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Research Article

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Causes of death amongst medical schemes patients diagnosed with COVID-19, COVID-19 suspected and other diagnoses, South Africa

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Abstract

Background: *The COVID-19 epidemic has adversely affected health systems globally, with some on the verge of collapse as countries experienced subsequent waves. By 24 October 2021, nearly five million people globally have succumbed to the pandemic. Hardly hit are the elderly and those with comorbidities.*

Objectives: *The primary objective of this study was to invstigate demographic characteristics of COVID-19 related deaths of private patients privately funded by medical schemes. The secondary objective of this research was to analyse and compare the causes of deaths related to COVID-19 diagnosis and other diagnoses amongst medical scheme patients.*

Methods: *The study design was a retrospective study on medical schemes patients' mortality data, mainly the private sector data in South Africa. The study included secondary data from fifty-two medical schemes and was collected at an aggregated level as the researcher did not access the complete patient database. The analysis included hospital mortality data collected from medical schemes between March 2020 and August 2021. The schemes accounted for 8,1 million people (lives or beneficiaries of medical schemes). ICD-10 discharge diagnoses were grouped into three categories; mainly COVID-19 confirmed related deaths, COVID-19 suspected cases and other conditions. A laboratory-confirmed (RT-PCR assay) and Antigen tests conducted in private hospitals were used to identify COVID-19 deaths as per the World Health Organisation's (WHO) guidelines.*

Results: *The incidence rate was 1,664 per million beneficiaries, and the case fatality rate was 2,6 percent. The median age of female patients who died after hospital admission was higher than males at 65 (54-77) and 63 (54-73) years, respectively. The median length of stay in hospital was 11 (5-23) days for females, slightly higher than for male patients at 10 (4-20) days. Over two-thirds of the deaths were COVID-19, and under ten percent were COVID- 19 suspected, 35 percent and 8 percent, respectively. Those dependent on respirators accounted for 3,6 percent of the patients who died. Three percent of patients were in isolation, and the other three percent had pneumonia, unspecified. Just under a third of COVID-19 related deaths were treated in ICU, compared to the 43 percent treated in the General Ward, just under 13 percent from High Care and just under 10 percent were treated in other facilities, including other step-down rehabilitation centres.*

Conclusion: *This study highlighted a more significant proportion of males in COVID-19 confirmed and suspected, but a more significant proportion of female deaths in other diagnoses. This study also found the risk of mortality amongst COVID-19 suspected patients who were 70 years and older.*

Keywords: COVID-19, Mortality, Medical Schemes, South Africa.

Background

Nearly five million people globally have succumbed to COVID-19 as of October 2021, the elderly and those with comorbidities experiencing higher mortality rates. COVID-19 infections have declined, with South African officially out of the third wave as of October. The country recorded more than 2,9 million lives infected, nearly 89,000 deaths, and just over 17.6% percent of the population fully vaccinated as of 15 October 2021. COVID-19 data for the private patients funded by medical schemes follow a similar trajectory as national figures.

South Africa experienced deaths in the first, second, and third

waves of the COVID-19 pandemic [1]. Furthermore, StatsSA data showed that life expectancy reduced due to the COVID-19 pandemic [1] StatsSA further depicts a decline in life expectancy of both males and females from 62,4 years in 2020 to 59,3 years in 2021 (3,1-year drop) and from 68,4 years in 2020 to 64,6 years for (3,8-year drop), respectively [1].

The number of deaths on patients admitted in hospitals has also increased since the number of deaths reported by DATCOV in South Africa depicts just over 433 770 admissions. A significant proportion of COVID-19 patients admitted were discharged alive from the hospitals, 74,3 percent. Just over a percent were still in hospital and just under three percent transferred to other facilities. COVID-19 related deaths accounted for 21.6 percent of all admissions, non-COV-19 admissions accounted just under a percent, 0.1 percent [2].

