Comparative Retrospective Analysis of Communicable versus Non-Communicable Disease Mortality in HIV-Uninfected Patients at a Tertiary Care Facility, South Africa

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Background and study aim: The global health sector is deeply impacted by both infectious diseases and non-communicable diseases (NCDs). Despite considerable advances in combating infections such as HIV/AIDS and TB, there is a persistent need for detailed mortality data among HIV-negative individuals. This research examined the prevalence of infectious diseases and NCDs, along with their mortality contributions, in HIV-negative patients at King Edward VIII Hospital, Durban, South Africa.

Patients and Methods: A retrospective cross-sectional study was carried out, analysing medical records of HIV-negative patients aged ≥ 12 years who died in 2018. Data analysis was performed to compute descriptive statistics, univariate Chi-Square tests for distribution assessment, and bivariate analyses for categorical variable associations (gender, age, and ethnicity). Logistic regression evaluated the effects of multiple variables on mortality outcomes.

Results: The study included 183 of the 588 deaths recorded. The demographic distribution was nearly even between females (49.7%) and males (50.3%), primarily of Black African descent (73.2%). Age was predominantly in the 55–64 (29.5%) and 65–74 (25.7%) ranges. The leading NCD was hypertension (56 cases). NCDs were responsible for 72.1% of the deaths, infectious diseases for 18.6%, and both for 9.3%. There was a significant gender-based disparity in mortality causes, with males being more likely to die from infectious diseases (OR: 2.383; 95% CI 1.042 to 5.452; p=0.040).

Conclusion: The data highlights a higher mortality rate due to NCDs compared to infectious diseases in non-HIV-infected patients in KwaZulu-Natal. This calls for more longitudinal studies to track trends in this population.

INTRODUCTION

Non-communicable diseases (NCDs) are recognized as a critical global public health challenge. In 2016, NCDs were responsible for approximately 40.5 million deaths globally, including 17.0 million premature deaths in individuals under the age of 70 years [1]. Collectively, NCDs surpass all other causes of death, with cardiovascular diseases, cancers, chronic respiratory conditions, and diabetes mellitus being the primary contributors. These four categories alone accounted for 84.0% of the global NCD mortality burden, with respective annual death tolls of 17.9 million, 9.0 million, 3.9 million, and 1.6 million [2]. Other significant contributors include oral diseases, rheumatic fever, rheumatic heart disease, and obesity [3].

Concurrently, communicable diseases continue to pose significant health challenges, particularly in the African region. Diseases such as tuberculosis (TB), and HIV and AIDS remain major causes of mortality [4, 5]. Despite global

declines in mortality from communicable diseases such as respiratory infections and diarrheal diseases, these conditions remain prevalent. In 2019, lower respiratory infections ranked among the top four causes of death globally, with 2.6 million fatalities, marking a decrease of 460,000 from the year 2000. The World Health Organization notes that malaria, TB, and HIV/AIDS are still among the top 10 causes of death worldwide, although mortality from these diseases has reduced over the past two decades [6].

South Africa, in particular, exhibits a dual burden of disease, having some of the highest rates of both infectious and noncommunicable diseases across both rural and urban settings. In 2019, HIV led to 143,850 deaths, while lower respiratory infections, TB, sexually transmitted infections, and meningitis caused 28,940, 19,780, 2,350, and 2,220 deaths, respectively [7].

Research predominantly focuses on HIV-positive populations, highlighting a gap in surveillance and understanding of disease trends among HIV-uninfected individuals. This study addresses this gap by examining the primary communicable diseases and NCDs contributing to mortality and their associated risk factors in patients without HIV who were admitted to King Edward VIII Hospital between January 1 and December 31, 2018.

PATIENTS/MATERIALS AND METHODS

This was a cross-sectional study including all patients admitted at King Edward VIII Hospital in 2018 (from 1 January to 31 December). Subjects were eligible for the study if they were human immunodeficiency virus (HIV)-uninfected, at least 12 years old and deceased.

