Texila International Journal of Public Health
ISSN: 2520-3134
DOI: 10.21522/TIJPH.2013.11.03.Art029

COVID-19 Infections and Deaths between Rural and Urban Provinces of Zimbabwe, 2020: A Spatial Variations Analysis

Blessing Silwangani[1*], Davison Munodawafa[2], Addmore Chadambuka[3]
[1]*Public Health, Texila American University, Guyana*
[2]*Department of Community Medicine, Midlands State University, Faculty of Medicine and Health Sciences, Gweru, Zimbabwe*
[3]*Department of Primary Health Care Sciences, University of Zimbabwe, Harare, Zimbabwe*

Abstract

Zimbabwe continues to record new COVID-19 cases as is the case in other countries. Although the Ministry of Health in Zimbabwe continues to publish daily situation reports (SitRep), and regular surveillance updates, no review of existing data has been done to establish the regional trends of the disease over time. This desk review study seeks to analyze the trends (province by province) of the COVID-19 in Zimbabwe for year 2020 in order to establish if spatial variations in infection rates and deaths exist. Ultimately, the aim is to come up with appropriate context-specific prevention and control measures. The study also seeks to establish whether or not there is a difference in COVID-19 infection rates and deaths between urban and rural provinces of Zimbabwe. A historical research design that made use of available secondary data on COVID-19 in Zimbabwe was used. COVID-19 statistics for year 2020 as provided by the Zimbabwe Ministry of Health and Child Care were accessed from the website and reviewed. A hypothesis test to determine if there was a difference in COVID-19 attack rates between urban and rural provinces of Zimbabwe was also done. An independent samples t-test using Microsoft excel was done on cumulative COVID-19 cases data for the entire year 2020. The study revealed that spatial variations in COVID-19 infections and deaths between urban and rural provinces of Zimbabwe existed. Urban provinces recorded more COVID-19 cases in 2020 compared to rural provinces.

Keywords: *COVID-19, Infection rate, Psychological distress, Spatial, Variations, Vaccine hesitancy.*

Introduction

COVID-19 is a contagious zoonotic disease caused by a novel coronavirus, named the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) [1]. A sudden COVID-19 outbreak was first reported in Wuhan, China, in December 2019 before being declared a pandemic, massively affecting countries like Italy, Spain and the USA. In less than 3 months, the disease had spread to all parts of the world, including Zimbabwe [1]. The World Health Organization (WHO) declared COVID-19 a global health emergency on 30 January 2020, before characterizing it as a pandemic on 11th March 2020 [1].

Within weeks of onset, COVID-19 had spread to over 100 countries across the world [1] and by the end of June 2020, over 10 million cases had been reported to the WHO, with over 500,000 fatalities [2]. To these totals, the African region contributed 306 794 cases and 6 192 deaths [3] making it the fifth most affected region globally. Zimbabwe was not spared from the pandemic either, as it recorded a total of 605 cases and 7 deaths during the same period [4].

Zimbabwe reported its first case of COVID-19 on the 21st of March 2020 [5]. The case was a

Received: 12.07.2023 ***Accepted: 21.09.2023*** ***Published on: 29.09.2023***
****Corresponding Author: bsilwas@gmail.com***

38-year-old male resident of Victoria Falls who had travelled to the United Kingdom on 7th March 2020 and returned to the country on 15th March 2020 [1]. It was also reported that a British tourist who had visited Victoria Falls earlier that week had tested positive for COVID-19 upon returning to the United Kingdom [1]. Zimbabwe declared a 21-day national lockdown starting on 30th March 2020 [1]. By 25th May 2020, two months after the first case had been confirmed; Zimbabwe had 56 confirmed cases, including 27 active cases, 4 deaths and 25 recoveries [4]. Whilst the Ministry of Health and Child Care (MOHCC) in Zimbabwe produces daily situation reports, and regular surveillance updates are done, no review of existing data has been done in Zimbabwe to establish the regional trends of the disease over time including whether or not there are spatial variations in these trends.

Just like the case in most developing countries, Zimbabwe's healthcare system faces a plethora of challenges. Many health facilities lack basic consumables including medicines and sundries [6]. Shortages of intravenous fluids, gloves and essential medicines have been widely reported. Lack of access to personal protective equipment (PPE) is another barrier to service delivery. Authorities have failed to supply appropriate PPE [6]. Thus, Healthcare workers have found it difficult to handle patients whose COVID-19 status is unknown. There have been multiple reports of patients being denied access to treatment without valid test results [6]. This situation puts the country at a very vulnerable position in terms of the COVID-19 pandemic and this research provides an opportunity for unearthing further healthcare challenges to make appropriate recommendations.

Recent analyses of the evolution of the COVID-19 outbreak in the African region show the variable distribution of the disease within countries, with differing risk levels. In many countries, the outbreak has mainly affected the capital cities and large urban centres, with most rural communities either free of COVID-19 or reporting sporadic cases [7].

This desk review study analyzed the regional trends (province by province) of the COVID-19 disease in Zimbabwe for year 2020 to establish whether there were spatial variations in infection rates and deaths with the aim of coming up with appropriate context-specific prevention and control measures. The study also established whether there was a difference in COVID-19 attack rates between urban and rural provinces of Zimbabwe. The study's hypothesis reads, "There is no significant difference in the number of COVID-19 cases recorded for urban and rural provinces of Zimbabwe for the year 2020".

