



Article

Adult mortality in sub-saharan Africa, Zambia: Where do adults die?

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ABSTRACT

Place of death remains an issue of growing interest and debate among scholars as an indicator of quality of end-of-life care in developed countries. In sub-Saharan Africa, however, variations in place of death may suggest inequalities in access to and the utilization of health care services that should be addressed by public health interventions. Limited research exists on factors associated with place of death in sub-Saharan Africa. The study examines factors associated with the place of death among Zambian adults aged 15–59 years using the 2010–2012 sample vital registration with verbal autopsy survey (SAVVY) data, descriptive statistics and multivariate logistic regression analysis. Results show that more than half of the adult deaths occurred in a health facility and two-fifths died at home. Higher educational attainment, urban versus rural residence, and being of female gender were significant predictors of the place of death. Improvement in educational attainment and investment in rural health facilities and the health care system as a whole may improve access and utilization of health services among adults.

Introduction

Globally, place of death has continued to generate a lot of interest and debate as a key performance indicator of quality of end-of-life care (Black et al., 2016; Cohen et al., 2015; Dasch, Blum, Gude, & Bausewein, 2015; Pollock, 2015). Place of death is where a deceased person spent the final hours of their life (Earle et al., 2003). The most common places of death are: home, hospital, hospice, nursing home and other place (Cohen et al., 2015; Dasch et al., 2015). In end-of-life care a death at home is considered a quality marker of a good death (Black et al., 2016; Gomes, Calanzani, & Higginson, 2011). On the contrary, others argue that the place of death is not the most important priority but managing the experience of dying for patients and families (Munday, Petrova, & Dale, 2009; Pollock, 2015). Most people prefer to die at home, however, majority of the deaths occur in a health facility and not in the preferred place of death (Black et al., 2016; De Roo et al., 2014; Escobar Pinzon et al., 2011; Gomes, Calanzani, Gysels, Hall, and Higginson, 2013; Gomes et al., 2011). The preference of a home death is supported by the notion that an individual can die peacefully in a dignified manner in the presence of the family or close relations (Gomes et al., 2011; Gomes & Higginson, 2006; Kinoshita et al., 2014; McNamara & Rosenwax, 2007). In addition, the cost of hospitalization is minimized (Pollock, 2015). On the other hand, a

health facility death is perceived as undesirable, costly and associated with poor quality of care (Kinoshita et al., 2014; Pollock, 2015). There are variations, however, in preference of place of death and the evidence presented by studies is mixed (Lackan, Eschbach, Stimpson, Freeman, & Goodwin, 2009; Pollock, 2015).

While in developed countries, a home death is considered a good death, however, in sub-Saharan African countries this may have a different implication in that a person who dies at home could have failed to access and utilize health care services. Conversely, an individual who dies in a health facility may be presumed to have accessed and utilized health care services (Kiwanuka et al., 2008).

Studying factors associated with the place of death is one way of understanding inequalities in access to and the utilization of health services by populations of different backgrounds. Combined with morbidity and mortality data, understanding place of death may assist health planners, decision makers and public health policy in resource allocation to improve access to and the utilization of health services in hospitals and other health facilities in a country (Gao, Ho, Verne, Gordon, & Higginson, 2014; Hong et al., 2011; McNamara & Rosenwax, 2007).

Studies have revealed that the place of death is associated with, and influenced by, a number of different types of factors: first, individual level factors such as demographic factors, age and sex (Black et al.,

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2016; Dasch et al., 2015; Jayaraman & Joseph, 2013); sociodemographic: marital status (Cardenas-Turanzas, Carrillo, Tovalín-Ahumada, & Elting, 2007; Cohen et al., 2015; Jayaraman & Joseph, 2013), ethnicity (Coupland, Madden, Jack, Moller, & Davies, 2011; Lackan et al., 2009), religion (Anteneh, Araya, & Misganaw, 2013); socioeconomic factors: education (Cardenas-Turanzas et al., 2007; Cohen et al., 2015); second, factors associated with the illness, that is, the duration of illness and causes of death (Black et al., 2016; Cohen et al., 2015); and third, environmental or ecological factors such as residence (Gao et al., 2014; Goodridge, Lawson, Rennie, & Marciniuk, 2010; Houttekier et al., 2009; Lavergne et al., 2015); social support (Cohen et al., 2010; Dasch et al., 2015; Kinoshita et al., 2014) and the type of health care services available (Cardenas-Turanzas, Torres-Vigil, Tovalín-Ahumada, & Nates, 2011; Costa, 2014; Kinoshita et al., 2014; Pollock, 2015). Some studies have found variations in the place of death among adults by age and sex; women and older people were more likely to die at home (Gomes et al., 2011). Conversely, other studies found the opposite (Lin & Lin, 2007). The type of health condition may also dictate the place of death in terms of dying at home or in a health facility. Some health conditions can only be managed at a health facility and not at home (Costa, 2014; Gomes & Higginson, 2006; Howell et al., 2015).

Previous studies on place of death have used death certificates or population based data to examine associations with predictor factors, in the United States of America (Grunier et al., 2007); in Canada (Goodridge et al., 2010; Jayaraman & Joseph, 2013); in Mexico (Cardenas-Turanzas et al., 2007); in Australia (Currow, Burns, & Abernethy, 2008; McNamara & Rosenwax, 2007); in Europe (Dasch et al., 2015; Reich, Signorell, & Busato, 2013); in Asia (Hong et al., 2011; Lin & Lin, 2007; Yamasaki et al., 2008; Yun, Lim, Choi, & Rhee, 2006); and in sub-Saharan Africa (Anteneh et al., 2013; Gysels, Pell, Straus, & Pool, 2011; Harding et al., 2013).