Table 1: Admissions by discharge type-South Africa. Source: NICD, 2021

	N	%
Admissions	433 770	
discharged alive	322 110	74.3%
Died	93 907	21.6%
Transfer to other facility	12 650	2.9%
In Hospital	4 834	1.1%
Died (non-COVID)	271	0.1%

There is comprehensive literature on the effect of demographic characteristics such as age, gender, and comorbidities. The literature revealed that adults above the age of 60 and those with pre-existing medical conditions had a higher likelihood of severe COVID- 19 infection [3]. Chronic conditions such as hypertension are ranked amongst the high-risk factors to COVID-19. A study by Araújo, Nunes , Costa et al found hypertension to be one of the most frequent risk conditions for severe COVID-19 [4]. A study by Ebrahim, Geffen, Giacomin et al. looked at the effect of COVID-19 among the elderly; the study found that in six of the 11 countries, people 60 years older accounted for over three- quarters of deaths [5]. A study by Pillay-van Wyk et al. [6] found the age-standardised death rate from COVID-19 to be 64.5 (95 percent confidence interval (CI) 62.3-66.8) deaths, i.e., deaths per million population [6]. These trends are also notable in medical schemes which provide funding for private clients and utilise services in the private health sector. Medical schemes accounted for under fifteen percent of the South African population in 2020, the balance of the population is accounted for by the public sector. Age, gender, and comorbidities have consistently been found to be significant risk factors to COVID -19. However, very few studies have assessed the actual causes of death on patients diagnosed with COVID-19.

Study Objectives

The primary objectives of this study was to assess the cause of death among medical schemes that were treated in the private sector. The secondary objective was to compare mortality for patients diagnosed with COVID-19, COVID-19 suspected diagnosis, and Other types of diagnosis treated in private hospitals and subsequently died.

Literature Review

Risk Factors associated with COVID-19 deaths

Age, commodities, males are principal risk factors associated with COVID-19 hospital admissions, complications and deaths [7]. Studied conducted in South Africa also found age as statistically associated with in-hospital COVID-19 mortality [8,9]. Various studies have also linked COVID-19 morbidity, mortality, older age profiles, such as patients older than 60 [10-14]. Furthermore, Yanez et al. found that persons older than 65 years vs between 55 and 64 years had nearly eight percent of dying from COVID-19 than those between [10].

Men and women do not have healthcare-seeking behaviour; as a result, prevalence of chronic conditions does not always follow the same pattern. This phenomenon is notable with COVID-19, where men with COVID-19 are at a much higher risk of death than women, irrespective of age [11]. Male gender, number and severity of most comorbidities were significant predictors of COVID-19-related deaths. A study by Yanez et al. found that men had higher mortality rates than women at 77 percent [10]. Pantea Stoian et al. found in the present study that a more significant number of COVID-19 related deaths occurred in men rather than women (62.5 percent men vs 37.5 percent women) [15].

There is 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 [9,12,16].

Methodology

Study design

The study design was a retrospective study design on medial schemes patients' mortality data. The study included secondary data collected at an aggregated level from medical schemes, and the complete patient database was not accessible-the analysis comprised mortality data from 52 medical schemes, accounting for

8,1 million beneficiaries. The endpoint was the death of a patients admitted to private hospital. The hospital ICD-10 discharge diagnosis was grouped into three main categories: COVID-19 confirmed related deaths, COVID-19 suspected deaths, and deaths due to other conditions [17,18]. A laboratory-confirmed (RT-PCR assay) and the Antigen tests were used to identify COVID-19 cases [19,20]. 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 who died from other types of diagnosis.

Ethical Considerations

The data sourced from the Council for Medical schemes were reported at the aggregated level. As a result, no personal nor confidential patient information was depicted.

Statistical analysis

SAS 9.4 and STATA 14 were used to conduct statistical analyses [18]. Continuous variables were depicted with median [interquartile range (IQR)]. Categorical variables were summarised using frequency and proportions. A Chi-square test was used to compare categorical variables, and an α of less than 0.05 was considered statistically significant.

Results

Demographic characteristics

Covid-19 confirmed deaths accounted for 35% of deaths, Covid-19 suspected patients accounted for 8%, and those dependent on respirators accounted for 4% of all deaths. The median age of all deaths was 61 (52-72) years. The median age of the COVID-19 suspected diagnosis was higher than the confirmed diagnosis at 70 (56-81) years and 63 (54-75) years, respectively. The median age of deaths related to pneumonia-unspecified was lower than 60 years at 58 (49-71) years. When adjusting for COVID-19 deaths and gender, there were significantly more male patient deaths than females, where females accounted for 60.4 percent of deaths and males accounted for 39.6 percent, p<0.001.