Methods

Study design**:** A historical study was conducted which collected and analyzed COVID-19 data for the period January 2020 to December 2020. Historical research refers to the process of critical inquiry into past events to produce an accurate description and interpretation of those events [8]. The historical research design was used as it has the unique advantage of being suitable for trend analysis given that this study sought to establish the COVID-19 disease trends in Zimbabwe for the year 2020. The daily COVID-19 statistics were consolidated into monthly and quarterly statistics to establish the total quarterly cases of COVID-19 and deaths per province.

The total quarterly COVID-19 cases and deaths for urban provinces in comparison to rural provinces was established. The COVID-19 quarterly infection rate per province for the year 2020 was also calculated by dividing the total number of cases for the quarter by the total population of that province multiplied by 1000 (cases/population x 1000).

Average quarterly infection rates for both urban and rural provinces were then calculated, and a comparison was made on the disease trend in both categories. To get the average quarterly cases for urban provinces, the totals for each quarter for the two urban provinces were added and divided by 2. On the other hand, the average quarterly cases for rural provinces were obtained

by adding the totals for each quarter for all 8 rural provinces before dividing the total by 8.

Finally, a hypothesis test was carried out to determine if there was a difference in COVID-19 infection rates between urban and rural provinces of Zimbabwe. An independent samples t-test using Microsoft Excel was done on cumulative COVID-19 cases for the entire year 2020 comparing rural and urban provinces. The assumptions for the test were as follows: the data are numeric; observations are independent of one another and there are equal variances between the two groups. The degrees of freedom for this test were (n1-1) + (n2-1), where n1 and n2 represent the number of observations in groups one and two respectively. The alpha level of significance was 0.05.

Inclusion and Exclusion Criteria

The study only used COVID-19 statistical data for the period January 2020 to December 2020 as provided by the Ministry of Health and Child Care in Zimbabwe through their official website. Any data outside that timeframe was excluded from the study. All the 10 provinces of Zimbabwe were included in this desk-review study. The reason for choosing statistical data for the year 2020 emanated from the fact that, unlike the case with other subsequent years the data was readily available on the Ministry of Health's website for the entire year which made it possible to carry out a comprehensive analysis.

Data Analysis

Data were analysed using Microsoft Excel. The data was retrieved from the Ministry of Health and Child Care website and manually entered into Excel for analysis to produce tables and graphs. Hypothesis testing was also done in Microsoft Excel using an independent samples t-test.

Permission and Ethical Considerations

Written permission to conduct the study was sought and obtained from the Ministry of Health and Child Care in Zimbabwe.

Results

Overall, urban provinces recorded higher cases of COVID-19 (7556 cases) during year 2020 compared to rural provinces which recorded 6902 cases as shown in Table 1.

Table 1. Zimbabwe's Quarterly Covid-19 Cases per Province for Year 2020

Name of Province	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Bulawayo (Urban)	0	58	1389	2051
Harare (Urban)	4	215	3037	802
Mashonaland West	0	41	290	436
Mashonaland East	4	51	340	364
Mashonaland Central	0	10	195	215
Midlands	0	55	536	539
Matabeleland North	1	16	119	433
Matabeleland South	0	54	723	729
Masvingo	0	53	178	479
Manicaland	0	29	449	563
Total	**9**	**582**	**7256**	**6611**

From the compiled data, the two urban provinces (Bulawayo and Harare) recorded the most cases of COVID-19 in all quarters except for quarter 1 compared with other provinces. The differences in the number of COVID-19 infections between urban and rural provinces were further magnified through calculations to determine the average quarterly totals of COVID-19 cases for urban provinces in comparison to rural provinces. We found out that

urban provinces recorded an average of 2; 137; 2213 and 1427 COVID-19 cases during quarters 1; 2; 3 and 4 respectively compared to rural provinces which recorded an average of 1; 39; 354 and 470 cases for 4 quarters respectively as shown in Figure 1.

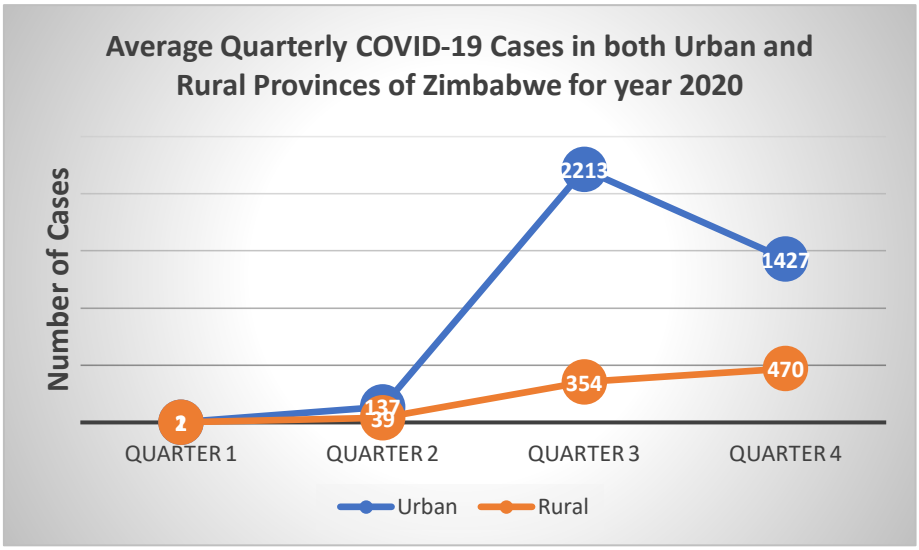

Figure 1. Average Quarterly COVID-19 Cases in both Urban and Rural Provinces of Zimbabwe

