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Medical Schemes and COVID-19 Related Mortality - South Africa: An Explorative Study

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1. Abstract

1.1. Background: The COVID-19 epidemic has adversely affected health systems globally,

with some on the verge of collapse, as countries experienced the second wave of the pandemic. Millions of people have died from the pandemic, particularly the elderly and those with comorbidities. COVID-19 infections are also increasing at an alarming rate, with South Africa recording more than 2,5 million infections, nearly 75,000 fatalities, and just over 6 percent of the population fully vaccinated as at 09 August 2021. While the number of infections continues to rise, so do the number of fatalities. These trends are also evident in medical scheme environments.

1.2. Objectives: The objective of this paper was to study and report on the demographic characteristics of COVID-19 related fatalities in medical schemes.

1.3. Methods: The study design was an explorative analysis of medical schemes patients' mortality data, post hospitalisation. The review period was hospital mortality data reported between March 2020 and August 2021. Primary ICD-10 admission and discharge diagnoses were stratified into three main categories; mainly COVID-19 confirmed related fatalities, COVID-19 suspected cases, and other conditions. A laboratory-confirmed (RT– PCR assay) that a COVID-19 test was used to identify COVID-19 fatalities as per the World Health Organisation's (WHO's) guidelines and definitions.

1.4. Results: Mortality data from a total of 52 medical schemes was analysed. The schemes analysed accounted for 8,1 million people. The total number of fatalities reported was 13,466, affecting 1,664 per million beneficiaries over the review period. The weighted average of patients who died was not statistically significant when controlling for gender. The weighted average age of all fatalities was 63. The average inpatient days in the hospital before death was 12 days. Over two-thirds of the deaths were COVID-19 confirmed admissions, 35 percent and 8 percent were COVID-19 suspected admissions, and the remaining 57 percent died due to other underlying conditions. More male patients than female patients died of COVID-19 (60.4 percent vs 39.6 percent, $p<0.001$). Just under a third of COVID-19 related fatalities were discharged from the ICU, compared to the 43 percent released in the General Ward, just under 13 percent from High Care and just under 10 percent were from other facilities, including other step-down rehabilitation centres.

1.5. Conclusion: The study found evidence that mortality, post hospitalisation in COVID-19 confirmed admissions mainly occurred in those over the age of 60. In the main, males reported higher mortality rates, compared to females; as a result of COVID-19. Most COVID-19 fatalities occurred in those discharged from High Care, followed by ICU fatalities. Those who died in ICU stayed two days longer than those in High care, with inpatient days of 12 and 10 days, respectively. The study also found evidence of mortality due to COVID-19 in younger age groups. However, this was not significant in the primary age groups 0 to 9, 10 to 19 and 20 to 29 combined, reporting less than 1 percent of fatalities due to COVID-19. The findings are consistent with recent studies at the population level, further depicting and providing evidence of the

age factor in COVID-19 related fatalities.

2. Background

Millions of people have died from the pandemic, in particular the elderly and those with comorbidities. COVID-19 infections are also increasing at an alarming rate to more than 204 million infections, claiming more than 4,3 million lives as of 08 August 2021. The African continent accounts for 3 percent of the global fatalities. South Africa accounted for 36 percent of fatalities in the African continent and 1 percent globally, making South Africa the epicentre of COVID-19 on the African continent.

South Africa has recorded nearly 75,000 fatalities, and just over 6 percent of the population was fully vaccinated as at 09 August 2021. While the number of infections continues to rise, so do the number of fatalities. These trends are also evident in the medical schemes environment, mainly privately funded and operating in the private sector. Medical schemes account for just under 16 percent of the South African population and for just over 50 percent of health care spending in the country. Recent studies have investigated the demographic profile conducted in the private sector. A study by Pillay- van Wyk et al. (2020) found the age-standardised death rate from COVID-19 to be 64.5 (95 percent confidence interval (CI) 62.3 - 66.8) fatalities, i.e., fatalities per million population (Pillay-van Wyk et al., 2020) [8].

3. Study Objectives

This research aimed to study and report on the demographic characteristics of COVID- 19 related fatalities in medical schemes.

