



HHS Public Access

Author manuscript

Crisis. Author manuscript; available in PMC 2017 November 01.

Published in final edited form as:

Crisis. 2016 November ; 37(6): 445–453. doi:10.1027/0227-5910/a000383.

Suicide Attempts and Deaths in Sofala, Mozambique, From 2011 to 2014:

Who, Where, and From What

Bradley H. Wagenaar^{1,2}, Manuela Raunig-Berhó¹, Vasco Cumbe^{3,4}, Deepa Rao^{1,5}, Manuel Napúa⁶, and Kenneth Sherr^{1,2}

¹ Department of Global Health, University of Washington, Seattle, WA, USA

² Health Alliance International, Seattle, WA, USA

³ Sofala Provincial Health Directorate, Department of Mental Health, Ministry of Health, Beira, Mozambique

⁴ Beira Central Hospital, Department of Medicine, Psychiatric Services, Beira, Mozambique

⁵ Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, USA

⁶ Beira Operations Research Center, Ministry of Health, Beira, Mozambique

Abstract

Background—Mozambique was recently estimated to have the highest suicide rate in Africa.

Aims—To fill a knowledge gap on suicide attempts and deaths in Mozambique.

Method—We reviewed a census of 898 emergency psychiatric consultations from March 2013 to July 2014 and 1,173 violent death autopsy records from June 2011 to August 2014 at Beira Central Hospital in Sofala, Mozambique.

Results—In all, 18.0% of emergency psychiatric consultations were suicide attempts. Females were disproportionately represented (68.3%, $p < .001$), and the mean age was 26.8 years. Rat poison was used in 66% of attempts, followed by unspecified methods (19.8%), and unspecified poisoning (6.8%). Of the violent death autopsies, 10% were suicides. Suicide deaths were more

Bradley H. Wagenaar Department of Global Health, University of Washington, Harris Hydraulics Laboratory, Box 357965, Seattle, WA 98195-7965, USA, Tel. +1 (206) 221-4970, Fax +1 (206) 685-8519, wagenaarb@gmail.com.

The authors have no conflicts of interest to report.

About the authors

Dr. Wagenaar is Acting Instructor in the Department of Global Health at the University of Washington. He is also a technical advisor for Health Alliance International, a center of the Department of Global Health at the University of Washington, WA, USA.

Ms. Raunig-Berhó is an MPH student in the Department of Global Health at the University of Washington, WA, USA.

Dr. Cumbe is a licensed psychiatrist, Director of Psychiatry and the Mental Health Service at the Beira Central Hospital, and Provincial Head of the Mental Health Service in Sofala Province, Mozambique. He is also a PhD student in the Department of Psychiatry at the Federal University of São Paulo, Brazil.

Dr. Rao is a licensed clinical psychologist and Associate Professor in the Departments of Global Health and Psychiatry and Behavioral Sciences at the University of Washington (UW), WA, USA. She is Director of the UW Program on Global Mental Health and Associate Director of the UW Global Health MPH Program.

Dr. Napúa is a medical doctor and Scientific Director at the Beira Operations Research Center in Beira, Mozambique.

Dr. Sherr is Associate Professor in the Department of Global Health (DGH) at the University of Washington, WA, with adjunct appointments in epidemiology and industrial and systems engineering. He is also Director of Implementation Science for Health Alliance International and Co-Director of the DGH's PhD program in implementation science.

likely to be male (67.3%, $p < .001$), and the mean age was 30.8 years. Common methods were hanging (43.2%), unspecified substance (28.0%), or rat poison (26.3%). Common places of death were the hospital or hospital transit (46.4%) and the household (35.7%). Female suicide deaths more often involved toxic substances and males more often employed hanging.

Conclusion—Females more often present with suicide attempts, but deaths due to suicide are more frequent among males. Females more often use toxic substances, whereas males more often use lethal methods, such as hanging. Policies to reduce the availability or toxicity of rat poison should be considered.

Keywords

suicide attempts; methods of suicide; mental health systems; epidemiology; Mozambique

Over 800,000 individuals globally are estimated to have died from suicide in 2012 (World Health Organization [WHO], 2014), although this number is very likely an under-estimate due to misclassification of suicide deaths (Rockett & Thomas, 1999) as well as limited coverage of vital registration (Mathers, Fat, Inoue, Rao, & Lopez, 2005) and autopsy systems (Kapusta et al., 2011) in many countries. Trends in suicide rates have shown disparate patterns globally over the past decade. While estimated suicide rates have dropped over 45% in low- and middle-income countries (LMICs) in the Western Pacific Region, rates have increased over 35% in LMICs in the African region (WHO, 2014). Across all countries, there are an estimated 1.9 male suicides for every female suicide and 20 suicide attempts for each completed suicide (WHO, 2014). Unfortunately, WHO member states only report suicide mortality statistics; globally there are no official or routinely collected data on suicide attempts.

Sex ratios for completed suicide differ markedly across the world, most often attributed to differences in methods of suicidal behavior and specific sociocultural factors (Biddle et al., 2010; Booth, 1999; Gunnell & Eddleston, 2003; Park, Ahn, Lee, & Hong, 2014; Phillips, Li, & Zhang, 2002; Phillips, Yang, et al., 2002). Globally, women are more likely to attempt suicide, but often employ a less lethal method than males do, leading to the so-called suicide paradox whereby females are more likely to attempt suicide but males have higher rates of death due to suicide (Bertolote et al., 2005; Nock et al., 2008; Schrijvers, Bollen, & Sabbe, 2012). This is not the case in China, where females have historically had higher rates of completed suicide than males, although this pattern has been changing rapidly. This distinctive pattern of high rates of female suicide in China has been attributed to elevated rates of completed suicide among rural women using highly toxic dichlorvos and parathion organophosphate pesticides, along with unique sociocultural factors in China (Eyer et al., 2003; Hendin et al., 2008; Meng, 2002; Phillips, Li, et al., 2002; WHO, 2014; Zhang & Ma, 2012).