Bulawayo province, which is one of the urban provinces had far higher infection rates during quarter 3 (2.1184) and quarter 4 (3.1281) compared to other provinces. Another urban province (Harare) followed closely during quarter 3 with an infection rate of 1.4474 cases per 1000 people. In third place was Matabeleland South province, one of the 8 rural provinces under study with notable infection rates for quarters 3 and 4 of 1.0554 and 1.0642 per 1000 people respectively.

Table 2. COVID-19 Quarterly Infection Rates per Province in Zimbabwe for Year 2020

Name of Province	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Bulawayo (Urban)	0	0.0884	2.1184	3.1281
Harare (Urban)	0.0019	0.1025	1.4474	0.3822
Mashonaland West	0	0.0283	0.2	0.3007
Mashonaland East	0.003	0.0381	0.2543	0.2722
Mashonaland Central	0	0.0088	0.1711	0.1886
Midlands	0	0.0339	0.3304	0.3322
Matabeleland North	0.0013	0.022	0.16	0.5821
Matabeleland South	0	0.0788	1.0554	1.0642
Masvingo	0	0.0357	0.1197	0.3222
Manicaland	0	0.0165	0.2558	0.3208

The average quarterly COVID-19 infection rates for urban provinces (0.00095, 0.09545, 1.7829 and 1.75515) were far much higher than those of rural provinces (0.000538, 0.032763, 0.318338 and 0.422875) for the 4 quarters respectively as depicted in Figure 2.

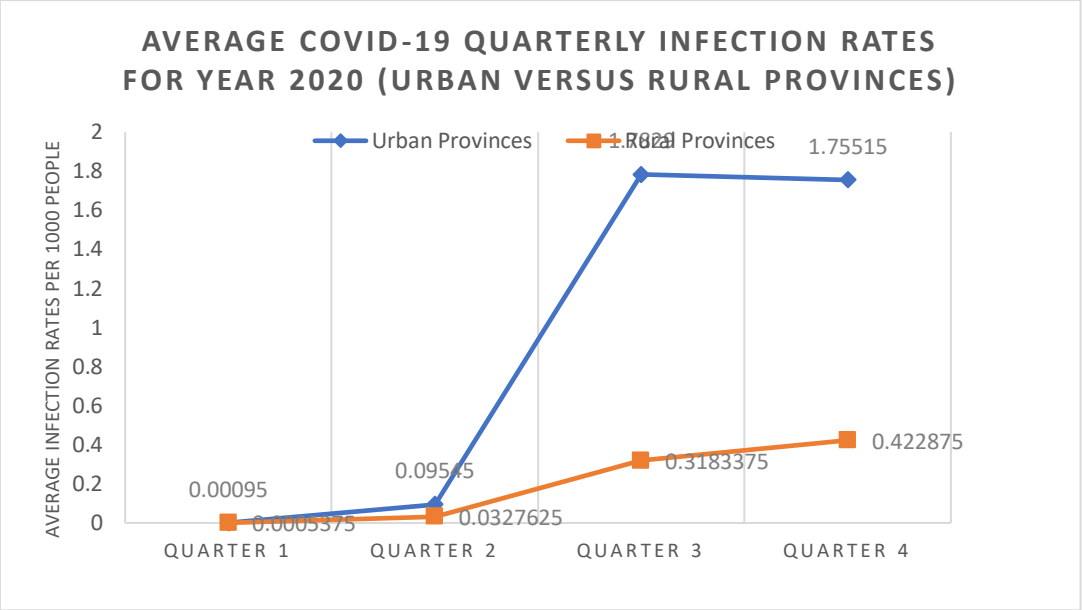

Figure 2. Average Quarterly COVID-19 Infection Rates for Zimbabwe for Year 2020 (Urban Versus Rural Provinces)

The quarterly deaths from COVID-19 are depicted in Table 3. In all quarters, both urban provinces recorded more deaths from COVID-19 compared to all the 8 rural provinces combined. The two urban provinces recorded far higher deaths from COVID-19 (252) compared to all 8 rural provinces combined (111) during the year under review.

