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MORTALITY IN SUB-SAHARAN AFRICA: WHAT IS KILLING ADULTS AGED 15-59 YEARS IN ZAMBIA?

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Abstract

The question of cause-of-death remains of interest among demographers, epidemiologists and public health researchers. Adults in the age group 15-59 years play a significant role in the socio-economic development of a country. However, in most of sub-Saharan African countries, the coverage and accuracy of data on adult mortality has been deficient compared to that of under-five (age group 0-4) mortality. As a result, little research exists on causes-of-death in this age group in most of sub-Saharan Africa and adult mortality remains a health burden for many countries in this part of Africa. Using the 2010-2012 Zambia Sample Vital Registration with Verbal Autopsy (SAVVY) survey data and computing age-sex and cause-specific death rates and ratios as well as constructing cause-deleted life tables, this study examined the causes-of-death among adults in age group 15-59 years. The study found that HIV/AIDS was the major leading cause-of-death across all demographic and socioeconomic background characteristics of the deceased adults. HIV/AIDS deaths increased by age and peaked in age group 35-39 and were higher among females than males. Injuries and accidents were the second leading cause-of-death among males while among females it was tuberculosis. Injuries and accidents were more prevalent in age group 15-35, the highly educated and the never married. Diseases of the circulatory system were the third leading cause-of-death among female decedents while tuberculosis was the third leading cause of death among males. Malaria was the fourth leading cause-of-death for both males and females. Adult deaths attributable to non-communicable diseases were more evident in older ages 45-59. Eliminating HIV/AIDS as a cause of death would have the most impact in reducing adult mortality in Zambia and contribute significantly to the number of additional years of life gained compared to eliminating the other causes-of-death. Therefore, health programmes and interventions on HIV/AIDS should be further supported and strengthened as they would significantly contribute to the reduction of adult mortality in Zambia in line with sustainable development goals (SDGs).

Keywords

Cause of death, adult mortality, verbal autopsy, cause-specific mortality, HIV/AIDS, Zambia.

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Mortality in Sub-Saharan Africa: What is Killing Adults Aged 15-59 Years in Zambia?

Vesper H. Chisumpa, Clifford O. Odimegwu, Nandita Saikia

1. Introduction

The critical need for information on causes of death for health policy, planning, targeting, allocation of resources, monitoring and evaluating population health programmes and interventions is well documented in demographic, public health and epidemiological literature (Bradshaw and Timaeus 2006; Rao, Lopez and Hemed 2006; Herbst, Mafojane and Newell 2011; Olshansky and Hayflick 2011; Mberu, Wamukoya, Oti *et al.* 2015). Knowing causes of death facilitates designing and targeting of appropriate health interventions to save lives. However, in 2013, 56 per cent of the deaths worldwide were not officially reported (GBD 2015 Mortality and Causes of Death Collaborators 2016); implying that the causes of death for these deaths remain unknown. This scenario is more prevalent in most sub-Saharan African countries where death registration is incomplete due to inefficient and rudimentary civil registration and vital statistics systems (World Health Organization 2010; United Nations 2015). The coverage of death registration is less than 25 per cent in majority of the sub-Saharan African countries (World Health Organization 2010). Therefore, determining causes of death in such a situation is challenging as a significant proportion of deaths are not captured because they occur outside health facilities, mostly at home, where they are neither attended to by health providers nor the cause of death certified. Mortality data on causes of death in sub-Saharan Africa, therefore, remain limited. The only available information on causes of death is that captured through routine medical record systems at health facilities and some specialised surveys. Causes of death captured by the censuses have several limitations. For example, there is no systematic medical procedure followed to establish the cause of death and medical classification.

Few studies, however, have examined the causes of death in the adult mortality age group in greater depth in Zambia (Kelly, Feldman, Ndubani *et al.* 1998; Dzekedzeke, Siziya and Fylkesnes 2008; Mudenda, Kamocha, Mswia *et al.* 2011; Rathod, Timæus, Banda *et al.* 2016). Available studies have examined the causes of death across all ages of the population without detailed focus on age group 15-59. In addition, they also did not explore the variations of causes of death in this age group by socio-economic background characteristics. The impact of eliminating leading causes of death has also not been examined. The age group 15-59 is the most economically productive segment of the population and their health status has an impact on household welfare and the socioeconomic development of a country, therefore, there is need to understand the causes of death in this age group so that appropriate health programmes and interventions can be designed to reduce mortality.

Previous studies show that the causes of death of infant and child mortality are well known and researched compared to those of adults in age group 15-59 years in sub-Saharan Africa (Bradshaw and Timaeus 2006; Reniers, Masquelier and Gerland 2011; Mberu, Wamukoya, Oti *et al.* 2015). In most sub-Saharan African countries, the coverage and accuracy of data on adult mortality has been more limited compared to that of infant and child mortality (age group 0-4). In addition, population censuses and Demographic and Health Surveys in sub-Saharan Africa have mainly collected more information on child health than adult health. For old-age mortality, which is above 60 years, the dearth of data on this type of mortality in sub-Saharan Africa is even more limited. Consequently, there are more health programmes and interventions focusing on infant and child mortality than on adult mortality. By and large, mortality of adults in age group 15-59 years remains high in most sub-Saharan African countries especially in southern Africa (Koyanagi and Shibuya 2010; United Nations 2015; Rajaratnam, Markus, Rector *et al.* 2010). Accurate and reliable data on causes of death to further study adult mortality are not readily available in most of these countries. Even in cases where deaths are captured, the cause of death may not be reported or may be misclassified, particularly in rural areas. In rural areas burial permits may not be required.

In 2006, Rao and colleagues commended the World Health Organization (WHO) for introducing the Sample Vital Registration and Verbal Autopsy (SAVVY) survey in selected sub-Saharan African countries. Rao et al (2006) recommended the SAVVY as the most viable interim solution to obtaining information on causes of death to meet the needs of both health policy and for monitoring the impact of health programmes and interventions in sub-Saharan Africa. Therefore, in the absence of a complete and efficient civil registration and vital statistics system to capture deaths, the SAVVY has become an alternative source of cause of death data (Carter, Hufanga, Rao *et al.* 2012; Ndila, Bauni, Mochamah *et al.* 2014). The use of verbal autopsy (VA) data is increasing in most sub-Saharan Africa countries (Glynn, Calvert, Price *et al.* 2014; Weldearegawi, Melaku, Spigt *et al.* 2014). Previous studies have used VA data to establish cause-specific mortality, behavioural risk factors, and the impact of public health interventions among others (Melaku, Sahle, Tesfaye *et al.* 2014; Oti, van de Vijver and Kyobutungi 2014; Rosario, Costa, Timoteo *et al.* 2016; Ashenafi, Eshetu, Assefa *et al.* 2017). Despite the criticisms about the accuracy and reliability of VA data, these studies have shown that VA data are a useful source of cause of death information in resource-limited settings.

In Zambia, the SAVVY was implemented from 2010 to 2012 with a pilot phase in 2009 (Central Statistical Office [Zambia] 2014). Therefore, the availability of detailed VA data that is nationally representative provides an opportunity to explore the causes of death among adults in age group 15-59 years. Zambia's civil registration and vital statistics system is not different from those of other African countries where death registration is incomplete. The national health management information system (HMIS) exists mainly in urban health facilities while in rural areas the manual system of record keeping is predominant. Fragmented parallel electronic medical record systems do exist as well operated by private health facilities and donor-funded health programmes mainly focused on HIV/AIDS programmes. It is not clear, however, whether these private medical record systems are

linked to the national health record system, and whether they frequently report to the Ministry of Health or not. Health data from the private health sector are not publicly available while those from the HMIS system suffer from data quality issues. The Department of National Registration, Passports and Citizenship (DNRPC) has also been piloting a programme of death registration and cause of death attribution at mortuaries in two provinces of Zambia: Copperbelt and Lusaka. The VA method is used upon arrival of the deceased's body at the mortuary. Information about the deceased and cause of death is captured using electronic questionnaires load on computer tablets.

This study aims at examining the causes of death among adults in age group 15-59 using the 2010-2012 SAVVY data to answer the research question: What are the causes of death among adults in age group 15-59 in Zambia? The impact of eliminating the top 5 causes of death on adult mortality is also explored. The study is relevant to health programmes and interventions aimed at reducing adult mortality in line with the Sustainable Development Goals and the African Agenda 2063.

2. Literature Review and Theoretical Framework

Previous research has shown that causes of death vary by demographic and socio-economic background characteristics of the deceased persons. A study by Mberu and others (2015) in Kenya found that tuberculosis, injuries and HIV/AIDS were the major causes of death among adults aged 15 years and above. In Ethiopia, Melaku and others (2014) found tuberculosis, cerebrovascular diseases and accidental are the leading causes of death among adults aged 15 years and above. In another study by Mudenda and others (2011) in Zambia found that HIV/AIDS, malaria and injuries and accidents were the leading causes of death across all age groups. Rathod and others (2016) in a study conducted in Lusaka urban in Zambia found tuberculosis, HIV/AIDS and malaria to be the leading causes of death among adults aged 15 years and above. The Global Burden of Disease study on mortality and cause of death for 2013 also found that HIV/AIDS, tuberculosis and malaria were the leading causes of death in adults aged 15-49 years in Zambia (Murray, Ortblad, Guinovart *et al.* 2014). Tuberculosis, traffic accidents and malaria were the leading causes of death among adults in age group 15-49 in Angola (Rosario, Costa, Timoteo *et al.* 2016).

Differences in causes of death have also been found among males and females. Mberu and others (2015) found that HIV/AIDS death were twice higher among females than males. In Mudenda and others' (2011) study the number of HIV/AIDS deaths was higher for males than females. In Tanzania, Rao and others (2006) found higher proportions of HIV/AIDS deaths among females than males. Injuries and accidents as causes of death also vary among males and females. In Kenya, deaths attributed to injuries and accidents were 4 times higher among males than females (Mberu, Wamukoya, Oti *et al.* 2015). Male deaths attributable to injuries and accidents were also significantly higher than for females across all ages in Mudenda and others' (2011) study in Zambia. Similarly in Ethiopia, male deaths due to injuries and accidents were significant higher than for females (Melaku, Sahle, Tesfaye *et al.* 2014). The same was found in Tanzania (Rao, Lopez and Hemed 2006).

Causes of death also vary by age. Studies have found that deaths due to injuries and accidents are higher among young adults in the age range 15-49 than older adults (Melaku, Sahle, Tesfaye *et al.* 2014; Mberu, Wamukoya, Oti *et al.* 2015). Deaths due to injuries and accidents progressively decrease with an increase in age. Deaths of adults aged 50 years and above attributable to non-communicable diseases were higher than among young adults (Melaku, Sahle, Tesfaye *et al.* 2014; Mberu, Wamukoya, Oti *et al.* 2015; Rosario, Costa, Timoteo *et al.* 2016). Studies have also observed that the proportion of deaths attributable to communicable diseases tends to decrease with an increase in age whereas deaths due to non-communicable diseases increase with age (Rao, Lopez and Hemed 2006; Melaku, Sahle, Tesfaye *et al.* 2014; Mberu, Wamukoya, Oti *et al.* 2015; Rosario, Costa, Timoteo *et al.* 2016). Some studies have also found that female deaths due to communicable diseases are higher than for males (Rao, Lopez and Hemed 2006; Melaku, Sahle, Tesfaye *et al.* 2014).

Variations in causes of death have also been found by marital status. A study in Ethiopia found that deaths due to external causes were higher among the never married (Melaku, Sahle, Tesfaye *et al.* 2014). Another study in Angola found that deaths attributed to communicable disease were higher among the less educated than the more educated (Rosario, Costa, Timoteo *et al.* 2016). Studies have also examined the causes of death by urban-rural residence and found mixed results. In some studies deaths due communicable diseases are higher in rural than urban areas (Melaku, Sahle, Tesfaye *et al.* 2014) while in others the opposite is the case (Ashenafi, Eshetu, Assefa *et al.* 2017). Some studies have found increasing deaths attributable to non-communicable diseases in both urban and rural areas (Tollman, Kahn, Sartorius *et al.* 2008; Mayosi, Flisher, Lalloo *et al.* 2009; Melaku, Sahle, Tesfaye *et al.* 2014).

Previous studies show that in addition to HIV/AIDS as the leading cause of death among adults, several sub-Saharan African countries also have to deal with the emerging epidemic of non-communicable diseases (NCDs) such as hypertension, cardiovascular diseases, diabetes, and cancers (prostate, breast and cervical) (GBD 2015 Mortality and Causes of Death Collaborators 2016; Murray, Ortblad, Guinovart *et al.* 2014). Non-communicable diseases are associated with affluent lifestyles and as developing countries modernise more people will adopt these lifestyles that lead to NCDs, which according to the epidemiological transition theory are degenerative and man-made (Omran 1971). Adults in age group 15-59 year are the most at risk of suffering from NCDs (Oti, van de Vijver and Kyobutungi 2014; United Nations 2015).

In Zambia, NCD deaths attributed to cardiac diseases increased by more than two-fold from about 400 deaths in 2008 to nearly 910 deaths in 2009. Mortality due to diabetes increased from 100 deaths in 2008 to about 190 deaths in 2009. Deaths attributed to hypertension also doubled from about 190 deaths in 2008 to 400 deaths in 2009 (Ministry of Health [Zambia] 2011, 2014).

The findings from previous studies show that HIV/AIDS, tuberculosis, malaria and injuries and accidents are the leading causes of death among adults in sub-Saharan Africa and notable variations have been observed by demographic and socio-economic background characteristics of the deceased. Studies also show that there is growing interest

in using VA data to understand causes of death in sub-Saharan African countries with incomplete death registration. There is need to understand the factors associated with causes of death especially in the most productive segment of the population so as to design appropriate health interventions.

The study is premised on the proximate determinants framework for adult mortality which postulates that distal factors (demographic, socio-economic and geographical) indirectly influence cause-specific mortality whereas proximate factors (health behaviour, health conditions) directly impact on mortality (Rogers, Hummer and Krueger 2005).

3. Methods

3.1. Study Setting

Zambia, is a sub-Saharan African country with a population of about 15.5 million people as estimated in 2015 (Central Statistical Office 2016). About 61 per cent of the population live in poverty (Central Statistical Office [Zambia] 2012). The life expectance at birth is estimated at 53.4 years for females and 49.2 years for males (Central Statistical Office [Zambia] 2012). The country's civil registration and vital statistics system is rudimentary and therefore death registration is incomplete. The health system equally faces a lot of challenges as the infrastructure is unmaintained, there is lack of emergency equipment and transportation, shortage of essential drugs and critical health personnel, overcrowding, frustrated health providers, etc. In rural areas, the situation is worse than in urban areas.

3.2. Data

The study utilised the 2010-2012 SAVVY survey data. The survey was conducted by the Central Statistical Office (CSO), Ministry of Health (MoH), and the Department of National Registration, Passports and Citizenship with the objective of collecting accurate and reliable information for mortality indicators to assess the impact of health programmes in Zambia.

The SAVVY survey used a nationally representative sample of census supervisory areas (CSAs) and standard enumeration areas (SEAs) selected from the 2000 census of population and housing sampling frame. Seventy-six (76) homogeneous CSAs were selected, 46 in rural areas and 30 in urban areas of each province for vital registration with verbal autopsy. The target population were all individuals living in households in the selected CSAs. In rural areas, the target was 1,200 households and urban areas, 1,800 households. A total sample population of 109,200 was targeted.

World Health Organisation standard SAVVY questionnaires and methodology of reporting causes of death were used. A household questionnaire asked the following questions as a basis for verbal autopsy interviews: "Is there a usual member of this household who died in the last 12 months?"; "Was this person male or female?", and "How old was this person?" For all deaths identified, a verbal autopsy questionnaire for death of a person aged 15 years and above collected more detailed information about the deceased

person on age at death, sex, marital status, occupation status at time of death, education level, cause of death, history of illness, risk factors, health service utilisation, place of death, and relationship to the deceased among others. The next of kin or an adult respondent knowledgeable about the deceased person responded to the verbal autopsy questionnaire.

SAVVY fieldwork staff included nurses, environmental health technicians, and other medical personnel who were trained as verbal autopsy interviewers (VAIs); mostly members of community health committees served as community key informants (CKIs) who reported deaths that occurred to VAIs and facilitated appointments with households that experienced a death. Medical doctors and clinical officers (nosologists) from the Ministry of Health classified and coded the causes of death using the WHO ICD-10 guidelines and coding practice. Death certificates were issued for each completed verbal autopsy of the deceased persons in cases where they were not available (Central Statistical Office [Zambia] 2014).

