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COVID-19 infections and vaccine uptake among health workers in Namibia, 2020–2023

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Abstract

Introduction: COVID-19 infected over 775 million people globally, with Namibia accounting for 172,560 infections and 4,109 deaths from 2020 to 2024. About 4,975 infections and 20 deaths were recorded among health workers from 2020 to 2023 in Namibia. With the launch of COVID-19 vaccine globally, Namibia rolled out the vaccination campaign in March 2021. This study, therefore, described the epidemiology of COVID-19 infections, the level of COVID-19 vaccine uptake and factors associated with vaccine uptake among health workers in Namibia from 2020 to 2023.

Methods: An analytic longitudinal study was conducted. A secondary data analysis using the Namibian national COVID-19-line list was performed. All 4975 documented health workers out of 178965 COVID-19 positive entries in the national COVID-19-line list were captured in this study. A case was defined as any health worker in the Namibia health system with laboratory-confirmed SARS-CoV-2 infection from January 2020 to December 2023. The uptake of the COVID-19 vaccine was defined as any confirmed SARS COV-2 cases who received at least one dose of the COVID-19 vaccine. We assessed associations between independent variables and binary outcomes using Generalised Estimating Equations (GEE) with a logit link and binomial distribution to account for both clustering within regions and correlation arising from repeated measurements among the same individuals using SPSS version 25. Odds ratios (ORs) were determined, and statistical significance was determined at a 95% confidence interval (CI) with a p-value of <0.05.

Results: Out of 4975 cases analysed, 3,595 (72.3%) were female. The age group 25-34 years had the highest number of infections with 2,157 (43.4%). Of the 2,564 health workers eligible for vaccination,1024 (40%) received the COVID-19 vaccine, and out of 20 deaths, 19 (95%) were from the unvaccinated groups. Medical doctors, compared to pharmacy personnel, had a positive association with vaccine uptake (OR = 1.71, 95%CI: 1.02–2.87, p = 0.041). Additionally, comorbidity was a strong predictor of vaccine uptake among health workers.

Conclusions: This study found that less than half of eligible health workers with laboratory-confirmed SARS-CoV-2 infections in Namibia were vaccinated against COVID-19 between 2020 and 2023. Comorbidity was a strong predictor of vaccine uptake among health workers.

Keywords: COVID-19, Health, Namibia, Vaccination, 2020-2023

Citation

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Introduction

COVID-19 infected over 775 million people globally [1], with Namibia accounting for 172,560 infections and 4,109 deaths from 2020 to 2024 [2]. The World Health Organisation [WHO] estimates that between 80,000 and 180,000 health workers died of COVID-19 between January 2020 and May 2021 [3]. Furthermore, about 4,975 infections and 20 deaths were recorded among health workers from 2020 to 2023 in Namibia [3]. Namibia rolled out the COVID-19 vaccination campaign in March 2021 in two of the 14 regions and further rolled out to the rest of the country in April 2021[4]. The rollout targeted the frontline health workers and high-risk individuals to protect them from fatal complications of infection. The uptake of the COVID-19 vaccine has been varied across the regions and the continent.

A systematic review and meta-analysis of COVID-19 vaccine acceptance among healthcare workers in Africa revealed that less than half of healthcare workers accepted the COVID-19 vaccine. This was attributed to concerns about side effects, doubts regarding its safety, short duration of clinical trials, limited information and community trust [5]. Furthermore, findings recorded in Namibia showed a low uptake of COVID-19 vaccines observed in the general public, with only 207, 950[6.9%] Namibians vaccinated, representing a total of 159 881(10.6%) for first dose and only 48,069 (3.2%) second dose from the 1,501,041 (60%) projected targeted population by the MoHSS after four months of the vaccination campaign rollout [4]. The factors that contributed to the low uptake in Namibia included misinformation in the communities. Factors that contributed to the low vaccine uptake among health workers included concerns over the safety and efficacy of the vaccines and vaccine hesitancy [4]. The level of vaccine uptake and factors driving vaccine uptake are unknown among the frontline health workers, given their strategic importance in the effort to contain the pandemic and provide the routine health care services to the populace. This study therefore described the epidemiology of COVID-19 infections, the level of COVID-19 vaccine uptake and factors associated with vaccine uptake among health workers in Namibia from 2020 to 2023.

