

Causes of mortality among female sex workers: Results of a multi-country study

Brian Willis,^{a*} Emily Perttu,^a Meghan Fitzgerald,^{a,b} Heather Thompson,^{a,c} Swarna Weerasinghe,^{a,d} and Wendy Macias-Konstantopoulos^{a,e}

^aGlobal Health Promise, Portland, OR, United States

^bU.S. Overseas Cooperative Development Council, Washington DC, United States

^cSchulich School of Medicine, McMaster Faculty of Medicine, Grey Bruce Health Services, Hamilton, Ontario, Canada

^dDepartment of Community Health and Epidemiology, Dalhousie University, Faculty of Medicine, Halifax, Nova Scotia, Canada

^eCenter for Social Justice and Health Equity, Department of Emergency Medicine, Massachusetts General Hospital and Harvard Medical School, Boston, MA, United States

Summary

Background The vast majority of studies on female sex workers (FSW) focus on causes of morbidity while data on causes of mortality are scarce. In low- and middle-income countries, where civil registry and vital statistics data are often incomplete and FSW may not be identified as such in official registries, identifying causes of mortality among FSW has proven challenging.

Methods As part of a larger investigation on the maternal health of FSW, the current study used the Community Knowledge Approach (CKA) to identify causes of mortality among FSW in LMIC across three global regions in 2019. The CKA, validated to identify maternal, neonatal, and jaundice-associated deaths among women living in a community, was employed to identify deaths of any cause among communities of FSW. Study participants, recruited by in-country partner non-governmental organizations (NGOs) working with local FSW, provided detailed information about FSW deaths in their communities.

Findings 1280 FSW participated in 165 group meetings through which 2112 FSW deaths were identified. Of these reported deaths, 57.9% occurred in 2019 and 57.2% were among women aged 20-29. Causes of death included abortion (35.5%), other maternal causes (16.6%), suicide (13.6%), murder (12.5%), unclassified causes (11.6%), HIV/AIDS (7.9%), and accidents (3.2%). A total of 3659 children lost their mothers.

Interpretation Maternal death comprised the leading cause of FSW mortality in our sample. This methodology can be used by local governments and NGOs to identify unrecognized patterns and clusters of FSW deaths in near-real time and urgently steer targeted preventative strategies.

Funding New Venture Fund.

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Keywords: Female sex workers (FSW); Maternal mortality; Maternal health; Abortion; Violence; Suicide; HIV/AIDS

Introduction

Female sex workers (FSW) are a vulnerable population at high risk for adverse health outcomes, including premature mortality. However, the vast majority of studies on FSW health focus on morbidity, particularly on HIV, especially in low- and middle-income countries (LMIC).¹ Although understanding causes of morbidity among FSW is important, mortality in this population

is relatively understudied. While some documented morbidities among FSW also contribute to mortality, such as HIV, there are other sources of mortality among FSW that are not well-described or captured by research on morbidity. Morbidities that can increase mortality risk include, but are not limited to, HIV, cardiovascular disease, physical and sexual abuse, mental health problems, and drug use. For example, in some African countries, up to 55% of FSW are infected with HIV, while in Kenya, 17.0% of FSW had a diagnosed cardiovascular disease.^{2,3} In addition, many FSW are at risk for physical and sexual violence; among FSW in Côte d'Ivoire,

*Corresponding author.

E-mail address: bwillis@globalhealthpromise.org (B. Willis).

eClinicalMedicine

2022;52: 101658

Published online 21 September 2022

<https://doi.org/10.1016/j.eclinm.2022.101658>

<https://doi.org/10.1016/j.eclinm.2022.101658>

Research in context

Evidence before this study

We searched PubMed and CINAHL for peer-reviewed studies in English published on or after January 1, 2000. Search terms included ["sex work" or "sex worker" or "prostitution" or "prostitute"] and ["mortality" or "death"]. Our search did not identify any global studies on causes of mortality among female sex workers (FSW). Two studies on HIV-related mortality among FSW are available, one conducted in a middle-income country (India) and one in a low-income country (Burkina Faso). A third study focused on causes of maternal mortality among FSW in a lower-middle income country (Cambodia). An additional study from a high-income country (USA) documented cause-specific mortality among FSW from 1967 to 1999. The four studies that contained mortality data on FSW reported small numbers of deaths using varying methodologies. Though all of these publications reported data from single-country studies, our search also yielded one publication that reported results from a systematic review and meta-analysis of morbidity and mortality data from four highly marginalized populations in high income countries that specifically included "sex workers." Published in *The Lancet* in 2018, results indicated that "sex workers were the least well investigated" population, and no data on FSW were included in the standardized all-cause mortality ratio meta-analysis.