Table 1: Hospital discharge diagnosis by age and the length of stay.

			Age	ALOS
ICD-10 Primary Discharge Diagnosis Description	N	%	Median IQR	
Confirmed	4682	35%	64 (54-75)	8 (4-16)
Other	1911	14%	62 (54-71)	12 (5-23)
Suspected	1086	8%	70 (56-81)	8 (3-16)
Dependence on respirator	483	4%	59 (51-66)	26 (14-41)
Isolation	431	3%	62 (55-72)	14 (7-27)
Pneumonia, unspecified	396	3%	58 (49-70.5)	8 (4-19)
Adult respiratory distress syndrome	316	2%	60 (53-70)	15 (8-27)
Other viral pneumonia	271	2%	63 (54-73)	13 (6-21)
Essential (primary) hypertension	222	2%	63 (56-71)	10.5 (5-20)
Laboratory examination	168	1%	64.5 (54-77)	10 (3-22)
Acute renal failure, unspecified	153	1%	61 (56-71)	19 (8-32)
Dyspnoea	151	1%	61 (52-73)	11 (5-21)
Unspecified acute lower respiratory	135	1%	59 (52-73)	9 (5-17)
Acute respiratory failure, Type I	128	1%	60 (52-69)	17 (8-29)
Special screening examination for o	93	1%	63 (55-71)	21 (8-35)
Hyperglycaemia, unspecified	85	1%	60 (55-70)	20 (8-32)
Blood transfusion (without reported	74	1%	61 (51-69)	32 (16-48)
Tachycardia, unspecified	71	1%	58 (51-64)	18 (10-32)

Table 1 above further depicts that median LOS for COVID-19 confirmed deaths, COVID-19 suspected, Pneumonia-unspecified, Adult respiratory distress syndrome, Other viral Pneumonia and Essential (primary) hypertension were 8 (4-16), 12 (3-16), 26 (14-41), 8 (4-19), 15 (8-27), 13 (13 6-21), 11 (5-20) days respectively.

Incidence rate

The incidence rate of 1,664 per million beneficiaries is depicted in figure 1 below. The incidence declines when excluding the largest biggest open and restricted schemes to 2,387 and 1,188 per million beneficiaries, respectively. The incidence when both schemes are excluded in the data declines to just under 2000 per million beneficiaries. The incidence at the national level for South Africa as of 25 October 2021 was 1,518 [21]. The Council for

Medical Schemes annual report depicts just over 500 000 lives of the private sector that have been infected by COVID-19 [22]. The Case Fatality Rate (CFR) for medical schemes was estimated at 2,69%, and for South Africa was 3%, thus depicting a similar effect in the private sector [21].

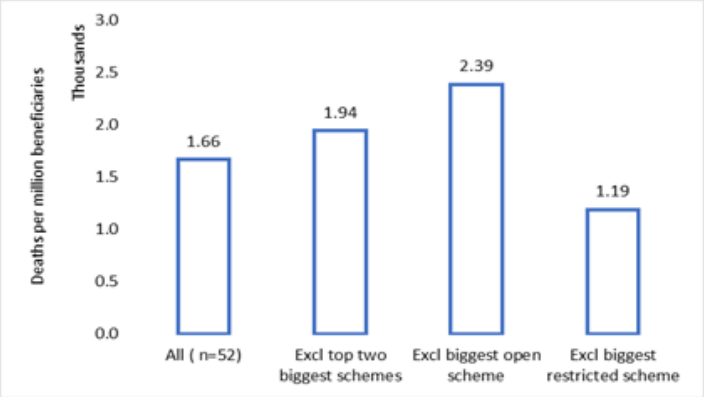

Figure 1: Incidence amongst all beneficiaries.