Methods

Study design and setting

A longitudinal study was conducted among health workers in Namibia using secondary data from the Namibian national COVID-19-line list. Namibia has a population of about three million people, with 51.3% being female [8]. Namibia is served by 36 hospitals, 56 health centers, 322 clinics,1150 outreach points and over 200 private health facilities. Windhoek Central Hospital in the Khomas region is the national referral hospital. In addition, Namibia has four intermediate hospitals, namely, Katutura, Rundu, Oshakati and Onandjokwe hospitals. A total of 97 Intensive Care Unit beds were provided in Namibia before the COVID-19 pandemic [9]. 76% of Namibians live within 10km of health facilities. The Khomas and Erongo regions have the highest number of health facilities [10]. With the Namibian population of about three million, 60% of the population density is concentrated in the northern regions, specifically, Ohangwena, Omusati, Oshana and Oshikoto [11].

Study population

This study captured all 4,975 documented health workers with laboratory confirmation of SARS-CoV-2 who had a Polymerase Chain Reaction (PCR) test through nasopharyngeal or oropharyngeal swabs in n the national COVID-19-line list out of a total of 178,965 COVID-19 positive entries. All health workers in Namibia who were captured in the national COVID-19-line list between 2020 and 2023, with confirmed SARS-CoV-2 infection verified by either PCR, were included. Health workers in Namibia who were not captured in the national COVID-19-line list between 2020 and 2023, or without confirmed SARS-CoV-2 infection verified by PCR, were excluded.

Operational definitions

A case was defined as any health worker in the Namibia health system with laboratory-confirmed SARS-CoV-2 infection from January 2020 to December 2023. The uptake of the COVID-19 vaccine was defined as any confirmed SARS COV-2 cases who received at least one dose of the COVID-19 vaccine [6]. A health worker was defined as a professional primarily engaged in improving health by providing preventative, curative, promotional or rehabilitative healthcare services; a paid or unpaid person [7].

Data management

Positive cases were recorded in COVID-19 case investigation forms and transferred into a national COVID-19-line list in Microsoft Excel, which served as the source of information. The variables which were captured in the line list included date of reporting, sex, age, occupation, region, district, health worker status, comorbidities, signs and symptoms, vaccination status, name of vaccine, number of vaccine doses received, travel history, hospital admission status, health facility type, test type, specimen type, laboratory results, patient status outcome and epidemiological week. Single imputation was performed for missing data.

Data collection and analysis

Data was extracted from the National COVID-19-line list in Microsoft Excel. All entries identified as health workers were selected for analysis. Variables relevant to the study objectives, such as demographic, clinical, and vaccination-related factors, were extracted. The dataset

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was cleaned and analysed using Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics were summarised using frequencies and proportions.

The level of COVID-19 vaccine uptake was assessed. Associations between independent variables and binary outcomes were assessed using Generalised Estimating Equations (GEE) with a logit link and binomial distribution to account for both clustering within regions and correlation arising from repeated measurements among the same individuals. Variables of clinical importance and possible confounders were included in the multivariable model. Associations were assessed by calculating odds ratios (ORs, and statistical significance was determined at a 95% confidence interval (CI).

Ethical considerations

The study protocol was approved by the Ministry of Health and Social Services (MoHSS) Research Ethics Committee. An authorisation to conduct the study was issued by the Executive Director of MoHSS and sent to the Epidemiology division at the national level. All records were de-identified to protect the confidentiality of the information collected, and the anonymity of all health workers were respected and protected.

Table 1. Social demographic and clinical characteristics of COVID-19 infections among health workers in Namibia, 2020–2023

Variables	Frequency (N = 4975)	Percentage (%)
Sex		
Female	3595	72.3
Male	1380	27.7
Age (Years)		
15–24	386	7.7
25–34	2157	43.4
35–44	1222	24.6
45–55	792	15.9
55+	418	8.4
Occupation		
Others+	2055	41.3
Nurse	1906	38.3
Medical doctor	645	13.0
Pharmacy personnel	194	3.9
Environmental Health practitioner	63	1.3
Emergency care practitioner (Paramedics)	61	1.2
Laboratory personnel	51	1.0

Results

Socio-demographic and clinical characteristics of COVID-19 infections among health workers

Out of 4,975 cases analysed, 3595(72.3%) were female. The mean age of the cases was 37±11 years. The age group 25-34 years was the highest with 2157 (43.4%), followed by the age group of 35-44 years with 1222 (24.6%). Nurses had 1906 (38.3%) infections (Table 1). Other cardiovascular diseases and diabetes topped the list of comorbidities recorded among the health workers, with 311(6.3%) and 90 (1.8%), respectively (Table 2).