3.3. Analysis

Descriptive statistics in form of frequencies and percentages were used to describe the causes of death by demographic, socio-economic and geographical background characteristics of the deceased persons in age group 15-59 years. The Chi-square test was used to examine associations between causes of death and categorical variables, that is, demographic and socio-economic background characteristics of the deceased population. Cause-specific mortality rates were computed using standard demographic methods (Lamb and Siegel 2004; McGehee 2004) by demographic, socioeconomic and geographical characteristics of the deceased persons. Furthermore, age specific death rates (ASDRs), age-cause-specific death rates (ACSDRates), and age-cause-specific death ratios (ACSDRatios) were also computed (McGehee 2004).

Life table techniques were employed to construct cause-deleted/associated single decrement life tables (ASDLT) to assess the contributions of the causes of death thereby establishing their relative significance to adult mortality (Preston, Heuveline and Guillot 2001; Kintner 2004). Probabilities of death from each cause of death were also derived. The ASDLT were constructed by relating observed deaths in the population in the age interval *x*, *x*+*n* ($_nM_x$) to the deaths of the life table in the same age interval ($_nm_x$) by assuming that they are equal, implying that the force of mortality is constant ($_nM_x = _nm_x$), where $_nM_x$ are age-specific mortality rates in the study population and $_nm_x$ are life table age specific mortality rates. Preston et al (2001) have a presented detailed explanation on this association elsewhere. According to Preston et al (2001) the cause-deleted/associated single life table is constructed by assuming that the force of mortality is constant in an age interval ($_n^*m_x = _nM_x^i = _nm_x^i$) and the associated single decrement probability of dying from cause *i* in the age interval *x*, *x*+*n* is computed as: $_n^*q_x = 1 - e^{-n \times _nM_x^i}$ (Preston et al., 2001). The other life table functions were computed as per standard life table relationships (Preston, Heuveline and Guillot 2001). To estimate the number of years gained as a result of eliminating a

particular cause of death the life expectancy at each age derived from the SAVVY life table was subtracted from that of the constructed cause-deleted life table. The percentage reduction in the probability of dying after eliminating the cause of death was also computed.

Stata version 14.2 statistical software was used to extra the data which was exported to Microsoft Excel for further demographic analysis. The *svy* Stata command was used to account for the weight in survey design and ensure national representativeness of the sample.

3.4. Ethical Considerations

The 2010-2012 SAVVY data were obtained from the Central Statistical Office (Zambia) with permission. In undertaking the SAVVY, the Central Statistical Office abided by all ethical procedures and approvals as required by the Ethics Review Committee. Prior to the release of the dataset, all personal identifiers were removed.

4. Results

4.1. Causes of Death by Selected Background Characteristics of Deceased Persons

There were 1,078 deaths of adults in age group 15 to 59 years from 2010 to 2012. Male adult deaths were 54 per cent whereas for females they were 46 per cent. Table 1 presents the top 15 leading causes of deaths by selected background characteristics of the deaceased adults in age group 15-59. The table shows that the leading cause of death among males and females is HIV/AIDS. Female (44.1 per cent) decedents experienced more HIV/AIDS deaths than males (37.9 per cent). Adult males (15.3 per cent) died more from injuries and accidents than females (6.3 per cent). The association is statistically significant (p-value= 0.0000). Examining the causes of death by age, there are variations, HIV/AIDS deaths are common across all age groups, progressively increasing with age peaking in age group 35-44 where slightly more than 50 per cent of the deaths are due to HIV/AIDS. The proportion of HIV/AIDS deaths decreases after age group 45-49. Slightly above one-tenth of tuberculosis deaths occurred in age groups, 15-19 (10.9 per cent) and 45-49 (11 per cent). Malaria related deaths are higher in age groups 15-19 (8.3 per cent), 20-24 (9.5 per cent), and 25-29 (8 per cent). Deaths due to diseases of the circulatory system are notable in age groups 45-49 (11.3 per cent) and 55-59 (18.2 per cent). Injuries and accidents deaths are evident in age groups 15-19 (19.1 per cent), 20-24 (15 per cent), 25-29 (14.6 per cent), 35-39 (11.4 per cent) and 55-59 (13.4 per cent). The differences in variation in deaths are statistically significant (p-value=0.0072).

In both rural and urban areas HIV/AIDS deaths were leading, 40.8 per cent and 40.7 per cent, respectively. Injuries and accidents deaths were almost the same proportions, 11.7 per cent in rural areas and 10.5 per cent in urban areas. There is no statistical difference in the variation of deaths by causes of death between rural and urban areas (p-value=0.3088). At

provincial level, HIV/AIDS deaths were common with the exception of Copperbelt, Luapula, Northern and North-Western provinces, the rest of the provinces had HIV/AIDS deaths above 40 per cent. Malaria deaths were higher in Copperbelt province (15.7 per cent) than the rest of the provinces. Tuberculosis deaths were higher in Luapula (10.9 per cent), Northern (11.8 per cent) and North-western (10.7 per cent) provinces than the other provinces. Deaths due to injuries and accidents were higher in Central (12.6 per cent), Luapula (11.5 per cent), Lusaka (12.5 per cent), Northern (12.3 per cent) and Southern (13.2 per cent) than the rest of the provinces. There is no statistical difference in deaths due to causes of deaths among the provinces (p-value=0.5347).

Across all educational attainment levels, HIV/AIDS deaths were leading. HIV/AIDS deaths were higher among decedents with primary level educational attainment (45.1 per cent) and lower among the deceased who had higher level of educational attainment (24.9 per cent). Deaths due to injuries and accidents were higher in decedents who had higher level of educational attainment (19.6 per cent) than those who had primary level of educational attainment (9.6 per cent). There is no statistical difference in variation of deaths by educational attainment levels. More than half (53.2 per cent) of HIV/AIDS deaths were among the widowed/divorced/separated marital status category. In other categories, more than one-third of the deaths were due to HIV/AIDS: married/living with partner (38.6 per cent) and never married (33.8 per cent). Injuries and accidents deaths were higher among the never married (16.9 per cent) and married (11.5 per cent) than the widowed/divorced/separated. There was no statistical difference (p-value=0.1375).

HIV/AIDS deaths were commmon across all occupation types. Higher HIV/AIDS deaths among the service/shop/market sales workers (46.5 per cent) and lower among the legislators/senior officials/managers (23.7 per cent). Malaria deaths were higher among clerks (11.6 per cent) and plant machine operators/assemblers (10.2 per cent) than the other occupations. Diabetes mellitus deaths were higher among decedents who were legislators/senior officials/manager (10.6 per cent) than the other occupations. The proportion of tuberculosis deaths was higher among legislators/senior officials/managers (10.1 per cent) and those who were professionals (17.8 per cent) than the other occupations. Meningitis deaths are notable among deceased adults who were craft and related trade workers (10. 1 per cent). Deaths due to injuries and accidents were higher among professionals (24 per cent) and lower among those were technicians/associate professionals (4.8 per cent). The variation in deaths was border line statistically (p-value=0.0523).

In terms of risk behaviour, more than 40 per cent of HIV/AIDS deaths occurred among adults who drunk alcohol. In addition, more injuries and accidents deaths happened among those who consumed alcohol (12.2 per cent). The statistical significance is borderline (p-value=0.0541). Furthermore, about 43 per cent HIV/AIDS deaths occurred among those who smoked tobacco as well as 12.6 per cent injuries and accidents deaths. The association is not statistically significant (p-value=0.2130).

With respect to family relationship, across all relationship types, HIV/AIDS deaths were common with a peak among siblings (50.4 per cent). The proportion of tuberculosis deaths was higher among siblings (10.4 per cent) than the other type of relationships. Injuries and

accidents deaths were higher among the deceased who were fathers (22.5 per cent) and lower among those who were children to the respondent (7.6 per cent). The association was statistically significant (p-value=0.0000).

In terms of place of death, nearly half (45.1 per cent) HIV/AIDS deaths occurred in a hospital while 41 per cent took place at home. Almost half (49.1 per cent) injuries and accidents deaths occurred at other places. The differences are statistically significant (p-value=0.0000).

Table 1. Cause of death by demographic and socioeconomic background characteristics of the deceased adults in age group in 15-59 years, Zambia, 2010-2012

Variable	Diarrhoeal diseases	HIV disease	Malaria	Neoplasms	Nutritional & other anemias	Diabetes mellitus	Malnutrition	Tuberculosis	Meningitis	Disease of the circulatory system	Pneumonia/ ARI	Other disorders of the digestive	Disorders of the kidney	Maternal causes	Injuries & Accidents	All other causes	Ill-defined & undetermined causes	Total (%)	Number (15-59)	P-value
Sex																				**0.0000**
Male	1.3	37.9	6.6	1.9	0.8	1.9	0.6	8.3	1.5	4.6	2.9	1.4	1.0	0.0	15.3	7.9	6.0	100.0	582	
Female	1.5	44.1	6.5	4.6	1.7	1.6	0.4	7.5	1.6	6.5	1.7	1.2	0.2	3.9	6.3	7.5	3.3	100.0	496	
Age group																				**0.0072**
15-19	4.1	23.6	8.3	1.4	4.2	0.0	1.3	10.9	2.7	2.7	1.4	0.0	0.0	5.3	19.1	9.4	5.7	100.0	67	
20-24	0.9	31.5	9.5	3.5	2.6	0.0	0.0	7.2	2.8	3.5	4.3	0.0	0.0	4.5	15.0	7.9	7.0	100.0	107	
25-29	1.7	37.5	8.0	1.3	0.6	1.9	0.0	8.3	1.4	4.3	1.1	2.5	0.0	2.9	14.6	8.4	5.4	100.0	163	
30-34	1.7	47.1	5.2	2.3	0.6	1.7	0.0	8.9	1.2	3.0	4.1	1.8	0.6	1.2	9.9	7.2	3.6	100.0	168	
35-39	0.9	54.4	6.5	3.4	0.4	1.5	0.0	4.0	1.9	1.9	3.0	1.0	0.0	2.1	11.4	3.4	4.3	100.0	195	
40-44	2.5	50.4	4.9	3.3	0.0	0.8	0.7	6.8	1.7	6.5	0.7	0.8	1.6	0.0	9.1	8.8	1.6	100.0	118	
45-49	0.9	38.6	5.7	3.8	0.9	1.8	0.0	11.0	1.9	11.3	0.9	0.9	1.9	0.0	2.7	12.1	5.5	100.0	103	
50-54	0.0	32.5	4.4	5.7	2.3	4.6	1.0	9.9	0.0	7.8	3.3	2.3	2.2	0.0	7.5	7.6	9.0	100.0	94	
55-59	0.0	21.4	7.6	5.1	2.7	4.6	5.0	9.3	0.0	18.2	0.0	1.9	0.0	0.0	13.4	8.9	1.9	100.0	62	
Residence																				**0.3068**
Rural	1.7	40.8	6.0	2.9	1.3	1.4	1.0	8.0	1.1	5.9	2.4	1.0	0.4	2.4	11.7	8.6	3.4	100.0	596	
Urban	1.0	40.7	7.3	3.4	1.1	2.1	0.0	7.9	2.1	5.0	2.2	1.7	1.0	1.0	10.5	6.5	6.5	100.0	482	
Province																				**0.5347**
Central	0.0	43.2	4.4	0.0	2.6	5.2	0.0	4.4	7.0	6.5	2.9	1.5	0.0	1.6	12.6	5.4	2.8	100.0	69	
Copperbelt	0.0	37.9	15.7	1.4	3.0	1.4	1.4	7.2	0.0	1.5	2.9	5.9	1.4	0.0	8.8	7.3	4.4	100.0	67	
Eastern	3.1	44.9	6.4	3.8	1.0	2.2	1.2	4.7	0.5	4.3	2.6	0.5	0.0	2.0	9.6	8.6	4.6	100.0	183	
Luapula	1.3	37.4	8.2	1.3	1.3	0.0	1.1	10.9	3.1	6.9	2.4	1.3	0.7	2.5	11.3	9.0	1.2	100.0	153	
Lusaka	1.2	40.4	5.3	4.1	1.6	0.5	0.0	7.4	0.9	5.4	2.1	1.8	1.2	0.8	12.5	6.9	8.1	100.0	245	
Northern	4.0	25.5	4.4	0.0	1.4	4.4	0.0	11.8	1.4	7.4	2.7	0.0	0.0	6.9	12.3	16.5	1.5	100.0	70	
North Western	2.1	37.8	2.6	4.4	0.0	2.8	0.0	10.7	2.5	15.8	4.4	0.0	0.0	0.0	7.3	7.0	2.5	100.0	40	
Southern	0.0	44.6	2.4	5.4	0.7	3.2	0.0	8.6	0.9	5.1	0.9	1.6	1.7	0.0	13.2	5.4	6.3	100.0	126	
Western	0.7	45.1	9.9	4.0	0.0	0.8	0.8	8.9	0.8	3.3	2.2	0.0	0.0	3.2	9.8	5.3	5.2	100.0	126	

Variable	Diarrhoeal diseases	HIV disease	Malaria	Neoplasms	Nutritional & other anemias	Diabetes mellitus	Malnutrition	Tuberculosis	Meningitis	Disease of the circulatory system	Pneumonia/ ARI	Other disorders of the digestive	Disorders of the kidnev	Maternal causes	Injuries & Accidents	All other causes	Ill-defined & undetermined causes	Total (%)	Number (15-59)	P-value
Educational attainment																				**0.0818**
None	4.0	34.1	7.7	2.2	2.1	3.1	2.9	7.0	2.0	2.9	0.9	1.0	0.0	1.0	10.1	10.7	8.3	100.0	96	
Primary	1.1	45.1	5.1	2.5	1.1	0.7	0.4	8.3	1.0	7.1	2.8	0.8	0.6	2.1	9.6	7.7	3.9	100.0	511	
Secondary	1.2	39.6	8.7	3.9	1.5	2.4	0.0	7.6	1.8	3.6	2.0	2.1	0.3	1.8	12.3	6.1	5.2	100.0	377	
Higher	1.6	24.9	4.8	1.5	0.0	3.2	1.5	7.7	1.5	7.7	3.0	1.5	4.5	1.6	19.6	12.4	3.0	100.0	63	
Marital Status																				**0.1375**
Never Married	1.5	33.8	7.0	2.7	1.1	1.2	0.7	7.9	2.0	3.4	2.6	0.8	0.4	1.5	16.9	9.3	7.3	100.0	253	
Married/Living with a partner	1.7	38.6	6.8	3.3	1.2	2.3	0.5	7.8	1.6	6.4	2.1	1.6	0.9	2.6	11.5	7.1	4.2	100.0	566	
Widowed/Divorced/Separated	0.8	53.2	5.8	3.1	1.5	1.1	0.3	8.1	1.1	5.2	2.6	1.2	0.4	0.4	5.0	7.0	3.2	100.0	255	
Occupation																				**0.0523**
Legislators/Senior Officials/Managers	5.0	23.7	5.0	5.3	0.0	10.6	5.1	10.1	0.0	5.0	0.0	5.0	0.0	5.1	9.8	5.1	5.2	100.0	20	
Professionals	0.0	27.1	0.0	4.3	0.0	4.5	0.0	17.8	0.0	0.0	0.0	0.0	8.6	0.0	24.0	8.9	4.8	100.0	22	
Technicians/Associate Professionals	0.0	43.4	0.0	0.0	0.0	4.5	0.0	9.2	4.3	0.0	4.1	4.2	0.0	0.0	4.8	12.6	12.9	100.0	23	
Clerks	0.0	42.8	11.6	2.9	0.0	0.0	0.0	9.3	0.0	7.3	2.8	3.1	0.0	1.5	5.7	8.8	4.3	100.0	67	
Service/Shop/Market sales workers	0.0	46.5	5.8	5.4	1.1	3.5	0.0	8.0	1.0	6.1	0.0	2.1	0.0	1.1	10.4	7.0	2.0	100.0	99	
Skilled Agricultural/Fishery workers	1.9	39.6	6.9	2.9	0.9	1.5	0.6	7.9	0.9	5.2	3.2	1.2	1.0	2.3	13.5	6.7	3.8	100.0	332	
Craft and related trade workers	0.0	42.9	3.3	0.0	0.0	7.4	0.0	6.6	10.1	0.0	0.0	0.0	0.0	3.2	10.3	9.5	6.8	100.0	30	
Plant and Machine Operators/Assemblers	1.8	35.8	10.2	3.5	3.5	0.0	0.0	9.2	0.0	4.9	0.0	3.9	0.0	1.7	18.7	5.2	1.6	100.0	55	
Elementary Occupations	1.6	41.8	6.2	2.9	1.7	0.9	0.7	7.0	2.1	6.3	2.7	0.5	0.4	1.6	9.2	8.4	6.0	100.0	430	
Alcohol Consumption																				**0.0541**
Yes	1.0	44.2	6.4	2.4	0.4	1.0	0.8	8.7	0.8	4.5	2.3	1.1	0.6	0.0	12.2	8.6	4.9	100.0	469	
No	1.7	38.3	6.6	3.7	1.9	2.3	0.3	7.5	2.1	6.4	2.3	1.5	0.7	3.2	10.0	6.9	4.6	100.0	601	
Tobacco Smoking																				**0.2130**
Yes	0.7	42.6	5.5	2.5	1.0	0.4	1.1	11.0	1.1	3.8	2.6	0.8	0.4	0.4	12.6	9.5	4.1	100.0	261	
No	1.6	40.4	6.8	3.4	1.3	2.2	0.4	6.9	1.7	6.1	2.3	1.5	0.7	2.3	10.5	7.2	4.8	100.0	808	