4. Literature Review

4.1. Complications, Risk Factors and the Mortality Rate of COVID-19

Age is considered the principal risk factor associated with COVID-19 hospital admissions and complications. Jassat et al. (2020) found that an older age is one of the factors statistically associated with in-hospital COVID-19 mortality (Jassat et al., 2020) [2]. Various studies have also linked COVID-19 morbidity, mortality and severity to older age profiles, such as patients older than 60 (Yanez et al., 2020; Jin et al., 2020; Sanyaolu et al.,2020; Mueller et al., 2020) [16, 3, 11, 7]. Furthermore, Yanez et al. (2020) found that persons older than 65 had a 7.7 percent greater chance of dying from COVID-19 than those between the ages of 55 and 64 (IRR = 7.7, 95%CI = 7.4, 7.9) (Yanez et al., 2020) [16].

While men and women have the exact same prevalence rate of COVID-19, studies have found that men with COVID-19 are at a higher risk of bad outcomes or death than women, irrespective of age (Jin et al., 2020). According to Himmels et al. (2020) age is one of the essential factors associated with increased mortality due to COVID-19 complications (Himmels et al., 2020) [4]. Male gender, number and severity of most comorbidities were significant predictors of COVID-19-related deaths. A study by Yanez et al. (2020) found that men had higher mortality rates than women at 77 percent (Yanez et al., 2020) [16]. Pantea Stoian et al. (2020) found in the present study that a greater number of COVID-19 related fatalities occurred in men rather than women (62.5 percent men vs 37.5 percent women) (Pantea Stoian et al., 2020) [9]. A study by Jin et al. (2020) revealed that the older the ages and the higher the comorbidities, the more significant was the severity and mortality rate in patients with COVID-19 (Jin et al., 2020) [3]. Several studies found an increased admission rate into intensive care units (ICU) and higher mortality rates caused by COVID-19 disease in older patients, especially those at the age of 65 and older who had comorbidities and were infected (Sanyaolu et al., 2020; Jassat et al., 2020; Kennedy et al., 2020) [11, 2, 5].

5. Methodology

5.1. Study Design

The study design was an explorative analysis of medical schemes patients' mortality data, post hospitalisation. The review comprised hospital mortality data reported for the period between March 2020 to August 2021. The inclusion criterion was the length of stay (LoS). The endpoint was a fatality report using the primary ICD-10 discharge diagnosis. The hospital discharge diagnosis was further stratified into three main categories: namely; COVID-19 confirmed related fatalities, COVID-19 suspected fatalities and fatalities due to other conditions. A laboratory-confirmed (RT – PCR assay) that a COVID-19 test was used to identify COVID-19 cases as per the World Health Organisation's (WHO's) guidelines and definitions (WHO, 2020b; WHO, 2020c). The first two groups comprised COVID-19 related diagnoses, mainly COVID-19 confirmed and COVID-19 suspected diagnoses, as per the WHO case definitions. The third group were patients with a hospital admissions diagnosis linked to other types of ICD-10 discharge diagnoses.

5.2. Statistical Analysis

Data mining and statistical analyses were conducted in SAS 9.4 (North Carolina, USA) and STATA 14. Continuous variables were depicted as mean ± SD, median [interquartile range (IQR)], or percentages. The student t-test was used to compare differences between continuous variables. Categorical variables were depicted as frequency and proportions. A Chi-square test was used to compare categorical variables. For unadjusted comparisons, a 2-sided α of less than 0.05 was considered statistically significant.

6. Results

6.1. Demographic Characteristics

This study analysed mortality data from 52 medical schemes, and the schemes analysed accounted for 8,1 million beneficiaries. The total number of fatalities reported was 13,466, derived from 1,664 per million beneficiaries over the review period. The weighted average of patients who died was not statistically significant when

