, and Spain and during a period of time when there was inadequate knowledge on the management of ARDS in COVID-19 cases.[25] Understanding the characteristics of COVID-19-related ARDS is pivotal to early identification and precise treatment.[26]

This evidence reflected the urgent need for an improvement in local health capacity in terms of management of ARDS in COVID-19 cases in West Sumatra Province, as well as in the global perspective setting. In addition to other predictors, the most significant risk factor was COVID-19 pneumonia. A certain kind of COVID-19 pneumonia is brought on by SARS-CoV-2 and is distinguished by bilateral lung involvement and possible severity. In contrast, regular pneumonia symptoms are similar to COVID-19 pneumonia and can arise from various infections, they are not usually as severe.[27,28] While deciding what the government's actions should implement during the pandemic, the description of mortality rates and mortality predictors is crucial information. Even though the pandemic has been proclaimed over, policies based on thorough epidemiological studies are essential to consider in efforts to control and prevent the spread of COVID-19.[8,29,30]

The weakness of this study was that information on mortality had not been comprehensively audited. The definition of a COVID-19 death was developed for the earliest phase of the pandemic in 2020, but not all COVID-19 deaths met these fixed criteria.[31] A comprehensive audit of COVID-19 deaths is needed in the future. Big data was used for this study; hence, the results inherently lead to significant findings. However, big data offers opportunities and challenges; the significance depends on thoughtful analysis and context.[32,33]

Conclusion

Determining the risk factors and epidemic intensity requires an understanding of the predictors of death in hospitalized COVID-19-verified patients. This study adds to the body of information on the various patterns of COVID-19 incidence and mortality across cities and districts when calculated proportionately and adjusted for the population size and the number of cases found. The top five risk factors for COVID-19 mortality include ADRS and comorbidities in the form of pneumonia, cancer, COPD, diabetes, and heart disease.

Abbreviations

COVID-19: coronavirus disease 2019; LMIC: low- and middle-income countries; RT-PCR: real-time PCR; PHC: primary health care; COPD: Chronic Obstructive Pulmonary Disease; ARDS: Acute Respiratory Distress Syndrome; CFR: Case Fatality Ratio; IQR: interquartile ranges; OR: odds ratio; CI: confidence interval.

Ethics Approval and Consent to Participate

The ethical clearance of the study had been approved by the Ethics Committee of the Faculty of Public Health, Universitas Andalas (Approval Number: No.2/UN.16.12/KEP-FKM/2022).

Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this manuscript.

Availability of Data and Materials

Data and materials are available upon request.

Authors' Contribution

Conceptualization: DD and ASEP; methodology: DD and ASEP; data collection: DD, ASEP, and YP; data preparation: DD, ASEP, and YP; data analysis: DD, ASEP, and YP; interpretation: DD and ASEP; writing—original draft preparation: DD and ASEP; writing—review and editing: DD, ASEP, and YP. All authors have read and agreed to the published version of the manuscript.