Table 3. Quarterly Deaths from COVID-19 in Zimbabwe for the Year 2020

Name of Province	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**
Bulawayo (Urban)	0	3	41	51
Harare (Urban)	1	1	119	36
Mashonaland West	0	1	11	2
Mashonaland East	0	0	4	10
Mashonaland Central	0	0	4	1
Midlands	0	1	8	2
Matabeleland North	0	0	3	0
Matabeleland South	0	0	7	5
Masvingo	0	0	2	11
Manicaland	0	0	22	17
Total	**1**	**6**	**221**	**135**

The quarterly average COVID-19 deaths for urban and rural provinces is shown in Figure 3. The two urban provinces (Harare and Bulawayo) had far much higher average quarterly COVID-19 deaths of 0.5, 2, 80 and 43.5 for quarters 1, 2, 3 and 4 respectively compared to rural provinces which recorded averages of 0, 0.3, 4.6 and 2.5 for the same quarters respectively.

The results of the hypothesis test are indicated in Table 4.

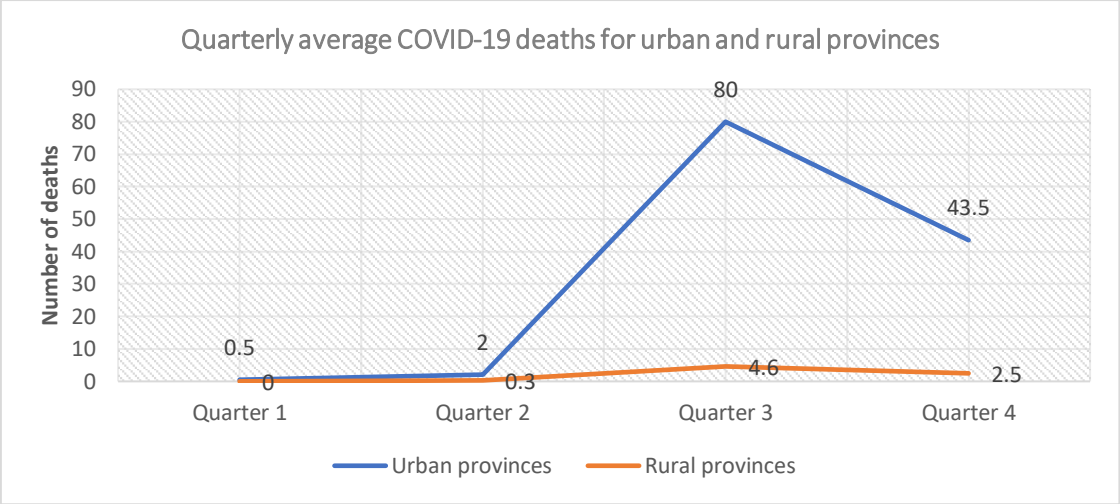

Figure 3. Quarterly Average COVID-19 Deaths for Urban and Rural Provinces in Zimbabwe 2020

Table 4. Results of Hypothesis testing using Microsoft Excel

t-Test: Two-Sample Assuming Equal Variances	**Variable 1**	***Variable 2***
Mean	3778	862.75
Variance	156800	120363.9286
Observations	2	8
Pooled Variance	124918.4375	
Hypothesized Mean Difference	0	
Df	8	
t Stat	10.4333199	
P(T<=t) one-tail	3.08933E-06	
t Critical one-tail	1.859548038	
P(T<=t) two-tail	6.17867E-06	
t Critical two-tail	2.306004135	

A comparison of the calculated t-value (10.433) to the tabled t-value/t critical two-tail (2.306) shows that the calculated t-value is more than the tabled t-value (10.433 > 2.306). We therefore rejected the null hypothesis and concluded that there is a difference between means. The observed difference between the sample means (3,778 for urban provinces and 863 for rural provinces) is convincing enough to say that the COVID-19 infection rates between urban and rural provinces of Zimbabwe differ significantly.

The statistical findings are relevant and significant to the study. The statistical analysis proved that there is a difference in the number of COVID-19 cases and deaths between rural and urban provinces of Zimbabwe with urban provinces recording more cases and deaths compared to rural provinces. This in turn provided the basis for the study to review other relevant literature for the purposes of establishing possible causes for this variation.

It should be noted that this study had its own share of potential confounders or biases. The most significant one is the possibility of recording rural COVID-19 cases as urban cases due to changes in residential addresses. It is normal for rural populations in Zimbabwe to seek specialized treatment in urban areas whenever they fall sick. It is also common for the same people to give urban residential addresses of their relatives who will have hosted them whilst on treatment at urban health facilities. This might have significantly distorted the findings of this study as rural-based COVID-19 victims might have been inaccurately recorded

as urban dwellers. Due to their poor economic status and strong belief in traditional medicines, most of the COVID-19 victims in rural areas might have gone unrecorded, another aspect that might have affected the validity of this study.

Discussion

The aim of this study was to determine if there was spatial variation in the number of COVID-19 cases and deaths between urban and rural provinces of Zimbabwe. Determination of existing spatial heterogeneity in COVID-19 cases and deaths across Zimbabwe is very important in determining appropriate control and preventive measures for the disease. This will allow for the crafting of context-specific policies that are sensitive to such spatial variations [9]. The patterns/trends we identify in this study will help to improve our understanding of the drivers of the spread of COVID-19, with an eye toward helping policymakers design responses that are sensitive to the specificities of different locations.