Variable	Diarrhoeal diseases	HIV disease	Malaria	Neoplasms	Nutritional & other anemias	Diabetes mellitus	Malnutrition	Tuberculosis	Meningitis	Disease of the circulatory system	Pneumonia/ ARI	Other disorders of the digestive	Disorders of the kidnev	Maternal causes	Injuries & Accidents	All other causes	Ill-defined & undetermined causes	Total (%)	Number (15-59)	P-value
Family Relationship																				**0.0000**
Father	1.0	32.2	5.4	2.4	0.0	3.4	0.0	5.7	1.2	6.1	2.1	1.3	1.1	5.6	22.5	6.6	3.4	100.0	86	
Mother	2.4	44.8	10.6	2.4	2.3	0.4	0.0	7.4	2.1	4.6	0.5	1.0	0.5	2.0	9.3	5.6	4.2	100.0	202	
Spouse	1.6	32.1	6.2	5.0	0.4	2.9	0.5	8.8	1.3	7.8	3.1	2.4	0.5	1.0	13.0	9.7	3.7	100.0	216	
Sibling	0.0	50.4	3.6	1.0	1.5	1.0	1.5	10.4	1.0	4.8	2.5	0.5	0.0	2.0	9.3	4.0	6.5	100.0	192	
Child	2.6	38.4	8.7	6.2	0.6	2.0	0.6	6.1	0.6	6.0	1.3	1.9	0.6	1.9	7.6	9.7	5.2	100.0	149	
Other relative	0.9	42.3	4.8	2.1	1.7	1.4	0.5	7.6	2.7	4.5	4.0	0.9	0.9	0.8	10.5	9.4	5.0	100.0	220	
No relation	0.0	45.9	0.0	0.0	0.0	0.0	0.0	9.3	0.0	0.0	0.0	0.0	0.0	0.0	18.1	18.0	8.7	100.0	11	
Place of Death																				**0.0000**
Hospital	0.9	45.1	6.7	5.1	1.5	2.5	0.0	7.9	2.1	5.0	2.2	1.6	0.9	2.4	6.5	7.3	2.2	100.0	434	
Other health facility	3.4	39.1	7.8	0.0	0.9	1.7	0.0	7.0	1.8	6.6	6.2	1.8	0.0	4.4	8.9	7.0	3.5	100.0	111	
Home	1.3	41.6	6.3	2.5	1.3	1.4	1.3	9.3	1.1	6.3	1.9	0.9	0.7	0.7	9.0	7.0	7.4	100.0	447	
Other	2.1	16.1	5.6	0.0	0.0	0.0	0.0	2.2	1.2	2.2	0.0	1.1	0.0	1.2	49.1	13.7	5.7	100.0	86	
Total	**1.4**	**40.7**	**6.6**	**3.1**	**1.2**	**1.7**	**0.5**	**7.9**	**1.6**	**5.5**	**2.3**	**1.3**	**0.6**	**1.8**	**11.2**	**7.7**	**4.8**	**100.0**	**1078**	

Source: Computations from 2010-2012 SAVVY data files

4.2. Leading Causes of Death

Table 2 shows the ranking of the causes of death among adults in the age group 15-59 years, HIV/AIDS emerges as the leading cause of death. About 41 per cent of deaths among all adult decedents were attributed to HIV/AIDS. The proportion of HIV/AIDS deaths is higher among deceased adult females (44.1 per cent). About 38 per cent of adult males died of HIV/AIDS. Table 2 shows that more adult females died from HIV/AIDS than males.

Table 2. Leading cause of death among adults in age group 15-59, Zambia, 2010-2012

	Male			Female			Total		
Cause of death	**Number**	**%**	**Rank**	**Number**	**%**	**Rank**	**Number**	**%**	**Rank**
HIV disease	221	37.9	1	218	44.1	1	439	40.7	1
Tuberculosis	48	8.3	3	37	7.5	2	86	7.9	3
Disease of the circulatory system	27	4.6	5	32	6.5	3	59	5.5	5
Malaria	39	6.6	4	32	6.5	4	71	6.6	4
Injuries & Accidents	89	15.3	2	31	6.3	5	120	11.2	2
Neoplasms	11	1.9		23	4.6		34	3.1	
Maternal causes	0			19	3.9		19	1.8	
Nutritional & other anemias	5	0.8		9	1.7		13	1.2	
Pneumonia/ARI	17	2.9		8	1.7		25	2.3	
Diabetes mellitus	11	1.9		8	1.6		19	1.7	
Meningitis	9	1.5		8	1.6		17	1.6	
Diarrhoeal diseases	7	1.3		8	1.5		15	1.4	
Other disorders of the digestive system	8	1.4		6	1.2		14	1.3	
Malnutrition	4	0.6		2	0.4		6	0.5	
Disorders of the kidney	6	1.0		1	0.2		7	0.6	
All other causes	46	7.9		37	7.5		83	7.7	
Ill-defined & undetermined causes	35	6.0		16	3.3		52	4.8	
Total	**582**	**100.0**		**496**	**100.0**		**1,078**	**100.0**	

Source: Computations from 2010-2012 SAVVY data files

Examining the causes of death by sex in Table 2, it is notable that the second ranking causes of death differ for males and females. For males, injuries and accidents deaths (15.3 per cent) are the second leading cause of death while for females it is tuberculosis (7.5 per cent). Tuberculosis is third ranked as a cause of death for males (8.3 per cent) whereas for females it is diseases of the circulatory system (6.5 per cent). Interestingly, injuries and accidents are fifth (5th) ranked for females while for males diseases of the circulatory system assume the same ranking. Both are ranked immediately below malaria which is ranked fourth (4th) as a leading cause of death for both males (6.6 per cent) and females (6.5 per cent).

It is also notable that while males were dying of pneumonia/ARI and diabetes mellitus in the sixth (6th) and seventh (7th) rankings respectively, females were dying of neoplasms and maternal causes in the same raking order. Furthermore, while disorders of the kidney

(0.2 per cent) are least ranked as cause of death among females; a proportion of 1 per cent of male deaths were attributed to the same cause of death.

4.3. Causes of Death and Rural-Urban Residence

Table 3 further disaggregates the causes of death by rural-urban residence and sex. In both rural and urban areas, the proportion of HIV/AIDS deaths is highest. Females had a higher proportion of HIV/AIDS deaths than males irrespective of whether rural or urban area. The proportion of neoplasm deaths was higher among women in urban (5.5 per cent) than rural (3.9 per cent) areas. Diabetes mellitus deaths were higher among urban males (2.6 per cent) than rural males (1.3 per cent). A higher proportion of tuberculosis deaths among males than females in both rural and urban areas is evident. The proportion of deaths attributed to diseases of the circulatory system was higher among females than males in both rural and urban areas. In rural areas, a higher proportion (3.1 per cent) of pneumonia/ARI attributed deaths was experienced than in urban areas (2.6 per cent) among deceased adult males. Injuries and accidents attributed deaths were higher among males than females in both rural and urban areas. The proportion was even higher among rural males (16 per cent) than urban males (14.5 per cent).

Table 3. Causes of death among adults by rural-urban residence, Zambia, 2010-2012

	Male			Female			Both		
Cause of death	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
Diarrhoeal diseases	1.8	0.7	1.3	1.6	1.4	1.5	1.7	1.0	1.4
HIV disease	37.9	38.0	37.9	44.0	44.2	44.1	40.8	40.7	40.7
Malaria	5.3	8.1	6.6	6.7	6.1	6.5	6.0	7.3	6.6
Neoplasms	1.9	1.8	1.9	3.9	5.5	4.6	2.9	3.4	3.1
Nutritional & other anemias	0.9	0.7	0.8	1.8	1.7	1.7	1.3	1.1	1.2
Diabetes mellitus	1.3	2.6	1.9	1.7	1.4	1.6	1.4	2.1	1.7
Malnutrition	1.2	0.0	0.6	0.7	0.0	0.4	1.0	0.0	0.5
Tuberculosis	8.5	8.1	8.3	7.4	7.7	7.5	8.0	7.9	7.9
Meningitis	1.3	1.9	1.5	1.0	2.3	1.6	1.1	2.1	1.6
Disease of the circulatory system	5.5	3.6	4.6	6.4	6.7	6.5	5.9	5.0	5.5
Pneumonia/ARI	3.1	2.6	2.9	1.6	1.8	1.7	2.4	2.2	2.3
Other disorders of the digestive system	1.3	1.6	1.4	0.7	1.9	1.2	1.0	1.7	1.3
Disorders of the kidney	0.7	1.4	1.0	0.0	0.5	0.2	0.4	1.0	0.6
Maternal causes	0.0	0.0	0.0	5.0	2.4	3.9	2.4	1.0	1.8
Injuries & Accidents	16.0	14.5	15.3	7.2	5.2	6.3	11.7	10.5	11.2
All other causes	9.4	6.1	7.9	7.8	7.1	7.5	8.6	6.5	7.7
Ill-defined & undetermined causes	4.0	8.4	6.0	2.7	4.1	3.3	3.4	6.5	4.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number (15-59)	309	274	582	288	208	496	596	482	1078

Source: Computations from 2010-2012 SAVVY data files

4.4. Causes of Death and Provincial Residence

Like at the national level, HIV/AIDS deaths had the highest proportions in each province (Table 4). Among deceased males, Western province (46.2 per cent) had the

highest proportion of HIV/AIDS deaths and Northern the lowest (24.6 per cent). A higher proportion of malaria deaths is notable among male decedents in Copperbelt province (16.3 per cent) than the rest of the provinces. Diabetes mellitus deaths were higher in Northern (6.2 per cent) province than other provinces. Proportions of deaths attributable to tuberculosis were higher in Luapula (13.6 per cent), Northern (15.8 per cent) and North-Western (17.2 per cent). Meningitis deaths were higher in Central (5.3 per cent) and Luapula (4.9 per cent). The proportions of deaths attributable to diseases of the circulatory system among males were higher in Central (6.9 per cent), Luapula (6.0 per cent) and North-Western provinces (8.7 per cent). Injuries and accidents attributable deaths were high across all provinces but higher in Central (17.7 per cent), Lusaka (16.8 per cent), Northern (17.8 per cent) and Southern (16.2 per cent).

Among deceased females, table 4 shows a similar pattern of HIV/AIDS attributable deaths. Eastern province had the highest proportion of HIV/AIDS deaths (54 per cent) while Northern province had the lowest (26.2 per cent). Copperbelt and Western provinces had higher proportions of adult female deaths attributable to malaria, 15.1 per cent and 11.2 per cent, respectively. Neoplasms deaths were higher among women in Lusaka (5.5 per cent), North-Western (6.2 per cent) and Western (7.1 per cent) provinces. Deaths due to nutritional and other anaemia (5.8 per cent) as well as diabetes mellitus (8.3 per cent) were higher among females in Central province. A higher proportion of deaths attributable to tuberculosis is notable in Southern province (13.9 per cent). Meningitis deaths are higher among females in Central province (9.1 per cent) while deaths attributable to disorders of the digestive system are higher in Copperbelt province (12.4 per cent). A higher proportion of women died from maternal causes in Northern province (12.9 per cent) than other provinces. Injuries and accidents attributable deaths were higher in Luapula (8.2 per cent) and Southern (8.5 per cent).

Table 4. Causes of death among male and female adults by provincial residence, Zambia, 2010-2012

Male

Cause of death	Central	Copperbelt	Eastern	Luapula	Lusaka	Northern	North Western	Southern	Western	Total
Diarrhoeal diseases	0.0	0.0	2.7	1.3	1.3	5.6	0.0	0.0	0.0	1.3
HIV disease	41.5	39.2	37.1	34.4	36.2	24.6	33.1	44.0	46.2	37.9
Malaria	5.3	16.3	7.3	7.3	6.6	6.3	0.0	1.4	8.4	6.6
Neoplasms	0.0	0.0	3.7	0.0	3.4	0.0	0.0	2.6	0.0	1.9
Nutritional & other anemias	0.0	2.6	1.8	0.0	0.6	0.0	0.0	1.2	0.0	0.8
Diabetes mellitus	2.7	2.6	1.9	0.0	0.7	6.2	0.0	4.0	1.7	1.9
Malnutrition	0.0	2.6	1.0	1.1	0.0	0.0	0.0	0.0	1.8	0.6
Tuberculosis	2.7	5.5	5.6	13.6	8.6	15.8	17.2	5.2	8.6	8.3
Meningitis	5.3	0.0	0.0	4.9	0.7	3.1	0.0	1.4	0.0	1.5
Disease of the circulatory system	6.9	2.9	5.8	6.0	4.2	3.3	8.7	4.2	1.7	4.6
Pneumonia/ARI	5.2	2.9	2.9	3.6	2.6	5.7	0.0	1.4	1.6	2.9
Other disorders of the digestive system	2.7	0.0	0.0	1.3	2.8	0.0	0.0	2.6	0.0	1.4
Disorders of the kidney	0.0	2.6	0.0	1.3	1.2	0.0	0.0	2.8	0.0	1.0
Maternal causes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Injuries & Accidents	17.7	11.3	13.7	14.3	16.8	17.8	7.7	16.2	15.0	15.3
All other causes	7.4	5.8	10.0	8.6	5.8	11.7	24.6	6.3	6.8	7.9
Ill-defined & undetermined causes	2.7	5.7	6.4	2.4	8.5	0.0	8.7	6.7	8.3	6.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number (15-59)	38	36	99	78	155	32	11	77	56	582

Female

Cause of death	Central	Copperbelt	Eastern	Luapula	Lusaka	Northern	North Western	Southern	Western	Total
Diarrhoeal diseases	0.0	0.0	3.5	1.3	1.1	2.5	2.9	0.0	1.3	1.5
HIV disease	45.4	36.3	54.3	40.6	47.5	26.2	39.7	45.6	44.3	44.1
Malaria	3.4	15.1	5.5	9.0	3.2	2.7	3.7	4.1	11.2	6.5
Neoplasms	0.0	2.9	3.8	2.7	5.5	0.0	6.2	10.0	7.1	4.6
Nutritional & other anemias	5.8	3.4	0.0	2.6	3.2	2.5	0.0	0.0	0.0	1.7
Diabetes mellitus	8.3	0.0	2.5	0.0	0.0	2.8	3.9	2.0	0.0	1.6
Malnutrition	0.0	0.0	1.3	1.2	0.0	0.0	0.0	0.0	0.0	0.4
Tuberculosis	6.4	9.1	3.7	8.1	5.3	8.4	8.1	13.9	9.1	7.5
Meningitis	9.1	0.0	1.2	1.3	1.1	0.0	3.5	0.0	1.4	1.6
Disease of the circulatory system	6.0	0.0	2.5	7.8	7.5	10.9	18.7	6.5	4.6	6.5
Pneumonia/ARI	0.0	3.0	2.2	1.2	1.1	0.0	6.2	0.0	2.7	1.7
Other disorders of the digestive system	0.0	12.4	1.1	1.3	0.0	0.0	0.0	0.0	0.0	1.2
Disorders of the kidney	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.2
Maternal causes	3.5	0.0	4.4	5.2	2.1	12.9	0.0	0.0	5.7	3.9
Injuries & Accidents	6.3	5.9	4.6	8.2	5.2	7.5	7.2	8.5	5.7	6.3
All other causes	2.9	9.0	6.9	9.4	8.7	20.7	0.0	4.0	4.2	7.5
Ill-defined & undetermined causes	2.9	3.0	2.5	0.0	7.4	2.8	0.0	5.6	2.8	3.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number (15-59)	31	32	83	75	90	37	28	49	70	496

Source: Computations from 2010-2012 SAVVY data files

4.5. Causes of Death and Age Group

Among adult male decedents, Table 5 shows that the proportion of HIV/AIDS deaths increases with age reaching a peak in age group 35-39 (50.5 per cent) and then decreases from age group 40-44 onwards. Malaria deaths were highest in age group 20-24 (11.9 per cent). A progressive increase in the proportion of neoplasm associated deaths with age is notable in age groups 45-59, 3.4 per cent to 3.6 per cent. Diabetes mellitus deaths were higher in age group 50-54 (5.3 per cent). The proportion of tuberculosis attributable deaths appears to increase progressively with age from age group 40-44 (8.4 per cent) among males and peaking in age group 55-59 (17.6 per cent). Deaths due to the diseases of the circulatory system were highest in age group 55-59 (22 per cent). The proportion of deaths related to injuries and accidents are highest among males in age group 15-19 (36 per cent) and decreases progressively with age until age group 45-49 (5.2 per cent) when deaths gradually increase to 12.3 per cent in age group 55-59.