A number of risk factors for death due to suicide have been consistently observed across countries and cultures, including: the presence of a mental disorder, family history of psychopathology, stressful life events in the past month, young or old age, low socioeconomic status, and previous suicide attempts (Phillips, Yang, et al., 2002; Vijayakumar, John, Pirkis, & Whiteford, 2005; Vijayakumar & Rajkumar, 1999; Yoshimasu,

Kiyohara, & Miyashita, 2008). Across eight diverse emergency-care settings in LMICs, self-poisoning has been identified as the primary method of attempted suicide across all locations, accounting for 69–98% of attempts. In neighboring South Africa, 71% of suicide attempts identified in the ER were female and the mean age was 21 years (Fleischmann et al., 2005). Of 300 attempted suicides presenting at the Department of Emergency Medicine at a large referral hospital in Dar es Salaam, Tanzania, the mean age of attempted suicide was 23.7 years, 68.7% of attempts were females, and 91% of attempts employed self-poisoning in the form of medication or poison (Ndosi & Waziri, 1997). In a South African study of patients seen for a suicide attempt at a referral hospital in Bloemfontein, the median age of patients was 22 years, 68.9% were female, and drug overdose was the most common method of attempt (du Toit et al., 2008).

Previous suicide prevention efforts in diverse settings have focused on: (a) reducing the availability or toxicity/danger of commonly used suicide methods such as pesticides, domestic gasoline, or handguns; (b) media interventions to ensure responsible reporting practices around suicide to limit imitation or glamorization of suicide; (c) school-based interventions around crisis management and coping skills; and (d) ensuring positive attitudes toward suicidal patients and understanding of local idioms of distress among medical professionals (Bhana, Petersen, Baillie, Flisher, & The Mhapp Research Programme Consortium, 2010; Etzersdorfer, Vijayakumar, Schony, Grausgruber, & Sonneck, 1998; Hagaman et al., 2013; Hendin et al., 2008; Khan, 2005; WHO, 2001, 2008a, 2008b). Up to 45% of individuals who die by suicide visit their primary care physician within 1 month of suicidal death and over 75% of suicide deaths have contact with their provider within 1 year of death, highlighting the missed opportunities for prevention without adequate integration of mental health and targeted suicidal screening into primary care settings (Luoma, Martin, & Pearson, 2002).

According to the 2014 WHO world suicide report, Mozambique has the seventh highest suicide rate in the world (27.4/100,000), with a rate over double the global average of 11.4 per 100,000 (WHO, 2014). However, Mozambique has no published national suicide statistics, no comprehensive vital registration system, and, to our knowledge, there are only two peer-reviewed publications that mention suicide. The first details that suicides made up 4.2% of deaths due to injury in Maputo City in the year 2000 (Nizamo, Meyrowitsch, Zacarias, & Konradsen, 2006), and the second indicates that, of injury-related maternal deaths from 1991 to 1995 in Maputo, 33% were due to suicide (Granja, Carla, Zacarias, & Bergstrom, 2002).

In terms of emergency room (ER) psychiatric services for self-harm, at psycho-trauma centers in northern Uganda, 5.2% of consultations were for suicide attempts (Nakimuli-Mpungu et al., 2013). In South Africa, 17.7% of all consultations of youth under age 19 referred in a psychiatric department were for attempted suicide (Schlebusch, 1985). In Ethiopia, 19.2% of patients attending an adult outpatient psychiatry clinic had previously attempted suicide, with the most common attempt method being hanging (Mekonnen & Kebede, 2011). In Malawi, deaths due to suicide accounted for 17% of autopsies conducted at the Queen Elizabeth Central Hospital, with a mean age of 33.4 and 77% of deaths being male; in this setting the most common method of suicide death was self-poisoning with

carbamate rat poison or organophosphate pesticides (79%), followed by hanging (19%; Dzumalala, Milner, & Liomba, 2006). In Uganda, a retrospective review of suicide death records found a mean age of 30.6, a majority of suicide deaths among males (77%), and hanging as the most common method of death (63%), followed by self-poisoning (26%; Kinyanda, Wamala, Musisi, & Hjelmeland, 2011).

To date, there are no peer-reviewed studies in Mozambique on the epidemiologic profile (age, gender profile, method used) of suicide deaths. In addition to a lack of detailed understanding around suicide deaths in Mozambique, there are no peer-reviewed studies in Mozambique detailing the demographic and epidemiologic profile of utilization of ER psychiatric services, including suicide attempts.

The purpose of the present study was to address these gaps in the mental health literature, representing the first assessment of attempted suicide identified in the ER by age, sex, and diagnosis, as well as analyzing deaths due to suicide and suicide methods used. We aim for these data to inform future policies and programs to improve the prevention, care, and treatment for mental disorders and suicidal behavior across Mozambique and other similar LMICs.

Method

Study Setting

Sofala Province, Mozambique, has approximately two million inhabitants (United States Central Intelligence Agency, 2014a) and 14 psychiatric technicians, two adult psychiatrists, one child psychiatrist, and 11 clinical psychologists providing mental health services operating out of 18 health facilities. Twelve of 13 districts have at least one clinic providing outpatient mental health-care services, primarily located at large central or district-level referral hospitals. In the Mozambican system, psychiatric technicians can diagnose and prescribe psychotropic medications following a 2-year training program in place since the first cadre graduated in 1996 (dos Santos, 2011).