The study found that there are indeed variations in COVID-19 infections and deaths between urban and rural provinces of Zimbabwe. The hypothesis test that was carried out further confirmed the existence of spatial heterogeneity in terms of COVID-19 infections between urban and rural provinces of Zimbabwe. This revelation lays the foundation for the need for further studies to determine the factors behind these variations with a view of devising location-specific strategies to address the identified factors. As indicated in the results section above, urban provinces recorded a far higher number of COVID-19 cases during the year 2020 compared to rural provinces. One of the reasons for this disparity might be the failure by most people in rural provinces to access health care facilities where testing for COVID-19 could be done. This might have resulted in a huge number of unconfirmed cases in rural areas of Zimbabwe going undetected and unrecorded. This observation is supported by other notable authors who observed that rural areas have fewer available testing sites in comparison to larger metropolitan cities [10]. This view is further supported by another study whose findings revealed that resource constraints and staff shortages in health care affect rural areas' ability to detect, respond, prevent, and control infectious disease outbreaks [11]. Due to resource constraints, vaccination rates were found to be lower in rural than in urban areas, especially in farming and mining-dependent counties [12]. Another study that was carried out in Bangladesh noted that the poor management in the health sector of Bangladesh has been an issue of major concern during the early stage of COVID-19 which incorporates deficiency of medical equipment, lack of facilities for testing COVID-19, poor patient management, and uncertainty in the medication system [13].

The other reason for this disparity in COVID-19 cases between urban and rural provinces might be attributed to the social vulnerability of urban areas due to numerous social gatherings for the purposes of entertainment. This view is supported by another study whose findings revealed that six of the ten counties which had the highest case rates in the state were identified as having high levels of social vulnerability [14].

High population density in urban areas compared to rural areas was another reason that made residents of urban areas more vulnerable to COVID-19 in comparison to their rural counterparts. Population density is likely just one of many key factors that determine the vulnerability of a specific location to the virus [14]. In large urban areas of the United States of America, the susceptibility driven by high population density and enhanced connectivity forced the implementation of strict non-pharmaceutical interventions such as lockdowns and social distancing practices [15]. Condensed residences in urban areas may expedite the SAR-CoV-2 transmission, leading to a higher total number of COVID-19 confirmed cases [13]. Higher urban COVID-19 infection and mortality rates during the early part of the pandemic were largely attributable to higher population density

and location of transportation hubs that facilitated quick spread [16].

Overcrowding and shortage of housing in most urban areas are some of the factors that lead to the spread of infectious diseases including COVID-19. Living in crowded places creates a conducive atmosphere for the spread of pandemics such as COVID-19. Overcrowding and shortage of housing is one of the well-known long-standing problems affecting low- and middle-income countries (LMICs), for example, in the continents of Africa and Asia [17].

Use of public transport especially in urban areas can be a contributory factor to the finding that there were more cases of COVID-19 in urban than in rural provinces of Zimbabwe. People in urban areas of Zimbabwe largely depend on public transport as they commute to and from their places of work daily. The use of public transport places commuters at increased risks of spreading and getting infected from the COVID-19 virus as they are always crowded and without barriers like face masks most of the time. This observation is supported by a systematic review on SARS-CoV-2 cluster infections which concluded that public transport was one of the important cluster infections [18]. In addition, studies of train passengers in China indicated that there was a transmission risk of SARS-CoV-2 among passengers, and that the relative risk depended on the seat location (social distance) and travel duration [19, 20]. Given that COVID-19 primarily spreads in densely populated indoor areas, urban public transport (UPT) systems pose significant risks [21]. Economic and cultural factors might have caused disparities in the recording of COVID-19 cases between rural and urban provinces of Zimbabwe. Urban dwellers are generally regarded as more economically stable compared to their rural counterparts as most of them are gainfully employed. This might have made it possible for them to seek immediate treatment at health care facilities whenever they fell sick from COVID-19. On the other hand, rural dwellers with very little income at their disposal could not afford high treatment and hospitalization costs, forcing them to resort to cultural and traditional treatment remedies. Traditional remedies, including roots and leaves, were widely used in rural areas. Zumbani/Umsuzwane (*Lippia javanica*), for example, was extensively used and became commercialized as a tea, soon available in shops [22].

COVID-19 vaccine hesitancy might also have contributed to the disparities in the spread of COVID-19 between rural and urban provinces of Zimbabwe. This observation is supported by findings from a study that was carried out in Malaysia in 2023 which revealed that nearly a third of the participants in the study were hesitant to vaccinate their children [23]. The same study also suggested that highly educated parents were more skeptical and more likely to perceive the vaccine as unsafe and ineffective for their children [23] which may also explain why cases were higher in urban than rural areas of Zimbabwe. This observation is further supported by another study whose findings revealed that compared to rural areas, urban residents had a lower acceptance rate for COVID-19 vaccines [24]. This may be because city dwellers are more informed and aware about the COVID-19 vaccine than rural dwellers, so they are more worried about side effects and are more likely to avoid vaccination before effectiveness is confirmed [24]. Urban areas are mostly populated by highly educated parents compared to their rural counterparts. Furthermore, women, urban dwellers, those of Christian faith, those with higher educational attainment, higher self-reported social class, social media use, and information-seeking tendencies remained as predictors of hesitancy [25]. The perception toward vaccine effectiveness in controlling COVID-19 was also greatly influenced by the social media information and by geography [26]. The participants residing in urban areas had a higher chance of believing that there was no need for vaccination for post-COVID-19 patients [26].