Added value of this study

Our study examines causes of death among 2112 FSW in eight countries reported to have occurred between 2014 and 2019. To our knowledge, this is the first multi-country study to identify deaths of FSW and reports the largest number of FSW deaths collected in a single study. Our study helps address the significant evidence gap related to causes of mortality among FSW. This study also demonstrates that, among communities of FSW, our methodology, the Community Knowledge Approach (CKA), can be reliably used to collect information about causes of FSW mortality.

Implications of all the available evidence

Our findings suggest that causes of death among FSW may differ from the leading causes of morbidity among FSW and that in some countries, maternal causes are the primary contributor of FSW deaths. Leading causes of mortality may vary geographically within and across countries, underscoring the need for local and national studies that engage FSW and sex worker organizations. Data on FSW mortality are obviously critical for preventing premature deaths among FSW. However, since many FSW are also mothers, their deaths also directly affect the lives and health of thousands of children. When implemented on an ongoing basis, researchers and outreach workers at non-governmental organizations could use the CKA to uncover unregistered deaths, thereby helping to identify patterns and clusters of death and implement targeted preventative interventions.

the prevalence of physical and sexual abuse was 53.6% and 43.2%, respectively.^{4–6} FSW also experience substance use disorders, which can increase their risk for other health problems such as hepatitis C infection, overdoses, and other related health problems.^{4,7} Finally, many FSW experience mental health problems; among FSW in LMIC, the pooled prevalence of depression was 41.8% with 22.8% experiencing suicide ideation and 6.3% a recent suicide attempt.⁸

FSW risk for adverse health outcomes, including mortality, is exacerbated by the barriers to care they experience. Access barriers include distance to health care services, limited financial means, fear of being exposed, lack of confidentiality, and discriminatory treatment by health care providers.^{9,10} Such barriers also decrease access to sexual and reproductive health care services, including contraception, which may result in unplanned pregnancies and excess morbidity and mortality from complications of unsafe abortion.^{11,12}

In contrast to the many studies on FSW morbidity, we only identified four English-language studies on FSW mortality published since 2000. Each of these studies used a different methodology to record deaths of FSW. The largest of these studies, conducted in the U.S., reported 100 deaths of FSW with the leading causes being violence and overdose (19.0% and 18.0% respectively).¹³ A study from India reported 45 deaths of FSW, of which 88.9% were due to HIV.¹⁴ One study, from Cambodia reported 32 maternal deaths with abortion ($n=13$, 40.6%) being the single leading cause of death.¹⁵ The smallest study was from Burkina Faso and reported 4 deaths out of 47 FSW (one due to TB, one due to wasting disease, and two from unknown causes).¹⁶ Another study used HIV infection rates among FSW to estimate 106,000 HIV-related deaths among FSW globally in 2008, of which 98,000 would have occurred in sub-Saharan Africa.¹⁷ Finally, a systematic review and meta-analysis on morbidity and mortality in high-income countries among four highly marginalized populations including "sex workers" reported "sex workers were the least well investigated" population and no FSW studies were included in the standardized all-cause mortality ratio meta-analysis.¹⁸

A major challenge to identifying causes of FSW mortality in many LMIC is the lack of systematic and comprehensive health data collection across the population. Identifying maternal deaths is especially challenging in countries that lack robust civil registry and vital statistics (CRVS) systems.¹⁹ To compensate for incomplete data on deaths of women, numerous death counting methodologies have been developed specifically to identify maternal deaths that occur outside of health facilities. These methods include MADE-IN/MADE-FOR, the Maternal Death Surveillance and Response (MDSR) system, civil registrations, household surveys, Reproductive Age Mortality Studies (RAMOS), the sisterhood methodology, informant method, and community

knowledge approach.^{20–26} Within resource-poor populations, identifying deaths among vulnerable groups such as FSW, refugees, and internally displaced persons, is arguably even more difficult than identifying maternal deaths in the general population.