In sub-Saharan Africa, knowledge on factors associated with place of death among adults remains limited due to little research. Part of the reason is the lack of fully developed and complete vital registration systems that collect detailed information on deaths, the causes of death and the place of death. In Zambia, censuses and demographic and health surveys are the only major sources of mortality data. They are, however, limited with respect to the scope and detail of mortality data collected, they do not collect information on place of death. A verbal autopsy survey undertaken from 2010 to 2012 in Zambia collected detailed mortality information including on place of death which is useful for examining factors associated with place of death in a sub-Saharan African context. Furthermore, health care access and utilization in Zambia is inequitable and dependent on development assistance for health to deal with the burden of diseases. Inequality in health care access and utilization has mainly been attributed to high poverty levels among the population, long distances to health facilities in rural areas, poor health infrastructure, stigma of certain diseases, inadequately health providers (nurses and doctors) relative to the population, lack of medical equipment, and stock outs of essential medical drugs (Hjortsberg, 2003; Ministry of Health [Zambia], 2011). These and other factors make health care access and utilization problematic for the population. Therefore, a study on Zambia becomes an important context for understanding the factors associated with the place of death in sub-Saharan Africa.

The study adds to the literature on place of death by focusing on a sub-Saharan African country, Zambia, where adult mortality is high and has been largely attributed to HIV/AIDS. Zambia's National Health Policy recognizes the large unmet need of and necessity to upscale palliative care services for life limiting illnesses such as HIV/AIDS and other chronic illnesses affecting adults (Ministry of Health [Zambia], 2012). The Ministry of Health, therefore, introduced palliative care programmes as well as capacity building initiatives to respond to the need. Government palliative care services are inadequate, and private hospices, Non-governmental organizations and community

based organizations complement in offering palliative care services. An umbrella body, the Palliative Care Association of Zambia, coordinates the other organizations.

The study focuses on the age group 15–59 years which consists of the young and middle aged adults who are in the reproductive ages as well as the most productive segment of the population. These constitute approximately 50 per cent of Zambia's estimated population of 15.5 million in 2015 (Central Statistical Office (CSO), 2013). Studying deceased adults in the mentioned age group may provide an insight into understanding if any relationship exists between place of death, and access to and the utilization of health services by extrapolation. Understanding this relationship is relevant in designing targeted interventions aimed at reducing adult mortality.

Furthermore, previous studies on the place of death conducted elsewhere have been restricted to examining factors associated with specific health conditions in end-of-life care, for example, cancer (Cohen et al., 2015; Cooper, 2014), malignancy (Howell et al., 2015), chronic respiratory diseases (Munday et al., 2009), diabetes and hypertension (Reich et al., 2013; Slobbe, Arah, de Bruin, & Westert, 2008), and have mainly focused on palliative care in developed countries (Black et al., 2016; Dasch et al., 2015; De Roo et al., 2014; Gomes et al., 2011; Goodridge et al., 2010; Grunier et al., 2007; Houttekier, Cohen, Pepersack, & Deliëns, 2014).

The study investigates the factors that influence where adults aged 15–59 died during a two-year period (2010–2012) in Zambia. Factors of interest in this study are age, gender (sex), marital status, type of residence (urban/rural), education level, occupation, and cause of death of the deceased.

We sought to answer the research question: what factors determine where adults aged 15–59 die and how are they associated with place of death in Zambia? Our objective was, therefore, to examine the factors associated with the place of death among deceased adults aged 15–59 years in Zambia.

The study demonstrates that analyzing factors associated with place of death enhances our understanding of where adults in the reproductive and productive age group die in sub-Saharan Africa. This information may be useful in targeting and improving access to and utilization of health services prior to death.

Theoretical framework

The social ecological theory is based on the premise that there are interrelationships between an individual and their environment. An individual's interaction with the environment (e.g. family relations, community structures, religion, societal customs, economy) influence personal outcomes like behavior, health, mortality, etc. (Bronfenbrenner, 1979). The theory enables us to understand why there are variations in individual behavioural or health outcomes like mortality across different community environments. Place of death is one of the factors that is influenced by individual-level and community-level circumstances with respect to mortality.

The social ecological model, adapted from the social ecological theory (Bronfenbrenner, 1979), is the most frequently used to examine factors associated with individual and health outcomes. The model is adapted to suit the behavioural or health outcome and population segment being studied as it relates to the environment. The most common adaptations of the model at individual level are personal factors that influence directly individual outcomes (age, sex, education level, socioeconomic status, employment); at social environment level are the relationships (family, peers), cultural values and norms, socioeconomic status of the community, institutions and organisations, access to social support, influence of health and other professionals, and society overall in which the individual interacts; at physical environment level is the natural and built environments; and at policy level is legislation and policies (health, education, environmental policies). These levels allow the design of appropriate strategies and

interventions that do not target only the individual but go beyond the specific levels where the need is required. The social ecological theory has been applied in a number of studies to examine community socioeconomic conditions and variations in individual health outcomes like mortality (Kawachi & Berkman, 2003; Wen & Gu, 2011).

In this study, we use the social ecological model as a theoretical framework within which to examine that determinants of place of death among the deceased adults aged 15 to 59 in sub-Saharan Africa, Zambia. The study does not focus on all the variables in the framework but on the following: at individual level (age, sex, marital status, education); epidemiological (cause of death); and at ecological level (type of residence (rural-urban), and occupation type). We hypothesize that place of death is influenced by individual level factors as well as ecological factors.