On the other hand, some studies also found that more accurate information and knowledge about COVID-19 led to the adoption of more positive approaches towards the prevention of COVID-19 [27, 28]. The COVID-19 pandemic caused a lot of psychological distress amongst both Healthcare workers and the general population. The numerous effects of COVID-19 on various aspects of human health, as well as the increasing number of patients and deaths, have resulted in psychological disorders such as stress, anxiety, depression, distress, and suicide among people in society [29]. This observation is further supported by a study that was done in Myanmar whose findings revealed that 55.6% experienced mild to moderate psychological distress and 7% experienced severe psychological distress due to the COVID-19 pandemic [30]. In addition, in another similar study, a significant proportion of the study participants were facing mild to severe depression and anxiety symptoms which was very alarming as the pandemic was still increasing across Malaysia [31]. In Bangladesh, 44.3% of respondents were suffering from mild to moderate distress and 9.5% were suffering from severe distress in another similar study that was carried out in that country [32].

Healthcare workers were not spared either from anxiety or stress resulting from the pandemic. The COVID-19 pandemic was associated with mild anxiety and depression among healthcare workers in Egypt [33]. The physical and psychological effects of the pandemic on healthcare workers in Zimbabwe might have compromised on their commitment and ability to perform their duties to the best of their abilities especially in urban areas where most of the COVID-19 patients were admitted. This observation is supported by findings from some studies that cited burnout, low resilience and low quality of life as some of the negative effects of the pandemic on healthcare workers [34, 35]. This might have led to the death of several patients in urban hospitals as healthcare workers suffered from both burnout and the fear of contracting the COVID-19 disease in the absence of adequate protective clothing and equipment. The psychological effects of the pandemic on healthcare workers were further magnified in another study that was carried out in Albania where mild levels of anxiety were expressed in 26.9% of participants while 7.2% of them expressed moderate levels [36]. In the same study, 23.1% and 12.1% of participants expressed mild and moderate depression levels respectively with high levels of risk perception also prevalent [36]. A similar global study also revealed evidence of a high prevalence of anxiety (60%) and depression symptoms (53%) among healthcare workers across the regions [37]. The issue of limited resources for use by healthcare workers is also cited in another study which indicated that in Palestine healthcare workers have been experiencing compounded stress given their preexisting limited access and resources as imposed by the Israeli colonial system and their management of the novel coronavirus [38]. The study also revealed that there was a huge disparity in terms of COVID-19 deaths between rural and urban provinces with the latter recording far much more COVID-19 deaths compared to the former. A higher number of COVID-19 deaths in urban areas might be attributed to the fact that urban provinces recorded a huge number of cases compared to rural provinces hence they also recorded higher deaths compared to rural provinces which recorded far much fewer cases. This variation may be associated with differences in a range of variables that capture population density, modes of transportation, urbanicity and distance to major airports with direct flights to countries where COVID-19 was prevalent early on [9].

Conclusion

The study found that there are indeed variations in COVID-19 infections and deaths between urban and rural provinces of Zimbabwe. Urban provinces had a higher number of cases and deaths compared to rural

provinces. However, there is a need to carry out in-depth studies to determine the actual factors that might be causing these disparities so as to come up with location-specific control and preventive measures for this pandemic. The study recommends that appropriate resources be provided in all healthcare facilities in Zimbabwe so as to adequately combat the current and future pandemics. In addition, comprehensive psychosocial support should be provided to both healthcare workers and the generality of the people of Zimbabwe to prevent and control COVID-19-induced mental conditions such as anxiety, stress, and depression.

Acknowledgements

The authors would like to thank the Ministry of Health and Child Care in Zimbabwe for granting them permission to conduct this desk review study. Thanks also to my supervisors for their support and guidance throughout this study.

Conflict of Interest Statement

The authors declare that they have no conflict of interest. All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report. We certify that the submission is original work and is not under review at any other publication.

References

[1] Murewanhema, G., Burukai, T., Mazingi, D., Maunganidze, F., Mufunda, J., Munodawafa, D., & Pote, W., 2020, A descriptive study of the trends of COVID-19 in Zimbabwe from March-June 2020: policy and strategy implications. *Pan African Medical Journal*. 2020 Nov 9;37(Suppl 1):33. doi: 10.11604/pamj.supp.2020.37.33.25835. PMID: 33456657; PMCID: PMC7796830, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7796830/.

[2] World Health Organization. Coronavirus disease (COVID-19) situation report 162. 2020. Jun 30, Accessed 9 September 2023 from https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports.

[3] World Health Organization. Coronavirus disease (COVID-19) situation report 163. 1 July 2020, https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200701-covid-19-sitrep-163.pdf.

[4] Government of Zimbabwe, Ministry of Health and Child Care, COVID 19 Daily Updates retrieved from http://www.mohcc.gov.zw/index.php?option=com_phocadownload&view=category&id=15&Itemid=741&limitstart=20.