Modifying existing methodologies to account for deaths among difficult to reach populations can be effective. For example, the informant method, a methodology that uses community informants and focus groups to identify maternal deaths was modified for use in humanitarian settings, such as refugee camps. This methodology was validated and found to have a sensitivity between 55.0% and 72.5% in refugee camps in four countries, performing better than the existing surveillance systems in three of the four camps.²⁵

Given the dearth of mortality data among FSW, the absence of CRVS systems for reliably capturing FSW deaths, as well as the expense of household surveys and related logistical challenges with a highly mobile population, we used the community knowledge approach (CKA), to identify causes of death among communities of FSW. The CKA was validated in a study that identified maternal, neonatal, and jaundice-associated deaths among women living in a community with an 80–100% sensitivity.²⁶ Recognized advantages of the CKA include its high sensitivity for identifying deaths and the relatively short time amount of time required to employ this death-counting method. While this methodology was not designed specifically for use among FSW communities nor designed to capture data on every death and every cause of death, we aimed to identify causes of mortality among FSW in the communities included in this study. Thus, while our methodology cannot provide a comprehensive representation of all FSW deaths within these countries, our results can inform the funding and intervention strategies pursued by UN agencies, governments, donors, and non-governmental organizations (NGOs) to target and prevent deaths of FSW.

Our methodology borrows and expands on similar methodologies that have been developed to identify deaths among women and other hard-to-reach vulnerable populations in resource-poor settings, many of which occur outside of health facilities and thus cannot be accounted for in health facility records. Unlike in its validation study that focused on identifying maternal, neonatal, and jaundice-associated deaths among women living in a community, we leveraged the CKA methodology to identify all causes of death among FSW in these communities. In addition, our study did not rely on interviewing family members, a common element of other studies on maternal death in low-resourced communities, because many FSW do not disclose their employment as sex workers to their families and many migrate away from their families who therefore may not know about their deaths or have accurate information about the circumstances surrounding their deaths.

Methods

Study design and participants

This study is part of a larger exploratory study conducted across eight countries between January 16, 2019 and October 1, 2019 and designed to examine the maternal health of FSW. Using the CKA methodology, groups of FSW were convened to elicit and discuss health information corresponding to FSW in their communities. Here, we present the data collected on reports of FSW deaths from all causes.

Country site selection for this study was based on various criteria including: large number of FSW; high prevalence of maternal deaths or high maternal mortality rate; high HIV infection rates among FSW; presence of local partner organizations; and contribution to the overall geographic regional diversity of the study. Based on these factors, we conducted our research in eight countries: Angola, Brazil, The Democratic Republic of the Congo (DRC), India, Indonesia, Kenya, Nigeria, and South Africa (Table 1).

Local sex worker organizations (SWOs) and NGOs that provide services to FSW in these eight countries served as local partners. Within each country, we focused on select cities based on the recommendations of local and national partners with consideration for urban and rural settings and the location where partners work with FSW. Within each city, local partners determined the best locations to convene groups of FSW for data collection based on their knowledge of venues that would be acceptable to study participants. Eligible FSW were recruited from a wide range of settings, including bars, brothels, on the streets, and in parks and fields.

Local SWOs and NGOs partners screened potential study participants based on predetermined eligibility criteria: (1) age ≥ 18 years; (2) mother to at least one child aged ≤ 10 years; (3) engaged in full-time sex work during the three preceding years; and (4) interactive with other FSW in the community. The minimum age of 18 years ensured that participants were not commercially sexually exploited children. Participants also had to have at least one child aged 10 years or younger to complete the maternal and child health components of the larger study, however, during data gathering discussion groups, participants reported deaths of all FSW in the community, including those with and without children.

Eligible participants were informed that study participation was voluntary and would not impact services. Interested participants were verbally consented for study participation and indicated consent with an “x” or check mark on the consent form to include FSW who do not read or cannot sign their names. No personal identifiers were collected by study staff. Local partners ensured each enrolled participant was restricted to a single group when more than one group was convened in any given location. Group sessions were conducted in safe and private locations as recommended by local