Methods

Data source

We used data from a sample vital registration with verbal autopsy survey (SAVVY) conducted from 2010 to 2012 to examine the factors associated with place of death. The SAVVY was conducted by the Central Statistical Office and Ministry of Health using the World Health Organization (WHO) standard methodology of reporting causes of death. The SAVVY was a cross-sectional and nationally representative survey. Its objective was to produce estimates of vital statistics and mortality by cause of death at national level (Central Statistical Office (CSO). 2014).

A nationally representative sample of 76 census supervisory areas (CSAs) from urban (46) and rural areas (30) in each of the 9 provinces of Zambia¹ was selected using a one-stage proportion to size probability sampling design from the 2000 census of population and housing sampling frame. The target population was all individuals living in households in the selected CSAs. A sample population of 109,200 was selected. A baseline census to collect demographic characteristics of the population and households was conducted in the selected CSAs. Information on births and deaths was collected from the households. Households that had experienced a death in the last 12 months were identified by community key informants; then a detailed verbal autopsy questionnaire was administered that asked questions about the deceased on age at death, the sex of the deceased, marital status, occupation, education, cause of death, history of illness, risk factors, health service utilization, and place of death. The international classification of diseases (ICD) version 10 was used to classify and code the causes of death by qualified Ministry of Health medical doctors and nosologists. Stringent quality control measures were put in place to ensure that the collected data were of high quality. The SAVVY data are the first at national level in Zambia to provide detailed mortality histories of deceased persons and therefore are appropriate to use in examining factors that determine the place of death among adults aged 15–59 years. We created a subset dataset from the main dataset comprising only a sample of decedents aged 15 to 59 years for statistical analysis.

Ethical approval for conducting the 2010–2012 SAVVY was provided by the University of Zambia Research Ethics Committee. All respondents consented to their voluntary and independent participation in the survey. The SAVVY dataset used was obtained with permission from the Central Statistical Office of Zambia. The dataset was stripped of personal identifiers before it was made available to the public.

¹ In 2011 a tenth (10th) new province, Muchinga, was created by splitting Northern province into two and adding one district from Eastern province. Muchinga province is not included in this analysis since the survey data were collected before the province was created.

Variables and measures

Place of death

The dependent (outcome) variable is the place of death which is the place where the deceased person died. Based on previous studies (Anteneh et al., 2013; Black et al., 2016; Jayaraman & Joseph, 2013), we initially categorized place of death as “Health facility” which included all government and private health facilities, “Home”, which is the deceased's home or a relative's home, and “Other” which is any other place, in the descriptive analysis; and later dichotomized into two categories and coded as 0 “Non-health facility” (home+other) and 1 “Health facility” to facilitate the application of multivariate logistic regression analysis. We combined two categories “home” and “other” into one category “Non-health facility” because of the small number of cases in the “other” category. Our category of interest is death in a health facility, which we coded as “1” as a proxy indicator for access to and utilization of health care services.

Explanatory variables

We selected independent (explanatory) variables considered to be associated with place of death of the deceased person based on previous studies (Anteneh et al., 2013; Black et al., 2016; Cohen et al., 2015; Jayaraman & Joseph, 2013). These selected key explanatory variables are summarized in Table 1 with their coding categories and description as guided by previous studies.

Statistical analysis

We performed statistical analysis using Stata version 12.1 (StataCorp, 2011). We used descriptive statistics to describe the counts and proportions of adults who died by place of death and their background characteristics at the time of death. We conducted bivariate analysis by applying simple logistic regression models (Bruce, Pope, & Stanistreet, 2008) whereby only one independent variable was modeled with the dependent variable at a time. We did this to establish the association of each independent variable with the dependent variable. This stage also provided the unadjusted odds ratios of the probability of an adult dying in a health facility or not. We included explanatory variables that were statistically significantly associated with the outcome variable at p -value < 0.05 significance level in next level of multivariate logistic regression modeling.

We applied multivariate logistic regression analysis (Bruce et al., 2008) to examine the association of the explanatory variables with the outcome variable, place of death, as well as to assess the net contribution of each explanatory variable to the outcome variable while controlling for other predictor variables in the model. We used the odds ratio as a measure of the net effect of the explanatory variables on the outcome variable. An odds ratio of 1 means there is no difference whereas an odds ratio greater than 1 implies the deceased adult was more likely to die in a health facility, and an odds ratio less than 1 means an adult was less likely to die in a health facility. We set the statistical test at 5 per cent level of significance and computed 95 per cent confidence intervals.

We tested the explanatory variables for multi-collinearity by performing correlations, variable inflation factor (VIF) and tolerance tests. The model specification was tested using the Stata *linktest* command immediately after running the model. We tested the Goodness-of-fit of the model using the Hosmer and Lemeshow test (Hosmer, Lemeshow, & Sturdivant, 2013). All the tests indicated a good model fit. We applied sample weights throughout the analysis using the Stata *svy* command to account for undercounting and over counting due to the sample design of the survey.

Table 1
Variables used in the analysis of predictors of place of death among adults aged 15–59.