Cause of death by age

Figure 2 below shows the proportion of deaths by age bands and cause of death. A noteworthy feature of the data is that the age band 70+ years accounted for more than half of the deaths of patients who were COVID-19 suspected. This further depicts this as a vulnerable group, a higher risk age group. A similar phenomenon, death in the age group 70+ years accounted for 36 percent of deaths that were COVID-19 confirmed. Patients' dependent on respirators were mainly accounted for in the age band 50-69, which accounted for 65% of deaths dependent on a respirator. Deaths on patients that had pneumonia, unspecified, were mainly accounted for in the age band 50-59. This age band accounted for 30 percent of death in this group of patients. Ninety-nine percent of deaths in patients diagnosed within the age bands 40+ years, the remaining one percent was in the age band 30-39 years. Overall, the 40+ age band accounted for 92, 95, 95, 87, 96, 99, and 97 percent of deaths for patients who died from the following diagnosis; COVID-19 Suspected, COVID-19 Confirmed, Dependence on the respirator, Pneumonia- unspecified, Other Essential (primary) hypertension and those that were in isolation, respectively.

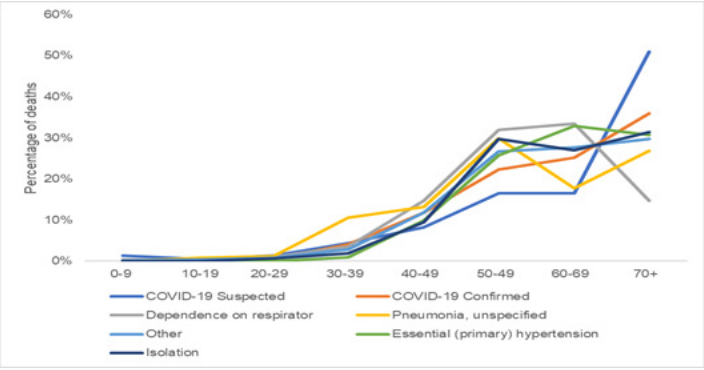

Figure 2: Proportion of deaths by age bands and cause of death.

Deaths by admitting facility

Significantly more deaths occurred in the high care unit, accounting for 39 and 40 percent for female and male patients, respectively. The second higher group were patients treated in the ICU, 24 and 28 percent for females and males. Just over a fifth of female patients was treated in other facility type compared to the sixteen percent of males. Figure 3 below shows deaths by hospital discharge facilities, gender, and age. Significantly more deaths 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 deaths was in patients treated in ICU. The age group of 60 and older accounted for fifteen percent of deaths.

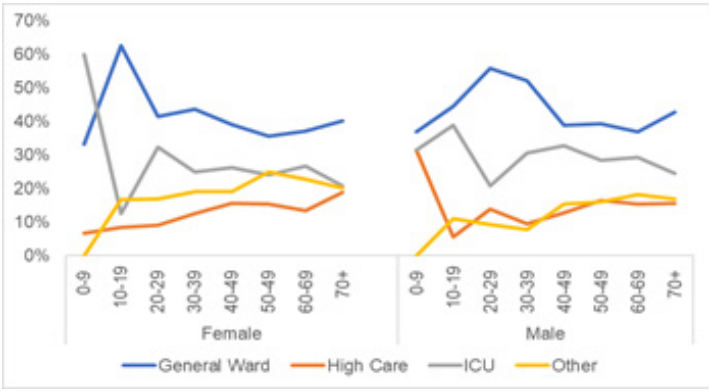

Figure 3: Deaths by Facility, Gender, and Age.

Table 2 below shows deaths adjusted for hospital discharge facility type and admission diagnosis type. Generally, more patients in the General Ward; 44 percent of patients diagnosed with COVID-19. This was followed by ICU, which accounted for 33 percent, High Care and other types of facilities accounted for 14, 10 percent, respectively. Pneumonia, unspecified diagnosed patients, followed the same phenomenon where the general ward accounted for 46 percent of admissions, followed by ICU and High Care with 20 and 15 percent, respectively. Other types of facilities accounted for 19 percent of admissions on patients diagnosed with pneumonia, unspecified. More than half of patients suspected of COVID-19 were treated in the general ward, 55 percent. ICU and High Care accounted for almost the same proportion, at 23 and 21 percent, other admitting facilities accounted for a tiny percent.

COVID-19 suspected patients treated in the General Ward and High had a much older age profile, with a median age of 71 and 72 years, respectively. The demographic profile of patients who were diagnosed with pneumonia, unspecified were younger than in other facilities with the median age of 57 (43-70) years for those treated in General Ward and High Care, the median age of patients treated in ICU and other facilities was 61 (55-68) and 58 (53-75) years respectively. The second younger profile across facilities was patients Dependence on respirators treated in the General Ward, and these patients had a median age of 59 (50-67) years. Those treated in High Care and ICU had a similar age profile with a median age of 60 (52-66) years.