controlling for gender. The weighted average age of all fatalities was 63. The average inpatient days in the hospital before death was 12 days. Over two-thirds of deaths were COVID-19 confirmed admissions, 35 percent and 8 percent were COVID-19 suspected admissions, and the remaining 57 percent deaths were due to other underlying conditions, as depicted in Figure 1 below (Figure 1). Table 1 below illustrates that the median average age of COVID-19 confirmed fatalities in females was higher than in males, aged 65 IQR (54 to 77) and 63 IQR (54 to 73), respectively. COVID-19 suspected discharge diagnosis fatalities showed slightly higher than the COVID-19 confirmed fatalities, with the median age for females also being higher than that of males, namely 72 (57 to 82) and 67 (55 to 79), respectively. More females died of non-COVID-19 related diagnoses than their male counterparts, 53.95 percent vs 46.05 percent, p<0.001. The median age was 61 (52 to 72) vs 62 (54 to 71). The average inpatient days for COVID-19 related fatalities for males and females were 11.54 (SD=11.16) years and 11.80 (SD=10.81) years, respectively. Inpatient fatalities linked to COVID-19 suspected that discharge diagnoses were slightly higher at 12.26 (Sd=13.48) and 12.08 (SD=13.15) years for females and males, respectively. The marginally higher inpatient days for a COVID-19 suspected diagnosis than for COVID-19 have confirmed that COVID-19 fatalities had a slightly higher age profile (Table 1). Table 2 below shows case facilities by discharge diagnosis and age bands; the table further depicts those fatalities tended to occur at older ages. Lower or younger age categories accounted for less than 4 percent of fatalities across all three discharge category diagnoses. Age categories younger age profiles <30 years are depicted as COVID-19 confirmed fatalities namely 0.83 percent. Other types of diagnosis accounted for 1.57 percent in <30-year age bands, and COVID-19 suspected fatalities accounted for3.31 percent. Most fatalities for COVID-19 confirmed that related fatalities occurred in the age band 60+, accounting for 60.98 percent of fatalities. Most fatalities related to COVID- 19 suspected diagnosis were accounted for in the age band 60+, accounting for 76.50 percent. Lastly, non-COVID-19 related fatalities were accounted for in age bands 60+, accounting for over half of the fatalities at 55.66 percent (Table 2).

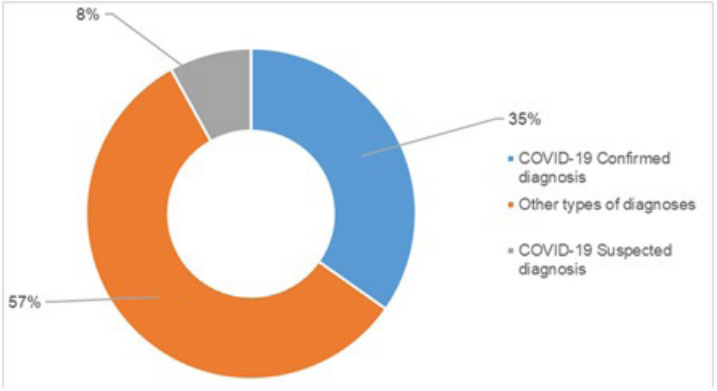

Figure 1: Fatality by hospital discharge primary ICD-10 diagnosis, %

Table 1: Case facilities by gender and inpatient days by ICD-10 primary discharge

Inpatient days						*Age*	
ICD-10 Primary Hospital Discharge Diagnosis Description	***Gender***	***N***	***%***	***Mean***	***Std Dev***	***Median (IQR)***	***P-value***
COVID-19 Confirmed diagnosis	**Female**	1,854	39.6	11.54	11.16	65 (54 to 77)	<0.0001
	Male	2,828	60.4	11.8	10.81	63 (54 to 73)	
Other types of diagnoses	**Female**	4,153	53.95	12.06	12.13	61 (52 to 72)	<0.0001
	Male	3,545	46.05	11.42	10.96	62 (54 to 71)	
COVID-19 Suspected diagnosis	**Female**	511	47.05	12.26	13.48	72 (57 to 82)	0.05309
	Male	575	52.95	12.08	13.15	67 (55 to 79)	

Table 2: Case facilities by age categories and inpatient days by hospital discharge ICD-10 primary discharge diagnosis

Inpatient Days					
ICD-10 Primary Hospital Discharge Diagnosis Description	***Age categories***	***N***	***%***	***Mean***	***Std Dev***
COVID-19 Confirmed diagnosis	**0 to 9 years**	4	0.09	4	2.83
	10 to 19 years	10	0.21	15.5	20.78
	20 to 29 years	25	0.53	14.52	20.06
	30 to 39 years	192	4.1	10.45	11.15
	40 to 49 years	552	11.79	12.32	11.14
	50 to 49 years	1,044	22.3	12.54	11.13
	60 to 69 years	1,177	25.14	12.25	11.41
	70+ years	1,678	35.84	10.67	10.05