Vaccination uptake and status of COVID-19 infections and deaths among health workers in Namibia

A total of 2,564 health workers were eligible for vaccination. Among these, 1024 (40%) received the COVID-19 vaccine, whereas 1540 (60%) remained unvaccinated (Table 3). A total of 20 COVID-19-infected health workers died, of whom 12 (60%) were not vaccinated because the vaccination program had not yet been rolled out, seven (35%) were eligible but were not vaccinated, and one (5%) was vaccinated. So out of 20 deaths, 19 (95%) were unvaccinated. Among the vaccines available in Namibia, Johnson Johnson had the highest uptake and dose completion of 98.3%, followed by Sinopharm (82.7%) (Table 4). Of the 1024 health workers who took the vaccine, the majority 532 (51.9%), got the vaccine in 2021, and a decrease in vaccination was observed over the years, with the least vaccinations being observed in 2023, with 95 (9.3%) (Figure 1).

Table 2. Comorbidities among COVID-19 health workers in Namibia, 2020–2023

Comorbidities (N = 4975)	Present (%)	Absent (%)
Other cardiovascular diseases	311 (6.3)	4664 (93.7)
Diabetes	90 (1.8)	4885 (98.2)
Chronic lung disease	64 (1.7)	4911 (98.7)
HIV	60 (1.2)	4915 (98.8)
Asthma	56 (1.1)	4919 (98.9)
Hypertension	55 (1.1)	4920 (98.9)
Renal disease	6 (0.1)	4969 (99.9)
Chronic neurological disease	7 (0.1)	4968 (99.9)
Malignancy	5 (0.1)	4970 (99.9)
TB	4 (0.1)	4971 (99.9)
Obesity	23 (0.5)	4952 (99.5)
Liver disease	8 (0.2)	4967 (99.8)

Factors associated with COVID-19 vaccine uptake among health workers in Namibia, 2020-2023

A total of 2,564 health workers were eligible for vaccination; however, only 1,024 healthcare workers were vaccinated. Variables of clinical importance and possible confounders were included in the multivariable model. Multivariable GEE logistic regression showed that the age group 15–24 years (OR = 0.56, 95% CI: 0.37–0.85, p =0.006), compared to the age group of 55+, was statistically less likely to be vaccinated against COVID-19. Medical doctors (OR = 1.71, 95% CI: 1.02–2.87, p = 0.041), compared to Pharmacy personnel, had a positive association with vaccine uptake, indicating higher odds of being vaccinated because the odds ratio was more than one. Furthermore, comorbidity was a strong predictor for vaccine uptake among health workers, as health workers with one comorbidity (OR=1.72, 95%CI: 1.16-2.55,