Among females, HIV/AIDS is the leading cause of deaths across all age groups. HIV/AIDS deaths increase progressively with age from 30.2 per cent in age group 15-19 to peak at 61.3 per cent in age group 35-39 and then decrease gradually to 28.9 per cent in age group 50-54 as shown in Table 5. The age group 55-59 has unexpected increase in HIV/AIDS deaths (35 per cent). The proportion of malaria related deaths among females is highest in age group 50-54 (12 per cent). High proportions of deaths attributable to neoplasms are notable in age groups 35-39 (6.9 per cent), 50-54 (9.5 per cent) and 55-59 (6.9 per cent). The proportion of deaths attributable to nutritional anaemias–6.3 per cent in age group 50-54 and 5.7 per cent in age group 55-59–as well as deaths due to diabetes mellitus are notable in age group 55-59 (6.3 per cent). Proportions of tuberculosis deaths are higher in age groups 15-19 (12.6 per cent), 30-34 (11.9 per cent) and 45-49 (13.7 per cent). Deaths attributable to diseases of the circulatory system are higher in age groups 20-24 (12.7 per cent), 40-44 (10 per cent), and 55-59 (14.5 per cent).

Table 5. Causes of death among male and female adults by age group, Zambia, 2010-2012

Male										
Cause of death	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	Total
Diarrhoeal diseases	6.0	0.0	0.0	2.1	0.7	3.3	1.7	0.0	0.0	1.3
HIV disease	15.6	24.0	33.6	44.5	50.5	45.4	41.9	34.5	9.3	37.9
Malaria	9.3	11.9	7.4	6.4	7.1	6.3	5.5	0.0	8.2	6.6
Neoplasms	0.0	3.9	1.3	0.0	1.5	1.7	3.4	3.5	3.6	1.9
Nutritional & other anemias	6.2	2.0	0.0	0.0	0.7	0.0	1.7	0.0	0.0	0.8
Diabetes mellitus	0.0	0.0	2.5	2.1	1.5	1.7	0.0	5.3	3.1	1.9
Malnutrition	0.0	0.0	0.0	0.0	0.0	1.4	0.0	1.6	6.1	0.6
Tuberculosis	8.9	8.3	9.0	6.4	3.9	8.4	8.6	13.7	17.6	8.3
Meningitis	0.0	0.0	2.6	1.1	3.0	1.7	1.9	0.0	0.0	1.5
Disease of the circulatory system	2.9	1.9	3.5	3.4	0.8	8.1	5.5	5.2	22.0	4.6
Pneumonia/ARI	0.0	5.9	0.0	5.5	4.0	1.5	0.0	5.2	0.0	2.9
Other disorders of the digestive system	0.0	0.0	2.5	2.2	0.8	0.0	1.7	1.8	3.6	1.4
Disorders of the kidney	0.0	0.0	0.0	1.2	0.0	1.6	3.6	3.4	0.0	1.0
Injuries & Accidents	36.0	17.9	22.3	15.3	17.1	8.1	5.2	6.9	12.3	15.3
All other causes	8.7	10.2	7.1	7.6	4.5	7.9	12.2	8.5	10.7	7.9
Ill-defined & undetermined causes	6.4	14.1	8.1	2.3	3.8	3.1	7.0	10.5	3.6	6.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number (15-59)	31	46	85	91	124	59	54	59	33	582

Female										
Cause of death	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	Total
Diarrhoeal diseases	2.5	1.5	3.6	1.3	1.2	1.7	0.0	0.0	0.0	1.5
HIV disease	30.2	37.0	41.8	50.1	61.3	55.4	34.9	28.9	35.0	44.1
Malaria	7.4	7.7	8.7	3.7	5.4	3.4	6.0	12.0	6.9	6.5
Neoplasms	2.5	3.3	1.2	4.9	6.9	4.9	4.2	9.5	6.9	4.6
Nutritional & other anemias	2.4	3.1	1.3	1.3	0.0	0.0	0.0	6.3	5.7	1.7
Diabetes mellitus	0.0	0.0	1.2	1.2	1.5	0.0	3.7	3.4	6.3	1.6
Malnutrition	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.4
Tuberculosis	12.6	6.3	7.6	11.9	4.0	5.1	13.7	3.4	0.0	7.5
Meningitis	5.0	4.8	0.0	1.3	0.0	1.7	2.0	0.0	0.0	1.6
Disease of the circulatory system	2.4	4.7	5.2	2.6	3.7	4.9	17.7	12.4	14.0	6.5
Pneumonia/ARI	2.6	3.0	2.4	2.5	1.2	0.0	1.9	0.0	0.0	1.7
Other disorders of the digestive system	0.0	0.0	2.5	1.2	1.3	1.5	0.0	3.2	0.0	1.2
Disorders of the kidney	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.2
Maternal causes	9.8	8.0	6.2	2.7	5.7	0.0	0.0	0.0	0.0	3.9
Injuries & Accidents	5.1	12.7	6.1	3.6	1.3	10.0	0.0	8.7	14.5	6.3
All other causes	9.9	6.3	9.8	6.7	1.3	9.7	12.1	5.9	6.9	7.5
Ill-defined & undetermined causes	5.0	1.6	2.4	5.1	5.2	0.0	3.9	6.4	0.0	3.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number (15-59)	37	61	78	77	70	59	49	34	29	496

Source: Computations from 2010-2012 SAVVY data files

4.6. Causes of Death and Educational Attainment

Education is a promoter of modern medicine use, hygienic practices and better knowledge of nutrition. More educated people tend to use modern medicine, have better hygienic practices and adopt healthy behaviours (e.g. nutrition, sport). Table 6 shows causes of death in relation to educational attainment of the deceased adults. The table shows that from primary to higher levels of educational attainment, the proportion of HIV/AIDS deaths decrease progressively with an increase in level of educational attainment. For both males and females, deceased adults who attained primary level of education had the highest proportions of HIV/AIDS deaths, 43.5 per cent and 46.7 per cent respectively. Malaria related deaths were higher among those with no education for males (8.5 per cent) while for females it was among those with secondary level of education (11 per cent). Among females, neoplasm deaths were higher among those with secondary and higher educational attainment, 7.3 per cent and 5.2 per cent respectively. Diabetes mellitus deaths were higher among males with none (5.9 per cent) and higher (4.6 per cent) educational levels. Among females, the proportion of tuberculosis deaths appears to increase progressively with level of education to 10.2 per cent for deceased women who had higher education.

For males, the opposite is the case for primary level of education. The proportion of tuberculosis deaths decreases with level of education from 9.2 per cent among those who had primary education to 6.6 per cent with higher education. Deaths due to diseases of the circulatory system were higher among those with higher education level (8.8 per cent) for males while for females it was among those with primary level education (9.3 per cent). The proportion of deaths attributable to injuries and accidents was higher among those with higher educational attainment for males and females, 20.9 per cent and 16.4 per cent respectively.

Table 6. Causes of death among all adults by education level, Zambia, 2010-2012

	Male					Female					Both				
Cause of death	None	Primary	Secondary	Higher	Total	None	Primary	Secondary	Higher	Total	None	Primary	Secondary	Higher	Total
Diarrhoeal diseases	5.8	1.1	0.8	2.2	1.3	3.0	1.1	2.1	0.0	1.5	4.0	1.1	1.2	1.6	1.4
HIV disease	11.6	43.5	37.6	28.6	37.9	45.4	46.7	43.2	15.9	44.1	34.1	45.1	39.6	24.9	40.7
Malaria	8.5	5.9	7.5	4.5	6.6	7.4	4.4	11.0	5.3	6.5	7.7	5.1	8.7	4.8	6.6
Neoplasms	0.0	2.4	2.0	0.0	1.9	3.3	2.6	7.3	5.2	4.6	2.2	2.5	3.9	1.5	3.1
Nutritional & other anemias	2.9	0.4	1.1	0.0	0.8	1.6	1.8	2.2	0.0	1.7	2.1	1.1	1.5	0.0	1.2
Diabetes mellitus	5.9	0.4	2.0	4.6	1.9	1.7	1.0	3.0	0.0	1.6	3.1	0.7	2.4	3.2	1.7
Malnutrition	5.8	0.4	0.0	2.2	0.6	1.4	0.4	0.0	0.0	0.4	2.9	0.4	0.0	1.5	0.5
Tuberculosis	8.8	9.2	7.6	6.6	8.3	6.1	7.4	7.5	10.2	7.5	7.0	8.3	7.6	7.7	7.9
Meningitis	0.0	1.2	2.1	0.0	1.5	3.1	0.7	1.4	5.2	1.6	2.0	1.0	1.8	1.5	1.6
Disease of the circulatory system	5.7	4.7	3.9	8.8	4.6	1.4	9.3	3.1	5.0	6.5	2.9	7.1	3.6	7.7	5.5
Pneumonia/ARI	0.0	3.9	2.0	4.3	2.9	1.4	1.8	2.0	0.0	1.7	0.9	2.8	2.0	3.0	2.3
Other disorders of the digestive system	3.1	0.9	2.1	0.0	1.4	0.0	0.8	2.2	5.2	1.2	1.0	0.8	2.1	1.5	1.3
Disorders of the kidney	0.0	1.3	0.0	6.3	1.0	0.0	0.0	0.7	0.0	0.2	0.0	0.6	0.3	4.5	0.6
Maternal causes	0.0	0.0	0.0	0.0	0.0	1.4	4.1	5.1	5.5	3.9	1.0	2.1	1.8	1.6	1.8
Injuries & Accidents	14.9	11.8	17.8	20.9	15.3	7.7	7.5	2.1	16.4	6.3	10.1	9.6	12.3	19.6	11.2
All other causes	11.7	7.6	7.4	6.7	7.9	10.3	7.8	3.7	26.2	7.5	10.7	7.7	6.1	12.4	7.7
Ill-defined & undetermined causes	15.4	5.4	6.1	4.3	6.0	4.7	2.5	3.5	0.0	3.3	8.3	3.9	5.2	3.0	4.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number (15-59)	32	248	244	45	582	64	263	133	19	496	96	511	377	63	1078

Source: Computations from 2010-2012 SAVVY data files

4.7. Causes of Death and Marital Status

Mortality literature shows that marital status is associated with the risk of death, though with mixed evidence. Table 7 shows the association between cause of death and marital status. Again, HIV/AIDS takes centre stage as the leading cause of death. The proportion of HIV/AIDS deaths was higher among the deceased adults who were widowed, divorced, and separated for both males and females, 48.6 per cent and 55.8 per cent, respectively. Malaria related deaths were highest among the never married (7.7 per cent) for males and 8 per cent for females among the widowed, divorced and separated. The proportion of tuberculosis deaths was higher among the never married (10.2 per cent) for females and 12.7 per cent among the widowed, divorced and separated for males. Deaths due to diseases of the circulatory system were higher among the married/living with partner (9.7 per cent) for females and 8.1 per cent among the widowed, divorced and separated for males. The proportion of injuries and accidents deaths was highest among the never married (24 per cent) for males and 8.9 per cent for the married/living with partner for the females.

Table 7. Causes of death among all adults by marital status, Zambia, 2010-2012

	Male				Female				Both			
Cause of Death	Never married	Married/ Living with a partner	Widowed/ Divorced/ Separated	Total	Never married	Married/ Living with a partner	Widowed/ Divorced/ Separated	Total	Never married	Married/ Living with a partner	Widowed/ Divorced/ Separated	Total
Diarrhoeal diseases	1.7	1.5	0.0	1.3	1.1	1.9	1.2	1.5	1.5	1.7	0.8	1.4
HIV disease	28.5	39.8	48.6	37.9	44.0	36.9	55.8	44.1	33.8	38.6	53.2	40.7
Malaria	7.7	7.5	1.9	6.6	5.5	5.9	8.0	6.5	7.0	6.8	5.8	6.6
Neoplasms	1.7	1.8	2.3	1.9	4.5	5.3	3.6	4.6	2.7	3.3	3.1	3.1
Nutritional & other anemias	1.1	0.8	0.0	0.8	1.0	1.6	2.3	1.7	1.1	1.2	1.5	1.2
Diabetes mellitus	1.2	2.5	1.2	1.9	1.1	2.1	1.0	1.6	1.2	2.3	1.1	1.7
Malnutrition	0.6	0.6	0.9	0.6	1.0	0.4	0.0	0.4	0.7	0.5	0.3	0.5
Tuberculosis	6.7	7.9	12.7	8.3	10.2	7.6	5.5	7.5	7.9	7.8	8.1	7.9
Meningitis	1.3	1.8	1.0	1.5	3.3	1.2	1.2	1.6	2.0	1.6	1.1	1.6
Disease of the circulatory system	4.1	3.9	8.1	4.6	2.2	9.7	3.6	6.5	3.4	6.4	5.2	5.5
Pneumonia/ARI	1.8	3.0	4.2	2.9	4.4	0.8	1.7	1.7	2.6	2.1	2.6	2.3
Other disorders of the digestive system	0.0	2.2	1.2	1.4	2.3	0.8	1.3	1.2	0.8	1.6	1.2	1.3
Disorders of the kidney	0.6	1.2	1.0	1.0	0.0	0.4	0.0	0.2	0.4	0.9	0.4	0.6
Maternal causes	0.0	0.0	0.0	0.0	4.3	6.0	0.6	3.9	1.5	2.6	0.4	1.8
Injuries & Accidents	24.0	13.4	6.2	15.3	3.3	8.9	4.3	6.3	16.9	11.5	5.0	11.2
All other causes	9.1	7.4	7.4	7.9	9.6	6.8	6.8	7.5	9.3	7.1	7.0	7.7
Ill-defined & undetermined causes	9.9	4.5	3.3	6.0	2.3	3.8	3.1	3.3	7.3	4.2	3.2	4.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number (15-59)	166	322	92	582	87	244	162	496	253	566	255	1078

Source: Computations from 2010-2012 SAVVY data files

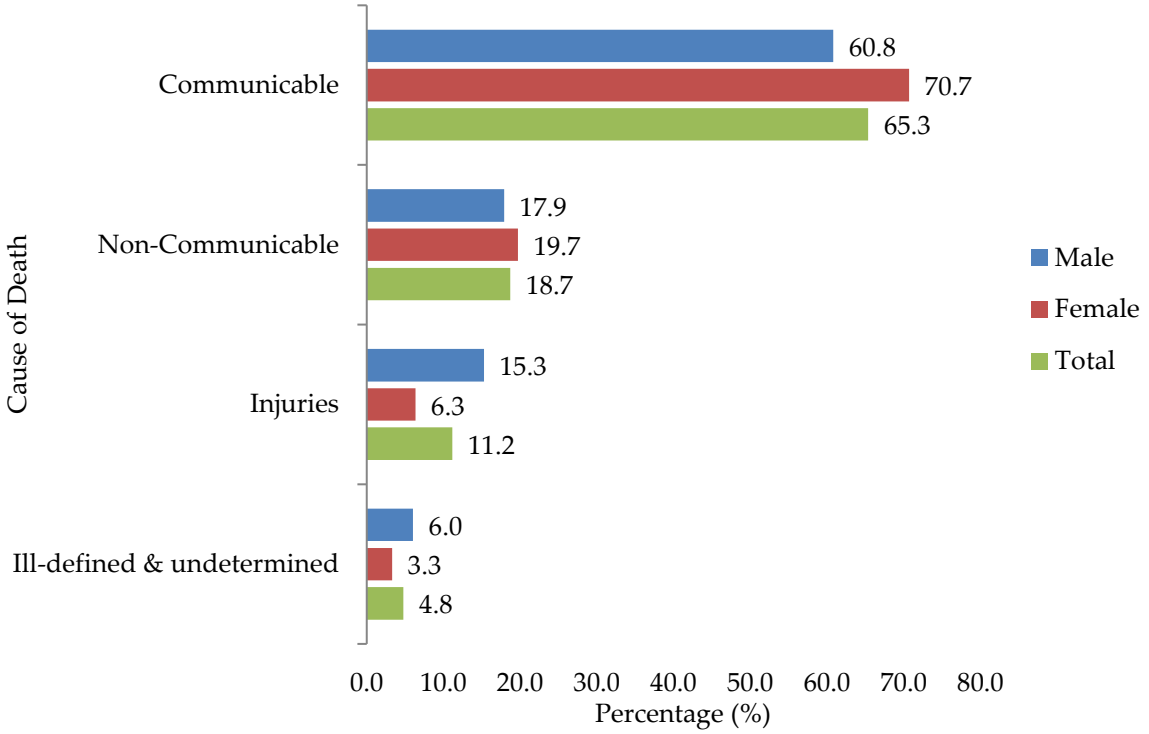
4.8. Global Burden of Diseases Major Groups of Causes of Death

The Global Burden of Diseases (GBD) classifies the causes of diseases into major groups using the international classification of diseases (ICD) system which is in its current 10th version (ICD-10). The main groups are: group I-communicable diseases, group II-non-communicable diseases (NCDs), and group III- external causes or injuries. Group I-communicable diseases include infectious and parasitic diseases caused by pathogens such as bacteria, viruses, fungi and that are spread directly or indirectly from one person to another. The group include diseases like HIV/AIDS, tuberculosis, malaria, diarrhoea, measles, rabies, and others. Maternal and perinatal (causes e.g. maternal haemorrhage, birth trauma) and nutritional deficiency conditions are also in group I. Group II-non-communicable diseases these are health conditions that are non-infectious and cannot be transmitted from one person to another. Non-communicable diseases include diabetes mellitus, neoplasms, cancer, malignant conditions, asthma, cardiovascular conditions, etc. Group III-external causes or injuries–cause mortality–and include accidents, suicide, homicide, and others.