Other types of diagnoses	**0 to 9 years**	15	0.19	12.87	23.72
	10 to 19 years	26	0.34	10.15	17.76
	20 to 29 years	80	1.04	10.91	17.5
	30 to 39 years	342	4.44	10.16	10.88
	40 to 49 years	914	11.87	11.65	10.87
	50 to 49 years	2,036	26.45	12.8	12.09
	60 to 69 years	2,011	26.13	12.25	11.34
	70+ years	2,273	29.53	10.73	11.23
COVID-19 Suspected diagnosis	**0 to 9 years**	15	1.38	9.93	16.47
	10 to 19 years	6	0.55	10.67	7.69
	20 to 29 years	15	1.38	16.6	18.22
	30 to 39 years	48	4.42	12.6	11.98
	40 to 49 years	90	8.29	12.26	13.46
	50 to 49 years	179	16.48	15.13	18.38
	60 to 69 years	179	16.48	12.62	12.7
	70+ years	554	51.01	10.96	11.15

6.2. Fatalities by Hospital Discharge Trends

Significantly more fatalities occurred in the high care unit, accounting for 39 percent. The second highest category was ICU which accounted for 26 percent. Just under one fifth of deaths occurred in high care, and lastly, those that occurred in other types of facilities accounted for only 16 percent of fatalities (Figure 2).

Figure 3 below shows case fatalities by hospital discharge facilities, and further depicts fatalities in older age groups. Significantly more fatalities occur in patients admitted in the general ward. Those in the 60+ years age bands accounted for 23 percent of deaths in patients admitted into general wards.

The second highest group of fatalities was in patients admitted into ICUs, where the age group of 60+ accounted for 15 percent of deaths. High care accounted for 10 percent of deaths in the 60+ age group. Slightly more than 10 percent of fatalities discharged from other facilities accounted for 11 percent of deaths (Figure 3). Table 2 below shows fatalities adjusted for hospital discharge facility type and admission diagnosis type. On COVID-19 confirmed diagnosis fatality; more than 40 percent of deaths occurred in a general ward, (43.64 percent). The mean inpatient days in the general ward was 10.81 (SD=10.67) days, and the median age of 65 IQR (54 to 75). ICU accounted for the second-highest proportions of COVID-19 related fatalities namely 32.83 percent.