The Beira Central Hospital is one of three quaternary-level specialist facilities nationwide and provides the largest number of outpatient psychiatric consultations of any facility in Sofala Province, in addition to inpatient and emergency room psychiatric services. Adult outpatient, inpatient, and emergency psychiatric services at the Beira Hospital are staffed by two adult psychiatrists (one Mozambican and one Cuban), two psychiatric technicians, and three clinical psychologists. All Mozambican Ministry of Health clinics use the International Classification of Diseases, Tenth Edition (ICD-10) code (WHO, 1992) system to categorize diagnoses of mental disorders.

Emergency Room Record Review

We reviewed 898 ER psychiatric consultations, representing a census of those conducted at Beira Central Hospital in Sofala, Mozambique, from March 2013 to July 2014. At intake to the ER, if the attending provider recognizes that a given patient has an issue that is psychiatric in nature, they refer the patient to the on-call psychiatric specialist (psychiatrist or psychiatric technician) to conduct a specialized psychiatric consultation. The ER

psychiatric consultation registries are hand-written, bound books filled out by the psychiatric specialist at the time of consultation and include the variables of: date of consultation, age, gender, visit number (first visit or second+ visit), and diagnosis. Two abstractors entered data in Excel (Version 2013). Inconsistencies between data abstractors and illegible handwriting were resolved by revisiting the registry and cross-checking with the psychiatric specialist responsible for a given entry.

Legal Medicine Record Review

We reviewed 1,173 autopsies for violent deaths, representing a census of those conducted at Beira Central Hospital legal medicine department from June 2011 to August 2014. For suicide data, two data abstractors entered data in Excel 2013, and any inconsistencies between data abstractors or illegible handwriting were resolved by revisiting the registry and/or crosschecking with the legal medicine expert responsible for the registry entry. All available variables were abstracted and included: age, sex, race, date of autopsy, location of death, and cause of death.

Statistical Analyses and Variable Classification

ER diagnoses were tabulated and two-sample t tests were used to compare the continuous age distributions of subjects with each diagnosis with the mean age of the rest of the sample. Chi-squared tests were used to test for gender differences among diagnoses. Fisher's exact test was used if any cell was less than 5. Owing to reviewer concerns about missing data and multiple testing, we used a Bonferroni adjustment for the 11 statistical tests of diagnostic categories, resulting in an alpha level of 0.05/11, or 0.0045. Little's test (Little, 1988) was implemented to test for the missing completely at random (MCAR) assumption for all ER covariates (age, gender, % first visit); this resulted in a *p* value of .21, failing to reject the null hypothesis of MCAR.

Suicide death records were tabulated by suicide method, and procedures similar to the aforementioned ones were used to compare the continuous age distributions of each method (two-sample t tests), as well as gender differences (χ^2 tests or Fisher's exact). For each suicide method, the three most common places of death were tabulated. A one-sample test for proportions using the null hypothesis of 50% female and 50% male was used to test gender differences among all suicide deaths. Little's test applied to age and gender resulted in a *p* value of .44, failing to reject the null hypothesis of MCAR. A Bonferroni adjustment was applied for the five statistical tests of suicide methods, resulting in a *p*-value cut-off of .05/5, or .01. We used Stata 13 for all statistical analyses.

Results

Emergency Room Psychiatric Consultations

Of those without missing data (83.4% for age, 89.8 for gender, and 92.2 for visit number), the mean age of ER consultations was 30.0 (*SD* = 11.5), 59.1% of consultations were males, and 64.5% were first-visit consultations (see Table 1). A total of 149 (16.6%) records were missing data for age, 92 (10.2%) for gender, 70 (7.8) for visit number, and 30 (3.3%) were missing diagnostic information. Those missing gender information had a mean age of 30.1

years ($SD = 13.1$), and 29.4% ($n = 27$) were diagnosed with delirium, 21.7% ($n = 20$) with a suicide attempt, and 17.4% ($n = 16$) with psychomotor agitation. Of those missing age information, 46.0% were female ($n = 63$), and 27.5% ($n = 41$) were diagnosed with delirium, 17.5% ($n = 26$) with psychomotor agitation, and 14.8% ($n = 22$) with a suicide attempt.

Of the 898 ER psychiatric consultations, 18% ($n = 162$) were due to suicide attempt, with other common consultations for delirium ($n = 259$, 28.8% of consultations), psychomotor agitation ($n = 132$, 14.7%), psychosis ($n = 66$, 7.3%), and behavioral disorder due to psychoactive substance use ($n = 52$, 5.8%). Intoxication by rat poison (known locally as Rutex) was the most common method of suicide attempt ($n = 107$, 66.0% of attempts), followed by unspecified method ($n = 32$, 19.8%), unspecified medication intoxication ($n = 11$, 6.8%), and unspecified chemical intoxication ($n = 5$, 3.1%; see Table 2). Those presenting for a suicide attempt were significantly younger (mean age = 26.8 years, $p < .001$) than the average psychiatric ER patient, and were significantly more likely to be female (68.3% female, $p < .001$; Table 2).