The external causes are also referred to as unnatural causes, for example, road traffic accidents, committing suicide or death by gunshots. Figure 1 presents the main groupings of causes of death as per the GBD. The figure shows that overall 65.3 per cent of the causes of death among adults aged 15-59 years are due to communicable diseases. The proportion of communicable causes of death is higher among females (70.7 per cent) than males (60.8 per cent).

Figure 1 also shows that about one-fifth (19.7 per cent) of adult female deaths were attributable to non-communicable diseases while about 18 per cent of adult male deaths were due the same causes. The proportion of adult deaths due to external causes or injuries was higher among males (15.3 per cent) than females (6.3 per cent). The figure confirms and provides evidence that communicable diseases are the major contributors of causes of adult mortality in Zambia.

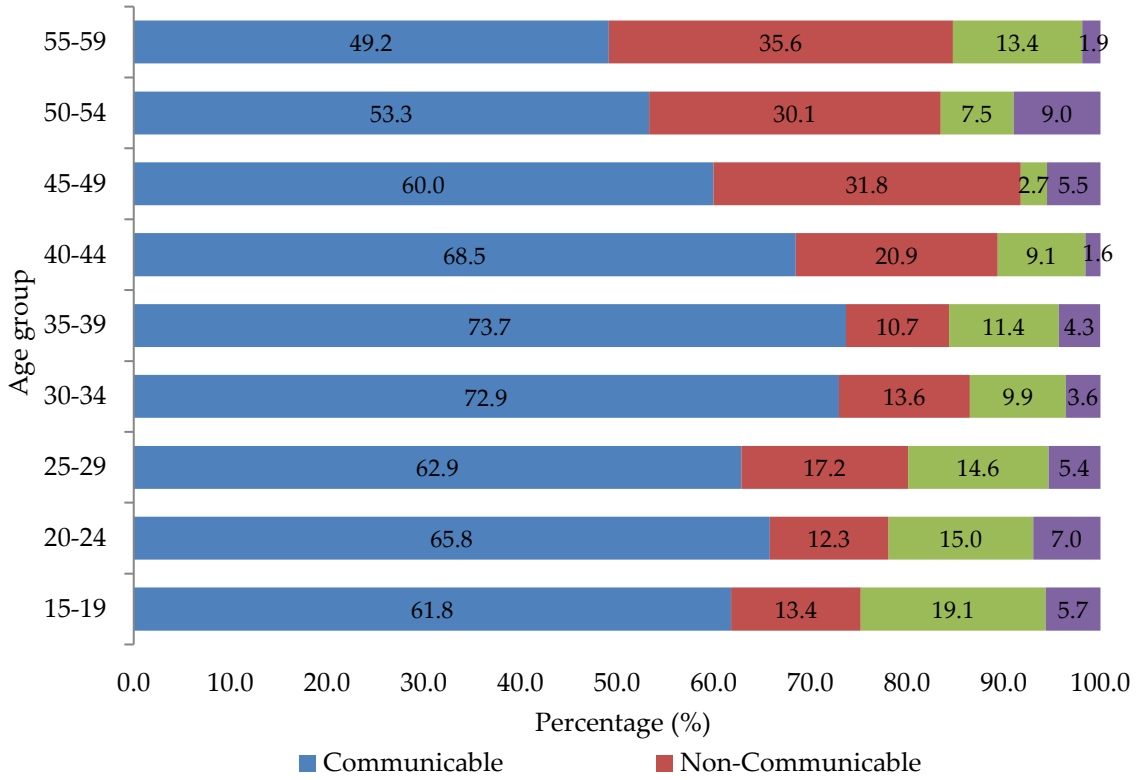
Figure 1. Percentage of adult deaths according to Global Burden of Diseases major groups of causes of death by sex, Zambia, 2010-2012



Source: Computations from 2010-2012 SAVVY data files (n = 1078)

Figure 2 presents the GBD groupings of causes of death by age group 15-59. Communicable diseases are the most prevalent causes of death across all ages, peaking in age group 35-39 (73.7 per cent) and lower in age group 55-59 (49.2 per cent). For NCDs causes of death, they increase from age group 40-44 to the highest proportion 35.6 per cent in age group 55-59. For external causes of death, injuries are more prevalent in age group 15-19 (19.1 per cent) and lowest in age group 45-49 (2.7 per cent). In the older age group 55-59 injuries increase again. It is also worth to note that there is an interesting pattern of changes to causes of deaths by age in line with the epidemiologic transition. The figure shows that from age group 35-39 to 55-59 the proportion of adult deaths due to communicable diseases decreases progressively with age. On the other hand, the opposite is the case for deaths attributable to non-communicable diseases.

Figure 2. Percentage of adult deaths according to Global Burden of Diseases major groups of causes of death by age group, Zambia, 2010-2012

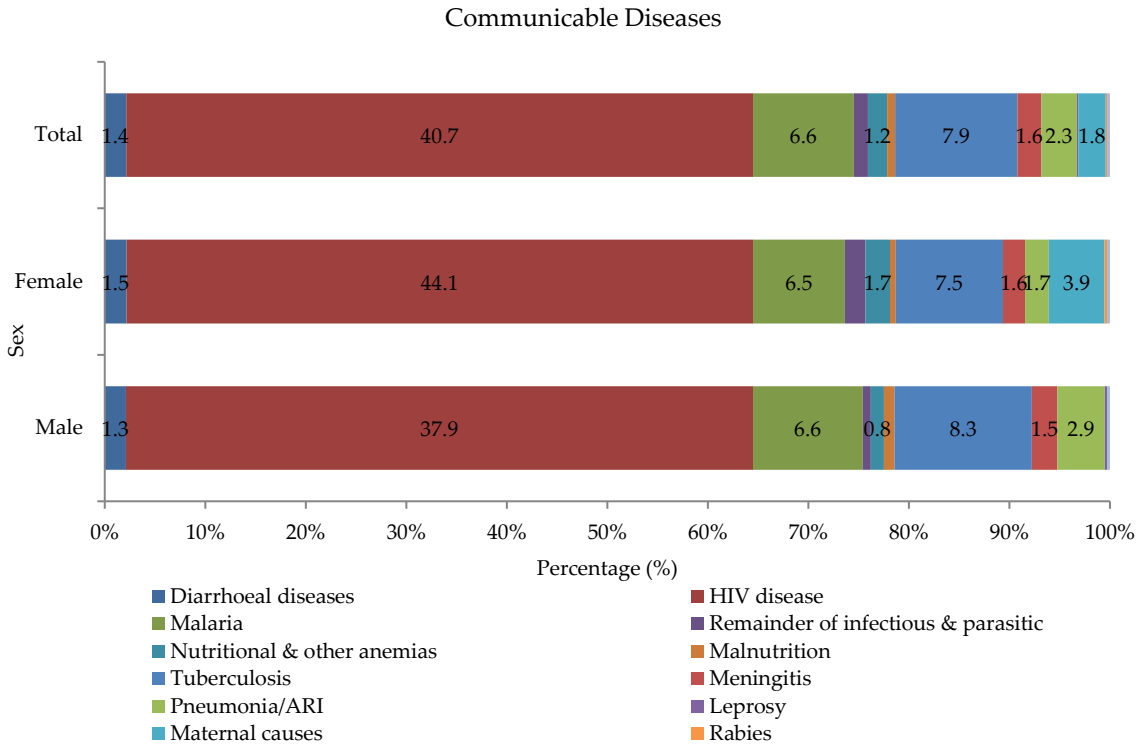


Source: Computations from 2010-2012 SAVVY data files (n = 1078)

4.9. Communicable Diseases Causes of Death

Figure 3 shows the grouping of infectious and parasitic causes of death among adults into the communicable diseases group. The figure shows that among the communicable diseases causes of death, HIV/AIDS remains the leading cause of death of adults in age group 15-59 (40.7 per cent) overall, and 44.1 per cent for females and 37.9 per cent for males. Tuberculosis is the second leading communicable cause of death, 7.9 per cent overall, and for females 7.5 per cent. Adult male decedents had the highest proportion of deaths attributable to tuberculosis, 8.3 per cent. Malaria is the third leading communicable cause of death for both males and females, 6.6 per cent and 6.5 per cent, respectively. Pneumonia/ARI is the fourth leading communicable disease among the deceased males (2.9 per cent) while among the female decedents it is maternal causes (3.9 per cent).

Figure 3. Percentage of adult deaths according to communicable causes of death by sex, Zambia, 2010-2012

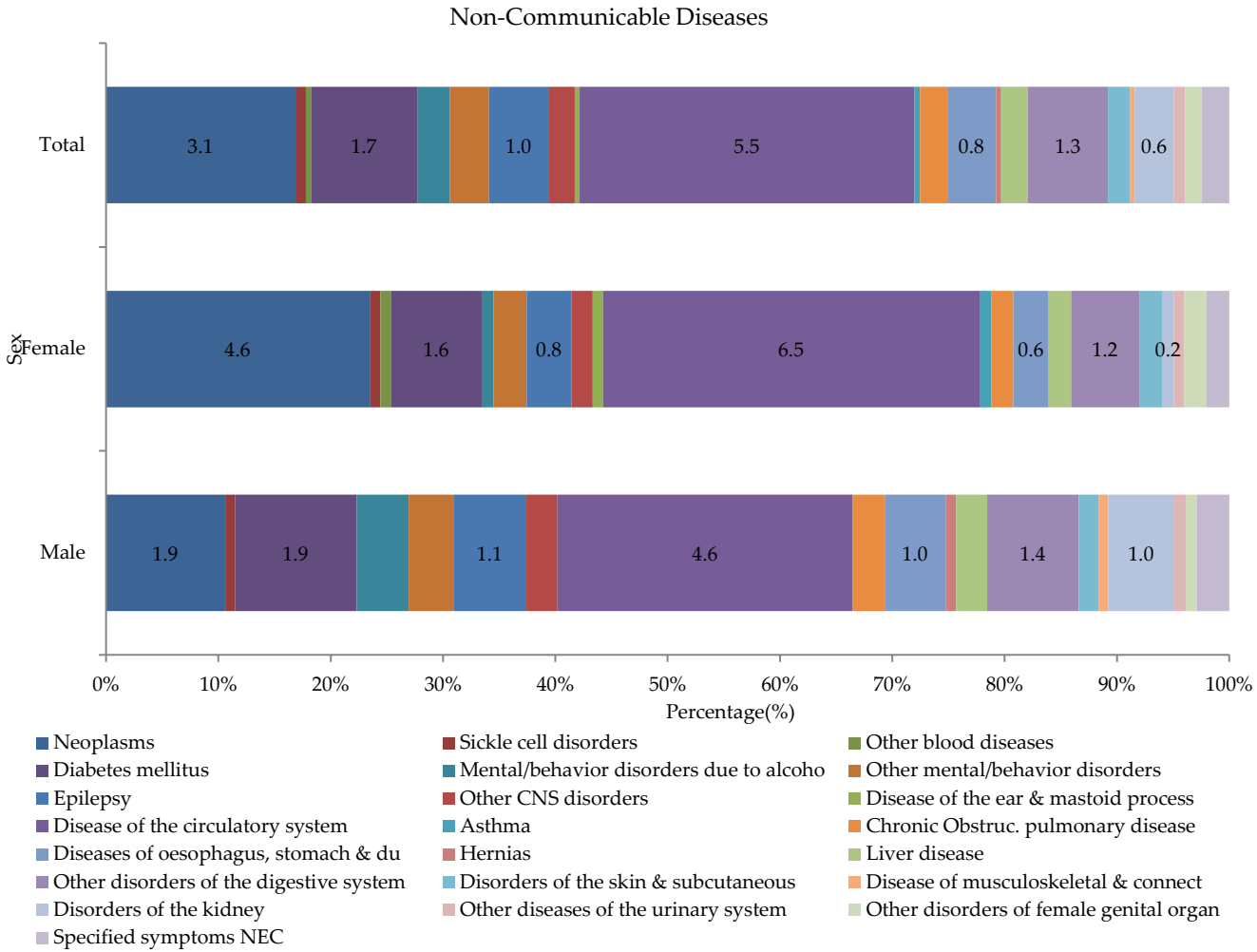


Source: Computations from 2010-2012 SAVVY data files (n = 1078)

4.10. Non-Communicable Diseases Causes of Death

Among the non-communicable causes of death, diseases of the circulatory system were the leading causes of death among adults, 5.5 per cent overall as shown in Figure 4. The proportion of deaths was higher among females (6.5 per cent) than among males (4.6 per cent). The second leading cause of death was neoplasms for females (4.6 per cent) while for males it was diabetes mellitus (1.9 per cent). Neoplasms was the third leading cause of death among deceased adult males (1.87 per cent) while for females it was diabetes mellitus (1.6 per cent).

Figure 4. Percentage of adult deaths according to non-communicable causes of death by sex, Zambia, 2010-2012

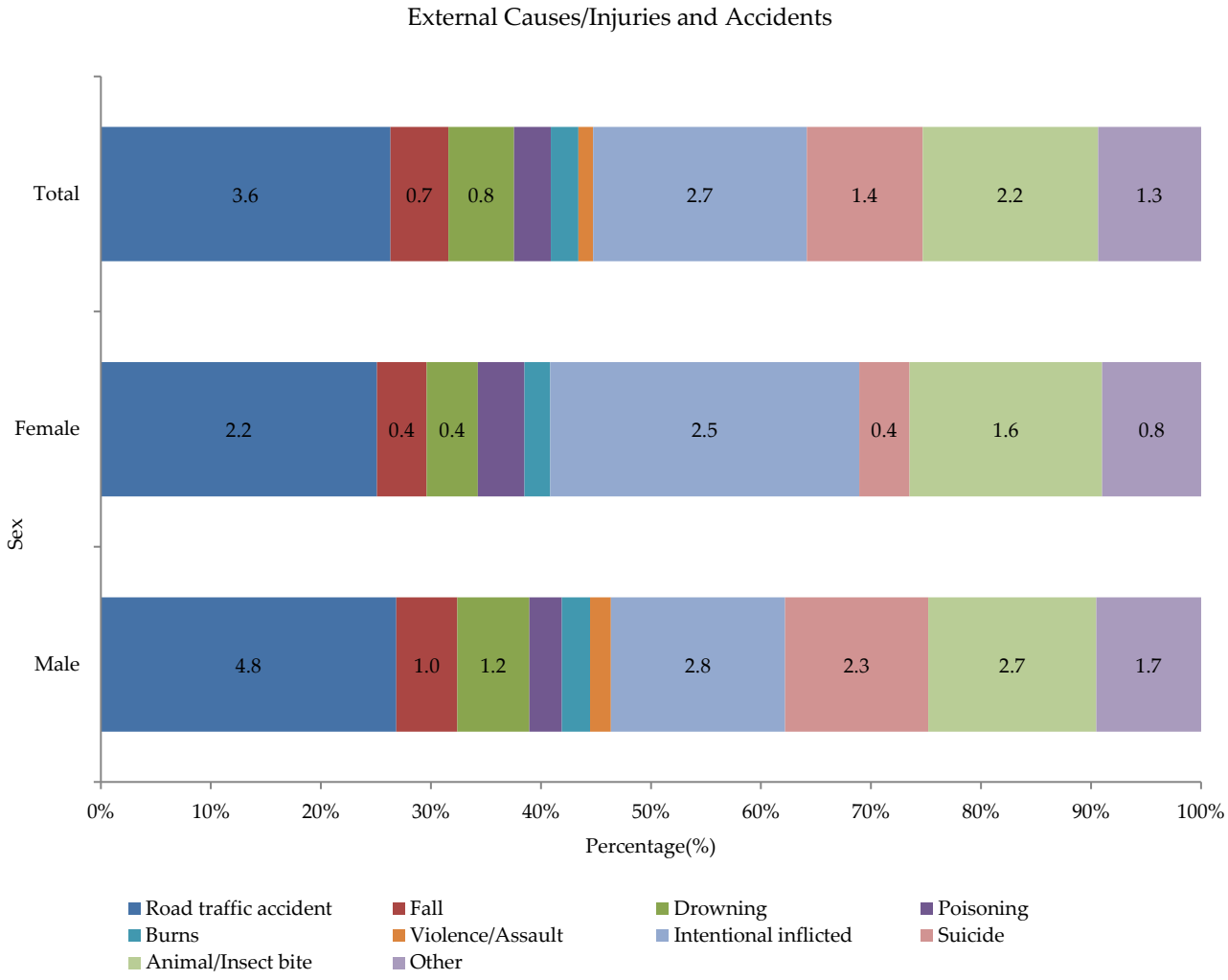


Source: Computations from 2010-2012 SAVVY data files (n = 1078)

4.11. External Causes of Death

External causes or injuries and accidents were the second leading cause of death among adults out of all causes (Figure 5). A disaggregation of the injuries and accidents shows that road traffic accidents were the leading cause of death among external causes for males (4.8 per cent) while for females it was intentional inflicted injuries (2.5 per cent). The proportion of male road traffic accident deaths was twice higher that of female deaths. Intentional inflicted deaths were the second leading cause of death among males (2.8 per cent) while among females it was road traffic accidents (2.2 per cent). Animal/insect bite deaths were the third leading cause of death among both males (2.7 per cent) and females (1.6 per cent). Males had a higher proportion of the animal/insect bite deaths.