HIV status was identified through a documented negative HIV ELISA laboratory test, or a skin prick rapid HIV test at the current admission and in the past two years. The medical records were reviewed for clinical, demographic, and laboratory determinants of death as stated on the death certificates. All HIV-infected patients and patients younger than 12 years were excluded from the study. Informed consent was not required for this study due to its retrospective design, and all participants were deceased, and the study did not pose any risk to them or their privacy. Permission to retrieve the medical records required was granted by the KwaZulu-Natal Department of Health NHRD Ref: KZ_202207_027.

Statistical analysis

The data was analysed utilising the Statistical Package for the Social Sciences (SPSS) (version 29) to provide an overview of patient records of mortality causes among HIV-uninfected individuals admitted to the medical wards of King Edward VIII Hospital. The analytical approach employed both descriptive and inferential statistical methods.

Descriptive analysis was done using the frequency tables and bar charts in the case of categorical variables, while numerical variables were summarised as mean, standard deviation and range with 95% confidence intervals for continuous variables (normally distributed), median and interquartile range (not normally distributed variables).

The logistic regression models were constructed, including the independent and dependent variables, confounders and variable selection.

- Independent Variables: Included demographic variables (like Gender, ethnicity and Age) and co-morbidities (Cancer, Cardiovascular Disease, Diabetes, Hypertension, COPD, Kidney Disease, and Liver Disease).
- Dependent Variables: "Death from non-communicable diseases" and "Death from communicable diseases", each coded as separate binary outcomes.

Outcome variables

The study's main outcome variables were death from NCD and communicable diseases derived from medical records and death certificate. The cause of death on the death certificate was listed as a single primary cause and not classified as either communicable disease or non-communicable disease (NCD) Death causes were classified as NCD or communicable disease after file review.

A predetermined level of significance was set at $p < 0.050$ for all statistical tests. In addition, a logistic regression model was formulated to assess the impact of various independent variables on a designated dependent variable.

The model aimed to elucidate the relationships and predictive power of the independent variables with respect to the dependent variable in question.

RESULTS

Participant demographics

There was a total of 588 recorded deaths in this study period. One hundred and eighty-three (183) patients were included in this study and all participants were HIV- negative at the time of death. Overall, 49.7% (91/183) of the study participants were female and 50.3% (92/183) were male. Most of the patients were of African ancestry (73.2%) followed by mixed race (15.8%), Indians/Asians (15.8%), and Whites (7.7%). The highest proportion of patients were aged 55–64 (29.5%) and 65–74 years (25.7%). The baseline demographic characteristics of the study population are summarised in Table 1.

Distribution of morbidities

The majority of the patients (30.6%) were hypertensive, 13.1% of the patients had type 2 diabetes mellitus, and 10.3% of the patients had chronic kidney disease. Congestive cardiac failure (4.9%), dilated cardiomyopathy (4.9%), cerebrovascular accident (3.8%), and dyslipidaemia (3.2%) were the least common conditions (Table 2). In the context of the current study, the distribution of co-morbidities describes the complexity of health conditions within the study sample. Of the 183 cases, 21.3% (39) had no co-morbidities. However, the majority of the cases did exhibit co-morbid conditions. Specifically, 30.6% (56) had one additional condition, and closely following this were cases with two co-morbidities, accounting for 29.0% (53) of the study population. Those with three co-morbidities comprised 15.8% (29) of the cases. A small proportion of the sample demonstrated a higher complexity in their health status; 1.6% (3) had four co-morbidities and another 1.6% (3) had as many as six additional conditions.

Causes of deaths

In this study, the data is presented as the distribution of cases based on the nature of the diseases - either communicable disease, non-communicable disease or a combination of both. Out of a total of 183 cases, non-communicable diseases manifested as the most prevalent category, comprising 72.1% (132) of the cases. In contrast, communicable diseases account for a considerably smaller proportion, constituting 18.6% (34) of the cases. A small proportion of the cases (9.3%; 17) exhibited concurrent communicable and non-communicable conditions (Figure 1). This data indicated the predominance of non-communicable diseases in the sampled population.