Suicide Deaths From Legal Medicine Violent Death Autopsy Records

Of the 1,173 autopsies for violent death conducted from June 2011 to August 2014, 118 (10.1%) were suicides, with other common records being accidents ($n = 777$, 66.2%), homicides ($n = 185$, 15.8%), and natural deaths ($n = 93$, 66.2%). The mean age of suicide deaths was 30.8 ($SD = 15.8$, range = 11–81), and there were significantly more male deaths ($n = 76$, 64.4% male, $p < .001$; Table 1). Seven individuals (5.9%) were missing age information and five (4.2%) were missing gender information. Missing age and gender data were co-occurring: of the seven individuals missing age information, four were missing gender information, and of the five individuals missing gender information, four were missing age information. Of those with missing age data, 57% ($n = 4$) died by hanging and 43% ($n = 3$) died by rat poison. Of those with missing gender data, 40% ($n = 2$) died by hanging, 40% ($n = 2$) died by rat poison, and 20% ($n = 1$) died by unspecified toxic substance.

The most common method of completed suicide was hanging ($n = 51$, 43.2%), followed by unspecified toxic substance ($n = 33$, 28.0%), intoxication by rat poison ($n = 31$, 26.3%), jumping from a high place ($n = 2$, 1.7%), and asphyxia ($n = 1$, 0.8%; Table 3). Men more often employed hanging (22.5% female) and women more often employed an unspecified toxic substance (46.9% female), although this difference was not statistically significant after controlling for multiple comparisons ($p = .04$). The majority of deaths for toxic substance ingestion occurred at the hospital (54.8%–75.0%), whereas the majority who used hanging died in their household ($n = 31$, 67.4%).

Discussion

This study sought to elucidate the epidemiologic profile of suicide attempts within the emergency care setting, as well as suicide deaths from violent death autopsies conducted at a large referral hospital in Sofala, Mozambique. We found that suicide attempts were the second most common cause of ER psychiatric visits in Central Mozambique, following delirium. Individuals presenting for suicide attempts were predominantly young females

(2.2:1 female-to-male ratio) who had ingested rat poison. By contrast, suicide deaths were most often young males (2.1:1 male-to-female ratio) who had ingested a toxic substance or employed hanging.

Our data indicate that the Mozambican suicide profile is similar to well-established Western suicide patterns whereby women attempt suicide at a higher rate than males, but die from suicide at lower rates, potentially due to the use of less-deadly suicide methods. Our findings are in line with a recent systematic review of suicidal behavior in African countries, finding that the most frequent methods of suicide across diverse settings are hanging and pesticide poisoning, and that men are, on average, around three times as likely to die from suicide as women (Mars, Burrows, Hjelmeland, & Gunnell, 2014). Our findings that females make up 68% of attempted suicide patients parallels similar studies conducted in Tanzania and South Africa, finding that females made up between 69 and 71% of attempted suicides in hospital settings (du Toit et al., 2008; Fleischmann et al., 2005; Ndosi & Waziri, 1997). Furthermore, our finding of 64% of suicide deaths among males is similar to other retrospective autopsy reviews in Malawi and Uganda, which both found that 77% of suicide deaths occurred among males (Dzamalala et al., 2006; Kinyanda et al., 2011).

That both suicide attempts and deaths were mostly among young individuals (48% of deaths under age 26) is not necessarily surprising given the young age structure of the population in Mozambique (67% of the population is under the age of 25 (United States Central Intelligence Agency, 2014b), yet highlights the importance of targeting youth and teenagers in future suicide prevention interventions. In our sample, suicide deaths were an average of 4 years older than suicide attempts, a trend that is similar across other studies in sub-Saharan Africa (du Toit et al., 2008; Dzamalala et al., 2006; Fleischmann et al., 2005; Kinyanda et al., 2011; Ndosi & Waziri, 1997). The preponderance of suicide attempts and deaths attributable to the ingestion of rat poison is similar to high rates of carbamate rodenticide self-poisoning in Malawi, suicide attempt case reports from Nigeria, and unintentional and intentional poisonings in South Africa (Dzamalala et al., 2006; Eze, 2014; Veale, Wium, & Muller, 2013).

Given that the majority of suicide deaths in our sample follow the ingestion of a toxic substance, and that a combined 64% of these patients die only after reaching the hospital, the improvement of hospital treatment protocols and training of emergency providers in poisoning interventions could have a significant effect on survival rates. Additional mixed-methods implementation science could target increased access and effectiveness of emergency transport or improved linkages and referral networks for patients at rural or peripheral facilities. Assessing and implementing strategies to manage stigma toward suicide and, more generally, to individuals suffering from mental health issues among the general population and health-care workers may be essential to obtain more accurate reporting of suicide and suicide attempts (Hagaman et al., 2013). Furthermore, the potentially stigmatizing attitudes of health workers, as well as the community as a whole, toward suicide victims likely decreases help-seeking and may negatively influence health worker behavior toward the care and treatment for suicide victims (Keusch, Wilentz, & Kleinman, 2006; Osafo, Knizek, Akotia, & Hjelmeland, 2012).

The next steps for these analyses could be to conduct specific mixed-method studies on: (a) community and health worker stigmatizing attitudes toward suicide victims and associated family or friends; and (b) death rates for suicide attempts with various methods to determine how to better improve treatment and suicide case-fatality rates. Future studies could focus on rural areas, as they may have higher suicide case-fatality rates, either due to less access to effective treatments or the use of different suicide methods, such as fertilizer, which may have higher death rates.