Variable	Coding categories	Description/definitions
Dependent variables		
Place of death	0: Non-Health facility; 1: Health facility (Ref.)	Place where the deceased died
Independent variables		
Residence	1: Rural (Ref.); 2: Urban	Urban or Rural residence
Sex	1: Male (Ref.); 2: Female	Sex of deceased person
Age	1: 15–24 (Ref.); 2: 25–34; 3: 35–44; 4: 45–54; 5: 55–59	Age in completed years of the deceased
Education level	1: None (Ref.); 2: Primary; 3: Secondary; 4: Higher	Highest education level attained by a deceased person
Marital status	1: Never married (Ref.); 2: Married/Living with partner; 3: Widowed/Divorced/Separated	Marital Status of deceased person
Occupation	1: Skilled Agricultural/Fishery Workers (Ref.); 2: Legislators/Senior Officials/Managers; 3: Professionals; 4: Technicians/Associate Professionals; 5: Clerks; 6: Service/Shop/Market Sales Workers; 7: Craft & related Trade Workers; 8: Elementary Occupations	Type of occupation of a deceased person
Cause of death	1: HIV disease (Ref.); 2: Diseases of circulatory system; 3: Tuberculosis; 4: Accident & Injuries; 5: Malaria; 6: Neoplasms; 7: Pneumonia/ARI; 8: Diabetes mellitus; 9: Diarrhoeal diseases; 10: All other causes	Underlying cause of death of the deceased person

Results

Descriptive findings

In the two-year period from 2010 to 2012, a total of 1078 deaths occurred among adults aged 15–59; including 582 (54 per cent) deaths among males and 496 (46 per cent) deaths among females. The mean age at death was 35.7 years for all adult decedents; and was 36.5 years for males and 34.8 years for females. By the age of 35, half of the adults had died (half of males died by the age of 36 and half of females died by the age of 34). Approximately 51 per cent of the adult deaths occurred in a health facility whereas 41.5 per cent of the deaths took place at home. Less than 10 per cent (7.7 per cent) of the adult deaths happened elsewhere.

Table 2 shows the weighted number and percentage distribution of adult deaths by background characteristics. By rural-urban residence, the majority of the adults (55.3 per cent) died in rural areas. More than half (51.4 per cent) of the adult deaths in rural areas took place at home whereas more than two-thirds (62.7 per cent) of deaths occurred at a health facility in urban areas.

More than half of the adult deaths (54 per cent) occurred among males. The majority of female adult deaths occurred in a health facility (52.6 per cent), compared to only 48.8 per cent of male adult deaths. About two-thirds of the adult deaths occurred in people aged 25–44 years, with most deaths occurring among those aged 25–34 years (30.8 per cent). There is no clear pattern of place of death by age group; however, nearly half or more than half of the adult deaths across all age groups took place in a health facility.

Table 2 also shows that by education level, nearly half (47.4 per cent) of adult deaths occurred among those with primary level education; whereas those with higher education experienced the lowest proportion of deaths (5.9 per cent). Higher levels of education were associated with death at a health facility (68.4 per cent) whereas no education was associated with death at home (63.5 per cent). The proportion of adult deaths in a health facility increased with education level, while the opposite trend occurred for deaths at home.

It can be observed that by marital status, more than half (52.5 per cent) of the adult deaths occurred to married and cohabiting individuals, and the majority of these deaths occurred in a health facility (52.4 per cent). Nearly half of the deaths among widowed, divorced and separated individuals were associated with both health facility (48.7 per cent) and home (47.5 per cent) place of death. For the never married, almost half of the deaths occurred in a health facility (49.2 per cent). There was no difference in the proportions of adult deaths and health facility deaths between the never married and the widowed, divorced and separated.

Approximately 40 per cent of the adult deaths occurred to those

with elementary occupations and one-third of deaths occurred among skilled agricultural and fishery workers (30.8 per cent). The legislators, senior officials and managers had the least proportion of adult deaths (1.8 per cent). Almost three-quarters (74.3 per cent) of the adult deaths of legislators, senior officials and managers took place in a health facility, whereas more than half of the deaths among the skilled agricultural and fishery workers occurred at home (56.8 per cent).

It is evident from Table 2 that HIV/AIDS was the leading cause of death among adults aged 15–59; approximately 41 per cent of deaths were due to this disease. More than half (54.5 per cent) of the adults with AIDS died in a health facility. Nearly the same proportion of adults with tuberculosis died in a health facility and at home, 49.3 per cent and 48.5 per cent, respectively. More than two-thirds of the adult deaths were due to neoplasms (66.6 per cent), pneumonia/ARI (65.9 per cent) and diabetes mellitus (67.8 per cent) occurred in a health facility. Accidents and injuries had the lowest proportion of adult deaths that occurred in a health facility (31.6 per cent).

In the descriptive analysis, rural-urban residence, sex, education level, marital status, occupation type, and cause of death were significantly associated with the place of death whereas age at death was not.

Multivariate logistic regression results

The probability of an adult dying in a health facility or not is expressed by odds ratios (ORs) in Table 3 below. The unadjusted odds ratios are the independent effects of an individual predictor variable when modeled with the outcome variable only, that is, an adult dying in a health facility or not. The adjusted odds ratios are the net effects of predictor variables on the outcome when modeled with other explanatory variables, hence, adjusting for residence, province, sex, age, education, marital status, occupation, and the cause of death in this model.

In the parsimonious model, several factors were associated with the place of death: level of education attainment, type of occupation, type of residence (rural and urban), and gender/sex. Different factors were associated with an adult dying at a particular place of death: cause of death, that is, accidents and injuries versus HIV/AIDS.

Type of residence was statistically significantly associated with place of death. In urban areas, adults were 1.9 times more likely to die in a health facility than in rural settings (OR: 1.89; 95% CI: 1.27, 2.81) adjusting for other explanatory variables in the model.

On its own, sex of an adult decedent was not significantly associated with place of death. However, in the presence of other predictors in the model, gender was significantly associated with place of death. Adult female decedents were 38 per cent (OR: 1.38; 95% CI: 1.09, 1.75) more likely to die in a health facility compared to male adult decedents.

Table 2
Weighted number and percentage distribution of adult deaths (15–59 years) by place of death and background characteristics, Zambia 2010–2012.