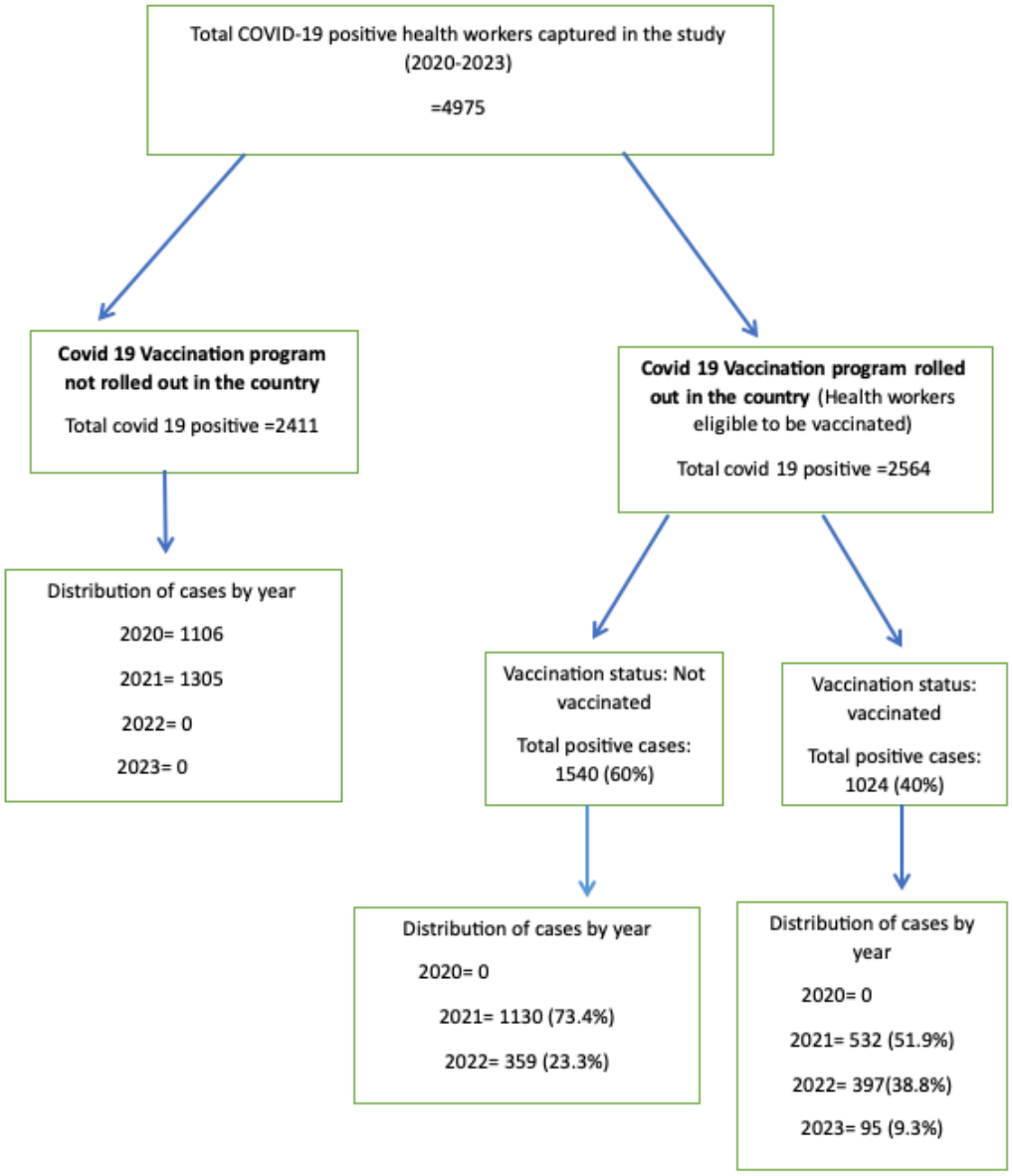

Figure 1. Data flow of COVID -19 vaccination status among health workers in Namibia.2020-2023

p-value 0.007) and those with two to three comorbidities (OR=1.69, 95%CI: 1.17-2.45, p-value 0.005) had higher odds of vaccination compared to those with zero comorbidities (Table 5). The highest case- fatality rates were observed in Khomas, Erongo, and the Northern regions, namely, Oshana, Oshikoto and Omusati regions, all with a case-fatality rate greater than 0.40 (Table 6).

Discussion

In this study, female health workers had more than half of the infections. This could be attributed to women dominating certain healthcare cadres such as nursing and caregiving roles[12]. Our findings are similar to a study done in Iran, which found most infections in female healthcare workers [13]. Similarly, a national surveillance study done in the United States found 79% of the infections

Table 3. Vaccination status of COVID-19 infections and deaths among health workers in Namibia, 2020–2023

Variable	Frequency (N = 4975)	Percentage (%)
Vaccination status		
Vaccinated	1024	20.5
Unvaccinated	1540	31.0
N/A	2411	48.5
Deaths by vaccination status (n=20)		
Vaccinated	1	5.0
Unvaccinated	7	35.0
N/A	12	60.0

N/A: Health workers who were not vaccinated because the vaccination program had not yet been rolled out in the country.