Date	Country	Cities	Total # of focus groups (% of all groups)	Total # of participants (% of all participants)
January	Brazil	Rio de Janeiro Salvador São Paulo	18 (10.9%)	80 (6.3%)
January	Angola	Luanda	12 (7.3%)	71 (5.5%)
February	South Africa	Cape Town Johannesburg Durban Port Shepstone	26 (15.7%)	144 (11.2%)
March	Indonesia	Jakarta	12 (7.3%)	76 (5.9%)
April	India	Bangalore Chennai Salem Nashik Hyderabad Warangal Gudibanda	20 (12.1%)	152 (11.9%)
May	Kenya	Nairobi Mombasa Kisumu	18 (10.9%)	175 (13.7%)
August	Nigeria	Lagos Calabar Abuja	32 (19.4%)	312 (24.4%)
September	Democratic Republic of the Congo	Bukavu Kinshasa	27 (16.4%)	270 (21.1%)
Total			165	1280

Table 1: Focus groups.

partners and lasted an average of 60 minutes. Data collection was facilitated by BW, the lead field researcher (LR), who recorded extensive notes and verbatim statements about deaths reported during the sessions. Local partner staff or interpreters approved by local partners and trained by the LR provided translation when needed. Participants received refreshments and compensation based on the amounts recommended by local SWOs and NGOs. In Angola and Brazil, local partners trained and supervised by the LR facilitated the sessions.

The study protocol, consent forms, and questionnaire were reviewed and approved by the Institutional Ethics Review Board of Portland State University, USA (Protocol #184888). Additionally, each local partner approved the use of the data collection questionnaire and study forms after having the opportunity to review them and ensure they met local ethical standards and participant protection requirements.

Data collection and quality assurance

We convened groups of FSW living or working in specific communities within each city and asked about deaths of other FSW in that community. In this study,

FSW participants served as key informants about deaths of other FSW in their community. We used a questionnaire to obtain detailed information about each death, including: the deceased woman's name; age at time of death; city and country where the death occurred; year it occurred; and if she was pregnant. If the participant reported that the woman died after an abortion, she was asked about the method of abortion and this was recorded when known. Details about deaths during or after giving birth were recorded along with any other known details about the death, such as where the woman died (home, brothel, hospital, or other location) and how many children she had at the time of death. During group meetings, data were hand recorded onto the questionnaire form by the LR.

Following each session, the LR and local partner together reviewed all deaths reported across all groups in that location and identified potential duplicates. If any two deaths matched on two reported details, only the details of the first reported death were recorded in the database.

Information from the questionnaires was transferred into an Excel spreadsheet and all entries were compared to the original questionnaires by the LR and the data entry assistant, who verified the accuracy of the entry

for each reported death. Finally, the LR and another member of the research team performed regular data-entry quality reviews for accuracy, completeness, and duplication by using original handwritten records from each group session to match entries.

Data analysis

Deaths across all years (2014–2019) were combined for each country and age group. Based on reported details, deaths were coded by the researchers and classified as abortion, murder, HIV/AIDS, suicide, accidents, and other causes. Maternal deaths were coded in accordance with the International Classification of Diseases 10th Revision (ICD-10)²⁷ classification system and further categorized as direct or indirect maternal deaths by the LR and a second member of the research team (HT) who is an obstetrician/gynecologist. Any categorical discrepancies were resolved through discussion and thoughtful review of the ICD-10 criteria until consensus was reached. There were no instances of substantial disagreement that required the involvement of additional research team members to resolve. Once all reported deaths were classified and categorized, frequency tables were created to organize deaths by cause, country, age group, and location of death.

Role of funding

The funder of this study had no role in study design, data collection, data analysis, data interpretation, or manuscript preparation.

Results

A total of 165 groups involving 1280 FSW participants, met in 24 cities across eight countries (Table 1) resulting in the report of 2112 unique FSW deaths occurring between January 2014 and September 2019. Of the reported deaths, more than half ($n=1233$, 58.4%) were reported to have occurred in 2019 and nearly a quarter ($n=509$, 24.1%) in 2018, with the remainder ($n=370$, 17.5%) reported to have occurred between 2014 and 2017. Data were collected in each country during different months in 2019, limiting the number of deaths during 2019 that could be reported in each country. For example, data collection was completed in Brazil by the end of January 2019 and in Angola and South Africa by the end of February 2019. Therefore, FSW in countries visited later in 2019, including Nigeria and the DRC (August and September 2019, respectively), had a longer look-back period in 2019 from which to report deaths.

All causes of death

Maternal deaths, including maternal suicides, comprise the leading cause of death among FSW ($n=1320$, 62.