Background characteristic	Health Facility	Home	Other	Total
	Number (%)	Number (%)	Number (%)	Number (%)
Residence***				
Rural	243 (40.7)	306 (51.4)	45 (7.6)	596 (55.3)
Urban	302 (62.7)	141 (29.3)	38 (7.8)	482 (44.7)
Sex*				
Male	284 (48.8)	240 (41.1)	58 (9.9)	582 (54.0)
Female	261 (52.6)	208 (41.9)	25 (5.1)	496 (46.0)
Age group				
15–24	91 (52.0)	63 (36.2)	21 (11.8)	175 (16.2)
25–34	165 (49.6)	144 (43.3)	24 (7.1)	332 (30.8)
35–44	168 (53.7)	122 (39.0)	20 (6.4)	313 (29.0)
45–54	91 (46.2)	91 (46.3)	15 (7.5)	197 (18.3)
55–59	30 (49.1)	27 (44.1)	4 (6.7)	62 (5.7)
Education level**				
None	32 (33.6)	61 (63.5)	3 (2.9)	96 (8.9)
Primary	231 (45.1)	243 (47.6)	35 (6.9)	511 (47.4)
Secondary	224 (59.3)	116 (30.7)	37 (9.8)	377 (35.0)
Higher	43 (68.4)	15 (23.5)	5 (8.1)	63 (5.9)
Marital status**				
Never married	124 (49.2)	96 (38.1)	32 (12.8)	253 (23.5)
Married/living with partner	297 (52.4)	226 (39.9)	43 (7.6)	566 (52.5)
Widowed/Divorced/Separated	124 (48.7)	121 (47.5)	8 (3.0)	255 (23.6)
Occupation**				
Legislators/Senior Officials/Managers	15 (74.3)	4 (20.6)	1 (5.1)	20 (1.8)
Professionals	15 (67.6)	4 (18.0)	3 (14.4)	22 (2.1)
Technicians/Associate Professionals	15 (65.8)	8 (34.2)		23 (2.1)
Clerks	41 (60.3)	23 (33.9)	4 (5.8)	67 (6.2)
Service/Shop/Market Sales Workers	60 (60.8)	29 (29.2)	10 (10.0)	99 (9.2)
Skilled Agricultural/Fishery Workers	120 (36.2)	189 (56.8)	22 (6.7)	332 (30.8)
Craft & related Trade Workers	20 (66.2)	4 (13.9)	6 (19.9)	30 (2.8)
Plant & Machine Operators/Assemblers	35 (64.0)	12 (22.0)	8 (14.0)	55 (5.1)
Elementary Occupations	224 (52.2)	175 (40.7)	29 (6.7)	430 (39.9)
Cause of death***				
HIV disease	239 (54.5)	186 (42.4)	13 (2.9)	439 (40.7)
Diseases of circulatory system	29 (49.1)	28 (47.8)	2 (3.2)	59 (5.5)
Tuberculosis	42 (49.3)	42 (48.5)		86 (7.9)
Accident & Injuries	38 (31.6)	40 (33.4)	42 (35.0)	120 (11.2)
Malaria	37 (53.1)	28 (40.1)	5 (6.8)	71 (6.6)
Neoplasms	22 (66.6)	11 (33.4)		33 (3.1)
Pneumonia/ARI	16 (65.9)	9 (34.1)		25 (2.3)
Diabetes mellitus	13 (67.8)	6 (32.2)		19 (1.7)
Diarrhoeal diseases	8 (49.8)	6 (38.4)	2 (11.8)	15 (1.4)
All other causes	138 (41.6)	131 (39.7)	62 (18.7)	331 (30.7)
Total	545 (50.6)	447 (41.5)	83 (7.7)	1078 (100)

Note: *p < 0.05, **p < 0.01, ***p < 0.001

The age of the adult decedents was not significantly associated with place of death. The level of education of the adult decedents was associated with place of death. The probability of dying in a health facility increased with the level of education. The likelihood of dying in

a health facility was 2.52 times (OR: 2.52; 95% CI: 1.37, 4.63) higher for adult decedents with a secondary level of education compared to decedents with no education. The odds of a health facility death were 3.38 times (OR: 3.38; 95% CI: 1.43, 8.02) higher for adult decedents with higher levels of education compared to those without education.

For marital status only the married/living with partner categories were significantly associated with place of death. Deceased adults who were married/living with partner were 34 per cent (OR: 1.34; 95% CI: 1.00, 1.80) more likely to die in a health facility compared to the never married adult decedents.

Not all occupation categories of type of occupation were statistically significant after adjusting for other predictors in the model. Adult decedents who were legislators/senior officials/managers were 3.49 times (OR: 3.49; 95% CI: 1.02, 11.88) more likely to die in a health facility compared to the skilled agricultural/fishery worker decedents. Deceased adults whose occupation was in service/shop/market sales were 95 per cent (OR: 1.95; 95% CI: 1.29, 2.94) more likely to die in a health facility compared to the skilled agricultural/fishery worker decedents. The odds of dying in a health facility for adult decedents whose occupation was craft and related trade were nearly three times (OR: 2.75; 95% CI: 1.00, 6.95) as that of their skilled agricultural/fishery worker counterparts. The plant and machine operator/assembler adult decedents were two and one half times (OR: 2.52; 95% CI: 1.43, 4.34) more likely to die in a health facility compared to the skilled agricultural/fishery worker decedents.

For cause of death, only deaths due to accidents and injuries were significantly associated with place of death. As expected, adult deaths due to accidents and injuries were 0.33 times (OR: 0.33; 95% CI: 0.18, 0.61) less likely to occur in a health facility compared to adults who died of HIV/AIDS. The other causes of death were not significantly different from HIV/AIDS with respect to the place of death.