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Table 4. Different types of COVID-19 vaccines received by health workers in Namibia, 2020–2023

Name of vaccine	One Dose	Two Doses	Three Doses	Four Doses	Not Indicated	Total	Required Dose	Completed course (%)
Sinopharm	68	390	33	0	63	554	2 + Booster	82.7
AstraZeneca	52	152	29	0	30	263	2 + Booster	77.6
Johnson & Johnson	116	4	1	0	1	122	1 + Booster	98.3
Pfizer	6	26	11	1	0	44	2 + Booster	72.7
Abdala	0	0	2	1	0	3	3 + Booster	100
Moderna	0	2	0	0	0	2	2 + Booster	100
Sputnik	0	1	0	0	1	2	2 + Booster	50
Not Indicated	6	13	8	–	7	34	–	–
Total	248	588	84	2	102	1024	–	–

were in females [14]. These findings are, however, different from a cross-sectional study done in India, which indicated higher covid infections in males compared to females [15]. Our study findings suggest a gender-sensitive occupational health policy is needed in Namibia. In addition, we need to strengthen infection prevention and control measures. Training and regular screening are to be provided to reduce exposure among female health workers.

The uptake of the COVID-19 vaccine among health workers in Namibia was 40%, which was lower than the 100% global vaccine uptake recommended by WHO [15]. The low uptake of COVID-19 vaccines by health workers might have been contributed to by safety concerns and fear of side effects [4]. Other factors that could have contributed to the low uptake could be the use of traditional medicine. Other reasons could include inconsistent supply of vaccines, namely AstraZeneca, Pfizer, and Johnson Johnson [4]. Low COVID-19 vaccine uptake poses a risk of high hospitalisation and increased preventable deaths.

However, our findings differ from those of studies conducted in other parts of the world. A study done among healthcare workers in Entebbe municipality in Uganda showed a higher uptake of the COVID-19 vaccine (65.6%) than our findings. The study indicated that the high uptake might have been attributed to the fear of healthcare workers contracting the Omicron strain, which was observed during that period of the study in the area [16]. Furthermore, findings in a worldwide systematic review contradict our findings since their results showed a high uptake of about 77.3% of the vaccine by health workers [17]. Policies that encourage continuous education on vaccine benefits should be put in place to enhance vaccine confidence among health workers. Furthermore, the Ministry of Health and Social Services should strengthen risk communication strategies to address misinformation and fears of vaccine safety.

Health workers having one, and those with two to three comorbidities, had high odds of receiving COVID-19 vaccination. This is similar to findings from a study done in Bangladesh, where the odds of vaccination uptake were higher in people with one and those with more than one comorbidity [18]. However, our findings are inconsistent with the results of a study conducted in Zimbabwe, where having no comorbidities had high odds of being vaccinated compared to those who had one and more comorbidities [19].

The high vaccine uptake among health workers with one and more than one comorbidity in Namibia could be attributed to the vaccination campaign implemented in Namibia, which followed the WHO SAGE Road map, whereby those with comorbidities were prioritised to receive the COVID-19 vaccine although it was voluntary [4]. The high uptake could also be attributed to the complete strategy implemented during the study period by the Ministry of Health and Social Services (MoHSS) and the Ministry of Information, Communication and Technology (MICT), with support from UN agencies to improve vaccine uptake [4]. High COVID-19 vaccination uptake among health workers with one or more than one comorbidity is essential as this will enhance protection and improve the quality of life of healthcare workers.

Limitations

This study is limited by potential selection bias, as only health workers with laboratory-confirmed SARS-CoV-2 infection from the COVID-19 national line list were included. Findings may not be generalizable to all health workers, and unmeasured factors such as personal beliefs could have influenced vaccine uptake. To address these gaps, future studies should incorporate qualitative approaches to explore attitudes and barriers, hence improve the reliability and applicability of findings.

Conclusions

This study found that less than half of eligible health workers with laboratory confirmed SARS-CoV-2 infection in Namibia were vaccinated against COVID-19 between 2021and 2023, which is below WHO's recommended coverage. Presence of comorbidity was a strong predictor for vaccine uptake among health workers. These findings highlight the need for targeted approaches such as making vaccination programs accessible and convenient in the workplace and correcting vaccine myths among health workers, to improve vaccine acceptance, strengthen pandemic response and reduce preventable deaths.