Table 2: Deaths by hospital discharge facilities and inpatient days by ICD-10 primary diagnosis.

				LOS	Age
Cause of death	**Facility**	**N**	**%**	**Median : IQR**	
Confirmed	General Ward	2043	44	8 (4-15)	64 (54-75)
	High Care	648	14	10 (5-18)	65 (55-77)
	ICU	1537	33	9 (4-17)	62 (53-73)
	Other	454	10	7 (3-14)	66 (56-77)
Dependence on respirator	General Ward	159	33	24 (14-37)	59 (50-67)
	High Care	80	17	28 (19-41)	60 (52-65.5)
	ICU	141	29	21 (13 - 43)	60 (53-66)
	Other	103	21	26 (15-51)	57 (50-66)
Essential (primary) hypertension	General Ward	83	37	8 (3-8)	66 (58-74)
	High Care	46	21	17 (10-26)	62 (56-69)
	ICU	41	18	15 (6-20)	61 (55-66)
	Other	52	23	8 (4-19)	63 (56-73)
Other1	General Ward	2245	34	10 (4-21)	61 (52-72)
	High Care	1033	16	16 (8-29)	63 (55-73)
	ICU	1458	22	14 (6-26)	61 (52-71)
	Other	1861	28	15 (7-28)	63 (54-72)
Pneumonia, unspecified	General Ward	183	46	6 (3-11)	57 (43-70)
	High Care	59	15	11 (8-20)	57 (46-70)
	ICU	79	20	14 (6-22)	61 (55-68)
	Other	75	19	11 (5-26)	58 (53-75)
Suspected	General Ward	599	55	7 (3-15)	71 (56-81)
	High Care	227	21	11 (4-23)	72 (57-83)
	ICU	255	23	6 (2-4)	67 (53-77)
	Other	5	0	5 (5-7)	62 (57-72)

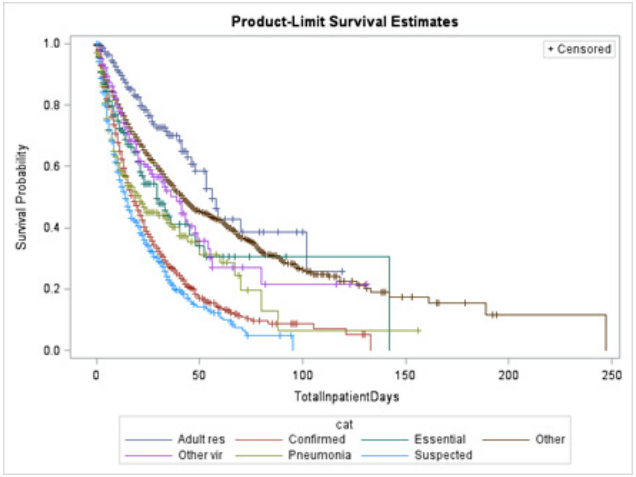

Figure 3: General Ward Admissions-time to death*.

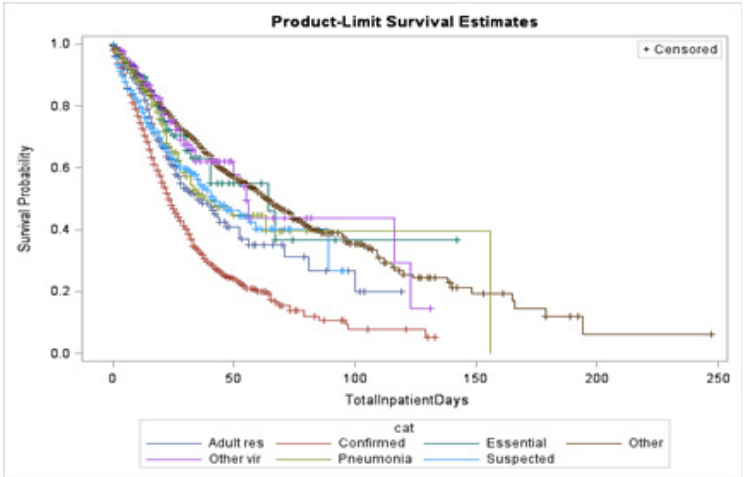

Figure 4: ICU Admissions-time to death*.

