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THE CORRELATION BETWEEN AGE, COMORBIDITIES, AND VACCINATION WITH THE MORTALITY RATE OF COVID-19 PATIENTS

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ABSTRACT: The objective of this study is to determine the primary factors that contribute to the mortality rate of COVID-19 in Indonesia, with a specific focus on age, comorbidities, and vaccination status. A retrospective analysis was performed utilizing patient data obtained from the West Lombok Health Office in the year 2020. The findings indicated that individuals aged 59 years or older had a considerably higher risk of mortality, with an odds ratio of 0.065 (95% confidence interval: 0.014 - 0.305). Comorbidities, specifically hypertension and diabetes mellitus, were found to be substantial risk factors. The odds ratio for hypertension was 63.64 (95% CI: 1.232 - 30.608), while the odds ratio for diabetes mellitus was 2.00 (95% CI: 1.593 - 2.512). The study revealed that being vaccinated considerably decreased the likelihood of death, with an odds ratio of 0.071 (95% CI: 0.015 - 0.334). Nevertheless, engaging in self-isolation was found to greatly elevate the likelihood of mortality, as indicated by an odds ratio of 195.429 (95% confidence interval: 22.894 - 1668.196). The Chi-Square test revealed a statistically significant association between vaccination status and COVID-19 mortality, with a p-value of 0.000 < 0.05. The logistic regression analysis revealed that the type of isolation had a very significant and large effect on COVID-19 mortality. The odds ratio (Exp(B)) was 96.604, showing a strong association between the type of isolation and the mortality rate. The p-value was 0.000, further confirming the statistical significance of this relationship. Therefore, the type of isolation plays a critical role in determining the death rate of COVID-19 patients. These findings emphasize the significance of immunization programs and efficient isolation measures in decreasing COVID-19 mortality. In summary, this study offers significant information that can be used to develop more focused health policies in Indonesia. It emphasizes the crucial importance of vaccination and isolation measures in effectively managing the COVID-19 pandemic. Gaining insight into these factors can assist in customizing health treatments to mitigate risks and enhance clinical outcomes for COVID-19 patients in Indonesia.
Keywords: covid-19, death rate, immunization, quarantine

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INTRODUCTION

Gaining insight into the variables that impact COVID-19 mortality is essential for formulating efficient approaches to control and intervene in the epidemic. Multiple studies have identified distinct risk factors linked to unfavorable outcomes in individuals with COVID-19. Li et al. (2021) performed a comprehensive evaluation and statistical analysis that highlighted the significance of advanced age as a contributing factor to the mortality rate of COVID-19.

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Kim et al. (2020) emphasized the influence of diabetes mellitus on the prognosis of COVID-19 patients, demonstrating that diabetes is a substantial determinant of the disease's outcome. Seyedtabib et al. (2024) underscored the significance of machine learning analysis in forecasting COVID-19 mortality using personal, clinical, preclinical, and laboratory characteristics. They underlined the necessity of comprehending the elements that contribute to mortality for efficient management.

Furthermore, COVID-19 mortality is influenced by individual characteristics such as comorbidities, genetic predisposition, and immunological factors, either directly or indirectly. Ramírez-Soto & Ortega-Cáceres (2022) emphasized the influence of these specific determinants on death rates, suggesting that high overall mortality can be viewed as an indirect result of COVID-19 mortality. Martins-Filho et al. (2021) discovered additional patient-level factors linked to COVID-19 mortality, such as co-occurring viral diseases and the combined effect of advanced age, hypertension, and diabetes. Studies have also examined the impact of chronic respiratory disorders, including asthma, on the mortality rate of COVID-19. These studies highlight the need of understanding the factors that contribute to morbidity and mortality in COVID-19 patients (Lieberman-Cribbin et al., 2020).

Moreover, studies have demonstrated that death rates in COVID-19 patients who are hospitalized are influenced by several factors such as social, economic, and regional determinants. Rodrigues et al. (2022) emphasized the significance of incorporating social and biological elements, along with ethnic and socioeconomic differences, in studies on COVID-19 mortality. Alizadehsani et al. (2022) found that factors like aging, cardiovascular disease, and symptoms have a substantial impact on the mortality of cardiovascular patients who are infected with COVID-19. Research has demonstrated that the combination of infectious and non-communicable chronic diseases, together with socioeconomic factors including race and poverty, might influence the death rates of COVID-19 (Jassat et al., 2020; Khayat et al., 2022). These characteristics suggest the necessity of a thorough and targeted strategy for handling the pandemic, taking into account the intricate relationships between age, comorbidities, and vaccination status, as well as the effects of centralized and self-isolation on clinical results.

A significant concern in this research is the lack of a thorough examination of how age, comorbidities, and immunization status impact COVID-19 death rates. A meticulous examination is essential to get a comprehensive evaluation of the interconnectedness of these factors and their combined influence on the death and recovery rates of COVID-19 patients. Thakur et al. (2021) highlighted the significance of taking into account geographical variations when assessing COVID-19 results. They suggested that geographical considerations should be taken into consideration when examining the impact of age and comorbidities on COVID-19 outcomes.

Cho et al. (2021) investigated the influence of comorbidity burden on mortality in COVID-19 patients by analyzing Korean health insurance data. They highlighted the importance of comorbidities in determining patient outcomes. Gaining insight into the impact of comorbidities on death rates is essential for the development of precise therapies and care plans for persons afflicted with COVID-

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19. Bello-Chavolla et al. (2021) examined the disparate influence of structural health variables and comorbidities on the severity and fatality of COVID-19 among the aged population in Mexico. Their study emphasized the intricate interplay between age, comorbidities, and structural factors in determining the consequences of the disease. This study highlights the need of considering factors beyond only age when evaluating the risk of COVID-19 death, and instead taking into account broader determinants of health.

An often suggested remedy is to perform a comprehensive examination that takes into account age, comorbidities, and immunization status all at once. This study attempts to discover the primary factors that contribute to the mortality rate of COVID-19 by analyzing data from different locations in Indonesia. In a retrospective single-center analysis, Al-aghbari et al. (2024) emphasized the significance of comprehending the impact of underlying health issues on patient outcomes. Through the analysis of certain comorbidities that contribute to mortality, healthcare providers can customize interventions to target the most crucial risk factors.

In their study, Singh et al. (2023) emphasized that age and other preexisting diseases are significant indicators of severe COVID-19 outcomes in India. This underscores the need to take into account multiple comorbidities when evaluating the risk of severe illness and death in COVID-19 patients. In their study, Yoshida et al. (2022) investigated the relationship between gender, comorbidities, and COVID-19 mortality. They highlighted the importance of developing preventative and treatment strategies that are tailored to each gender, taking into account the varying influence of comorbidities on the risk of mortality in men and women. An analysis of how comorbidities impact death rates in relation to gender can provide valuable insights for tailoring healthcare interventions for COVID-19 patients.