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References

1. World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. Geneva: World Health Organization; 2020.
2. World Health Organization. WHO COVID-19 dashboard: World. Geneva: World Health Organization; 2021.
3. World Health Organization. WHO COVID-19 dashboard: Indonesia. Geneva: World Health Organization; 2021.
4. Yu F, Lau L-T, Fok M, et al. COVID-19 Delta variants—Current status and implications as of August 2021. Precis Clin Med. 2021; 4 (4): 287-292. DOI: 10.1093/pcmedi/pbab024.
5. World Health Organization. Novel Coronavirus Disease (COVID-19): Situation Update Report - 65. New Delhi: World Health Organization India; 2021.
6. Ng A. Indonesia reported the highest new Covid cases in the world last week, says WHO. Consumer News and Business Channel (CNBC); 2021.
7. British Broadcasting Corporation (BBC). Covid-19: Indonesia announces lockdown in Java and Bali as cases surge. London: British Broadcasting Corporation (BBC); 2021.
8. Hale T, Angrist N, Hale AJ, et al. Government responses and COVID-19 deaths: Global evidence across multiple pandemic waves. PloS one. 2021; 16 (7): e0253116. DOI:10.1371/journal.pone.0253116.
9. Djalante R, Lassa J, Setiamarga D, et al. Review and analysis of current responses to COVID-19 in Indonesia: Period of January to March 2020. Prog Disaster Sci. 2020; 6: 100091. DOI: 10.1016/j.pdisas.2020.100091.
10. Levin AT, Owusu-Boaitey N, Pugh S, et al. Assessing the burden of COVID-19 in developing countries: Systematic review, meta-analysis and public policy implications. BMJ Glob Health. 2022; 7 (5): e008477. DOI: 10.1136/bmjgh-2022-008477.
11. Gill I, Schellekens P. Covid-19 is a developing country pandemic. Washington, DC: Brookings; 2021.
12. World Health Organization. Estimating mortality from COVID-19: Scientific brief. Geneva: World Health Organization; 2020.
13. Alizadehsani R, Alizadeh Sani Z, Behjati M, et al. Risk factors prediction, clinical outcomes, and mortality in COVID-19 patients. J Med Virol. 2021; 93 (4): 2307-2320. DOI: 10.1002/jmv.26699.
14. Okeahalam C, Williams V, Otwombe K. Factors associated with COVID-19 infections and mortality in Africa: A cross-sectional study using publicly available data. BMJ Open. 2020; 10 (11): e042750. DOI: 10.1136/bmjopen-2020-042750.
15. Dewi R, Kaswandani N, Karyanti MR, et al. Mortality in children with positive SARS-CoV-2 polymerase chain reaction test: Lessons learned from a tertiary referral hospital in Indonesia. Int J Infect Dis. 2021; 107: 78-85. DOI: 10.1016/j.ijid.2021.04.019.
16. Surendra H, Elyazar IR, Djaafara BA, et al. Clinical characteristics and mortality associated with COVID-19 in Jakarta, Indonesia: A hospital-based retrospective cohort study. Lancet Reg Health West Pac. 2021; 9: 100108. DOI: 10.1016/j.lanwpc.2021.100108.
17. Center for Disease Control and Prevention. Geographic differences in COVID-19 cases, deaths, and incidence — United States, February 12–April 7, 2020. MMWR Morb Mortal Wkly Rep. 2020; 69: 465–471. DOI: 10.15585/mmwr.mm6915e4.
18. Shi C, Wang L, Ye J, et al. Predictors of mortality in patients with coronavirus disease 2019: A systematic review and meta-analysis. BMC Infect Dis. 2021; 21 (1): 663. DOI: 10.1186/s12879-021-06369-0.
19. Kementerian Kesehatan Republik Indonesia. Pedoman pencegahan dan pengendalian coronavirus disease 19 (COVID-19) - Revisi 5 (COVID-19 prevention and control guideline - Fifth revision). Jakarta: Kementerian Kesehatan Republik Indonesia; 2020.
20. Pejabat Pengelola Informasi dan Dokumentasi Sumatera Barat. Data pantauan COVID-19 Provinsi Sumatera Barat. Padang: Pejabat Pengelola Informasi dan Dokumentasi Provinsi Sumatera Barat; 2021.
21. Hendarwan H, Syachroni S, Aryastami NK, et al. Assessing the COVID-19 diagnostic laboratory capacity in Indonesia in the early phase of the pandemic. WHO South East Asia J Public Health. 2020; 9 (2): 134-140. DOI: 10.4103/2224-3151.294307.
22. Aisyah DN, Mayadewi CA, Igusti G, et al. Laboratory readiness and response for SARS-Cov-2 in Indonesia. Front Public Health. 2021; 9: 705031. DOI: 10.3389/fpubh.2021.705031.
23. Bonanad C, Garcia-Blas S, Tarazona-Santabalbina F, et al. The effect of age on mortality in patients with COVID-19: A meta-analysis with 611,583 subjects. J Am Med Dir Assoc. 2020; 21 (7): 915-918. DOI: 10.1016/j.jamda.2020.05.045.
24. Berenguer J, Ryan P, Rodriguez-Bano J, et al. Characteristics and predictors of death among 4035 consecutively hospitalized patients with COVID-19 in Spain. Clin Microbiol Infect. 2020; 26 (11): 1525-1536. DOI: 10.1016/j.cmi.2020.07.024.
25. Hasan SS, Capstick T, Ahmed R, et al. Mortality in COVID-19 patients with acute respiratory distress syndrome and corticosteroids use: A systematic review and meta-analysis. Expert Rev Respir Med. 2020; 14 (11): 1149-1163. DOI: 10.1080/17476348.2020.1804365.
26. Li X, Ma X. Acute respiratory failure in COVID-19: is it "typical" ARDS? Crit Care. 2020; 24 (1): 198. DOI: 10.1186/s13054-020-02911-9.
27. Zhao D, Yao F, Wang L, et al. A comparative study on the clinical features of coronavirus 2019 (COVID-19) pneumonia with other pneumonias. Clin Infect Dis. 2020; 71 (15): 756-761. DOI: 10.1093/cid/ciaa247.
28. Gattinoni L, Gattarello S, Steinberg I, et al. COVID-19 pneumonia: Pathophysiology and management. Eur Respir Rev. 2021; 30 (162): 210138. DOI: 10.1183/16000617.0138-2021.
29. Mesas AE, Cavero-Redondo I, Álvarez-Bueno C, et al. Predictors of in-hospital COVID-19 mortality: A comprehensive systematic review and meta-analysis exploring differences by age, sex and health conditions. PLoS One. 2020; 15 (11): e0241742. DOI: 10.1371/journal.pone.0241742.
30. da Silva RE, Novaes MRCG, De Oliveira C, et al. National governance and excess mortality due to COVID-19 in 213 countries: A retrospective analysis and perspectives on future pandemics. Global Health. 2023; 19 (1): 80. DOI: 10.1186/s12992-023-00982-1.

31. White P, Crowe C, Bowe A, et al. An audit of COVID-19 death reporting in counties Cork and Kerry, Ireland, winter 2021-2022. Ir J Med Sci. 2023; 192 (4): 1589-1594. DOI: 10.1007/s11845-022-03211-7.
32. Sahay S. Big data and public health: Challenges and opportunities for low and middle income countries. Commun Assoc Inf Syst. 2016; 39 (1): 419 – 438. DOI: 10.17705/1CAIS.03920.
33. Batko K, Ślęzak A. The use of Big Data Analytics in healthcare. J Big Data. 2022; 9 (1): 3. DOI: 10.1186/s40537-021-00553-4.