Discussion

In this study, we examined determinants of the place of death among adults aged 15 to 59 years in a sub-Saharan African country, Zambia, using verbal autopsy data, descriptive statistics and multivariate logistic regression analysis. We found that the level of education attainment, type of occupation, type of residence (rural-urban), sex or gender, and marital status were significantly associated with place of death.

Our findings provide evidence that although the majority of adult deaths occurred in a health facility a sizeable proportion of adult deaths also occurred at home. While a high proportion of adult deaths occurring in a health facility may indicate access to and the utilization of health services, however, in a sub-Saharan African context of poverty and limited resources it may be viewed differently in terms of the quality of care of the health services provided. Poor health services may result in needless patient deaths. The health care system in Zambia, for example, has in the past decades faced challenges with respect to a lack of investment in infrastructure and equipment, inadequate funding and supply of essential drugs, critical shortages of qualified health providers, demotivated health staff due to low pay and poor conditions of service, work stoppages, and health provider attitudes towards clients, among others (WHO-AFRO, 2011). Whereas in well-established settings such as in developed countries, high quality health services attract patients (Houttekier et al., 2014). We found that the majority of the adult deaths occurred in a health facility which is consistent with previous studies conducted in other countries (Cohen et al., 2015; Dasch et al., 2015; Grunier et al., 2007; Houttekier et al., 2014; Howell et al., 2015; Jayaraman & Joseph, 2013; Pollock, 2015; Reich et al., 2013). However, a study conducted in Ethiopia found that the majority of the deaths occurred outside health facilities (Anteneh et al., 2013).

Majority of adult deaths occurred in rural areas and more than half of the deaths occurred at home. This finding is expected as rural areas in most sub-Saharan African countries have inadequate health facil-

Table 3

Unadjusted and adjusted multivariate logistic regression odds ratios for the probability of an adult dying in a health facility by predictor variables, Zambia 2010–2012.

Predictor variable	Unadjusted Odds Ratio	(95% CI)	Adjusted Odds Ratio	(95% CI)
Residence				
Rural (Ref.)	1.00		1.00	
Urban	2.45***	(1.83, 3.29)	1.89**	(1.27, 2.81)
Sex				
Male (Ref.)	1.00		1.00	
Female	1.17	(0.93, 1.47)	1.38**	(1.09, 1.75)
Age group				
15–24 (Ref.)	1.00		1.00	
25–34	0.91	(0.60, 1.37)	0.75	(0.47, 1.20)
35–44	1.09	(0.68, 1.77)	0.82	(0.48, 1.39)
45–54	0.79	(0.45, 1.40)	0.61	(0.30, 1.26)
55–59	0.89	(0.44, 1.79)	0.85	(0.37, 1.92)
Education level				
None (Ref.)	1.00		1.00	
Primary	1.64	(0.91, 2.96)	1.74	(0.91, 3.32)
Secondary	2.90***	(1.61, 5.22)	2.52**	(1.37, 4.63)
Higher	4.28***	(2.09, 8.79)	3.38**	(1.43, 8.02)
Marital status				
Never married (Ref.)	1.00		1.00	
Married/living with partner	1.14	(0.83, 1.57)	1.34*	(1.00, 1.80)
Widowed/Divorced/Separated	0.99	(0.65, 1.53)	1.01	(0.64, 1.60)
Occupation				
Skilled Agricultural/Fishery Workers (Ref.)	1.00		1.00	
Legislators/Senior Officials/Managers	5.07**	(1.73, 14.86)	3.49*	(1.02, 11.88)
Professionals	3.66*	(1.30, 10.33)	2.52	(0.79, 7.97)
Technicians/Associate Professionals	3.38**	(1.44, 7.91)	1.76	(0.64, 4.85)
Clerks	2.67***	(1.51, 4.73)	1.73	(0.95, 3.13)
Service/Shop/Market Sales Workers	2.72***	(1.79, 4.14)	1.95**	(1.29, 2.94)
Craft & related Trade Workers	3.44**	(1.26, 9.39)	2.75*	(1.09, 6.95)
Plant & Machine Operators/Assemblers	3.12***	(1.83, 5.31)	2.50**	(1.43, 4.34)
Elementary Occupations	1.93***	(1.42, 2.63)	1.39	(0.97, 1.99)
Cause of death				
HIV disease (Ref.)	1.00		1.00	
Diseases of circulatory system	0.80	(0.46, 1.38)	0.88	(0.49, 1.57)
Tuberculosis	0.84	(0.49, 1.45)	0.90	(0.53, 1.50)
Accident & Injuries	0.38***	(0.24, 0.62)	0.33***	(0.18, 0.61)
Malaria	0.94	(0.51, 1.72)	0.83	(0.46, 1.49)
Neoplasms	1.65	(0.76, 3.61)	1.20	(0.53, 2.70)
Pneumonia/ARI	1.60	(0.68, 3.80)	1.95	(0.77, 4.97)
Diabetes mellitus	1.75	(0.55, 5.54)	1.14	(0.31, 4.21)
Diarrhoeal diseases	0.82	(0.26, 2.64)	0.84	(0.30, 2.31)
All other causes	0.75	(0.52, 1.08)	0.71	(0.49, 1.02)

Note: *p < 0.05, **p < 0.01, ***p < 0.001; Ref.=Reference Category; CI=Confidence Interval

ities, and where they are available, they are not easily accessible to the rural population due to long distances. In Zambia, one of the National Health Policy's guiding principles is to ensure equitable access to health care services for all people irrespective of their geographical location in order to attain its goal of health for all. It recommends that health facilities should be located within a radius of 5 km for sparsely populated settlements (Ministry of Health [Zambia], 2012, p. 35). However, this is not the case in most rural areas of the country. In addition, the health care system in rural areas is not immune to the chronic problems of poor funding and human resource constraints. These challenges discourage people in rural areas from accessing health services. In contrast, urban settings have more health facilities that are easily accessible within reasonable distances, although they experience the same funding and human resource constraints; but not to the same extent as the rural health facilities.