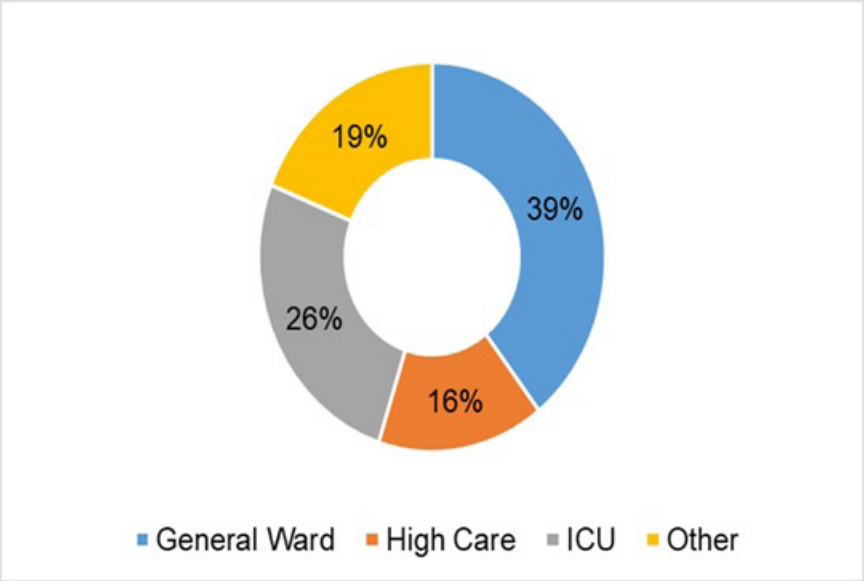

Figure 2: Fatalities by facility, %

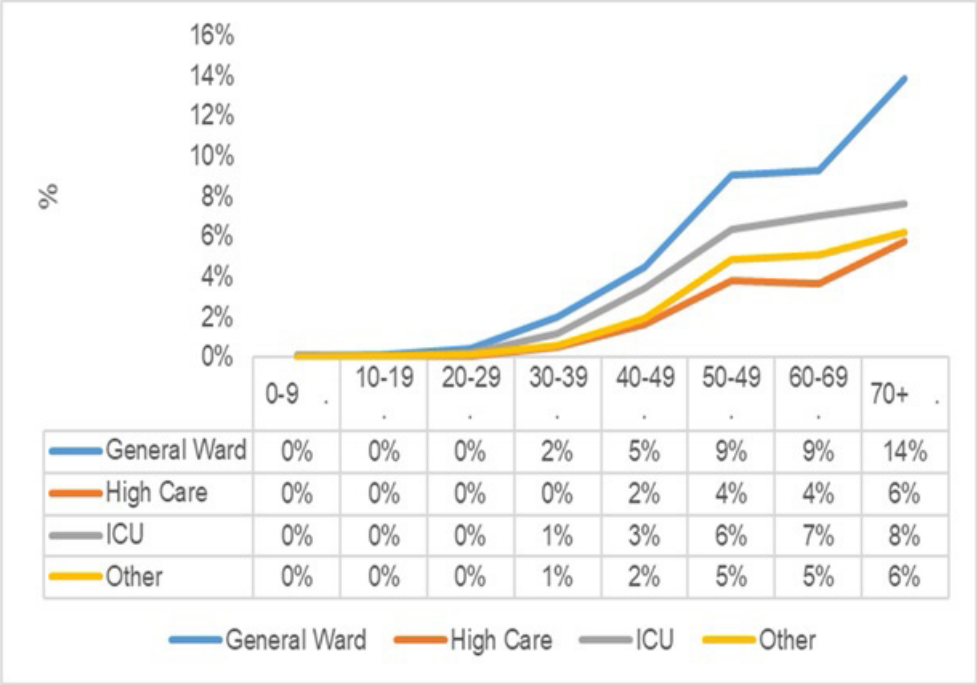

Figure 3: Fatalities by facility and age bands, %

This group's mean inpatient days and median age were 12.99 (SD=11.35) days and 62 IQR (53 to 73) years, respectively. High care accounted for the third-highest proportion of COVID-19 related fatalities, namely 13.84 percent. This group's mean inpatient days and median age were 12.62 (SD=11.19) days and 65 IQR (55 to 77) years, respectively. Other admitting facilities accounted for the fourth-highest proportion of COVID-19 related fatalities, accounting for 9.70 percent. This group's mean inpatient days and median age were 10.00 (SD=9.80) days and 61 IQR (52 to 72) years, respectively. Regarding COVID-19 suspected diagnosis fatalities, more than half of these deaths occurred in a general ward, namely 55.16 percent. The mean inpatient days in the general ward was 11.04 (SD=11.29) days, and the median age of 61 IQR (53 to 72). ICU accounted for the second-highest proportions of COVID-19 related fatalities, accounting for 23.48 percent. This group's mean inpatient days and median age were 10.74 (SD=12.00) days and 67 IQR (53 to 77) years, respectively. High care accounted for the third-highest proportion of COVID-19 suspected fatalities, accounting for 20.90 percent. This group's mean inpatient days and median age were 15.44 (SD=15.28) days and 72 IQR (57 to 77) years, respectively. Other admitting facilities accounted for the fourth highest proportions of COVID-19 suspected fatalities, at 5.00 percent.

On other types of diagnosis fatalities, more than a third of the deaths occurred in a general ward, namely 34.68 percent. The mean inpatient days in the general ward were 11.04(SD=11.29) days, and the median age was 61 IQR (52 to 72) years. Other types of admitting facilities accounted for the second-highest group, accounting for 27.16 percent. This group's mean inpatient days and median age were 11.43 (SD=10.77) days and 62 IQR (54 to 72) years, respectively. The ICU accounted for the third-highest proportion of fatalities, accounting for 22.33 percent. This group's mean inpatient days and median age were 12.82 (SD=13.20) days and 61 IQR (52 to 70) years, respectively. High care accounted for the fourth group of fatalities, accounting for 15.82 percent. This group's mean inpatient days and median age were 12.44 (SD=11.15) days and 62 IQR (55 to 73) years, respectively.