Overall, cardiovascular diseases (21.9%) were the most common cause of death among NCDs, followed by renal diseases (18.0%), cancer (15.8%), and neurological diseases (13.1%). Among communicable diseases, respiratory diseases were the main cause of death (18.6%). The second most common cause of death among communicable diseases was sepsis observed in 6.0% of the patients (Figure 2).

Factors associated with the cause of death.

In the unadjusted analyses (Table 3), there was no statistically significant association between ethnicity, age, gender, the number of co-morbidities and the cause of death ($p > 0.050$). In the adjusted analysis, gender was significantly associated with the cause of death [odds ratio (OR): 2.383; 95% CI 1.042 to 5.452; p=0.040]. An OR of 2.383 indicates that, when controlling for other factors in the model, males are approximately 2.4 times more likely to die from a communicable disease compared to females. This translates to the odds of a male dying from a communicable disease being 2.383 times higher than the odds for a female, when other variables like ethnicity, age, and number of co-morbidities are held constant. No confounders were identified in this study.

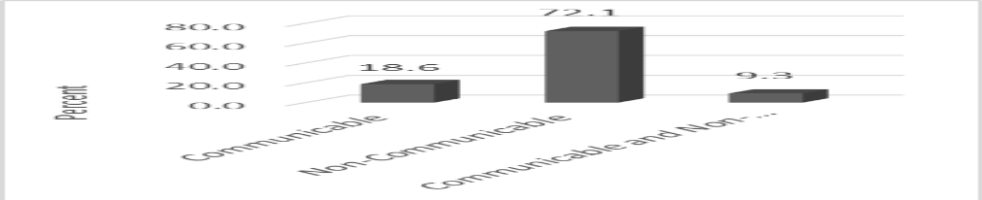

Figure 1: Distribution of deaths, by disease type of the HIV-uninfected patients (*n*=183).

Table 1: Demographic characteristics of 183 HIV-uninfected patients included in the study.

Characteristics	Overall *n (%)*
Gender	
Female	91 (49.7)
Male	92 (50.3)
Race	
Black African	134 (73.2)
Indians/Asian	29 (15.8)
White	14 (7.7)
Mixed race	6 (3.3)
Population (Years)	
Working age (15 – 64)	106 (57.9)
Elderly (≥ 65)	77 (42.1)
Age group (Years)	
15 – 24	7 (3.8)
25 – 34	10 (5.5)
35 – 44	8 (4.4)
45 – 54	27 (14.8)
55 – 64	54 (29.5)
65 – 74	47 (25.7)
75 – 84	23 (12.6)
≥ 85	7 (3.8)

Table 2: Existing medical conditions the study patients had before being admitted to hospital

Medical Condition	Frequency *n (%)*
Hypertension	56 (30.6)
Type 2 Diabetes Mellitus (DM)	24 (13.1)
Chronic Kidney Disease	19 (10.3)
Congestive Cardiac Failure (CCF)	9 (4.9)
Dilated Cardiomyopathy (DCMO)	9 (4.9)
Cerebrovascular Accident	7 (3.8)
Dyslipidemia	6 (3.2)
*Other	84 (45.9)

*Other conditions that had low occurrences (Appendix A)