Consistent with previous findings in Canada (Goodridge et al., 2010; Jayaraman & Joseph, 2013) and Germany (Dasch et al., 2015), we found that adult deaths were more likely to occur in a health facility in urban areas than in rural areas. Rural-urban residence as an

ecological factor was a predictor of the place of death among adult decedents aged 15 to 59 years.

The majority of adult deaths occurred in males, as expected. However, more than half of the adult female deaths occurred in a health facility. Sex of the adult decedents was significantly associated with the place of death. Consistent with previous studies in Ethiopia (Anteneh et al., 2013), in Japan (Kinoshita et al., 2014), in Scotland (Black et al., 2016), in Germany (Dasch et al., 2015), in Canada (Jayaraman & Joseph, 2013) and in United States (Grunier et al., 2007; Lackan et al., 2009), adult female deaths were more likely to occur in a health facility compared to male adult deaths. Males were more likely to die at home. In the sub-Saharan African context, possible explanations for this situation could be: first, a sizeable proportion of these deaths may be attributed to maternal causes; a point that requires further investigation. Second, while women play the traditional role of caring and they are available to provide home based care for men when they are ill up to the point of death; on the contrary, men are not available to provide the same care to women—instead—the women are taken to be hospitalized at a health facility where they die

(Anteneh et al., 2013; Dasch et al., 2015; Kinoshita et al., 2014). Additionally, women are also more likely to access and utilize health care services than men (Zyaambo, Siziya, & Fylkesnes, 2012).

We did not find a significant association between age and place of death. In the descriptive analysis, the proportions of adult deaths across the age groups were not significantly different from each other with respect to the place of death. Even when age at death was included as a discrete variable in the model, it was still not significant (results not shown). Our finding is contrary to previous studies conducted in other countries (Anteneh et al., 2013; Black et al., 2016; Cardenas-Turanzas et al., 2007; Costantini et al., 2000; Gomes et al., 2011; Hong et al., 2011; Jayaraman & Joseph, 2013; Lin & Lin, 2007). Previous studies found that age was a strong predictor of place of death. Younger people below the age of 60 years were more likely to die at home while older people above the age of 60 years were more likely to die in a health facility/nursing home.

The level of educational attainment of adult decedents was significantly associated with place of death. The likelihood of an adult death occurring in a health facility increased with the level of education. The opposite was the case for an adult death occurring at home with respect to the education level. Our finding is consistent with previous studies in Ethiopia (Anteneh et al., 2013), Korea (Cohen et al., 2015) and Mexico (Cardenas-Turanzas et al., 2007; Cohen et al., 2015). Education enlightens people, who in turn transform their attitudes and beliefs as they become more knowledgeable about health services. In addition, education is associated with income, which enables access to modern health services (Phiri & Ataguba, 2014; Zyaambo et al., 2012). It is, therefore, an important resource that facilitates healthy lifestyles, access to and utilization of health care. Contrary results, however, were found in Italy, Spain, Belgium and Czech (Cohen et al., 2015) were those with higher educational attainment were more likely to die at home than those with low educational attainment. In the United States of America there was no difference found with educational attainment (Cohen et al., 2015).

More than half of the adult deaths occurred among the married/living with partner decedents. The majority of these individuals died in a health facility. Consistent with previous studies in: Ethiopia (Anteneh et al., 2013), Canada (Goodridge et al., 2010; Jayaraman & Joseph, 2013), United States of America (Grunier et al., 2007), and Mexico (Cardenas-Turanzas et al., 2007) we found that adult decedents who were married/living with a partner were more likely to die in a health facility compared to the never married decedents. Conversely, Cohen et al., (2015) in a study comparing 14 countries and 4 continents, Africa excluded, found that married people were more likely to die at home compared with the divorced, unmarried and widowed. In most sub-Saharan African countries, marriage is still valuable and common. In Zambia, for example, 62 per cent of men and 52 per cent of women were currently married (Central Statistical Office (CSO), [Zambia], Ministry of Health (MoH), [Zambia], & ICF International, 2014). Marital status is sometimes used as a proxy indicator for social support.

The type of occupation of an individual may influence the place of death. We found that most of the adult deaths occurred among those with elementary occupations, closely followed by those in agricultural and fishery occupations. However, with the exception of the skilled agricultural/fishery workers, more than half of the adult deaths occurred in a health facility. Before adjusting for other explanatory variables in the model, all the adult deaths by occupation were more likely to occur in a health facility when compared to the skilled agricultural/fishery workers. However, after controlling for other explanatory variables in the model, only legislators/senior officials/managers; service/shop/market sales workers; craft and related trade workers; and plant and machine operators/assemblers were more likely to die in a health facility when compared to the skilled agricultural/fishery worker decedents. We expected that adult decedents in white-collar occupations were more likely to die in a health facility as white-collar occupations are associated with high levels of

education. Therefore, the type of occupation was a significant predictor of the place of death. Our finding, however, contradicts the study conducted in Ethiopia (Anteneh et al., 2013), that found no significant association between occupation type and the place of death, despite finding a high proportion of decedents who were professionals, managers or clerks dying in health facilities. Previous studies conducted in United States of America, Canada, Germany, Mexico, Japan, United Kingdom, did not include type of occupation in their examination of factors associated with place of death.