Figure 5. Percentage of adult deaths according to external causes of death by sex, Zambia, 2010-2012



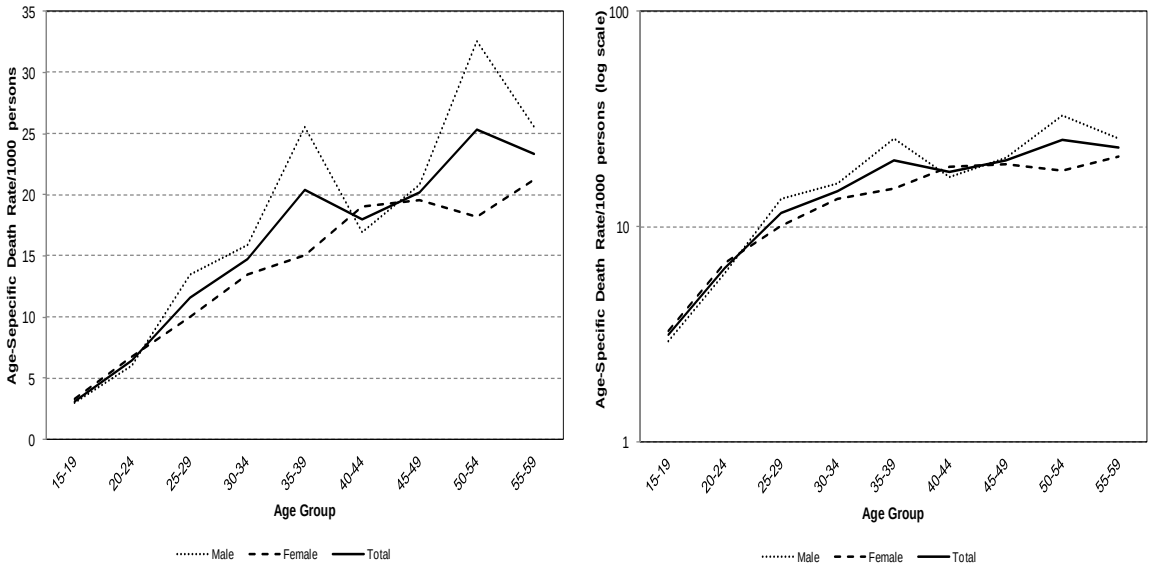
Source: Computations from 2010-2012 SAVVY data files (n = 1078)

4.12. Age-Cause-Specific Mortality Patterns

Age-cause-specific death rates and age-cause-specific death ratios were plotted in graphs to further understand the mortality patterns attributed to the causes of death among adults. The top 5 leading causes of death among adults in Zambia were selected to further explore the mortality patterns. They are: HIV/AIDS, injuries and accidents, tuberculosis, malaria and diseases of the circulatory system.

Figure 6 shows the plot of computed age-specific death rates per 1,000 persons for all-cause mortality for age group 15-59. Mortality increases progressively with age from age group 15-19 to 55-59. Males experience higher mortality than females. A plot of the age-specific death rates on a log scale gives a clear picture of the pattern of mortality by age. It is notable that between ages 25-45 as well as 50-59, adult males have a higher mortality than females. The humps in the curves in adult mortality ages could be reflective of the HIV/AIDS mortality.

Figure 6. All-cause mortality pattern by age and sex, Zambia, 2010-2012



Source: Computations from 2010-2012 SAVVY data files

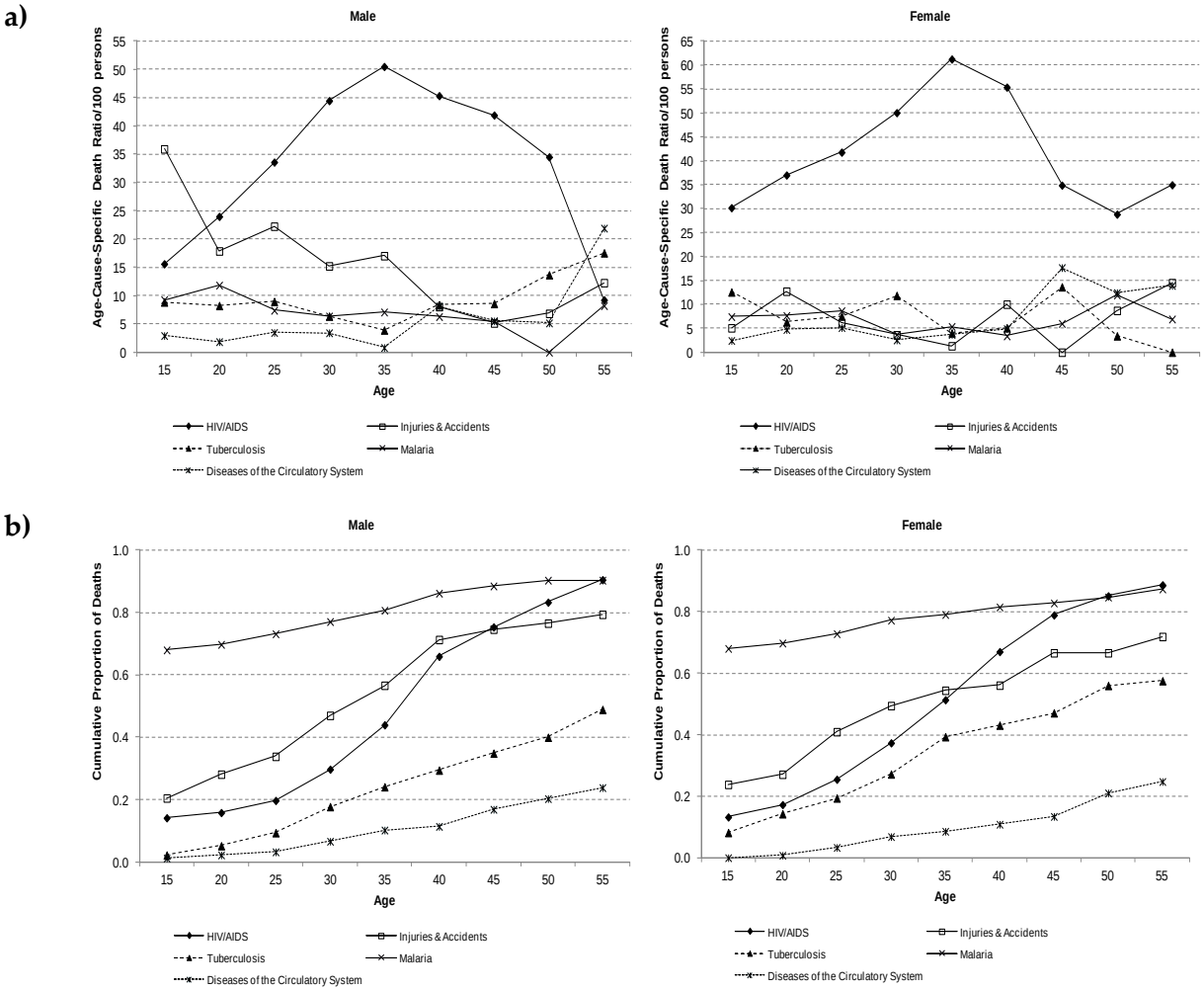
4.13. Age-Pattern of Specific Causes of Death

Figure 7 (a) shows the age-cause-specific mortality pattern of the top 5 leading causes of death by sex. The age-cause-specific death ratios magnify the effect of each cause of death based on all deaths. For both males and females, the HIV/AIDS curves clearly show the concentration of deaths attributed to the cause between ages 15 and 55. HIV/AIDS deaths progressively increase with age, peaking in age group 35-39 and then decrease gradually for both males and females. Malaria deaths are more concentrated in the younger adult ages

between age 15 and 20. Injuries and accidents deaths are higher among males between ages 15 and 35. Tuberculosis deaths are higher for males than females between ages 45 and 59. Deaths attributable to diseases of the circulatory system are higher for females than males from the age of 45 and above.

The cumulated proportions of deaths attributed to each of the five causes of death are presented in Figure 7 (b). There were more deaths attributed to malaria across all ages for both males and females than to any of the other causes of death. HIV/AIDS deaths are cumulatively higher from ages 40+ for males and 35+ for females when compared to injuries and accidents deaths. Deaths attributed to diseases of the circulatory system are the lowest when compared to the other causes.

Figure 7. Male and female age-cause-specific mortality pattern, Zambia, 2010-2012

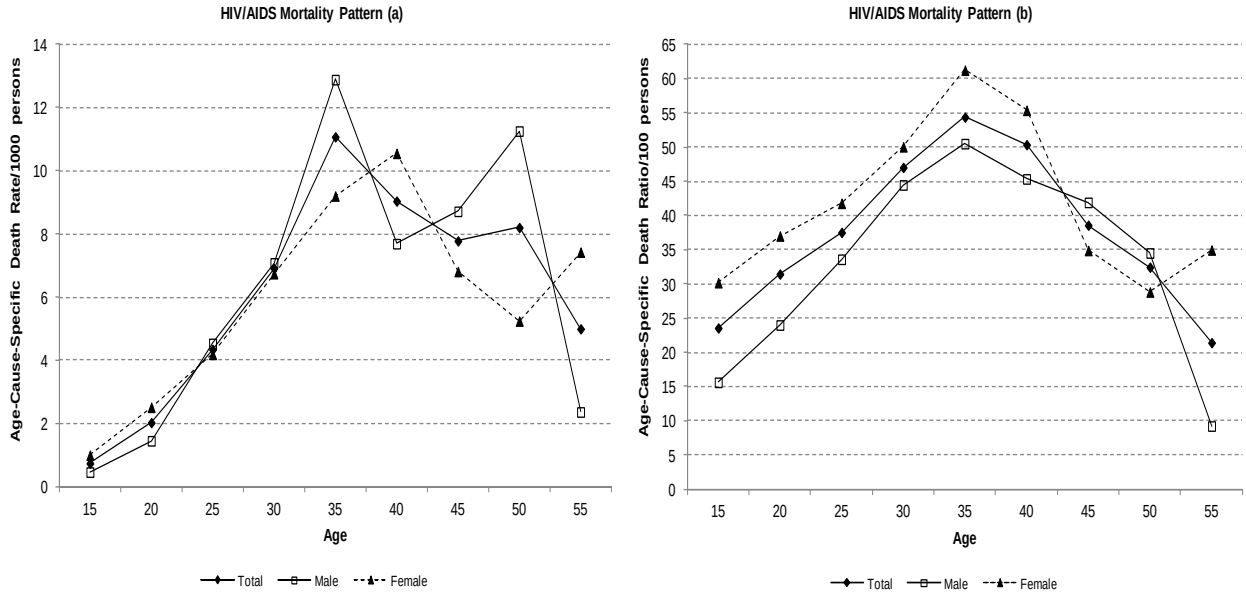


Source: Computations from 2010-2012 SAVVY data files

4.14. HIV/AIDS Mortality Pattern

Figure 8 shows the HIV/AIDS mortality pattern by age and sex. The age-cause-specific death ratios clearly show the HIV/AIDS mortality pattern. HIV/AIDS mortality increased progressively with age, peaking in age group 35-39 before starting to gradually decrease with age for both males and females. The age-cause-specific death ratios show that adult females experienced higher HIV/AIDS deaths than males between ages 15 and 45. The age-cause-specific death ratios show the significance of the cause of death in each age group while the age-cause-specific death rates measure the occurrence of deaths.

Figure 8. HIV/AIDS mortality pattern by age and sex, Zambia, 2010-2012



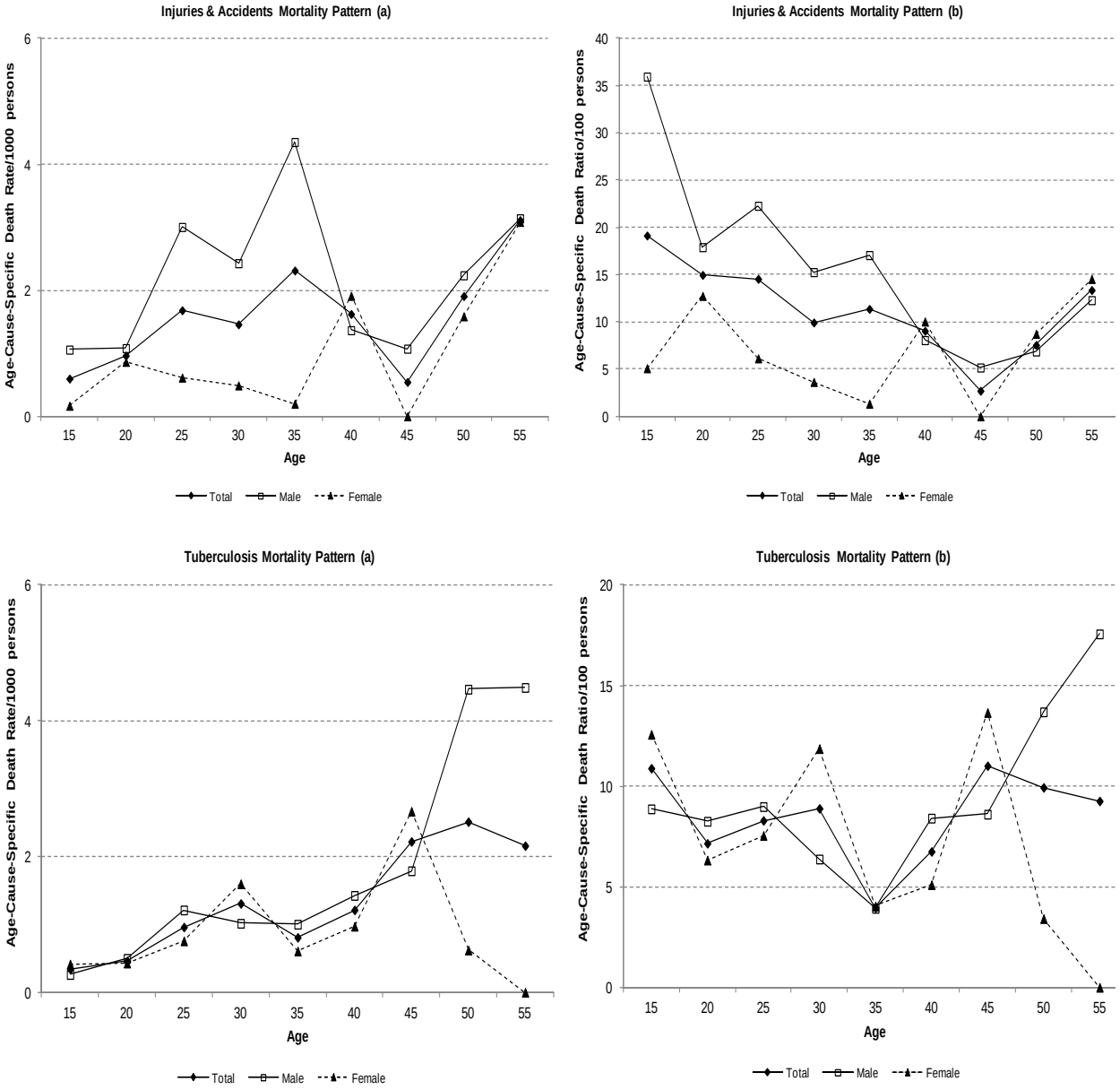
Source: Computations from 2010-2012 SAVVY data files

4.15. Injuries and Accidents and Tuberculosis Mortality Patterns

Deaths attributed to injuries and accidents are magnified by the plot age-cause-specific death ratios in Figure 9. The high concentration of injuries and accidents deaths was among males between ages 15 and 35 with the peak in age group 15-19. The age-cause-specific death rates show that deaths due to injuries and accidents increased progressively with age; higher between age 20 and 40 for males. Deaths due to injuries and accidents are higher in age group 40-45 for female.