An extensive analysis of the existing literature about the influence of age on COVID-19 mortality yields significant knowledge about the connection between age and the seriousness of outcomes in individuals who have contracted the virus. Multiple studies constantly underline that age is a crucial factor linked to COVID-19 mortality, underscoring the significance of comprehending how age impacts the evolution of the disease and the results for patients. Belmin et al. (2021) conducted a nationwide study in care institutions in France and discovered that age was a significant factor linked to COVID-19 mortality. The mortality rate for individuals aged 80 and above was 60 times greater than that of adults under 50. This study highlights the substantial influence of age on COVID-19 mortality rates, especially among the older population.

Age was discovered by Efendi et al. (2023) as a determining factor for mortality risk in COVID-19 patients in Indonesia. Mortality rates were found to increase with age, perhaps due to worsening health conditions or preexisting comorbidities. Gaining insight into the correlation between age and the likelihood of death is essential for categorizing risk and implementing focused interventions in elderly adults. In a study conducted by Sasson (2021), the correlation between age and COVID-19 mortality was investigated across different countries and causes of death. The findings indicated a significant rise in COVID-19 mortality as age increases, similar to the mortality rates associated with aging-related diseases such

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as pneumonia and influenza. The comparison underscores the substantial influence of age on global COVID-19 mortality rates.

Moon et al. (2021) created a nomogram that can forecast the likelihood of COVID-19-related death and survival. They found that individuals aged 70 years or older had a substantial impact on the chances of surviving or dying between 30 and 60 days after contracting COVID-19. This study highlights the significance of age as a predictor for patient outcomes and the risk of mortality. Baihaqi & Rumaropen (2022) identified multiple risk variables linked to COVID-19 mortality, such as age, clinical symptoms, underlying health conditions, and laboratory findings. These findings emphasize the intricate interplay of various factors that contribute to death, with age continually being identified as a substantial predictor of unfavorable outcomes.

These studies highlight the necessity of adopting a more comprehensive methodology to comprehend the intricate relationship between age, comorbidities, and vaccination status, and how these collectively impact COVID-19 mortality. This research intends to analyze patient data from different regions in Indonesia to identify the primary determinants that contribute to COVID-19 mortality. Additionally, it seeks to establish the impact of centralized isolation compared to self-isolation on these results.

It is essential to identify deficiencies in current research on the relationship between COVID-19 immunization and mortality in order to guide future investigations and public health policies. Multiple studies have offered valuable insights into these discrepancies and identified areas that require additional investigation. Nguyen et al. (2021) investigated the intents, attitudes, and reasons for not getting vaccinated against COVID-19 among populations given priority for early immunization in the United States. Their study emphasized the need of addressing vaccine hesitancy and overcoming obstacles to vaccine acceptance. This study highlights the significance of comprehending and tackling the factors that affect vaccination decisions in order to enhance coverage and decrease fatality rates.

In their study, Smith et al. (2022) investigated the relationship between COVID-19 mortality and vaccine coverage in the Hong Kong Special Administrative Region. They highlighted the importance of identifying and addressing gaps in vaccination coverage among different age groups to prevent excessive death rates, especially among older persons. This study emphasizes the significance of focused immunization efforts in safeguarding susceptible populations and mitigating COVID-19 mortality. Newman et al. (2022) conducted a study that specifically examined the issue of COVID-19 vaccination hesitancy among marginalized populations in the US and Canada. The main objective of the study was to identify areas where there is a lack of evidence and provide recommendations for future research and practical interventions. This research highlights the importance of tackling inequalities in vaccine acceptance among marginalized communities in order to enhance immunization rates and decrease COVID-19-related deaths.

Zanettini et al. (2021) did an ecological study in the US to investigate the relationship between influenza vaccination and COVID-19 mortality. The study found that there is a negative correlation between the percentage of older population

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receiving influenza vaccination and the number of COVID-19 deaths. This study indicates the potential advantage of administering influenza vaccines in decreasing COVID-19 mortality rates and emphasizes the necessity for additional research on the influence of current vaccines on COVID-19 outcomes. Baker et al. (2023) conducted a study to examine the connection between COVID-19 immunization and mortality in hospitalized patients. They highlighted the diminishing protective effect of vaccination over time and the possible advantages for obese and elderly individuals. This study emphasizes the need of continuous surveillance of immunization efficacy and the necessity for customized interventions to decrease fatality rates in particular patient categories.

Although there has been a lot of research that has identified important risk factors for COVID-19 mortality, there is still a lack of understanding of how these factors interact in specific situations, as in Indonesia. Prior studies have not comprehensively illustrated the interplay of age, comorbidities, and vaccination status in relation to COVID-19 mortality in Indonesia. Filling this gap is essential in order to gain a more comprehensive and profound understanding of the factors influencing COVID-19 mortality in Indonesia, and to develop more efficient and focused public health policies.

The aim of this study is to ascertain the primary determinants of COVID-19 mortality, with a specific focus on age, comorbidities, and vaccination status. Furthermore, this study seeks to ascertain the impact of centralized isolation versus self-isolation on the clinical outcomes of individuals with COVID-19. This technique is anticipated to offer more profound understanding of the dynamics of COVID-19 mortality in Indonesia, a subject that has not been widely investigated in prior study.

This study is unique since it focuses on thoroughly analyzing how age, comorbidities, and vaccination status interact with each other and collectively impact the mortality rates of COVID-19. The study will utilize patient data from many regions in Indonesia, ensuring comprehensive and representative coverage to get insights into Indonesia's unique circumstances during the COVID-19 pandemic. Prior research, conducted by Thakur et al. (2021) and Cho et al. (2021), has emphasized the significance of individual variables in various geographical settings. However, none of these studies have explicitly investigated Indonesia comprehensively.

This study encompasses the examination of COVID-19 patient data, specifically focusing on variables such as age, gender, kind of COVID-19 test, and type of isolation. The study aims to discern notable patterns and correlations among these variables in relation to the mortality rate of COVID-19. For example, Efendi et al. (2023) emphasized the need of comprehending the correlation between age and the risk of death, whereas Smith et al. (2022) stressed the necessity of immunization techniques specifically tailored to different age groups.

This study will also focus on the gaps reported by Nguyen et al. (2021) on vaccine hesitancy and obstacles to vaccine acceptance. These gaps are important in improving vaccination rates and decreasing mortality rates. In addition, the study will investigate the diminishing protective efficacy of vaccination over time, as mentioned by Baker et al. (2023), and the influence of comorbidities on COVID-

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19 mortality, as reported by Singh et al. (2023) . Therefore, this study is anticipated to make a substantial contribution to enhancing our comprehension of the factors that impact COVID-19 mortality in Indonesia. It will also serve as a foundation for implementing more efficient and focused intervention measures to manage the pandemic in the future.