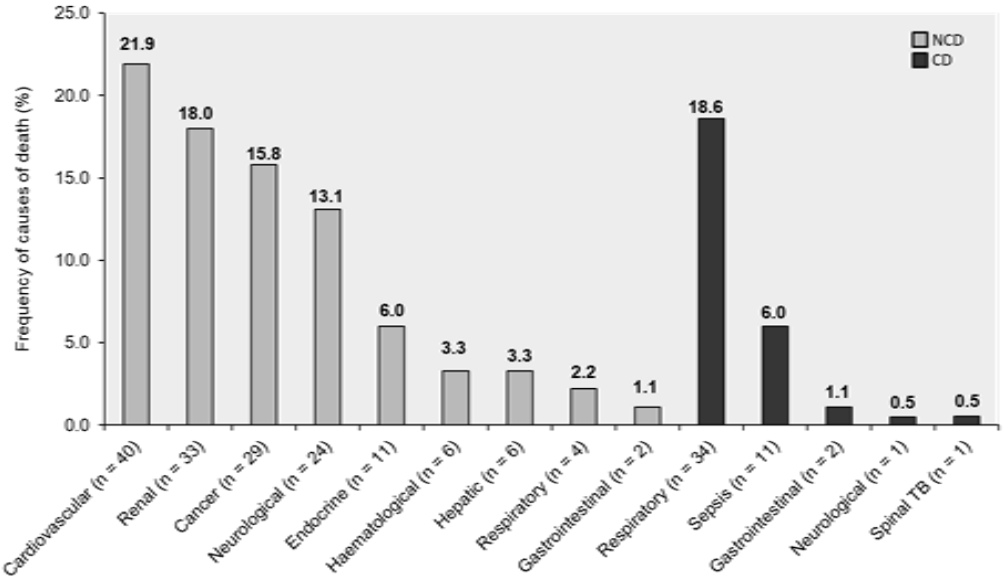

Figure 2: Distribution of specific causes of death among HIV-uninfected patients (*n*=183)

Table 3: Factors associated with causes of death.

Factor	Chi-Square	Chi-square (*p*-value)	Unadjusted OR (95% CI)	*p*-value	Adjusted OR (95% CI)	*p*-value
Ethnicity	10.285	0.072		0.0802		0.676
Gender	3.138	0.227	1.775 (0.828-3.805)	0.140	2.383 (1.042-5.452	0.040
Age	15.480	0.237		0.579		0.358
Number of co-morbidities	4.715	0.830	0.830 (0.594-1.161)	0.277	0.810 (0.571-1.147)	0.235

DISCUSSION

In the current study, the leading cause of death was NCDs (72.1%) followed by communicable diseases (18.6%). Similar to our findings, a report by the Department of Statistics South Africa reported that NCDs were the leading cause of death in 2018. In the report, 59.3% of death cases were due to NCDs, followed by 28.8% of deaths due to communicable diseases [8]. However, the percentage of deaths due to NCDs in our study is higher than the one reported by the Department of Statistics South Africa. In addition, they also observed a rise in the death rates due to NCDs from 46.6% in 2010 to 59.3% in 2018 [8]. These findings in conjunction with the current study results, provide evidence that NCDs remain the leading cause of mortality in South Africa.

This study showed that among the NCDs, cardiovascular diseases (21.9%) were the most common cause of death followed by renal diseases (18.0%). Similar to our findings, a study conducted by Nojilana et al. [9] recorded cardiovascular diseases as the leading cause of death in South Africa. These findings are consistent with surveillance data and other studies that report cardiovascular diseases as the leading cause of death among NCDs [8,10]. Among the communicable diseases, respiratory infections (18.6%) were the most common cause of death in this study cohort. A study conducted in Tanzania reviewing medical records of patients who died in 39 hospitals from 2006-2015, recorded 12.9% (32 042/247 976) deaths due to respiratory infections [11]. Deaths due to respiratory infections in their study is slightly lower compared to the current study.

It is important to note that the majority of the study participants had multiple co-morbidities, with 1.6% of the participants demonstrating a higher complexity in their health status (6 co-morbidities). Prior studies have reported that an increased number of co-morbidities is positively associated with an elevated risk of mortality and can complicate treatment [12,13] Co-morbidities can also exacerbate the prognosis and treatment outcomes of various diseases, including non-communicable diseases such as diabetes mellitus and hypertension [14]. This study found that most individuals who died from non-communicable or communicable diseases had one to three co-morbidities. This observation is consistent with a prior study in KwaZulu-Natal that identified cardiovascular diseases, respiratory diseases, and cancers as the leading causes of death among individuals with co-morbidities [13].