[5] Zimbabwe COVID-19 Situation Report, Issue No 10 31032020 Issue No 10 Zimbabwe COVID-19 Sitrep.pdf.

[6] Murewanhema, G., & Makurumidze, R., 2020, Essential health services delivery in Zimbabwe during the COVID-19 pandemic: perspectives and recommendations. *Pan Afr Med J*. 2020 Aug 11;35(Suppl 2):143. doi: 10.11604/pamj.supp.2020.35.143.25367. PMID: 33193958; PMCID: PMC7608772.

[7] World Health Organization. Guidance Document for a Differentiated Response to COVID-19 Outbreak in Urban and Rural settings 2021 Retrieved from https://www.afro.who.int/sites/default/files/Covid-19/Techinical%20documents/Guidance%20Document%20for%20a%20Differentiated%20Response%20to%20COVID-19%20Outbreak%20in%20Urban%20and%20Rural%20settings.pdf.

[8] Black, J.M & Ubbes, V.A., 2009, Historical Research: A Thematic Analysis of Convention and Conference Themes for Selected Professional Health Education Associations from 1975 to 2009, *International Electronic Journal of Health Education*, 2009;12:33-47 https://www.researchgate.net/publication/233858380_Historical_Research_A_Thematic_Analysis_of_Convention_and_Conference_Themes_for_Selected_Professional_Health_Education_Associations_from_1975_to_2009.

[9] Desmet, K., & Wacziarg, R., 2020, Understanding Spatial Variation in COVID-19 across the United States National Bureau of Economic Research ,1050

Massachusetts, MA 02138 June 2020, https://www.nber.org/system/files/working_papers/w27329/revisions/w27329.rev0.pdf.

[10] Turner-Musa, J., Ajayi, O., & Kemp, L., 2020, Examining social determinants of health, stigma, and COVID-19 disparities. Healthcare. 2020 Jun 12;8(2):168, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7349778/.

[11] Santibañez, S., Bellis, K.S., Bay, A., Chung, C.L., Bradley, K., Gibson, D., et al., 2019, Strengthening rural states' capacity to prepare for and respond to emerging infectious diseases, 2013–2015. *Southern Medical Journal.* 2019 Feb;112(2):101–5. pmid:30708375, https://pubmed.ncbi.nlm.nih.gov/30708375/.

[12] Sun, Y., & Monnat, S.M., 2022, Rural-urban and within-rural differences in COVID-19 vaccination rates. *J Rural Health.* 2022 Sep;38(4):916-922. doi: 10.1111/jrh.12625. Epub 2021 Sep 23. PMID: 34555222; PMCID: PMC8661570, https://pubmed.ncbi.nlm.nih.gov/34555222/.

[13] The obstacles to combat against COVID-19 pandemic and the remedies: *Bangladesh scenario Journal of Public Health Research.* Doi: https://journals.sagepub.com/doi/full/10.4081/jphr.2021.26271.

[14] Aabed, K., & Lashin, M.M.A., 2021, An analytical study of the factors that influence COVID-19 spread. *Saudi J Biol Sci*. 2021 Feb;28(2):1177-1195. doi: 10.1016/j.sjbs.2020.11.067. Epub 2020 Nov 26. PMID: 33262677; PMCID: PMC7690266, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7690266/.

[15] Cuadros, D.F., Branscum, A.J., Mukandavire, Z., Miller, F.D., MacKinnon, N., 2021, Dynamics of the COVID-19 epidemic in urban and rural areas in the United States. *Ann Epidemiol. 2021* Jul; 59:16-20. doi: 10.1016/j.annepidem.2021.04.007. Epub 2021 Apr 22. PMID: 33894385; PMCID: PMC8061094, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8061094/.

[16] Karim, S.A., & Chen, H.F., 2021, Deaths From COVID-19 in Rural, Micropolitan, and Metropolitan Areas: A County-Level Comparison. *J Rural Health.* 2021 Jan;37(1):124-132. doi: 10.1111/jrh.12533. Epub 2020 Nov 6. PMID: 33155723, https://pubmed.ncbi.nlm.nih.gov/33155723/.

[17] Ezeh, A., Oyebode, O., Satterthwaite, D., Chen, Y. F., Ndugwa, R., Sartori, J., & Lilford, R. J., 2017, The history, geography, and sociology of slums and the health problems of people who live in slums. *The lancet*, **389**(10068), 547– 558, https://pubmed.ncbi.nlm.nih.gov/27760703/.

[18] Liu, T., Gong, D., Xiao, J., Hu, J., He, G., Rong, Z., & Ma, W., 2020, Cluster infections play important roles in the rapid evolution of COVID-19 transmission: *A systematic review. Int J Infect Dis.* 2020 Oct; 99:374-380. doi: 10.1016/j.ijid.2020.07.073. Epub 2020 Aug 5. PMID: 32768702; PMCID: PMC7405860, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7405860/.

[19] Zhang, Y., Zhang, A., & Wang, J., 2020, Exploring the roles of high-speed train, air, and coach services in the spread of COVID-19 in China. *Transp Policy (Oxf).* 2020 Aug; 94:34-42. doi: 10.1016/j.tranpol.2020.05.012. Epub 2020 May 26. PMID: 32501380; PMCID: PMC7248624, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7248624/.