METHOD

This study is a retrospective analysis that uses secondary data. The West Lombok Health Department provided data and statistics about COVID-19 in 2020. The data was sourced from reports provided by multiple health centers under the supervision of the West Lombok Health Department, which had documented cases of COVID-19. The gathered data comprises demographic information such as age and gender, as well as details on vaccination status, the type of test conducted, the type of isolation implemented, any history of comorbidities, and the ultimate outcome of patients, which is classified as either recovered or deceased.

The selection of COVID-19 patient data for this study was based on specific criteria. These criteria included patients who had received confirmed positive COVID-19 results through PCR Swab or Rapid Diagnostic Test (RDT) Antigen. Additionally, the selected patients had complete information on the variables examined, such as age, gender, vaccination status, type of test, type of isolation, and comorbidity history. Data that was incomplete or did not fulfill the specified criteria for inclusion was not included in the analysis.

The data gathering process involved the examination and analysis of records obtained from the West Lombok Health Department. The gathered data were subjected to descriptive analysis in order to depict the distribution of the variables under investigation. Chi-Square testing and Odds Ratio analysis were conducted to establish the correlation between independent variables (age, gender, immunization status, kind of test, type of isolation, and comorbidity history) and the dependent variable (COVID-19 mortality). Furthermore, logistic regression analysis was employed to determine the variables that exerted the most significant influence on the mortality of COVID-19 patients.

The factors assessed in this study encompassed demographic and clinical characteristics. The demographic data encompassed the patients' age and gender (male and female), as well as their vaccination status, which indicated whether they had gotten the first, second, or third dosage of the vaccine. In addition, the COVID-19 test type, either PCR Swab or RDT Antigen, was also assessed. The method of patient isolation was classified as either centralized isolation or self-isolation. The patient's medical history included comorbidities such as diabetes mellitus, hypertension, chronic obstructive pulmonary disease (COPD), renal failure, and heart disease. Ultimately, the analysis also encompassed the result of patient care, including both recovery and mortality.

A descriptive data analysis was performed to demonstrate the features of the distribution of the variables under investigation. In addition, chi-square analysis was employed to assess the association between the independent and dependent variables. Logistic regression analyses were conducted using SPSS software version 26 to discover factors that exert a significant influence on COVID-19

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mortality. The methodology employed in this study adheres to the approach utilized in other studies conducted by Chun et al. (2021) and Grapsa et al. (2022). These investigations employed regression analysis to evaluate the correlation between different clinical parameters and health outcomes in patients affected by COVID-19. This research aims to provide a comprehensive understanding of the factors that contribute to COVID-19 patient mortality in West Lombok. By doing so, it can offer valuable insights and contribute to the establishment of more efficient and focused health policies.

RESULTS AND DISCUSSION

The Correlation Between Age, Gender, and COVID-19 Mortality

Table 1 presents the results of statistical tests showing that the odds ratio for the gender variable (female) is 1.314 (95% CI: 0.541 - 3.192). However, this result is not statistically significant, suggesting that gender is not a risk factor for death caused by COVID-19. The odds ratio for the age variable below 59 years is 0.065 (95% CI: 0.014 - 0.305), indicating that being above 59 years old is a substantial risk factor for death. The chi-square test findings indicate that there is no statistically significant link between the gender variable and patient status, as evidenced by a Pearson Chi-Square value of 0.365 and an asymptotic significance of 0.546. This suggests that there is no substantial disparity in the mortality risk across genders.

Table 1. Relationship Age, Gender, and COVID-19 Mortality (N=82)

Characteristic		Patient Status		Odds Ratio	CI (95%)	
		Deceased	Recovered		Lower	Upper
Gender	Female	20 (44%)	14 (38%)	1,314	0,541	3,192
	Male	25(56%)	23 (62%)			
Age	< 59 Years	24 (53%)	35 (95%)	0,065	0,014	0,305
	> 59 Years	21 (47%)	2 (5%)			

Prior studies have demonstrated that gender and age play a crucial role in influencing the results of COVID-19 disease. Brady et al. (2021) emphasized the insufficient consideration of gender disparities in COVID-19 research and the significance of comprehending these disparities in disease etiology and pharmacological treatments. Their research revealed substantial disparities in mortality and recovery rates between males and females, corroborating the conclusions of Cruz et al. (2023) who identified age, male gender, and comorbidities as factors linked to hospital mortality caused by COVID-19.

Geldsetzer et al. (2022) conducted a study examining gender disparities in COVID-19 death rates across 63 nations. The study emphasized the higher mortality burden experienced by men. Bauer et al. (2021) corroborated these findings by offering insights into the correlation between age, gender, and COVID-19 mortality. Rushovich et al. (2021) examined the differences in COVID-19 death rates among various racial groups in the United States, emphasizing the significance of examining the combined impact of gender and ethnicity when evaluating inequalities in COVID-19 mortality. Jin et al. (2020) highlighted that males infected

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with COVID-19 face an elevated likelihood of experiencing adverse outcomes and mortality. Kouchek et al. (2024) also demonstrated that older adults have an elevated risk of death, emphasizing the necessity for specific therapies tailored to this demographic. Atanasov et al. (2024) and Matsuo et al. (2023) emphasized the significance of taking into account distinct gender disparities in COVID-19 mortality rates.

The consequences of these findings are significant for the formulation of more precise health policy in Indonesia. The data emphasize the significance of customized intervention options in mitigating COVID-19 mortality. Implementing vaccination programs and health campaigns specifically aimed at senior individuals and men has the potential to greatly decrease mortality rates. Gaining insight into the correlation between gender and age in COVID-19 mortality can assist in formulating enhanced health policies and more precise intervention tactics.

Relationship Type of Test and Isolation with COVID-19 Mortality

Table 2 presents the results of statistical testing, showing that the odds ratio for the variable "Swab PCR" is 5.455 (95% CI: 1.748 - 17.021). This indicates that Swab PCR is a statistically significant risk factor for death caused by COVID-19. The odds ratio for the centralized isolation variable is 195.429 (95% CI: 22.894 - 1668.196), indicating a statistically significant association. This suggests that self-isolation is a substantial risk factor for death. The chi-square test findings indicate a significant link between the type of isolation and patient status. The Pearson Chi-Square value is 9.536 and the asymptotic significance is 0.002. This suggests that self-isolation considerably increases the chance of mortality.