The age-cause-specific death rates show that tuberculosis deaths increased progressively with age and were higher among males than females between ages 45 and 75 as shown in Figure 9. An examination of the age-cause-specific death ratios shows that tuberculosis deaths varied by age and female deaths were higher than for males in age groups 30-34 and 45-49. Tuberculosis deaths among males increased progressively with age from age 35 and above.

Figure 9. Injuries and accidents and tuberculosis mortality patterns by age and sex, Zambia, 2010-2012



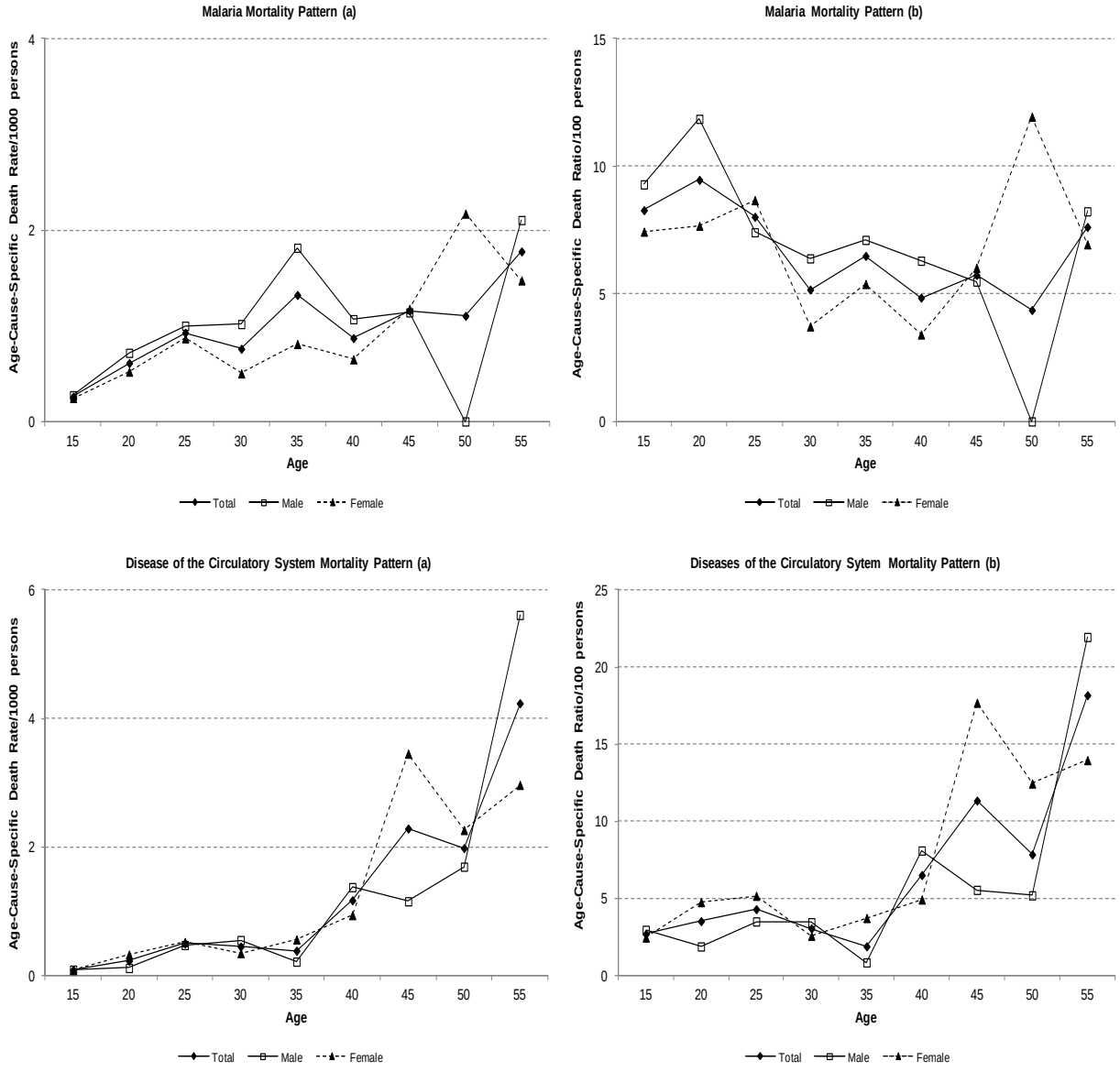
Source: Computations from 2010-2012 SAVVY data files

4.16. Malaria and Diseases of the Circulatory System Mortality Patterns

The age-cause-specific death ratios in Figure 10 show that malaria deaths were higher among males than females in the young adult ages between 15 and 20. Thereafter, malaria mortality decreases with age up to age 45 but remaining higher among males than females. From age 45, the malaria mortality pattern becomes unclear.

The age-cause-specific death rates show that deaths attributable to diseases of the circulatory system increased with age from age 40 and above and were higher among females than males as shown in Figure 10. The age-cause-specific death ratios show that deaths related to diseases of the circulatory system also increased with age and were higher among females between ages 20 and 25, then reaching a peaking in age group 45-49. The ratios show a clearer picture of what is happening in each age group with respect to deaths attributed to diseases of the circulatory system. Deaths of the diseases of the circulatory system are concentrated in older ages for both males and females.

Figure 10. Malaria and diseases of the circulatory system mortality patterns by age and sex, Zambia, 2010-2012



Source: Computations from 2010-2012 SAVVY data files

5. Cause of Death Elimination

This section examines the gain in life expectancy at adult ages after eliminating a particular cause of death. The relative importance of causes of death can be determined on the basis of potential number of years gained by eliminating those causes of death. From public health intervention prospective, higher the gain in life expectancy, higher level of intervention is needed for that specific cause of death. –In reality, however, some causes of death are interrelated and therefore, it may not be possible to completely eliminate a particular disease in order to achieve the intended health benefits.

5.1. HIV/AIDS Elimination

Table 8 shows the number of years gained in life expectancy at each age if HIV/AIDS were eliminated as a cause of death. In other words, this is the number of additional years of life that individuals at each age would expect to live if there was no HIV/AIDS as a cause of death. It is evident from the table that a significant number of additional years of life would be gained by eliminating HIV/AIDS as a cause of death for both males and females. The number of years gained are higher for females than males. For males, the highest number of years gained is about 5.8 years in age group 15-19 while for females it is 6.4 years in the same age group. Females gained more years because they experience a higher prevalence of HIV/AIDs as well as deaths. The table also shows the percentage reduction in the probability of dying if HIV/AIDS were eliminated. The percentage reduction is small in younger ages for both males and females but increases with age. The highest percentage reduction in the probability of dying is among females in age group 35-39 which is 60.5 per cent. For males, it is 49 per cent in the same age group.

Table 8. Number of years gained by eliminating the risk of HIV/AIDS, Zambia, 2010-2012

Age	Total				Male				Female			
	Life expectancy at corresponding ages-HIV/AIDS eliminated	Life expectancy at corresponding ages-all causes	Number of years gained	Percentage reduction in probability of dying	Life expectancy at corresponding ages - HIV/AIDS eliminated	Life expectancy at corresponding ages-all causes	Number of years gained	Percentage reduction in probability of dying	Life expectancy at corresponding ages - HIV/AIDS eliminated	Life expectancy at corresponding ages-all causes	Number of years gained	Percentage reduction in probability of dying
15-19	47.57	41.49	6.08	23.6	45.72	39.95	5.77	15.7	49.54	43.14	6.40	30.3
20-24	43.12	37.11	6.01	31.3	41.26	35.51	5.75	23.8	45.09	38.82	6.26	36.8
25-29	39.02	33.25	5.78	37.0	37.16	31.52	5.64	33.0	41.01	35.08	5.92	41.4
30-34	35.37	30.08	5.28	46.3	33.75	28.55	5.20	43.6	37.15	31.76	5.38	49.4
35-39	31.67	27.19	4.48	53.3	30.16	25.71	4.44	49.0	33.33	28.81	4.52	60.5
40-44	28.06	24.85	3.21	49.4	26.96	23.88	3.08	44.4	29.24	25.87	3.37	54.4
45-49	24.22	21.95	2.27	37.6	23.12	20.78	2.34	40.8	25.40	23.21	2.19	34.0
50-54	20.61	19.02	1.59	31.3	19.41	17.79	1.62	32.9	21.90	20.35	1.56	28.2
55-59	17.22	16.26	0.97	20.7	16.31	15.50	0.81	8.9	18.20	17.05	1.15	34.0

Source: Computations from 2010-2012 SAVVY data files

5.2. Injuries and Accidents and Tuberculosis Elimination

Table 9 shows the number of years of additional life that would be gained if injuries and accidents were eliminated. Significant gains in years of additional life are in ages 15-39 for males, with the highest number about 2.2 years in age group 15-19. For females, the gain in number of years is less than 1 year. The highest percentage reduction in the probability of dying is 35.9 per cent among males in age group 15-19 while for females it is 14.2 per cent in age group 55-59.

The number of additional years of life that would be gained if tuberculosis were eliminated as a cause of death are shown in Table 9. Both males and females would gain additional years of life but males would gain more years. The highest number of additional years of life gained is 1.7 years for males in age group 15-19 and 1.4 years for females in the same age group. The highest percentage reduction in the probability of dying is 16.8 per cent in age group 55-59 for males and 13.4 per cent for females in age group 45-49.

Table 9. Number of years gained by eliminating the risk of injuries and accidents, and tuberculosis, Zambia, 2010-2012

Injuries and accidents												
	Total				Male				Female			
Age	Life expectancy at corresponding ages -cause of death eliminated	Life expectancy at corresponding ages-all causes	Number of years gained	Percentage reduction in probability of dying	Life expectancy at corresponding ages -cause of death eliminated	Life expectancy at corresponding ages-all causes	Number of years gained	Percentage reduction in probability of dying	Life expectancy at corresponding ages -cause of death eliminated	Life expectancy at corresponding ages-all causes	Number of years gained	Percentage reduction in probability of dying
15-19	43.09	41.49	1.60	19.2	42.14	39.95	2.19	35.9	44.13	43.14	0.99	5.4
20-24	38.61	37.11	1.50	15.0	37.52	35.51	2.01	17.8	39.79	38.82	0.97	12.8
25-29	34.61	33.25	1.37	14.4	33.40	31.52	1.87	21.8	35.91	35.08	0.83	6.3
30-34	31.24	30.08	1.16	9.8	30.06	28.55	1.51	14.9	32.52	31.76	0.76	3.8
35-39	28.21	27.19	1.02	11.0	26.98	25.71	1.27	16.3	29.54	28.81	0.73	1.6
40-44	25.64	24.85	0.79	8.9	24.72	23.88	0.84	7.9	26.62	25.87	0.75	9.9
45-49	22.61	21.95	0.66	2.8	21.52	20.78	0.74	5.1	23.78	23.21	0.56	0.3
50-54	19.68	19.02	0.66	7.3	18.49	17.79	0.71	6.5	20.96	20.35	0.61	8.7
55-59	16.81	16.26	0.56	12.9	16.12	15.50	0.62	11.8	17.56	17.05	0.50	14.2
Tuberculosis												
15-19	43.08	41.49	1.59	11.0	41.67	39.95	1.71	8.9	44.58	43.14	1.44	12.8
20-24	38.65	37.11	1.54	7.3	37.20	35.51	1.69	8.3	40.19	38.82	1.37	6.5
25-29	34.75	33.25	1.50	8.3	33.17	31.52	1.65	8.8	36.41	35.08	1.33	7.7
30-34	31.50	30.08	1.42	8.8	30.11	28.55	1.56	6.3	33.02	31.76	1.26	11.8
35-39	28.51	27.19	1.32	4.0	27.25	25.71	1.54	3.8	29.88	28.81	1.08	4.2
40-44	26.19	24.85	1.34	6.7	25.48	23.88	1.60	8.2	26.93	25.87	1.06	5.2
45-49	23.26	21.95	1.31	10.8	22.34	20.78	1.56	8.3	24.25	23.21	1.03	13.4
50-54	20.21	19.02	1.19	9.6	19.32	17.79	1.53	12.9	21.16	20.35	0.81	3.6
55-59	17.34	16.26	1.09	9.0	16.87	15.50	1.36	16.8	17.87	17.05	0.82	0.3

Source: Computations from 2010-2012 SAVVY data files

5.3. Malaria and Diseases of the Circulatory System Elimination

Table 10 shows the number of additional years of life that would be gained if malaria as a cause of death were eliminated. The highest number of additional years of life gained is 1.1 years for both males and females in age group 15-19 if malaria were eliminated as a cause of death. It is notable from the table that the gain in the number of additional years of life decreases progressively with age from age group 15-19 for both males and females. This indicates that malaria is more of a public health concern among young adults. The highest percentage reduction in the probability of dying is 11.8 per cent in age group 20-24 among males and age group 50-54 among females.

Overall, the highest number of additional life years that would be gained if diseases of the circulatory system were eliminated as a cause of death is about 1.9 years in age group 45-49; with the highest percentage reduction in the probability of dying, 17.5 per cent in age group 55-59, as shown in Table 10. Females would gain more additional years of life than males. The number of additional years of life increase with age but decrease after reaching the peak years. The highest gain in number of additional years of life is 2.5 years among females in age group 45-49 while for males it is 1.4 years in age group 55-59. The highest percentage reduction in the probability of dying is 21 per cent among males in age group 55-59 and 17.3 per cent for females in age group 45-49. Unlike malaria which is concentrated in the young adult ages, diseases of the circulatory system are more prevalent in older ages.

Table 10. Number of years gained by eliminating the risk of malaria and diseases of the circulatory system, Zambia

Age	Total Life expectancy at corresponding ages-cause of death eliminated	Life expectancy at corresponding ages-all causes	Number of years gained	Percentage reduction in probability of dying	Male Life expectancy at corresponding ages-cause of death eliminated	Life expectancy at corresponding ages -all causes	Number of years gained	Percentage reduction in probability of dying	Female Life expectancy at corresponding ages-cause of death eliminated	Life expectancy at corresponding ages-all causes	Number of years gained	Percentage reduction in probability of dying
Malaria												
15-19	42.58	41.49	1.09	8.4	41.05	39.95	1.10	9.4	44.24	43.14	1.09	7.7
20-24	38.16	37.11	1.05	9.6	36.57	35.51	1.06	11.8	39.88	38.82	1.06	7.9
25-29	34.22	33.25	0.97	8.0	32.49	31.52	0.96	7.3	36.07	35.08	0.99	8.8
30-34	30.95	30.08	0.87	5.2	29.42	28.55	0.87	6.3	32.64	31.76	0.88	3.9
35-39	28.01	27.19	0.82	6.4	26.50	25.71	0.79	6.8	29.66	28.81	0.85	5.5
40-44	25.56	24.85	0.71	4.8	24.53	23.88	0.64	6.2	26.66	25.87	0.79	3.6
45-49	22.61	21.95	0.66	5.7	21.35	20.78	0.57	5.4	23.99	23.21	0.78	6.1
50-54	19.62	19.02	0.60	4.3	18.30	17.79	0.51	0.1	21.06	20.35	0.71	11.8
55-59	16.82	16.26	0.57	7.5	16.10	15.50	0.60	7.9	17.61	17.05	0.55	6.9
Diseases of the circulatory system												
15-19	43.13	41.49	1.64	2.9	41.17	39.95	1.21	3.1	45.34	43.14	2.20	2.7
20-24	38.76	37.11	1.65	3.7	36.72	35.51	1.21	2.0	41.04	38.82	2.22	5.0
25-29	34.90	33.25	1.66	4.4	32.75	31.52	1.23	3.5	37.31	35.08	2.23	5.3
30-34	31.75	30.08	1.67	3.1	29.79	28.55	1.24	3.4	34.00	31.76	2.24	2.8
35-39	28.91	27.19	1.72	2.0	26.97	25.71	1.26	0.9	31.14	28.81	2.33	3.9
40-44	26.69	24.85	1.84	6.4	25.27	23.88	1.39	7.9	28.29	25.87	2.42	5.0
45-49	23.81	21.95	1.85	11.1	22.12	20.78	1.34	5.4	25.73	23.21	2.52	17.3
50-54	20.80	19.02	1.78	7.6	19.15	17.79	1.36	4.9	22.68	20.35	2.33	12.2
55-59	18.06	16.26	1.81	17.5	16.94	15.50	1.43	21.0	19.35	17.05	2.30	13.6

Source: Computations from 2010-2012 SAVVY data files

5.4. Impact of Eliminating Selected Causes of Death on Adult Mortality

The impact of eliminating a few selected cause of death would have on adult mortality if they were eliminated is indicated in Table 11. The highest percentage reduction in the probability of dying between ages 15 and 60 years is 30.6 per cent overall and this is achieved by eliminating HIV/AIDS as a cause of death. Adult females would greatly benefit from eliminating HIV/AIDS as a cause of death as it would reduce their probability of dying between ages 15 and 60 years by 35 per cent. The impact of eliminating the other causes of death on improving adult survivorship is far less when compared to eliminating HIV/AIDS. Therefore, HIV/AIDS elimination should be priority for public health interventions.