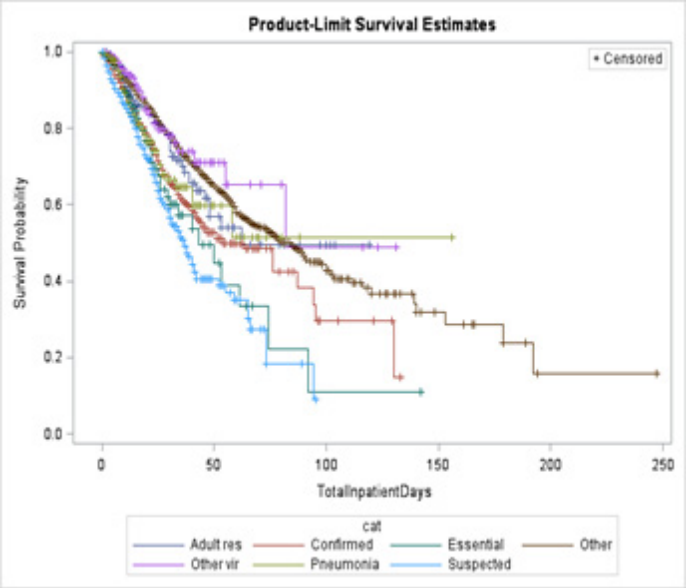

Figure 5: High Care admissions-time to death*.

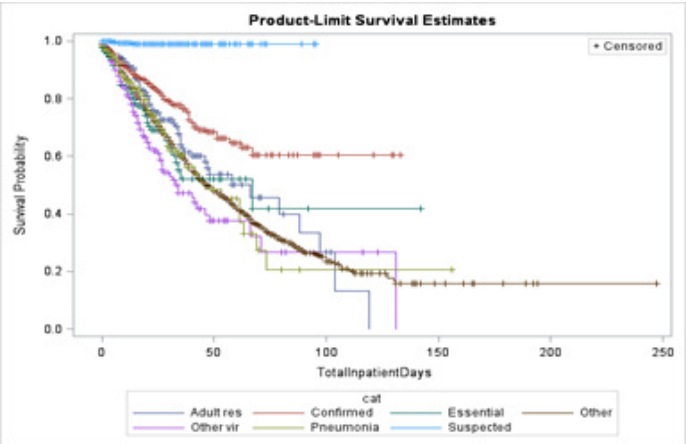

Figure 6: Other facility types of admissions-time to death*.*Legend for Figure 3- Figure 6: Confirmed: COVID-19 Confirmed Diagnosis; Suspected: COVID-19 Suspected Diagnosis; Pneumonia: Pneumonia, unspecified; Adult res: Adult respiratory distress syndrome: Other vir: Other viral pneumonia; Essential: Essential (primary) hypertension.

Figure 3-6 above depicts Kaplan–Meier survival estimates depicting the median delay (quartile 1-quartile 3) (in days) between General Ward, High Care, ICU and other types of admissions and death according to each cause of death. In each panel, deaths from COVID-19, Dependence on a respirator, Pneumonia- unspecified, Adult respiratory distress syndrome, Other viral pneumonia, Essential (primary) hypertension and other types of diagnosis.

Discussion

This research study sought to assess the characteristics of patients who died after a hospital's admission. The incidence rate was 1,664 per million beneficiaries, and the case fatality rate was 2,6 percent. These figures were similar to those reported at the national level in South Africa [23]. Other's countries such as Singapore and Qatar report CRF much lower at 1 percent [24]. There are, however, countries that have reported much higher CFR compared to South Africa, and these could be a function of strategies employed to arrest the pandemic; these countries include Yemen (28.9%), Italy (13.2%), the United Kingdom (12.4%), Belgium (11.6%), and France (11.0%) [25].

Pengqiang, Dandan, Aifeng Wang et al. conducted a meta-analysis on severe illness and death risk factors due to COVID. The authors reviewed 17 articles, where 16 of the 17 were from China, and found risk factors associated with severe illness and death to be age, sex, and multiple comorbidities [26]. This study found that patients older than 70 years were at a very high risk of dying either due to a confirmed COVID-19 or suspected diagnosis. Gao, J., Zhong, L., Wu, M. et al. found that patients aged 70 years and older had a higher chance of death ($p<0.001$) and a lower chance of recovery ($p<0.001$) than patients aged <70 years [27].