Table 2. Relationship Type of Test and Isolation with COVID-19 Mortality (N=82)

Characteristic		Patient Status		Odds Ratio	CI (95%)	
		Deceased	Recovered		Lower	Upper
Type of Test	Swab PCR	22 (60%)	40 (89%)	5,455	1,748	17,021
	RDT Antigen	15 (41%)	5 (11%)			
Type of Isolation	Centralized	1 (3%)	38 (84%)	195,43	22,894	1668,196
	Self Isolation	36 (97%)	7 (16%)			

Prior studies have demonstrated that the implementation of isolation measures and the specific types of tests employed had an impact on the death rates associated with COVID-19. The study conducted by Yu et al. (2022) investigated the effects of ongoing vaccination and voluntary isolation on the dynamics of COVID-19. The findings indicate that implementing isolation measures can effectively control the spread of the virus and decrease fatality rates. This study emphasizes the significance of isolation in managing the transmission of COVID-19. Torres et al. (2022) examined the effects of isolation capacity and sectorization on mortality rates in nursing homes. A study revealed that Type B nursing homes had a greater mortality risk in comparison to Type C nursing homes, underscoring the significance of implementing isolation measures to decrease mortality rates among susceptible populations. Diaz-Quijano et al. (2021) highlighted the

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significance of social separation in decreasing mortality rates in Brazilian federative units, underscoring the importance of complying with social isolation measures during the pandemic.

Tran et al. (2021) examined the impact of social distance on death rates in US counties and determined that adhering to social distancing measures had a substantial effect in reducing mortality rates. These results suggest that the choice of testing and isolation procedures is essential in managing the pandemic. Essentially, these findings emphasize the significance of developing and following good isolation strategies to decrease COVID-19 mortality. Enhancing the precision of testing techniques, such as the more precise Swab PCR in comparison to RDT Antigen, is also crucial. These findings provide evidence for the need to create more focused health policies in Indonesia, which can aid in the creation of more efficient public health interventions and enhance prevention initiatives.

Relationship Comorbidity History and COVID-19 Mortality

Table 3. Statistical tests reveal that individuals with a history of hypertension had an odds ratio of 63.64 (95% CI: 1.232 - 30.608), demonstrating that hypertension is a substantial risk factor for COVID-19-related mortality. A previous occurrence of renal failure is associated with a substantial odds ratio of 5.538 (95% CI: 0.636 - 48.262). However, this finding lacks statistical significance since the confidence interval encompasses the value of 1. Having a history of diabetes mellitus (DM) increases the risks of mortality by a factor of 2.00 (95% CI: 1.593 - 2.512), indicating that it is a substantial risk factor. To summarize, hypertension is the primary comorbid factor associated with mortality in COVID-19 patients, followed by diabetes mellitus and cardiac disease (with an odds ratio of 2.057 and a 95% confidence interval of 1.622 - 2.609), which is similarly statistically significant.

Table 3. Relationship Comorbidity History and COVID-19 Mortality (N=82)

Characteristic (History)		Patient Status		Odds Ratio	CI (95%)	
		Deceased	Recovered		Lower	Upper
DM	Yes	22 (60%)	40 (89%)	2	1,593	2,512
	No	15 (41%)	5 (11%)			
Hipertensi	Yes	1 (3%)	38 (84%)	63,64	1,232	30,608
	No	36 (97%)	7 (16%)			
COPD	Yes	-	5 (11%)	1,925	1,553	2,386
	No	37 (100%)	40 (89%)			
Stroke	Yes	-	2 (4%)	1,68	1,518	2,28
	No	37 (100%)	43 (96%)			
Kidney Failure	Yes	1 (3%)	6 (13%)	5,538	0,636	48,262
	No	36 (97%)	39 (87%)			
Heart Dease	Yes	-	10 (22%)	2,057	1,622	2,609
	No	37 (100%)	35 (78%)			

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The research suggests that the presence of comorbidities has a substantial impact on the death rates associated with COVID-19. A study conducted by Azhar et al. (2023) revealed that individuals diagnosed with COVID-19 who also suffer from comorbidities such as hypertension, diabetes mellitus, cardiovascular disease, or kidney disease are more susceptible to a fatal outcome. Henkens et al. (2022) corroborate these findings, asserting that conditions such as hypertension, diabetes mellitus, dyslipidemia, chronic renal disease, COPD, and a previous occurrence of heart disease elevate the likelihood of mortality due to COVID-19. A study conducted in India by Singh et al. (2023) found that those with comorbidities, such as diabetes mellitus, have a higher likelihood of experiencing catastrophic outcomes and mortality due to COVID-19. According to Sharma & Patidar (2021), cardiovascular disease, dementia, liver disease, kidney disease, and cancer are additional factors that contribute to an increased likelihood of severe illness and death in COVID-19 patients. These findings confirm that patients who have comorbidities are more likely to experience unfavorable outcomes.

Calandra et al. (2023) established that comorbidities such as chronic kidney disease, cancer, chronic obstructive pulmonary disease (COPD), significant heart problems, obesity, and type 2 diabetes increase the likelihood of severe illness and death in individuals with COVID-19. Comorbidities exacerbate the progression of infection and raise the probability of unfavorable consequences, such as mortality. These findings have substantial scientific and practical ramifications. From a scientific perspective, they provide more support for the idea that the presence of other medical conditions alongside COVID-19 is extremely important in determining the likelihood of death. Essentially, this data highlights the significance of customized intervention strategies for individuals with multiple health conditions in order to decrease mortality rates. Implementing more effective chronic disease management programs and implementing rigorous health monitoring can significantly decrease the likelihood of mortality. Additionally, implementing targeted health policies can bolster prevention efforts, especially for populations at high risk.

Relationship Vaccination Status and COVID-19 Mortality

Table 4. Statistical tests reveal that the odds ratio for the variable representing vaccination status (vaccinated) is 0.071 (95% CI: 0.015 - 0.334). This indicates that vaccinated individuals have a significantly reduced risk of mortality compared to those who are not vaccinated. Furthermore, this result is statistically significant. The Pearson Chi-Square value of 15.763 and an asymptotic significance of 0.000 indicate a strong link between vaccination status and patient status. This suggests that immunization has a substantial role in reducing the risk of death from COVID-19.

Table 4. Relationship Vaccination Status and COVID-19 Mortality (N=82)

Characteristic		Patient Status		Odd Ratio	CI (95%)	
		Deceased	Recovered		Lower	Upper
Vaccine Status	Yes	35 (95%)	25 (56%)	0,071	0,015	0,334
	No	2 (5%)	20 (44%)			

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Prior studies have demonstrated a substantial impact of vaccination status on the rates of death caused by COVID-19. Chun et al. (2021) discovered a link between the presence of other health conditions in cancer patients and their willingness to get the COVID-19 vaccine. On the other hand, Grapsa et al. (2022) said that complete immunization decreases the likelihood of death in patients who require intubation owing to COVID-19-induced acute respiratory distress syndrome. In a study conducted by Ju et al. (2024) , it was shown that those who have received full immunization have reduced rates of mortality after undergoing surgery. Additionally, Khawaja et al. (2023) discovered risk variables, such as age and type of cancer, that are related with hospitalization and mortality in cancer patients, regardless of whether they have been vaccinated or not.