There is limited data on the risk factors associated with deaths caused by NCDs. However, risk factors that are associated with NCDs have been described. In this study, the analysis of factors associated with death due to NCDs showed that gender was significantly associated with the cause of death. Males were approximately 2.4 times more likely to die from a communicable disease compared to females. The other variables like ethnicity, age, and number of co-morbidities were not associated with the cause of death. Risk factors such as gender (being female), age (older age), marital status (widowed) [15], smoking and physical inactivity [15,16] have been associated with increased risk of developing some NCDs. However, the association of these factors with death due to NCDs was not investigated.

Numerous studies have been conducted on gender differences in the prevalence of NCDs in KwaZulu-Natal, highlighting significant gender disparities in the burden of NCDs in the region [12,17]. A study conducted in a rural community in KwaZulu-Natal reported gender differences in the prevalence of NCDs, where women had a higher prevalence of NCDs than men and were more likely to have multiple NCDs [12]. These findings underscore the need for targeted interventions that address the specific NCD risk factors that affect women in this community. Another study conducted in urban and rural communities of KwaZulu-Natal by Ajaero et al. [18] revealed gender disparities in the prevalence and determinants of NCDs.

The strength of this study's methodology lies in its comprehensive evaluation of all medical causes of mortality in HIV-uninfected individuals who attended King Edward VIII Hospital over a full year. The use of a cross-sectional study design allowed for the collection and analysis of data from medical records of all HIV-uninfected individuals who died at the hospital medical wards during the study period. This approach provided a detailed understanding of the demographic, clinical profile of these individuals.

Furthermore, the use of all-cause mortality as an outcome measure is a reliable and objective measure of disease burden in a population. The inclusion of all ethnicities and individuals over the age of 12 in the study sample enhanced the external validity of the study findings, making them representative of a diverse patient population.

This study had the following limitations: firstly, this study only included individuals who died at King Edward VIII Hospital medical wards, which may not be representative of the broader population of HIV-uninfected individuals in KwaZulu Natal. Secondly, this study only included HIV-uninfected individuals. These may limit the generalizability of the study findings. Thirdly, the study only includes individuals who died within a specific time frame, which may not be representative of mortality patterns over a longer period. This may limit the ability to draw conclusions about trends in mortality over time or the impact of interventions aimed at reducing mortality rates. Lastly, patients who presented acutely and died within hours of admission and might not have had files opened may potentially have been excluded from the data. Despite these limitations, this study makes a significant contribution to the existing body of knowledge on mortality patterns and co-morbidities among HIV-uninfected individuals in KwaZulu Natal.

CONCLUSION:

This study provides evidence that the prevalence of NCDs, and deaths due to these diseases remain high in the KwaZulu-Natal region despite the high burden of communicable diseases. The prevalence of co-morbidities among the study participants warrants the need for further effective treatment regimens and intervention

programs to raise awareness in high-risk populations and adapt new strategies to combat preventable deaths from these diseases. An avenue for future research would be to conduct a more representative, reproducible multi-centred, prospective study in hospitals in South Africa and assess the change in the causes of death and co-morbidities of HIV-uninfected patients over time.

Conflict of interest: The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author, [PL]. The data are not publicly available due to containing information that could compromise the privacy of research participants.

Authors 'contributions: PL developed and conceptualized the study with assistance from NM. RM assisted with data collection. PL, NM and SP were involved in the discussion and review of manuscript before submission.

Ethical consideration: The study was approved by the Biomedical Research Ethics Committee (BREC) of the University of KwaZulu Natal (BREC/00004129/2022) NHRD Ref: KZ_202207_027.

HIGHLIGHTS:

- Non-communicable diseases (NCDs) are responsible for a staggering 72.1% of deaths among HIV-negative patients
- Cardiovascular diseases emerged as the leading cause within HIV-negative patients.
- Males are significantly more likely to die from communicable diseases compared to females.
- A considerable proportion of the studied population presented with multiple co-morbidities, notably hypertension and diabetes mellitus.