Consistent with previous findings, we found empirical evidence that HIV/AIDS was the leading cause of death among adult decedents in Zambia (Central Statistical Office (CSO), 2014; Mudenda et al., 2011). More than half of the adult decedents with HIV/AIDS died in a health facility. Additionally, more than one-third of the adults with HIV/AIDS died at home. The cause of death has been associated with the place of death as certain health conditions can only be treated at a health facility. Among the causes of death, we found that only accidents and injuries were significantly associated with the place of death. Adult deaths attributed to accidents and injuries were less likely to occur in a health facility compared to HIV/AIDS decedents. This was expected as accidents and injuries mostly happen away from the health facilities, for example, victims may die on the spot in a road traffic accident. Our finding is in agreement with the study in Ethiopia (Anteneh et al., 2013). The study in Ethiopia also found a significant difference between HIV/AIDS and cardiovascular diseases, which we did not find. The study also did not find a significant difference between HIV/AIDS and respiratory health conditions, tuberculosis, infectious and parasitic diseases in Ethiopia, which we identified. This is expected to some extent as some of these diseases are AIDS-related and may therefore not be significantly different from HIV/AIDS. We anticipated that the notion of “going-home-to-die” among the HIV/AIDS decedents would be exhibited as reported in other studies (Foster & Williamson, 2000; Whyte, 2005) in sub-Saharan Africa, but this was not the case. We found about 67 per cent of the deceased adults whose cause of death was neoplasms died in a health facility. Black et al., (2016) found that those with cancer were more likely to die in hospitals whereas those with Ischaemic Heart Disease (IHD) their common place of death was at home.

Our study has contributed to the literature on the place of death and adult mortality in sub-Saharan Africa. Specifically, it contributes to understanding the determinants of the place of death among young and middle aged adults in age group 15 to 59 years in sub-Saharan Africa. Our findings emphasize the need for researchers to understand factors that influence the place of death from a social ecological context in sub-Saharan Africa. Furthermore, for policy makers, our findings provide knowledge that may be relevant in targeting interventions at adults based on the determinants of place of death thereby assisting in improving access to and the utilization of health care services. Educational attainment, urban-rural residence and gender are the main determinants of place of death in a health facility in the study. Therefore, programmes that encourage educational attainment, investment in health infrastructure in rural areas and the health care system as a whole will contribute to improving the health status of adults. Equally important are programmes that improve the social status of women through gender mainstreaming in sub-Saharan Africa. The strength and novelty of the study is in its utilization of the 2010–2012 SAVVY a nationally representative survey of Zambia and that our findings could be extrapolated to other sub-Saharan African countries.

Limitations

Our study has several limitations. First, the lack of specific information on the timing of the utilization of health services, that is, whether it was early, late, or very late among adult decedents, which would have an effect on the place of death. We were unable to determine this; however, it does not affect the findings. Second, the

duration of an illness can also influence the place of death, however, this information was not collected and we were unable to determine the effect of the duration of illness on the place of death. It has not affected our findings. Third, due to the cross-sectional nature of the data utilized we could not establish causality as well as the direct linkage between place of death and access and utilization of health care services. We used place of death as a proxy for access and utilization of health care services (Marmot, Ryff, Bumpass, Shipley, & Marks, 1997; Reich et al., 2013; Reidpath & Allotey, 2007; Zyaambo et al., 2012). Fourth, the lack of detailed information on the income levels of the adult decedents meant that the effect of income on the place of death could not be determined, however, the use of variables such as education, type of residence and occupation that are associated with income is indicative of what the effect of income on the place of death would be. Fifth, the dataset we used did not have variables such as religion and ethnicity, as the survey did not collect this information. This meant that we were unable to establish the effect of religion on the place of death, which is important, as some religious beliefs have a profound impact on the place of death. We also could not establish the association between ethnicity and the place of death as previous studies did (Coupland et al., 2011; Lackan et al., 2009). In a sub-Saharan African context, cultural practices, customs and beliefs can influence the place of death. Sixth, we used verbal autopsy data, which has its own limitations in terms of biases in the reporting of events about the deceased. However, at the aggregate level, these biases are minimized and do not affect the study results (Mudenda et al., 2011).

Despite these limitations, our study provides clear findings on the factors associated with place of death in a sub-Saharan African context using the case of Zambia. Our findings are generally consistent with and reinforce what previous existing studies conducted elsewhere found. The findings also reaffirm the social ecological theory that interrelationships between individuals and the environment influence health outcomes. Individual factors e.g. education attainment and gender, and environmental factors, that is, urban-rural residence influenced the place of death.

Conclusion

Determinants of the place of death among young and middle aged adults may to some extent be conceptualized as a proxy for access and the utilization of health services in resource limited setting such as sub-Saharan Africa. More than half of adult deaths occurred in health facilities. We found that sex, level of educational attainment, type of occupation and rural-urban residence were strong predictors of the probability of where adults die whereas marital status was a weak predictor. Factors associated with illness, that is, the cause of death, with the exception of accidents and injuries, were not significantly different from HIV/AIDS adult deaths occurring in a health facility. Using this information, for health planners and decision-makers, improving education levels and investing in health infrastructure may contribute to improving access to and the utilization of health services among adults, especially in rural settings. In addition, the need to improve the quality of health services to prevent avoidable adult deaths is necessary in line with the post 2015 development agenda of sustainable development goals. Future research should investigate the effect of religion, ethnicity and the duration of illness on the place of death in sub-Saharan Africa. There is also need to understand the events that happen prior to death that determine the place of death through qualitative research in sub-Saharan Africa. Therefore, factors associated with either health facility deaths or home deaths are equally important and better perceived from a social ecological perspective.

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