This study corroborates the evidence that vaccination plays a vital role in diminishing COVID-19 mortality. Valeanu et al. (2023) shown that complete vaccination reduces mortality in patients who are intubated with acute respiratory distress syndrome. In contrast, Moldokmatova et al. (2021) discovered that combining immunization with non-pharmaceutical therapies can decrease the occurrence of COVID-19 and the number of deaths in Kyrgyzstan. These findings highlight the significance of implementing a thorough strategy to decrease mortality.

These findings have substantial scientific and practical ramifications. This study provides scientific proof that immunization effectively reduces mortality from COVID-19, which aligns with the conclusions of Grapsa et al. (2022) and Ju et al. (2024) regarding the positive impact of vaccination on reducing the likelihood of death and hospitalization. Essentially, this research emphasizes the significance of comprehensive vaccination programs and achieving high vaccination coverage in order to decrease COVID-19 mortality. This study also establishes a basis for the development of more focused health policy in Indonesia, where there is still inadequate evidence on the influence of immunization on COVID-19 mortality. This methodology can facilitate the development of more efficient public health interventions, particularly for the most vulnerable groups, and enhance preventive measures to substantially decrease mortality rates.

Analysis Of Covid-19 Mortality Risk Factors Using Multiple Variables

The study employed logistic regression analysis to ascertain the risk factors associated with mortality in COVID-19 patients. The findings indicated that the kind of isolation had a substantial influence on patient mortality, as evidenced by an Exp(B) value of 96.604 and a p-value of 0.000. Additional covariates, such as a prior history of COPD, stroke, and heart disease, demonstrated a substantial but statistically insignificant influence ($p \approx 1$). The variables, including gender, age, kind of test, history of diabetes mellitus, hypertension, kidney failure, and immunization status, did not have a statistically significant impact ($p > 0.05$). This validates that the specific form of seclusion plays a crucial role in influencing the results for patients.

Extensive research has been conducted on the effect of COVID-19 vaccine on death rates, emphasizing its significant contribution in mitigating the seriousness of the disease and reducing fatalities. Gül et al. (2023) discovered that the

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vaccination status of critically ill COVID-19 patients in Turkey had a substantial impact on their 28-day mortality rate. This finding enhances our comprehension of the preventive benefits of immunization. Similarly, Filho et al. (2023) found that vaccination significantly decreased hospitalizations, severity, and mortality among COVID-19 patients, highlighting the crucial role of vaccination in reducing adverse outcomes. These findings emphasize the necessity of implementing widespread immunization campaigns to enhance patient outcomes during the epidemic.

A comprehensive international study conducted by Mendoza-Cano et al. (2023) demonstrated a strong correlation between better vaccination coverage and reduced all-cause death rates across 178 nations. This study underscores the significant influence of immunization initiatives on the overall health of populations. Ince et al. (2022) conducted a comparative analysis of mortality rates among individuals who were administered the Sinovac and Biontech vaccines. The study revealed that Sinovac recipients had higher mortality rates, suggesting disparities in vaccine efficiency. In a retrospective cohort research, Baker et al. (2023) demonstrated a noteworthy decrease in mortality rates among vaccinated patients who were hospitalized. This data further supports the advantageous effects of vaccination in preventing deaths. These studies emphasize the vital importance of immunization in decreasing mortality rates, even among patients with severe illness.

Further research provides additional evidence that supports this conclusion. In their study, Huang et al. (2023) discovered that the proximity to healthcare facilities and the vaccination status had a substantial impact on COVID-19-related mortality in the United States. This finding introduces a spatial aspect to the influence of vaccination. The research conducted by Horvath et al. (2023) in Hungary during the delta wave demonstrated that immunization had a substantial impact in reducing overall mortality among COVID-19 patients who were hospitalized. This highlights the usefulness of vaccines in targeted healthcare environments. The research as a whole emphasizes the critical significance of COVID-19 vaccine in decreasing mortality rates and emphasizes the need of vaccination programs in public health measures to effectively fight against the pandemic.

CONCLUSION

Based on the result of study, can be concluded that (1) this study emphasizes the primary factors that contribute to the mortality rate of COVID-19 in Indonesia, including age, comorbidities, and vaccination status. Extensive data analysis revealed that older age, the existence of comorbidities such as hypertension and diabetes mellitus, and absence of vaccination substantially elevate the likelihood of mortality in individuals with COVID-19. Furthermore, this study demonstrates that the use of efficient isolation protocols and precise testing techniques is crucial in mitigating fatality rates; (2) the study findings suggest that employing centralized isolation and PCR Swab testing procedures is more efficacious in mitigating the risk of mortality when compared to self-isolation and RDT Antigen testing. These findings underscore the significance of enhancing healthcare infrastructure and allocating resources to enhance the efficacy of COVID-19 management.

Furthermore, the study reveals that comorbidities such as hypertension and diabetes mellitus are significant risk factors that contribute to the mortality rate of COVID-19. (3) this research further emphasizes the crucial role of vaccination in reducing COVID-19 mortality rates. Evidence indicates that individuals who have received vaccinations have a significantly reduced likelihood of mortality in comparison to those who have not undergone vaccination. These findings affirm the significance of comprehensive vaccination regimens and achieving high vaccination coverage in order to decrease COVID-19 mortality. Therefore, this study offers significant knowledge for the formulation of more focused health policies in Indonesia, specifically for interventions targeted at the most susceptible populations. These findings are anticipated to assist in developing more efficient public health methods to decrease COVID-19 fatality rates and enhance the quality of pandemic management in the future.

RECOMMENDATION

Future research on COVID-19 mortality in Indonesia should include data from various regions to address geographic disparities. Longitudinal studies are essential to track changes over time, while exploring genetic predispositions, immunological responses, and COVID-19 variant impacts will provide deeper insights. Data collection should cover demographic, clinical, socioeconomic, and mental health factors, and evaluate public health interventions. Addressing challenges like data quality, virus dynamics, public compliance, healthcare variability, resource constraints, and ethical considerations is crucial. This comprehensive approach will enhance understanding and support targeted interventions to reduce COVID-19 mortality in Indonesia.

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REFERENCES

Al-aghbari, N., Maldar, A., Angolkar, M., & Khurseed, R. (2024). *Impact of Comorbidity on Mortality in COVID-19 Patients: A Single-Center Retrospective Study*.