REFERENCES

1. Bennett JE, Stevens GA, Mathers CD, Bonita R, Rehm J, Kruk ME, et al. NCD Countdown 2030: worldwide trends in non-communicable disease mortality and progress towards Sustainable Development Goal target 3.4. *The Lancet.* 2018;392(10152):1072-88.
2. World Health Organization. Global action plan for the prevention and control of noncommunicable diseases 2013-2020. 2013. https://www.who.int/publications/i/item/9789241506236
3. Alwan AD, Maclean D, Mandil A, World Health Organization. Assessment of national capacity for noncommunicable disease prevention and control: the report of a global survey. 2001.
4. Modjadji P. Communicable and non-communicable diseases coexisting in South Africa. *Lancet Glob Health*. 2021;9(7):e889-e890.
5. Boutayeb A. The Impact of Infectious Diseases on the Development of Africa. Handbook of Disease Burdens and Quality of Life Measures. 2010:1171-1188.
6. World Health Organization. The top 10 causes of death. 2020. https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death
7. Liu Q, Jing W, Liu M, Liu J. Health disparity and mortality trends of infectious diseases in BRICS from 1990 to 2019. *J Glob Health.* 2022;12:04028.
8. Department: Statistics South Africa. Mortality and causes of death in South Africa: Findings from death notification. Statistical Release P03093. 2018. https://www.statssa.gov.za/publications/P03093/P030932018.pdf
9. Nojilana B, Bradshaw D, Pillay-van Wyk V, Msemburi W, Somdyala N, Joubert JD, et al. Persistent burden from non-communicable diseases in South Africa needs strong action. *S Afr Med J.* 2016;106:436-437.
10. Bigna JJ, Noubiap JJ. The rising burden of non-communicable diseases in sub-Saharan Africa. *Lancet Glob Health*. 2019;7(10):e1295-e1296.

11. Kishamawe C, Rumisha SF, Mremi IR, Bwana VM, Chiduo MG, Massawe IS, et al. Trends, patterns and causes of respiratory disease mortality among inpatients in Tanzania, 2006-2015. *Trop Med Int Health*. 2019;24(1):91-100.

12. Kushitor SB, Sanuade OA, Baatiema L, Kushitor MK, Afrifa-Anane EK, Awuah RB. Non-communicable disease comorbidities in KwaZulu-Natal Province, South Africa. *S Afr Med J*. 2021;111(2):149-158.

13. Sharman M, Bachmann M. Prevalence and health effects of communicable and non-communicable disease comorbidity in rural KwaZulu-Natal, South Africa. *Trop Med Int Health*. 2019;24(10):1198-1207.

14. Fang H, Liu Q, Xi M, Xiong D, He J, Luo P, et al. Impact of comorbidities on clinical prognosis in 1280 patients with different types of COVID-19. *J Investig Med*. 2021;69(1):75-85.

15. Bolarinwa OA, Olagunju O, Budu E, Seidu A, Odetokun IA, Al-Mustapha AI, et al. Prevalence of Non-Communicable Diseases and Associated Factors in South Africa: Evidence from National Income Dynamics Survey, 2008-2017. *Research Square*. 2020:1-19.

16. Abdool Kader Z, Mahomed O. Prevalence and risk factors associated with diabetes retinopathy amongst type II diabetes mellitus at a primary care vision clinic in the eThekwini District, KwaZulu-Natal in 2017. *Afr Vision and Eye Health*. 2020;79(1).

17. Phaswana-Mafuya N, Peltzer K, Chirinda W, Musekiwa A, Kose Z. Sociodemographic predictors of multiple non-communicable disease risk factors among older adults in South Africa. *Glob Health Action*. 2013;6:20680.

18. Ajaero CK, Wet-Billings ND, Atama C, Agwu P, Eze EJ. The prevalence and contextual correlates of non-communicable diseases among inter-provincial migrants and non-migrants in South Africa. *BMC Public Health.* 2021;21(1):999.

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