Table 11. Effect of eliminating causes of death on adult mortality, Zambia

	Probability of dying between age 15 and 60 years if cause is eliminated										
	All Cause	HIV/ AIDS	Percent reduction	Injuries & accidents	Percent reduction	Tuberculosis	Percent reduction	Malaria	Percent reduction	Diseases of circulatory system	Percent reduction
Male	0.5512	0.4038	26.75	0.5039	8.58	0.5128	6.98	0.5297	3.91	0.5246	4.83
Female	0.4703	0.3055	35.04	0.4449	5.40	0.4473	4.89	0.4463	5.10	0.4379	6.89
Total	**0.5117**	**0.3554**	**30.55**	**0.4748**	**7.21**	**0.4806**	**6.07**	**0.4888**	**4.46**	**0.4824**	**5.73**

Source: Computations from 2010-2012 SAVVY data files

6. Discussion and Conclusion

The study examined the causes of death among adults in the age group 15-59 years using 2010-2012 SAVVY data. The study found that the top 5 leading causes of death among adults in Zambia were HIV/AIDS, injuries and accidents, tuberculosis, malaria, and diseases of the circulatory system ranked in that order. This finding is consistent with previous studies by Mudenda *et al.*, (2011), GBD 2015 Mortality and Causes of Death Collaborators (2016), and Wang et al., (2016) who found that HIV/AIDS and malaria were the leading cause of death among adults. Also, Rathod *et al.* (2016) found that the top three most common causes of death among adults in Lusaka urban district were tuberculosis, HIV/AIDS and malaria in that order.

HIV/AIDS was the major leading cause of deaths across all demographic and socioeconomic background characteristics of the deceased adults. The proportions of deaths attributable to HIV/AIDS increased by age and peaked in age group 35-39 and then started to decrease. The pattern was the same by sex for both male and female HIV/AIDS deaths. This is consistent with results in a study by Masquelier *et al*., (2017) on age patterns and sex ratios of adult mortality in countries with high HIV prevalence. Consistent with previous studies, the study found a higher proportion of HIV/AIDS deaths among females than males (Rao, Lopez and Hemed 2006; Kanjala, Michael, Todd *et al.* 2014; Melaku, Sahle, Tesfaye *et al.* 2014; Mberu, Wamukoya, Oti *et al.* 2015). This may be attributed to the higher HIV prevalence in females than males as revealed by surveys conducted in Zambia (Central Statistical Office [Zambia], Ministry of Health [Zambia] and ICF International 2014; Chanda-Kapata, Kapata, Klinkenberg *et al.* 2016).

Irrespective of place of residence the proportion of HIV/AIDS deaths was higher among females than males. Some studies have tried to link this to be as a consequence of transactional sexual behaviour among young women as well as their vulnerability which predisposes them to contracting HIV as they try to meet their basic needs (Leclerc-Madlala 2003; Uchudi, Magadi and Mostazir 2012). Western province had the highest proportion of HIV/AIDS deaths for males while North-western province had the lowest. Western province is one of the provinces with high poverty levels and hosts a fishing industry (Central Statistical Office [Zambia] 2012). Previous studies have associated fish trade with high HIV prevalence (Seeley and Allison 2005; Béné and Merten 2008). For females, Eastern province had the highest proportion of HIV/AIDS deaths while North-western province had the lowest. It is not clear why Eastern province has the highest proportion of HIV/AIDS deaths. This requires further investigation.

The background demographic and socioeconomic factors were important in determining the distribution of proportions of HIV/AIDS as a leading cause of death among adults. The proportion of HIV/AIDS deaths decreased with the level of educational attainment. This finding is consistent with a study in Ethiopia that found a high proportion of adult deaths among the illiterate deceased persons (Melaku, Sahle, Tesfaye *et al.* 2014). Consistent with studies in Angola (Rosario, Costa, Timoteo *et al.* 2016) and Ethiopia (Melaku, Sahle, Tesfaye *et al.* 2014; Ashenafi, Eshetu, Assefa *et al.* 2017), the study found that HIV/AIDS deaths were higher among the formerly married (i.e. divorced/separated/widowed) for both males and females.

Northern, North Western and Luapula provinces had higher proportions of tuberculosis deaths compared to the other provinces. This could probably be due to inadequate health infrastructure considering that these provinces are predominantly rural and the populations are sparsely distributed to effectively provide health services. The government Directly Observed Treatment Short course (DOTS) strategy on tuberculosis implemented country-wide has to some extent helped in reducing the deaths attributed to tuberculosis. The DOTS strategy provides tuberculosis drugs free of charge at points of health service. One of the challenges, however, has been the treatment of multi-drug resistant tuberculosis. It is also well-known that tuberculosis is closely associated with HIV/AIDS (Naidoo, Grobler, Deghaye *et al.* 2015; Samandari, Agizew, Nyirenda *et al.* 2015) and probably some of the HIV/AIDS deaths may have been misclassified as tuberculosis deaths.

Unexpectedly, malaria attributed adult deaths were higher in Copperbelt province. This is not easy to explain since the province is one of the most urbanised area in the country. The province also has one of the highest HIV prevalence rates. Some studies have claimed to associate malaria with HIV/AIDS (Abu-Raddad, Patnaik and Kublin 2006; Mermin, Ekwaru, Liechty *et al.* 2006; Mandisodza 2010).

Adult male deaths attributed to accidents and injuries were twice as high as those of females, and particularly, consistent with previous studies, among young people in age group 15-25 (Melaku, Sahle, Tesfaye *et al.* 2014; Streatfield, Khan, Bhuiya *et al.* 2014; Ashenafi, Eshetu, Assefa *et al.* 2017). Some studies claim that young people are more

adventurous and end up in hazardous life-threatening situations compare to older adults who are usually careful (Waldon, McCloskey and Earle 2005; Rao, Lopez and Hemed 2006; Streatfield, Khan, Bhuiya *et al.* 2014). Injuries and accidents were the second leading cause of death among males while among females it was tuberculosis. The study found higher proportions of injury and accident deaths among male and female decedents who had higher level of educational attainment. This may not be conclusive, however, as these are just proportions and further analysis is required. Generally, education is seen to increase risk aversion. The never married decedents also had higher proportions of injury and accident deaths. This finding is consistent with studies conducted in Ethiopia (Melaku, Sahle, Tesfaye *et al.* 2014; Ashenafi, Eshetu, Assefa *et al.* 2017). Deaths due to injuries and accidents were higher in Central, Lusaka, Northern and Southern provinces than in the rest of the provinces. The possible reason could be the major highways that pass through these provinces as they carry a lot for traffic, and accidents are a daily occurrence.

Injuries and accidents in Zambia have increased and it is projected that deaths from these causes are likely to exceed those attributed to HIV/AIDS (Schatz 2008; World Health Organization 2013b; Lusakatimes.com 2014, 2015). Productive adult lives that are supposed to contribute to the country's economy and socioeconomic development are lost in significant numbers nearly each year through injuries and accidents. There is a need for the government and its agencies responsible for road safety to devise interventions that will curb the needless loss of adult lives through injuries and accidents. Failure to address this, the country will continue losing its most productive human resource.

Furthermore, overall, deaths attributed to suicide and violence were also higher among males than females. However, among female deaths by suicide and violence, intentional inflicted injury deaths were higher than for males. Poverty levels are high in Zambia and the economic performance of the country has been sluggish. This has put a lot of people under economic pressure in terms of their livelihoods. Other studies conducted in South Africa (Naidoo and Schlebusch 2014; Matzopoulosa, Prinslooa, Pillay-van Wyka *et al.* 2015; Pillay-van Wyk, Msemburi, Laubscher *et al.* 2016), Japan (Trovato and Heyen 2006; World Health Organization 2013a), Canada (Trovato and Heyen 2006; World Health Organization 2013a), South Korea (Yang, Khang, Chun *et al.* 2012) and Europe (Trovato and Heyen 2006; Bernal, Haro, Bernert *et al.* 2007; Stuckler, Basu, Suhrcke *et al.* 2009) also had similar findings with deaths due to suicide and violence being high among males as a result of economic pressure, alcohol and drug abuse, and poverty.

Diseases of the circulatory system were the third leading cause of death among female decedents while tuberculosis was the third cause of death among males. Malaria was the fourth leading cause of death for both males and females. It evident that communicable diseases remain one of the leading causes of death among adults. While government interventions have been directed at combating the communicable disease burden, a new epidemic of non-communicable diseases is on the rise, which is closely associated with the epidemiological transition (Omran 1971). The country's health infrastructure is inadequate to deal with the emerging epidemic of NCDs. Adult deaths attributable to non-communicable diseases increased with age and were more evident in older ages 45-59 while injuries and accidents were more prevalent in age group 15-35. This finding is consistent

with studies that have revealed evidence of the rising epidemic of NCDs in low- and middle-income countries (Murray and Feachem 1990; Holmes, Dalal, Volmink *et al.* 2010; Dalal, Beunza, Volmink *et al.* 2011; Ezeh, Bongaarts and Mberu 2012; Oti, van de Vijver and Kyobutungi 2014; Fedeli, Zoppini, Goldoni *et al.* 2015; GBD 2015 Mortality and Causes of Death Collaborators 2016; GBD 2015 Risk Factors Collaborators 2016; Allen, Williams, Townsend *et al.* 2017; Stringhini, Carmeli, Jokela *et al.* 2017). There is growing concern that the burden of NCDs will be heavier than the HIV/AIDS burden in the long term and that the impact will be more on the poor populations of the low- and middle-income countries (United Nations 2015).

NCDs are a health and economic burden associated with a large impact on workforce productivity, health expenditure, absenteeism, presenteeism (present at work but unable to work due to ailment), loss of critical skills and deaths. It is anticipated that the NCD burden will outstrip that of HIV/AIDS, malaria and tuberculosis. About 61 per cent of Zambia's population is poverty stricken; this implies that since NCDs are costly to treat and manage, more people are likely to die as they may not afford the resources to manage the health conditions. The Ministry of Health has attempted to develop an NCD strategic plan but it does not comprehensively address all the major NCDs in Zambia, for example, epilepsy, sickle cell disease, asthma and mental health conditions (Mukanu, Zulu, Mweemba *et al.* 2017). The epidemic of NCDs will continue to pose as a challenge to meeting the sustainable development goals if government does not respond effectively to this burden.

Therefore, the impact of the NCD epidemic is anticipated to be huge and costly financially. To minimise the impact of the burden of NCDs government health policy, programmes and interventions must devise strategies, develop infrastructures and specialised human resources to combat the epidemic. In addition, government should revise the current NCD strategic plan so that it comprehensively covers all major NCDs. The NCD strategic plan should be adequately funded and implemented effectively. Health promotion programmes through behavioural change and communication should be developed to raise awareness of NCDs in the general population and how they should live healthy and active lifestyles. However, this is going to be a challenge given that the available resources are already overstretched in fighting infectious diseases like malaria, tuberculosis, lower respiratory infections and above all the HIV/AIDS epidemic.

Apart from HIV/AIDS being the leading cause of death for both males and females, public health interventions must take cognisance of the gender differentials in causes of death and prioritise according to each particular sex. For example, while males were dying of pneumonia/ARI and diabetes mellitus in the 6th and 7th rankings respectively, females were dying of neoplasms and maternal causes in the same ranking order.

The study examined the impact of eliminating the leading causes of death on adult mortality by constructing cause-deleted life tables from a health policy and programmatic perspective. The study found that if HIV/AIDS were eliminated it would contribute the most number of additional years of life gained compared to eliminating the other causes of death. Eliminating HIV/AIDS as a cause of death would have the most impact in reducing adult mortality in Zambia. The percentage reduction in the probability of dying between

ages 15 and 60 years would be 30 per cent overall and 35 per cent for females. In addition, females in age group 15-19 would gain the highest number of years of additional life, 6.40, while for males in the same age group would gain 5.77 years. The percentage reduction in the probability of dying would be highest among females, 60.5 per cent and 49 per cent among males in the age group 35-39. This finding provides evidence that should reaffirm HIV/AIDS programmes, that is, the antiretroviral therapy (ART) interventions to further strengthen their efforts in ensuring that coverage and access of the drugs reaches those who need them. Studies have also proved that ART programmes have helped in reducing adult mortality (Reniers, Masquelier and Gerland 2011; Bendavid, Holmes, Bhattacharya *et al.* 2012; Kanjala, Michael, Todd *et al.* 2014; Murray, Ortblad, Guinovart *et al.* 2014). HIV/AIDS prevention programmes targeting adolescents should further be strengthened so that additional years of life could be added.

The contribution of the study to demographic and epidemiological literature is in understanding the causes of death of adults in age group 15 to 59 years in a sub-Saharan African country, that is, Zambia. The study has also provided evidence of the emerging epidemic of NCDs in Zambia especially among adults in the study age group. The study has also shown that injuries and accidents are major causes of deaths among adult males, the highly educated and the never married. From a health policy and programmatic perspective, the study has shown that eliminating HIV/AIDS in Zambia would have the most impact in reducing adult mortality and increase the number of additional years of life. The findings are reassuring to ART programmes. The study has also provided an answer to the research question and what the impact of eliminating leading causes of death would be on adult mortality in Zambia. The findings of the study also reinforce to some extent the proximate determinants framework on adult mortality.

The study has a number of limitations. First, the data used in the study are cross sectional and causality cannot be attributed. In addition, time variation of events cannot also be established. Second, the accuracy and reliability of the verbal autopsy data used in the study is dependent on the quality of information provided by the close relations of the deceased as well as the expertise of the interviewers. With the passage of time, there is recall bias on the part of the respondents to provide reliable information about events that led to the deceased dying. Also, when determining the cause of death by medical professionals based on verbal autopsy data there could be misclassifications. Therefore, cause of death data from verbal autopsy are not the same as cause of death data from clinical records. However, to ensure that verbal autopsy data were of high quality and useable, quality control measures were put in place during data collection. In addition, qualified medical personnel and nosologists were utilised in establishing and classifying the causes of death according to the WHO ICD-10 classification. Third, the low number of deaths overall could not permit further disaggregated analysis as this might have resulted in small sample sizes in some cells. Despite these limitations, the findings of the study remain plausible.

The study found that the top 5 leading causes of death among adults in age group 15-59 years in Zambia were HIV/AIDS, injuries and accidents, tuberculosis, malaria and diseases

of the circulatory system. HIV/AIDS was the major leading cause of deaths across all demographic and socioeconomic background characteristics of the deceased adults. Injuries and accidents were the second leading cause of death among male deaths while among females it was tuberculosis. Injuries and accidents deaths were higher among the deceased who had higher level of education and the never married. Diseases of the circulatory system were the third leading cause of death among female decedents while tuberculosis was the third cause of death among males. Malaria was the fourth leading cause of death for both males and females. Adult deaths attributable to non-communicable diseases are more evident in older ages 45-59. Eliminating HIV/AIDS as a cause of death would also have the most impact in reducing adult mortality in Zambia. Government health programmes and interventions on HIV/AIDS should further be strengthened in order to reduce adult deaths. Further research is needed to investigate the determinants of non-communicable diseases among adults in age group 15-59 years in Zambia.

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