7. Discussion

This research study sought to assess the characteristics of patients discharged to private hospitals who subsequently died from COVID-19 related causes, COVID-19 suspected, or other types of discharge diagnoses. The study analysed medical schemes and found that of the 13,466 patients who died; nearly 60 percent (57 percent) of patients died of other related diagnoses and just over a third of those died of COVID-19 related diagnoses (35 percent). A study done by Wu and McGoogan (2020) into 858 deaths across 27 countries reported a case fatality rate CFR of 34 percent (Wu & McGoogan, 2020). Only 8t percent of patients died of COVID-19 suspected diagnoses. The fatality ratio in this study was higher than that conducted by Jassat et al. (2020) who found a CFR of 18 percent among hospitalised patients in South Africa (Jassat et al., 2020) [2]. The findings of this study are consistent with a range of CFRs reported in Europe of 24 to 32 percent. More specifically, the results of this study are compatible with in-hospital mortality rate ranges from 30 to 32 percent in the United Kingdom (UK) and from 24 percent in Germany (Knight et al., 2020; Baqui et al., 2020; Jassat et al., 2020) [6, 1, 2]. Studies have shown that demographic characteristics such as age and gender have increased the risk of COVID-19, mainly in older patients; similarly, with mortality. A survey done by Jassat et al. (2020) found that factors such

as an older age and male sex, amongst others, were statistically associated with in-hospital COVID-19 mortality (Jassat et al., 2020) [2]. This study found the weighted average age of patients who died to be 63. When adjusting for COVID-19 fatalities and gender, there were significantly more male patient fatalities than female, at 60.4 percent vs 39.6 percent, p<0.001. Pantea Stoian et al. (2020) found in the present study that the highest number of COVID-19 related fatalities in men was greater that of women (62.5 percent men vs 37.5 percent women) (Pantea Stoian et al., 2020) [9]. The median average age of COVID-19 confirmed fatalities in females was higher than that of males, 65 IQR (54 to 77) and 63 IQR (54 to 73), respectively and those who died of COVID-19 suspected fatalities had a slightly higher median age for females than for males. These findings are consistent with global studies that have found that COVID-19 morbidity and mortality severity is associated with male patients older than 65 (Jassat et al., 2020) [2]. Jin et al. (2020) showed greater severity and mortality levels in older COVID-19 patients, particularly those with a higher number of comorbidities (Jin et al., 2020) [3]. Several studies found an increased admission rate into the intensive care unit (ICU) and mortality from COVID-19 disease in older patients, especially those of 65 years old and above who had comorbidities and were infected (Sanyaolu et al., 2020) [11].

Ruan et al., (2020) found that survival time from COVID-19 to death showed two peaks, with the first at approximately 14 days (22 cases) and the second at about 22 days (17 cases). This study found that the inpatient days varied across hospital facilities. The mean inpatient days for COVID-19 related discharge diagnosis from the general ward was 11.04 (SD=11.29) days. However, for COVID-19, the expected discharge diagnosis from high care was 15 days. These was also because of age, where higher inpatient days were consistent within the older age groups.

8. Conclusion

The study found evidence of mortality post hospitalisation in COVID-19 confirmed admissions which mainly occurred in patients over the age of 60. In the main, males reported higher mortality rates compared to females due to COVID-19. Most COVID-19 fatalities occurred in those in high care, followed by those in the ICU setting. Those who died in ICU stayed two days longer than those in high care, with inpatient days of 12 and 10 days, respectively. The study also found evidence of mortality due to COVID-19 in younger age groups. However, this was not significant, reporting less than 1 percent of fatalities due to COVID-19. The findings of this study are consistent with recent studies at a whole population level, further depicting and providing evidence of key demographic characteristics such as age and gender, as predictors of COVID-19 fatalities.

8.1. Study Limitations and Future Studies

A comprehensive analysis or the audit of fatalities was not conducted due to a lack of access to the primary data. Clinical records at discharge could provide further insight into the findings of this study, in particular in patients who had underlying conditions before contracting COVID-19. Further analysis adjusting for other risk factors such as age and gender could provide more insight into fatality rates. Studies have revealed that the risk of severe disease and death when adjusting for other factors such as comorbidities other than gender, reduces significantly (WHO, 2020a). Ruan et al. (2020) found that 63 percent of patients in the death group and 41 percent in the discharge group had underlying diseases (p = 0.0069) (Ruan et al., 2020) [10]. Ruan et al. (2020) further showed that patients with cardiovascular diseases have a significantly increased risk of death from SARS-CoV-2 infection (p < 0.001) (Ruan et al., 2020) [10]. Future research studies should conduct detailed analysis and should audit discharge diagnoses related to fatalities and other chronic conditions, including other facilities such as step-down and home-based care, and others related to mortality.

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