[20] Hu, M., Lin, H., Wang, J., Xu, C., Tatem, A.J., Meng, B., Zhang, X., Liu, Y., Wang, P., Wu, G., Xie, H., & Lai, S., 2021, Risk of Coronavirus Disease 2019 Transmission in Train Passengers: An Epidemiological and Modeling Study. *Clin Infect Dis.* 2021 Feb 16;72(4):604-610. doi: 10.1093/cid/ciaa1057. PMID: 32726405; PMCID: PMC7454391, https://pubmed.ncbi.nlm.nih.gov/32726405/.

[21] Feng, Y., Zhang, Y., Ding, X., Fan, Y., & Ge, J., 2023, Multi-scale risk assessment and mitigations comparison for COVID-19 in urban public transport: A combined field measurement and modeling approach. *Build Environ. 2023* Aug 15; 242:110489. doi: 10.1016/j.buildenv.2023.110489. Epub 2023 Jun 2. PMID: 37333517; PMCID: PMC10236904, https://pubmed.ncbi.nlm.nih.gov/37333517/.

[22] Bwerinofa I.J, Mahenehene J, Manaka M, et al. What is 'community resilience'? Responding to COVID- 19 in rural Zimbabwe. *BMJ Global Health* 2022;7: e009528. doi:10.1136/bmjgh-2022-009528.

[23] Factors influencing parents' hesitancy to vaccinate their children aged 5–11 years old against COVID-19: results from a cross-sectional study in Malaysia. https://doi.org/10.3389/fpubh.2023.1091015.

[24] Factors influencing the acceptability of COVID-19 vaccination: A cross-sectional study from Malaysia. *Vacunas Journal.* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8407950/; https://www.sciencedirect.com/science/article/pii/S1576988721000479#.

[25] COVID-19 Vaccine Hesitancy and Confidence in the Philippines and Malaysia: A Cross-sectional Study of Sociodemographic Factors and Digital Health Literacy. *PLOS Global Public Health.* October 17, 2022.

[26] COVID-19 Vaccine Hesitancy in Rural and Urban Communities: A global survey. *Frontiers in Public Health.* September 26, 2022. https://doi.org/10.3389/fpubh.2022.958668.

[27] Knowledge, Attitude and Practices Toward Coronavirus Disease (COVID- 19) in Southeast and South Asia: A Mixed Study Design Approach. *Frontiers in Public Health.* June 21, 2022. https://doi.org/10.3389/fpubh.2022.875727.

[28] Digital health literacy for COVID-19 vaccination and intention to be immunized: a cross sectional multi-country study among the general adult population Frontiers in Public Health. *Frontiers in Public Health*, 16 September 2022Sec. Public Health Education and Promotion; https://doi.org/10.3389/fpubh.2022.998234.

[29] The potential association of COVID-19 and Psychological Distress and Anxiety in Iran *International Journal of Epidemiology and Health Sciences* December 2022;3: http://www.ijehs.com/article_254985_6a8c46f2c5c2024a15dac171ed8d66cd.pdf.

[30] Factors Associated with Psychological Distress Among Myanmar Residents During Covid-19 Pandemic Crises. *Journal of Public Health Research.* Doi: https://journals.sagepub.com/doi/full/10.4081/jphr.2021.2279

[31] Depression and anxiety in Malaysian population during third wave of the COVID-19 pandemic. https://doi.org/10.1016/j.cegh.2021.100868.

[32] A survey of psychological distress among Bangladeshi people during the COVID-19 pandemic: *Clinical Epidemiology and Global Health.* January 14, 2021. https://doi.org/10.1016/j.cegh.2020.100693.

[33] Mental health, risk perception, and coping strategies among healthcare workers in Egypt during the COVID-19 pandemic. February 27, 2023. *Plos one* https://doi.org/10.1371/journal.pone.0282264.

[34] Demographic and work-related factors associated with burnout, resilience, and quality of life among healthcare workers during the COVID-19 pandemic: A cross sectional study from Malaysia. Front. Public Health, 16 December 2022. Sec. *Public Health Education and Promotion.* https://doi.org/10.3389/fpubh.2022.1021495.

[35] Burnout, resilience and the quality of life among Malaysian healthcare workers during the COVID-19 pandemic Frontiers in Public Health, 30 November 2022. Sec. *Public Health Education and Promotion.* https://doi.org/10.3389/fpubh.2022.1021497.

[36] Impact of COVID-19 pandemic on mental health, risk perception and coping strategies among health care workers in Albania - evidence that needs attention. *Clinical Epidemiology and Global Health* Volume 12, October–December 2021, 100824. Doi: https://doi.org/10.1016/j.cegh.2021.100824.

[37] The immediate impact of COVID-19 on mental health and its associated factors among healthcare workers: A global perspective across 31 countries. *Journal of Global Health*. August 23, 2021. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7649521/.

[38] Palestinian Healthcare Workers Mental Health Challenges during COVID-19 Pandemic: A Cross-Sectional Study. *Medical Research Archives.* October 31, 2022. https://esmed.org/MRA/index.php/mra/article/view/3125.