Alizadehsani, R., Eskandarian, R., Behjati, M., Zahmatkesh, M., Roshanzamir, M., Izadi, N. H., Shoeibi, A., Haddadi, A., Khozeimeh, F., Sani, F. A., Sani, Z. A., Roshanzamir, Z., Khosravi, A., Nahavandi, S., Sarrafzadegan, N., & Islam, S. M. S. (2022). Factors associated with mortality in hospitalized cardiovascular disease patients infected with COVID-19. Immunity, Inflammation and Disease, 10(3). https://doi.org/10.1002/iid3.561

Atanasov, V., Barreto, N., Franchi, L., Whittle, J., Meurer, J., Weston, B. W., Luo, Q. (Eric), Yuan, A. Y., Zhang, R., & Black, B. (2024). Evidence on COVID-19 Mortality and Disparities Using a Novel Measure, COVID excess mortality percentage: Evidence from Indiana, Wisconsin, and Illinois. PLOS ONE, 19(1), e0295936. https://doi.org/10.1371/journal.pone.0295936

Azhar, Z., Citra Tri Widyastuti, Khotimah, K., Mukhamad Rajin, Diah Ayu Fatmawati, & Herin Mawarti. (2023). RELATIONSHIP OF COMMORBID DISEASE TO

MORTALITY EVENTS IN COVID-19 PATIENTS. International Journal of Social Science, 1(2), 135–142. https://doi.org/10.53625/ijss.v1i2.5046

Baihaqi, F. A., & Rumaropen, H. (2022). Factors Associated with Mortality in COVID-19 Patients Treated at Serui General Hospital, Papua Indonesia. Majalah Kedokteran Bandung, 54(4), 208–214. https://doi.org/10.15395/mkb.v54n4.2864

Baker, T. B., Bolt, D. M., Smith, S. S., Piasecki, T. M., Conner, K. L., Bernstein, S., Hayes-Birchler, T., Theobald, W. E., & Fiore, M. C. (2023). The Relationship of COVID-19 Vaccination With Mortality Among 86,732 Hospitalized Patients: Subpopulations, Patient Factors, and Changes Over Time. Journal of General Internal Medicine, 38(5), 1248–1255. https://doi.org/10.1007/s11606-022-08007-0

Bello-Chavolla, O. Y., González-Díaz, A., Antonio-Villa, N. E., Fermín-Martínez, C. A., Márquez-Salinas, A., Vargas-Vázquez, A., Bahena-López, J. P., García-Peña, C., Aguilar-Salinas, C. A., & Gutiérrez-Robledo, L. M. (2021). Unequal Impact of Structural Health Determinants and Comorbidity on COVID-19 Severity and Lethality in Older Mexican Adults: Considerations Beyond Chronological Aging. The Journals of Gerontology: Series A, 76(3), e52–e59. https://doi.org/10.1093/gerona/glaa163

Belmin, J., Georges, S., Franke, F., Daniau, C., Cochet, A., Durand, C., Noury, U., Gomes do Espirito Santo, M. E., Fonteneau, L., Pariel, S., Lafuente-Lafuente, C., & Danis, K. (2021). Coronavirus Disease 2019 in French Residential Care Facilities: A Nationwide Study. Journal of the American Medical Directors Association, 22(6), 1142–1145. https://doi.org/10.1016/j.jamda.2021.03.013

Brady, E., Nielsen, M. W., Andersen, J. P., & Oertelt-Prigione, S. (2021). Lack of consideration of sex and gender in COVID-19 clinical studies. Nature Communications, 12(1), 4015. https://doi.org/10.1038/s41467-021-24265-8

Calandra, I. V., Sari, D. K., & Sinaga, B. Y. M. (2023). Relationship of Albumin Levels, Comorbidity and Vaccination History with Mortality Of COVID-19 Patients in RSUP. H. Adam Malik Medan. Contagion: Scientific Periodical Journal of Public Health and Coastal Health, 5(3), 1093. https://doi.org/10.30829/contagion.v5i3.16868

Cho, S. I., Yoon, S., & Lee, H.-J. (2021). Impact of comorbidity burden on mortality in patients with COVID-19 using the Korean health insurance database. Scientific Reports, 11(1), 6375. https://doi.org/10.1038/s41598-021-85813-2

Chun, J. Y., Kim, S. I., Park, E. Y., Park, S.-Y., Koh, S.-J., Cha, Y., Yoo, H. J., Joung, J. Y., Yoon, H. M., Eom, B. W., Park, C. M., Han, J.-Y., Kim, M., Lee, D.-W., Kim, J.-W., Keam, B., Lee, M., Kim, T. M., Choi, Y. J., … Lim, M. C. (2021). Cancer Patients' Willingness to Take COVID-19 Vaccination: A Nationwide Multicenter Survey in Korea. Cancers, 13(15), 3883. https://doi.org/10.3390/cancers13153883

Cruz, J. C., Martins, C. K., Katchborian Neto, A., de Araújo, C. M., Dellalibera-Joviliano, R., & Barbosa, F. (2023). Age, gender, and 11 comorbidities as risk factors associated with COVID-19 mortality: A retrospective cohort including 1.8 million individuals. Journal of Toxicology and Environmental Health, Part A, 86(14), 491–500. https://doi.org/10.1080/15287394.2023.2223598

Diaz-Quijano, F. A., Ribeiro, T. B., da Rosa, A. V., Reis, R., Aith, F., & Ventura, D. F. L. (2021). The impact of legislation on Covid-19 mortality in a Brazilian federative unit was mediated by social isolation. MedRxiv, 2021–2026.

Efendi, F., Haryanto, J., Has, E. M. M., Makhfudli, M., Indarwati, R., Kuswanto, H., Wahyuhadi, J., Farabi, M. J. Al, & Ho, K. H. M. (2023). Determinants of mortality risk among Indonesian patients with COVID-19. F1000Research, 11, 814. https://doi.org/10.12688/f1000research.109554.2

Bioscientist : Jurnal Ilmiah Biologi
E-ISSN 2654-4571; P-ISSN 2338-5006
Volume 12, Issue 2, December 2024; Page, 1526-1543
Email: bioscientist@undikma.ac.id

Filho, F. D., Gomes, D. K., & Rossato, S. D. (2023). Effect of Vaccination on COVID-19 Hospitalizations and Mortality. Jornal Brasileiro De Pneumologia, e20230254. https://doi.org/10.36416/1806-3756/e20230254

Geldsetzer, P., Mukama, T., Jawad, N. K., Riffe, T., Rogers, A., & Sudharsanan, N. (2022). Sex differences in the mortality rate for coronavirus disease 2019 compared to other causes of death: an analysis of population-wide data from 63 countries. European Journal of Epidemiology, 37(8), 797–806. https://doi.org/10.1007/s10654-022-00866-5

Grapsa, E., Adamos, G., Andrianopoulos, I., Tsolaki, V., Giannakoulis, V. G., Karavidas, N., Giannopoulou, V., Sarri, K., Mizi, E., Gavrielatou, E., Papathanakos, G., Mantzarlis, K. D., Mastora, Z., Magira, E., Koulouras, V., Kotanidou, A., & Siempos, I. I. (2022). Association Between Vaccination Status and Mortality Among Intubated Patients With COVID-19–Related Acute Respiratory Distress Syndrome. JAMA Network Open, 5(10), e2235219. https://doi.org/10.1001/jamanetworkopen.2022.35219