When adjusting for COVID-19 deaths and gender, there were significantly more male patient deaths than females, where females accounted for 60.4 percent of deaths and males accounted for 39.6 percent, $p<0.001$. Studies have also found that men with COVID-19 are more at risk for worse outcomes and death, independent of age (Jin et al., 2020). The authors found men dying from COVID-19 to be 2.4 times higher than women (70.3 vs 29.7%, $p=0.016$) [11]. Pantea Stoian et al. [15] found that the highest number of COVID-19 related deaths in men was more significant than that of women (62.5 percent men vs 37.5 percent women [15]. Another study conducted in Peru also found similar results in that men had a twofold higher risk of COVID-19 death within the overall population of Peru (odds ratio (OR), 2.11 [28]. Green, Nitzan, Schwartz, Niv & Peer studied sex differences in the case-fatality rates for COVID-19, the authored conducted a comparisons analysis of the age-related differences in seven countries [29].

The median average age of COVID-19 Confirmed deaths in females was higher than that of males, 65 (54 to 77) and 63 (54 to 73), respectively. Female patients with a COVID- 19 suspected diagnosis had a slightly higher median age than males, particularly the age band 70 years and older. 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 [30]. Studies found an increased admission rate into the intensive care unit (ICU) and mortality from COVID-19 disease in older patients, especially those 65 years old and above who had comorbidities and were infected [12].

A multicentre cohort study that included adults with PCR-confirmed SARS-CoV-2 infection that were admitted to one of five hospitals in the Netherlands showed a median duration of 6 days (3-13); 243 (24.6%) [31]. The proportion of COVID-19 diagnosed,

and Suspected diagnosis patients admitted in ICU was 33 and 23 percent, respectively. A multicenter prospective observational study among COVID-19 critical care patients in 11 ICUs in Libya from 29 May to 30 December 2020 found that the median. ICU length of stay for non-survivors had significantly shorter stay, 6 (3-10) days. This study found that the median length of stay for COVID-19 Confirmed and COVID-19 suspected who died that were treated in ICU was 9 (4-17) and 6 (2-14) days, respectively. Patients who were dependant on respirators had a longer length of stay in ICU, and the median LOS was 21 (13-43) days. Those diagnosed with pneumonia, unspecified that were treated in ICU, had a similar LOS to those diagnosed with Essential (primary) hypertension and those with another type of diagnosis. The median LOS was with 14 (6-22), 15 (6-20) and 14 (6-26) days, respectively.

Conclusion

This study highlighted a more significant proportion of males in covid confirmed and suspected, but a more significant proportion of female deaths in other diagnoses. The study also found that the incidence rate and the case fatality rate for medical schemes followed the phenomenon reported at the national level. However, these figures are slightly lower than of some African countries; the WHO recently analysed mortality data of 15 African countries, and the study found that 12 of the 15 countries reported higher case fatality rates than the African average of 2.5 percent, which is also slightly lower than figures reported in both private and public sector in South Africa [32-38]. This further depicts how South African mortality data compares to the African region and the global landscape. The length of stay for patients treated in ICU was two days longer than those treated in High care who also died, with a length of stay was 12 and 10 days, respectively. This study also found a higher risk of mortality amongst COVID-19 suspected patients 70 years and older. The study also revealed causes of death amongst private patients admitted to hospitals, these included pneumonia- unspecified, Adult respiratory distress syndrome, Other viral pneumonia and Essential (primary) hypertension amongst causes of death in medical schemes patients.

Study Limitations and Future Studies

A comprehensive analysis or audit of deaths 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 patients who had underlying conditions before contracting COVID-19. Future research studies should conduct detailed analysis and audit discharge diagnoses related to deaths and other chronic conditions, including other facilities such as step-down and home-based care and others related to mortality. Future research studies should conduct a detailed analysis and audit on causes of death in a both public and private hospital settings due to a COVID -19 discharge diagnosis and other types of diagnoses.

Competing Interests

None.

Authors' Contributions

The author drafted and proofread the article.

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