Mixed-method studies should additionally be conducted to understand why rat poison is so frequently used and to determine other common methods used for suicide attempts in rural and urban areas. Policies shown to be effective in other LMIC settings should then be adapted and tested around potential restriction of access to these common toxic substances, such as the use of safe storage boxes, or the reformulation of pesticides to be less toxic (Bhana et al., 2010; Etzersdorfer et al., 1998; Hagaman et al., 2013; Hendin et al., 2008; Khan, 2005; Konradsen et al., 2007; WHO, 2001, 2008a, 2008b). Historically, many deaths in the United States were linked to unintentional and intentional poisoning by highly toxic carbamate rodenticide (Waseem, Perry, & Bomann, 2010), leading to policies restricting public access to these substances and the substitution of Coumadin and other long-acting derivatives that are considered relatively safe (Centers for Disease Control and Prevention, 1997). More generally, residential access to organophosphate pesticides in the United States has been limited since the 1996 Food Quality Protection Act, which rapidly led to a 62% decrease in hospitalizations linked to organophosphate exposures from 1995 to 2004 (Sudakin & Power, 2007). Similar local, national, and regional regulatory policies and systems-level interventions are necessary to avoid preventable deaths from the ingestion of highly toxic rodenticides or other organophosphate poisons in LMICs; however, enforcement of bans on toxic substances can prove difficult, as South Africa has experienced following its 2012 ban on the toxic carbamate rodenticide Aldicarb (London & Rother, 2013). While it is easier to affect pesticide restriction/toxicity than restricting access to means of hanging, prevention interventions for hanging could center on changing perceptions of hanging as an easy, painless, effective, or rapid method of suicide (Biddle et al., 2010).

With the well-established connection between media reporting practices and the potential for suicide contagion, efforts could be directed toward policies and norms around suicide reporting in Mozambique. Case-control and other population-based epidemiologic studies should be prioritized to understand the population burden of suicidal behavior and Mozambican-specific risk factors for suicide attempts or deaths. Currently, less than 1% of the population is estimated to have access to basic mental health services in Mozambique (WHO, 2011); thus, the improved integration of mental health care, depression/mood disorder screening, and suicide prevention into primary care could have a positive impact on population rates of suicide attempts and deaths.

One major limitation of the present analyses is that our data are exclusively from one large referral hospital serving the northern region of Mozambique. While our data are a census of available records from this central hospital, we have no clear understanding of the population coverage of these suicide attempt or death data. Previous efforts to improve vital

registration systems in Mozambique have often excluded violent deaths from natural deaths. Going forward we urge these systems to be financed and built in parallel, rather than in a fragmented fashion – all deaths should be treated equally, whether violent or natural. In the shorter term, efforts should be made to triangulate all available suicide death information to estimate population and subpopulation burden. While the WHO has recently published data indicating that Mozambique has the highest suicide rate in Africa, the current low levels of vital registration, lack of an effective national reporting system on violent cause of death, lack of transparency in data sources used for the WHO estimates for Mozambique, and the lack of other rigorous peer-reviewed population-level suicide analyses preclude any strong statements regarding the validity of the published WHO statistics.

Another limitation centers on missing information regarding age, gender, and visit number. This issue was most pronounced in the ER psychiatric review, with 17% of age information, 10% of gender information, and 8% of visit number information missing. We cannot rule out systematic causes of missing data, although we hypothesize that missing data are a random subset of the dataset as the pattern of emergency diagnoses for those missing age or gender information mirrors that seen in the full sample. In addition, the age patterns of those for whom gender information was missing and the gender distribution of those for whom age data were missing also do not deviate significantly from those seen in the full sample.

Last, given the highly stigmatized nature of suicide attempts and deaths in Mozambique, it is likely that those who seek care from an ER setting or those who have their death registered in local records may differ systematically from those missed by these routine systems. However, violent death registration and autopsy coverage is supposed to cover the entire population catchment area of the Beira Central Hospital.

Conclusion

The majority of suicide attempts and deaths in Sofala, Mozambique, are among young individuals under the age of 30 who ingest toxic substances, with the single most common substance being rat poison. Females more often attempt suicide using toxic substances, while males make up the majority of suicide deaths and more often use hanging. Given recent WHO publications highlighting Mozambique as having the highest suicide rate in Africa, and seventh globally, this initial systems-level study should urgently be followed up with larger population-based studies to determine the risk factors, burden, and epidemiologic profile of suicide attempts across Mozambique. Policies and interventions to decrease access, toxicity, and/or allure around utilizing rat poison as a suicide method should be concurrently examined. Regional approaches may be necessary to regulate the sale and current widespread availability of highly toxic organophosphate pesticides and rodenticides in southern Africa. Systems-level assessments should be carried out to ensure those who attempt suicide receive optimal care given the constraints on the public-sector health system in Mozambique.

Acknowledgments

This work was supported by the African Health Initiative of the Doris Duke Charitable Foundation and the University of Washington's Royalty Research Fund. K. Sherr was supported by Grant Number K02TW009207

from the Fogarty International Center. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

This study was approved by the institutional review boards at the University of Washington and the Mozambican National Institute of Health.