Gül, F., Kasapoğlu, U. S., Sabaz, M. S., Ay, P., Doruk Oktay, B., Çalışkan, G., Demir, N., Sayan, İ., Kabadayı, F., Altuntaş, G., Gümüş, A., Kırca, H., Şanlı, D., Acil, F., Dedeoğlu, A., Ural, S. G., Akın Şen, İ., Macit Aydın, E., Dayanır, H., … Akıncı, S. B. (2023). The Impact of CoronaVac Vaccination on 28-Day Mortality Rate of Critically Ill Patients With COVID-19 in Türkiye. Balkan Medical Journal, 40(6), 435–444. https://doi.org/10.4274/balkanmedj.galenos.2023.2023-6-90

Henkens, M. T. H. M., Raafs, A. G., Verdonschot, J. A. J., Linschoten, M., van Smeden, M., Wang, P., van der Hooft, B. H. M., Tieleman, R., Janssen, M. L. F., ter Bekke, R. M. A., Hazebroek, M. R., van der Horst, I. C. C., Asselbergs, F. W., Magdelijns, F. J. H., Heymans, S. R. B., Al-Ali, A. K., Al-Muhanna, F. A., Al-Windy, N. Y. Y., Almubarak, Y. A., … van der Zee, P. M. (2022). Age is the main determinant of COVID-19 related in-hospital mortality with minimal impact of pre-existing comorbidities, a retrospective cohort study. BMC Geriatrics, 22(1), 184. https://doi.org/10.1186/s12877-021-02673-1

Horvath, V. J., Békeffy, M., Németh, Z., Szelke, E., Fazekas-Pongor, V., Hajdu, N., Svébis, M. M., Pintér, J., Domján, B. A., Mészáros, S., Körei, A. E., Kézdi, Á., Kocsis, I., Kristóf, K., Kempler, P., Rozgonyi, F., Takács, I., & Tabák, A. G. (2023). The Effect of COVID-19 Vaccination Status on All-Cause Mortality in Patients Hospitalised With COVID-19 in Hungary During the Delta Wave of the Pandemic. Geroscience, 46(2), 1881–1894. https://doi.org/10.1007/s11357-023-00931-1

Huang, W., Hernandez, I., Tang, S., Dickson, S., Berenbrok, L. A., & Guo, J. (2023). Association Between Distance to Community Health Care Facilities and COVID-19–related Mortality Across U.S. Counties in the COVID-19–vaccine Era. BMC Research Notes, 16(1). https://doi.org/10.1186/s13104-023-06366-3

Ince, U., Duran, H. T., & Yıldırım, Y. (2022). Effect of Sinovac or Biontech Vaccination on Mortality in COVID-19 Patients in the Intensive Care Unit. European Journal of Clinical Medicine, 3(3), 18–20. https://doi.org/10.24018/clinicmed.2022.3.3.210

Jassat, W., Cohen, C., Tempia, S., Masha, M., Goldstein, S., Kufa, T., Murangandi, P., Savulescu, D., Walaza, S., & Bam, J.-L. (2020). COVID-19 in-hospital mortality in South Africa: The intersection of communicable and non-communicable chronic diseases in a high HIV prevalence setting.

Jin, J.-M., Bai, P., He, W., Wu, F., Liu, X.-F., Han, D.-M., Liu, S., & Yang, J.-K. (2020). Gender Differences in Patients With COVID-19: Focus on Severity and Mortality. Frontiers in Public Health, 8. https://doi.org/10.3389/fpubh.2020.00152

Bioscientist : Jurnal Ilmiah Biologi
E-ISSN 2654-4571; P-ISSN 2338-5006
Volume 12, Issue 2, December 2024; Page, 1526-1543
Email: bioscientist@undikma.ac.id

Ju, J.-W., Kim, T., Yoon, S.-H., Kim, W. H., & Lee, H.-J. (2024). The impact of preoperative coronavirus disease 19 infection on early postoperative mortality during the vaccination era: a nationwide retrospective cohort study. Korean Journal of Anesthesiology, 77(2), 185–194. https://doi.org/10.4097/kja.23761

Khawaja, F., Angelidakis, G., Feldman, A., Ravi, V., Woodman, E., Bhatti, M., Ariza-Heredia, E., Elhajj, P., Spallone, A., Jiang, Y., & Chemaly, R. F. (2023). <scp>COVID</scp> -19 in cancer patients: The impact of vaccination on outcomes early in the pandemic. Cancer Medicine, 12(24), 22006–22022. https://doi.org/10.1002/cam4.6781

Khayat, F., Teron, L., & Rasoulyan, F. (2022). COVID-19 and health inequality: the nexus of race, income and mortality in New York City. International Journal of Human Rights in Healthcare, 15(4), 363–372. https://doi.org/10.1108/IJHRH-05-2021-0110

Kim, W., Kim, H., & Hwang, J. (2020). Sustainable Growth for the Self-Employed in the Retail Industry Based on Customer Equity, Customer Satisfaction, and Loyalty. Journal of Retailing and Consumer Services, 53, 101963. https://doi.org/10.1016/j.jretconser.2019.101963

Kouchek, M., Aghakhani, K., & Memarian, A. (2024). Demographic study of patients' mortality rate before and after the COVID-19 outbreak: A cross-sectional study. Health Science Reports, 7(2). https://doi.org/10.1002/hsr2.1845

Li, S., Li, G., Liu, N., & Wu, H. (2021). The Impact of Patient Satisfaction on Patient Loyalty With the Mediating Effect of Patient Trust. Inquiry the Journal of Health Care Organization Provision and Financing, 58, 004695802110072. https://doi.org/10.1177/00469580211007221

Lieberman-Cribbin, W., Rapp, J., Alpert, N., Tuminello, S., & Taioli, E. (2020). The Impact of Asthma on Mortality in Patients With COVID-19. Chest, 158(6), 2290–2291. https://doi.org/10.1016/j.chest.2020.05.575

Martins-Filho, P. R., Antunes de Souza Araújo, A., Pereira, L. X., Quintans-Júnior, L. J., de Souza Barboza, W., Cavalcante, T. F., Feitosa de Souza, M., de Oliveira Góes, M. A., & Santos, V. S. (2021). Factors Associated with Mortality among Hospitalized Patients with COVID-19: A Retrospective Cohort Study. The American Journal of Tropical Medicine and Hygiene, 104(1), 103–105. https://doi.org/10.4269/ajtmh.20-1170

Matsuo, K., Mandelbaum, R. S., Vallejo, A., Klar, M., Roman, L. D., & Wright, J. D. (2023). Assessment of Gender-Specific COVID-19 Case Fatality Risk per Malignant Neoplasm Type. JAMA Oncology, 9(8), 1113. https://doi.org/10.1001/jamaoncol.2023.0768

Mendoza-Cano, O., Trujillo, X., Huerta, M., Ríos-Silva, M., Guzmán-Esquivel, J., Lugo-Radillo, A., Benites-Godínez, V., Bricio-Barrios, J. A., Cárdenas-Rojas, M. I., Ríos-Bracamontes, E. F., Guzman-Solorzano, H. P., Baltazar-Rodríguez, G. M., Ruiz-Montes de Oca, V., Ortega-Macías, V. M., Ortega-Ramírez, A. D., & Murillo-Zamora, E. (2023). Assessing the Influence of COVID-19 Vaccination Coverage on Excess Mortality Across 178 Countries: A Cross-Sectional Study. Vaccines, 11(8), 1294. https://doi.org/10.3390/vaccines11081294

Moldokmatova, A., Dooronbekova, A., Zhumalieva, C., Mukambetov, A., Kubatova, A., Usenbaev, N., Kutmanova, A., Osmonov, A., Ibragimov, S., & Abdyldaev, T. (2021). Mathematical modelling of COVID-19 vaccination strategies in Kyrgyzstan. MedRxiv, 2012–2021.