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Table 5. Unadjusted and adjusted Generalized Estimating Equation analysis of factors associated with COVID-19 vaccine uptake among health workers in Namibia, 2020–2023

Variables	Vaccination status		Crude Odds Ratio (95% CI)	p-value	Adjusted Odds Ratio (95% CI)	p-value
	Yes N = 1024 (%)	No N = 1540 (%)				
Gender						
Female	709 (69.2)	1132 (73.5)	0.81 (0.68–0.96)	0.015	0.89 (0.74–1.07)	0.214
Male	315 (30.8)	408 (26.5)	Reference			
Age (years)						
15–24	47 (4.5)	150 (9.7)	0.44 (0.30–0.66)	<0.001	0.56 (0.37–0.85)	0.006*
25–34	439 (42.9)	680 (44.2)	0.91 (0.69–1.20)	0.503	0.95 (0.71–1.27)	0.736
35–44	272 (26.6)	373 (24.2)	1.03 (0.76–1.39)	0.846	1.08 (0.79–1.48)	0.621
45–55	179 (17.5)	214 (13.9)	1.18 (0.84–1.67)	0.336	1.08 (0.79–1.67)	0.431
55+	87 (8.4)	123 (8.0)	Reference			
Occupation						
Nurses	344 (33.6)	597 (38.8)	0.95 (0.61–1.48)	0.816	0.92 (0.58–1.45)	0.714
Medical doctor	184 (18.0)	163 (10.6)	1.86 (1.14–3.03)	0.013	1.71 (1.02–2.87)	0.041*
Others	429 (41.9)	673 (43.7)	1.05 (0.72–1.55)	0.790	1.02 (0.69–1.51)	0.929
Environmental Health practitioners	12 (1.2)	20 (1.3)	0.99 (0.44–2.19)	0.975	0.96 (0.43–2.16)	0.923
Emergency care practitioners (Paramedics)	14 (1.4)	15 (1.0)	1.54 (0.69–3.41)	0.289	1.42 (0.63–3.18)	0.394
Laboratory personnel	10 (0.9)	21 (1.3)	0.78 (0.35–1.74)	0.546	0.81 (0.36–1.82)	0.607
Pharmacy personnel	31 (3.0)	51 (3.3)	Reference			
Number of Comorbidities						
Zero comorbidities	880 (85.9)	1418 (91.1)	Reference			
One comorbidity	66 (6.4)	54 (3.5)	1.97 (1.35–2.87)	<0.001	1.72 (1.16–2.55)	0.007*
Two–Three comorbidities	76 (7.4)	63 (4.1)	1.94 (1.36–2.77)	<0.001	1.69 (1.17–2.45)	0.005*
>Three comorbidities	2 (0.2)	5 (0.3)	0.64 (0.12–3.31)	0.593	0.58 (0.11–3.06)	0.521

What is already known about this topic

- COVID-19 morbidity and mortality have been recorded globally among healthcare workers
- Low uptake of COVID-19 vaccine in Africa

What This Study Adds

- The study shows vaccination coverage was below the WHO'S recommended target
- Identifies the absence of comorbidities as a key factor linked to lower vaccine uptake
- Emphasizes the need for targeted and work-place based vaccination programs

Table 6. Regional health facility distribution of COVID-19 case fatality rate among health workers in Namibia, 2020–2023

Region	Cases	Deaths	CFR (%)
Erongo	480	2	0.42
Hardap	211	0	0
Karas	258	1	0.39
Kavango East	268	1	0.37
Kavango West	53	0	0
Khomas	1686	8	0.47
Kunene	153	0	0
Ohangwena	228	0	0
Omaheke	81	0	0
Omusati	288	2	0.69
Oshana	578	3	0.52
Oshikoto	299	2	0.67
Otjozondjupa	309	1	0.32
Zambezi	83	0	0
Total	4975	20	0.40

Conflict of Interest

The authors of this work declare no competing interests.

Data availability

The dataset upon which the findings are based belongs to the Ministry of Health and Social Services of Namibia under the Epidemiology sub-division. The dataset is publicly available upon request from the corresponding author and with permission from the Ministry of Health and Social Services.

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Authors' contributions

MWLM drafted the proposal, cleaned the data, analyzed the data, wrote the manuscript.

NPES reviewed the proposal, the results and the manuscript.

DME, LPN, RMN, SP reviewed the proposal and results.

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