References

- Bertolote JM, Fleischmann A, De Leo D, Bolhari J, Botega N, De Silva D, Wasserman D. Suicide attempts, plans, and ideation in culturally diverse sites: The WHO SUPRE-MISS community survey. *Psychological Medicine*. 2005; 35(10):1457–1465. doi:10.1017/S0033291705005404. [PubMed: 16164769]
- Bhana A, Petersen I, Baillie KL, Flisher AJ, The Mhapp Research Programme Consortium. Implementing the World Health Report 2001 recommendations for integrating mental health into primary health care: A situation analysis of three African countries: Ghana, South Africa and Uganda. *International Review of Psychiatry*. 2010; 22(6):599–610. doi: 10.3109/09540261.2010.536152. [PubMed: 21226648]
- Biddle L, Donovan J, Owen-Smith A, Potokar J, Longson D, Hawton K, Gunnell D. Factors influencing the decision to use hanging as a method of suicide: Qualitative study. *The British Journal of Psychiatry: The Journal of Mental Science*. 2010; 197(4):320–325. doi:10.1192/bjp.bp.109.076349. [PubMed: 20884956]
- Booth H. Pacific island suicide in comparative perspective. *Journal of Biosocial Science*. 1999; 31(4): 433–448. [PubMed: 10581875]
- Centers for Disease Control and Prevention. Poisonings associated with illegal use of Aldicarb as a rodenticide – New York City, 1994–1997. *Morbidity and Mortality Weekly Report (MMWR)*. 1997; 46(41):961–963. [PubMed: 9347907]
- dos Santos, PF. Availability of mental health services in Mozambique. University of Lisbon; Portugal: 2011. (Unpublished master's thesis) Retrieved from <http://run.unl.pt/handle/1036217708>
- du Toit E, Kruger J, Swiegers S, van der Merwe M, Calitz F, Philane L, Joubert G. The profile analysis of attempted-suicide patients referred to Pelonomi Hospital for psychological evaluation and treatment from 1 May 2005 to 30 April 2006. *South African Journal of Psychiatry*. 2008; 14(1):20–25.
- Dzamalala CP, Milner D. a, Liomba NG. Suicide in Blantyre, Malawi (2000–2003). *Journal of Clinical Forensic Medicine*. 2006; 13(2):65–69. doi:10.1016/j.jcfm.2005.08.006. [PubMed: 16271492]
- Etzersdorfer E, Vijayakumar L, Schony W, Grausgruber A, Sonneck G. Attitudes towards suicide among medical students: Comparison between Madras (India) and Vienna (Austria). *Social Psychiatry and Psychiatric Epidemiology*. 1998; 33:104–110. [PubMed: 9540384]
- Eyer F, Meischner V, Kiderlen D, Thiermann H, Worek F, Haberkorn M, Eyer P. Human parathion poisoning. A toxicokinetic analysis. *Toxicological Reviews*. 2003; 22(3):143–163. [PubMed: 15181664]
- Eze CU. Attributes of patients with suicide attempts seen at the Niger Delta University Teaching Hospital within a year: A case series. *Tropical Medicine & Surgery*. 2014; 2(3):2–6. doi: 10.4172/2329-9088.1000170.
- Fleischmann A, Bertolote JM, De Leo D, Botega N, Phillips M, Sisask M, Wasserman D. Characteristics of attempted suicides seen in emergency-care settings of general hospitals in eight low- and middle-income countries. *Psychological Medicine*. 2005; 35(10):1467–1474. doi: 10.1017/S0033291705005416. [PubMed: 16164770]
- Granja, Carla A, Zacarias E, Bergstrom S. Violent deaths: The hidden face of maternal mortality. *BJOG – An International Journal of Obstetrics and Gynaecology*. 2002; 109:5–8. [PubMed: 11843374]
- Gunnell D, Eddleston M. Suicide by intentional ingestion of pesticides: A continuing tragedy in developing countries. *International Journal of Epidemiology*. 2003; 32(6):902–909. doi: 10.1093/ije/dyg307. [PubMed: 14681240]