Moon, H. jeong, Kim, K., Kang, E. K., Yang, H.-J., & Lee, E. (2021). Prediction of COVID-19-related mortality and 30-day and 60-day survival probabilities using a nomogram. Journal of Korean Medical Science, 36(35).

Newman, P. A., Reid, L., Tepjan, S., Fantus, S., Allan, K., Nyoni, T., Guta, A., & Williams, C. C. (2022). COVID-19 vaccine hesitancy among marginalized populations in the US and Canada: Protocol for a scoping review. PLoS One, 17(3), e0266120.

Nguyen, K. H., Srivastav, A., Razzaghi, H., Williams, W., Lindley, M. C., Jorgensen, C., Abad, N., & Singleton, J. A. (2021). COVID-19 Vaccination Intent, Perceptions, and Reasons for Not Vaccinating Among Groups Prioritized for Early Vaccination — United States, September and December 2020. MMWR. Morbidity and Mortality Weekly Report, 70(6), 217–222. https://doi.org/10.15585/mmwr.mm7006e3

Ramírez-Soto, M. C., & Ortega-Cáceres, G. (2022). Analysis of Excess All-Cause Mortality and COVID-19 Mortality in Peru: Observational Study. Tropical Medicine and Infectious Disease, 7(3), 44. https://doi.org/10.3390/tropicalmed7030044

Rodrigues, W., da Costa Frizzera, H., Trevisan, D. M. de Q., Prata, D., Reis, G. R., & Resende, R. A. (2022). Social, Economic, and Regional Determinants of Mortality in Hospitalized Patients With COVID-19 in Brazil. Frontiers in Public Health, 10. https://doi.org/10.3389/fpubh.2022.856137

Rushovich, T., Boulicault, M., Chen, J. T., Danielsen, A. C., Tarrant, A., Richardson, S. S., & Shattuck-Heidorn, H. (2021). Sex Disparities in COVID-19 Mortality Vary Across US Racial Groups. Journal of General Internal Medicine, 36(6), 1696–1701. https://doi.org/10.1007/s11606-021-06699-4

Sasson, I. (2021). Age and COVID-19 mortality: A comparison of Gompertz doubling time across countries and causes of death. Demographic Research, 44, 379–396. https://doi.org/10.4054/DemRes.2021.44.16

Seyedtabib, M., Najafi-Vosough, R., & Kamyari, N. (2024). The predictive power of data: machine learning analysis for Covid-19 mortality based on personal, clinical, preclinical, and laboratory variables in a case–control study. BMC Infectious Diseases, 24(1), 411. https://doi.org/10.1186/s12879-024-09298-w

Sharma, R. K., & Patidar, A. B. (2021). Self-Concept (Self-Image) of Indian Nurses Working in Hospitals. International Journal of Advance Research in Nursing, 4(1), 195–199. https://doi.org/10.33545/nursing.2021.v4.i1.c.153

Singh, P., Bhaskar, Y., Verma, P., Rana, S., Goel, P., Kumar, S., Gouda, K. C., & Singh, H. (2023). Impact of comorbidity on patients with COVID-19 in India: A nationwide analysis. Frontiers in Public Health, 10. https://doi.org/10.3389/fpubh.2022.1027312

Smith, D., J. Hakim, A., M. Leung, G., Xu, W., William Schluter, W., T. Novak, R., Marston, B., & S. Hersh, B. (2022). COVID-19 Mortality and Vaccine Coverage — Hong Kong Special Administrative Region, China, January 6, 2022–March 21, 2022. China CDC Weekly, 4(14), 288–292. https://doi.org/10.46234/ccdcw2022.071

Thakur, B., Dubey, P., Benitez, J., Torres, J. P., Reddy, S., Shokar, N., Aung, K., Mukherjee, D., & Dwivedi, A. K. (2021). A systematic review and meta-analysis of geographic differences in comorbidities and associated severity and mortality among individuals with COVID-19. Scientific Reports, 11(1), 8562. https://doi.org/10.1038/s41598-021-88130-w

Torres, M. L., Palma Díaz, D., Oliver-Parra, A., Millet, J.-P., Cosialls, D., Guillaumes, M., Rius, C., & Vásquez-Vera, H. (2022). Inequities in the incidence and mortality due to COVID-19 in nursing homes in Barcelona by characteristics of the nursing homes. PLOS ONE, 17(6), e0269639. https://doi.org/10.1371/journal.pone.0269639

Tran, P., Tran, L., & Tran, L. (2021). The Influence of Social Distancing on COVID-19 Mortality in US Counties: Cross-sectional Study. JMIR Public Health and Surveillance, 7(3), e21606. https://doi.org/10.2196/21606

Valeanu, L., Andrei, S., Morosanu, B., Longrois, D., & Bubenek-Turconi, S.-I. (2023). The COVID-19 Vaccination Coverage in ICU Patients with Severe COVID-19 Infection

in a Country with Low Vaccination Coverage—A National Retrospective Analysis. Journal of Clinical Medicine, 12(5), 1749. https://doi.org/10.3390/jcm12051749

Yoshida, Y., Wang, J., & Zu, Y. (2022). Sex differences in comorbidities and COVID-19 mortality–Report from the real-world data. Frontiers in Public Health, 10. https://doi.org/10.3389/fpubh.2022.881660

Yu, Y., Shi, M., Hu, M., & Zhang, J. (2022). Assessing the Impact of Continuous Vaccination and Voluntary Isolation on the Dynamics of COVID-19: A Mathematical Optimal Control of SEIR Epidemic Model. Computational Intelligence and Neuroscience, 2022, 1–13. https://doi.org/10.1155/2022/3309420

Zanettini, C., Omar, M., Dinalankara, W., Imada, E. L., Colantuoni, E., Parmigiani, G., & Marchionni, L. (2021). Influenza Vaccination and COVID-19 Mortality in the USA: An Ecological Study. Vaccines, 9(5), 427. https://doi.org/10.3390/vaccines9050427