- Hagaman AK, Wagenaar BH, McLean KE, Kaiser BN, Winskell K, Kohrt BA. Suicide in rural Haiti: Clinical and community perceptions of prevalence, etiology, and prevention. *Social Science & Medicine* (1982). 2013; 83:61–69. doi:10.1016/j.socscimed.2013.01.032. [PubMed: 23465205]
- Hendin, H.; Phillips, MR.; Vijayakumar, L.; Pirkis, J.; Wang, H.; Yip, P.; Fleischmann, A. *Suicide and suicide prevention in Asia*. WHO; Geneva, Switzerland: 2008.
- Kapusta ND, Tran US, Rockett IRH, De Leo D, Naylor CPE, Niederkrotenthaler T, Sonneck G. Declining autopsy rates and suicide misclassification: A cross-national analysis of 35 countries. *Archives of General Psychiatry*. 2011; 68(10):1050–1057. doi:10.1001/archgenpsychiatry.2011.66. [PubMed: 21646567]
- Keusch G, Wilentz J, Kleinman A. Stigma and global health: Developing a research agenda. *The Lancet*. 2006; 367:525–527.
- Khan MM. Suicide prevention and developing countries. *Journal of the Royal Society of Medicine*. 2005; 98(10):459–463. doi:10.1258/jrsm.98.10.459. [PubMed: 16199814]
- Kinyanda E, Wamala D, Musisi S, Hjelmeland H. Suicide in urban Kampala, Uganda: A preliminary exploration. *African Health Sciences*. 2011; 11(2):219–227. [PubMed: 21857853]
- Konradsen F, Pieris R, Weerasinghe M, van der Hoek W, Eddleson M, Dawson A. Community uptake of safe storage boxes to reduce self-poisoning from pesticides in rural Sri Lanka. *BMC Public Health*. 2007; 7(13)
- Little RJ. A test of missing completely at random for multivariate data with missing data. *Journal of the American Statistical Association*. 1988; 83(404):1198–1202.
- London L, Rother H-A. Poisoning and pesticides. *The South African Medical Journal*. 2013; 103(9): 595–596. [PubMed: 24344418]
- Luoma J, Martin C, Pearson J. Contact with mental health and primary care providers before suicide: A review of the evidence. *American Journal of Psychiatry*. 2002; 159(6):909–916. [PubMed: 12042175]
- Mars B, Burrows S, Hjelmeland H, Gunnell D. Suicidal behaviour across the African continent: A review of the literature. *BMC Public Health*. 2014; 14(1):606. doi:10.1186/1471-2458-14-606. [PubMed: 24927746]
- Mathers CD, Fat DM, Inoue M, Rao C, Lopez AD. Counting the dead and what they died from: An assessment of the global status of cause of death data. *Bulletin of the World Health Organization*. 2005; 83:171–177. [PubMed: 15798840]
- Mekonnen D, Kebede Y. The prevalence of suicidal ideation and attempts among individuals attending an adult psychiatry out-patient clinic in Gondar, Ethiopia. *African Health Sciences*. 2011; 11(1): 103–107. [PubMed: 21572865]
- Meng L. Rebellion and revenge: The meaning of suicide of women in rural China. *International Journal of Social Welfare*. 2002; 11(4):300–309.
- Nakimuli-Mpungu E, Alderman S, Kinyanda E, Alden K, Betancourt TS, Alderman JS, Musisi S. Implementation and scale-up of psycho-trauma centers in a post-conflict area: A case study of a private-public partnership in northern Uganda. *PLoS Medicine*. 2013; 10(4) doi:10.1371/journal.pmed.1001427.
- Ndosi NK, Waziri MC. The nature of parasuicide in Dar es Salaam, Tanzania. *Social Science and Medicine*. 1997; 44(1):55–61.
- Nizamo H, Meyrowitsch D, Zacarias E, Konradsen F. Mortality due to injuries in Maputo City, Mozambique. *International Journal of Injury Control and Safety Promotion*. 2006; 13(1):1–6. [PubMed: 16537218]
- Nock MK, Borges G, Bromet EJ, Alonso J, Angermeyer M, Beautrais A, Williams D. Cross-national prevalence and risk factors for suicidal ideation, plans and attempts. *The British Journal of Psychiatry: The Journal of Mental Science*. 2008; 192(2):98–105. doi:10.1192/bjp.bp.107.040113. [PubMed: 18245022]
- Osafo J, Knizek B, Akotia C, Hjelmeland H. Attitudes of psychologists and nurses toward suicide and suicide prevention in Ghana: A qualitative study. *International Journal of Nursing Studies*. 2012; 49:691–700. [PubMed: 22177569]

- Park S, Ahn MH, Lee A, Hong JP. Associations between changes in the pattern of suicide methods and rates in Korea, the US, and Finland. *International Journal of Mental Health Systems*. 2014; 8(1): 22. doi:10.1186/1752-4458-8-22. [PubMed: 24949083]
- Phillips MR, Li X, Zhang Y. Suicide rates in China, 1995-99. *Lancet*. 2002; 359(9309):835-840. doi: 10.1016/S0140-6736(02)07954-0. [PubMed: 11897283]
- Phillips MR, Yang G, Zhang Y, Wang L, Ji H, Zhou M. Risk factors for suicide in China: A national case-control psychological autopsy study. *Lancet*. 2002; 360(9347):1728-1736. doi:10.1016/S0140-6736(02)11681-3. [PubMed: 12480425]
- Rockett IRH, Thomas BM. Reliability and sensitivity of suicide certification in higher-income countries. *Suicide and Life-Threatening Behavior*. 1999; 29(2):141-149. [PubMed: 10407967]
- Schlebusch L. Self-destructive behavior in adolescents. *South African Medical Journal*. 1985; 68(11): 792-795. [PubMed: 4071325]
- Schrijvers DL, Bollen J, Sabbe BGC. The gender paradox in suicidal behavior and its impact on the suicidal process. *Journal of Affective Disorders*. 2012; 138(1-2):19-26. doi:10.1016/j.jad.2011.03.050. [PubMed: 21529962]
- Sudakin DL, Power LE. Organophosphate exposures in the United States: A longitudinal analysis of incidents reported to poison centers. *Journal of Toxicology and Environmental Health. Part A*. 2007; 70(2):141-147. doi:10.1080/15287390600755224. [PubMed: 17365575]
- United States Central Intelligence Agency. Central Intelligence Agency World Factbook: Mozambique. 2014a. Retrieved from <https://www.cia.gov/library/publications/the-world-factbook/geos/mz.html>
- United States Central Intelligence Agency. Central Intelligence Agency World Factbook: Mozambique. 2014b. Retrieved from <https://www.cia.gov/library/publications/the-world-factbook/geos/mz.html>
- Veale D, Wium C, Muller G. Toxicovigilance I: A survey of acute poisonings in South Africa based on Tygerberg Poison Information Centre data. *The South African Medical Journal*. 2013; 103(5):293-297. [PubMed: 23971117]
- Vijayakumar L, John S, Pirkis J, Whiteford H. Suicide in developing countries (2): Risk factors. *Crisis: The Journal of Crisis Intervention and Suicide Prevention*. 2005; 26(3):112-119.
- Vijayakumar L, Rajkumar S. Are risk factors for suicide universal? A case-control study in India. *Acta Psychiatrica Scandinavica*. 1999; 99(6):407-411. [PubMed: 10408261]
- Waseem M, Perry C, Bomann S. Cholinergic crisis after rodenticide poisoning. *Western Journal of Emergency Medicine*. 2010; 11(5):524-527. [PubMed: 21293782]
- World Health Organization. The ICD-10 classification of mental and behavioral disorders: Clinical descriptions and diagnostic guidelines. Author; Geneva, Switzerland: 1992.
- World Health Organization. The World Health Report 2001: Mental health – new understanding, new hope. Author; Geneva, Switzerland: 2001.
- World Health Organization. Clinical management of acute pesticide intoxication: Prevention of suicidal behaviours. Author; Geneva, Switzerland: 2008a.
- World Health Organization. Preventing suicide: A Resource for media professionals. Author; Geneva, Switzerland: 2008b.
- World Health Organization. Mental Health Atlas 2011: Mozambique. Author; Geneva, Switzerland: 2011.
- World Health Organization. Preventing suicide – A global imperative. Author; Geneva, Switzerland: 2014.
- Yoshimasu K, Kiyohara C, Miyashita K. Suicidal risk factors and completed suicide: Meta-analyses based on psychological autopsy studies. *Environmental Health and Preventive Medicine*. 2008; 13(5):243-256. doi:10.1007/s12199-008-0037-x. [PubMed: 19568911]
- Zhang J, Ma Z. Patterns of life events preceding the suicide in rural young Chinese: A case control study. *Journal of Affective Disorders*. 2012; 140(2):161-167. doi:10.1016/j.jad.2012.01.010. Patterns. [PubMed: 22595373]

Table 1

Demographic characteristics of 898 emergency room (ER) psychiatric consultations conducted March 2013 to July 2014 and 118 suicide deaths from autopsies conducted June 2011 to August 2014 at Beira Central Hospital, Sofala Province, Mozambique

Characteristic	898 ER psychiatric consultations	118 suicide deaths
	<i>N</i> (%) unless noted	<i>N</i> (%) unless noted
Age, <i>M</i> (<i>SD</i>)	30.0 (11.5)	30.8 (15.8)
<18	36 (4.0)	19 (16.1)
18-25	274 (30.5)	38 (32.2)
26-35	273 (30.4)	19 (16.1)
36-45	100 (11.1)	14 (11.9)
46-55	28 (3.1)	10 (8.5)
56+	38 (4.2)	11 (9.3)
Missing	149 (16.6)	7 (5.9)
Gender		
Female	330 (36.8)	37 (31.4) *
Male	476 (53.0)	76 (64.4) *
Missing	92 (10.2)	5 (4.2)
Visit number		
1	534 (59.5)	Not recorded
2+	294 (32.7)	
Missing	70 (7.8)	

Note.

* $p < .001$ using one-sample test for proportion with null hypothesis of 50% female, 50% male.

Table 2

Proportion of consultations for suicide attempt, along with: visit number, age, and gender breakdown of 898 patients seeking care from emergency room psychiatric services from March 2013 to July 2014 at Beira Central Hospital, Sofala Province, Mozambique

Consultation type (n, %) ^a	Mean age (SD)	Percent female	% First visit
All other consultations combined (706, 78.6)	30.7 (11.7) *	35.2 *	58.2 *
Suicide attempt (162, 18.0)	26.8 (10.1) *	68.3 *	89.5 *
Chemical intoxication – rat poison (107, 66.0)	26.9 (9.9) *	65.5 *	88.0 *
Suicide attempt – unspecified (32, 19.8)	27.9 (12.3)	68.8 *	90.3 *
Medication intoxication – unspecified (11, 6.8)	24.9 (7.5)	81.8	90.0
Chemical intoxication – unspecified (5, 3.1)	21.8 (5.5)	80.0	100.0
Chemical intoxication – battery acid (3, 1.9)	All missing	100.0	100.0
Chemical intoxication – batteries (2, 1.2)	24 (0)	50.0	100.0
Chemical intoxication – gasoline (1, 0.62)	Missing	100.0	100.0
Suicide attempt – hanging (1, 0.62)	36 (0)	100.0	100.0
Missing consultation data (30, 3.3)	30.8 (10.9)	32.0	74.1

Note.

^a Percentages for subgroupings are out of the subgroup total, not out of the total $N = 898$.

* Significantly different from the average age, gender distribution, or % first visit using Bonferroni adjustment for 11 statistical tests, resulting in p -value cut-off of $.05/11 = .0045$.

Table 3

Most common suicide methods and place of death by age and gender for 118 suicide deaths from violent death autopsies conducted June 2011 to August 2014 at Beira Central Hospital's legal medicine department, Sofala Province, Mozambique

Suicide method (<i>n</i> , %) ^a	Mean age (<i>SD</i>)	Proportion female	Three most common places of death (<i>n</i> , %)
Hanging (51, 43.2)	33.7 (18.2)	22.5	Household (31, 67.4) Transit to hospital (3, 6.5) In public (3, 6.5) Missing (5, 9.8)
Toxic substance – unspecified (33, 28.0)	27.5 (13.0)	46.9	Beira Central Hospital (24, 75.0) Household (3, 9.4) In public (3, 9.4) Missing (1, 3.0)
Chemical intoxication – rat poison (31, 26.3)	29.0 (14.6)	34.5	Beira Central Hospital (17, 54.8) Household (5, 16.1) Transit to hospital (3, 9.7) Missing (0, 0)
Jumped from high place (2, 1.7)	35 (2.8)	50.0	Beira Central Hospital (2, 100.0) Missing (0, 0)
Asphyxia (1, 0.8)	51 (0.0)	0.0	Household (1, 100.0) Missing (0, 0)

Note.

^aNo missing data for suicide method.

* Significantly different from the average age, gender distribution, or % first visit using Bonferroni adjustment for five statistical tests of suicide methods, resulting in a *p*-value cut-off of $.05/5 = .01$.