5%), followed by murder ($n=265$, 12.5%), HIV/AIDS ($n=157$, 7.4%), non-maternal suicides ($n=114$, 5.4%), other causes including heart disease or unknown causes ($n=86$, 4.1%), accidents ($n=67$, 3.2%), tuberculosis ($n=57$, 2.7%), overdose ($n=31$, 1.5%), and cancer ($n=15$, 0.7%). Table 2 reports causes of death by country.

Maternal causes of death

The leading cause of the 1,320 maternal deaths (MD) reported was abortion, resulting in 750 deaths (56.8% of all MD, 35.5% of all deaths), followed by suicide ($n=174$, 12.8% of all MD, 8.2% of all deaths) and hemorrhage ($n=112$, 8.2% of all MD, 5.3% of all deaths). Of the 174 maternal suicides, 103 (59.2%) occurred during pregnancy, 35 (20.1%) within two months postpartum, and the remaining 36 (20.7%) suicides are late maternal deaths that occurred 2–12 months postpartum.

An additional 45 maternal deaths reported were classified as *indirect* MD (3.4% of all MD, 2.1% of all deaths) and included 10 HIV (0.8% of all MD) and 9 infection-related (0.7% of all MD) deaths. The majority of MD were reported in the three sub-Saharan African countries of Kenya, Nigeria, and the DRC ($n=1235$, 93.6% of all MD) and abortion accounted for more than half the maternal deaths reported in each of these countries (range: 56.6%–60.3%). Collectively, abortion-related deaths in these three sub-Saharan African countries ($n=708$) accounted for 94.4% of all abortion-related deaths reported across the eight countries. Table 3 provides a detailed account of maternal deaths by country and cause.

Non-maternal causes of death

Participants reported a total of 792 non-maternal deaths (non-MD), accounting for 37.5% of all deaths identified across the study (Table 2). Murder was the leading non-maternal cause of death, resulting in 265 deaths (33.5% of all non-MD) which includes 35 deaths that would otherwise be classified as maternal deaths. The largest number of murders, nearly one third of all murders ($n=83$, 31.3%), were reported in Kenya.

HIV/AIDS was the reported cause of 157 non-MD (19.8% of all non-MD, 7.4% of all deaths). The largest number of these deaths were reported in Nigeria and Kenya ($n=39$ and 37, respectively), but the highest percentage of total country non-MD due to HIV/AIDS were reported in Indonesia and India (20.7% and 20.5%, respectively) where the absolute number of HIV/AIDS-related deaths were notably less than in Nigeria and Kenya.

Although suicide was the second leading cause of all deaths with 288 total suicides (13.6% of all deaths) reported, non-maternal suicides ($n=114$, 39.6% of all suicides) comprised the third leading cause of non-maternal deaths accounting for 14.4% of all non-MD.

	Maternal Deaths*	Murder	HIV/AIDS	Suicide	Other/Unknown	Accident	Tuberculosis	Overdose	Cancer	Total Deaths by Country (% all deaths)
Number of deaths (% of deaths in country)										
Brazil	1 (2.6%)	13 (33.3%)	1 (2.6%)	1 (2.6%)	8 (20.5%)	1 (2.6%)	—	9 (23.1%)	5 (12.8%)	39 (1.8%)
Angola	6 (11.5%)	8 (15.4%)	3 (5.8%)	—	26 (50.0%)	6 (11.5%)	3 (5.8%)	—	—	52 (2.5%)
South Africa	23 (13.6%)	75 (44.4%)	32 (18.9%)	7 (4.1%)	7 (4.1%)	5 (3.0%)	6 (3.6%)	9 (5.3%)	5 (3.0%)	169 (8.0%)
Indonesia	12 (20.7%)	6 (10.3%)	12 (20.7%)	3 (5.2%)	6 (10.3%)	6 (10.3%)	1 (1.7%)	9 (15.5%)	3 (5.2%)	58 (2.7%)
India	43 (32.6%)	22 (16.7%)	27 (20.5%)	15 (11.4%)	9 (6.8%)	10 (7.6%)	4 (3.0%)	—	2 (1.5%)	132 (6.3%)
Kenya	312 (59.0%)	83 (15.9%)	37 (7.0%)	38 (7.2%)	7 (1.3%)	13 (2.5%)	36 (6.8%)	3 (0.6%)	—	529 (25.0%)
Nigeria	386 (73.2%)	37 (7.0%)	39 (7.4%)	19 (3.6%)	20 (3.8%)	25 (4.7%)	—	1 (0.2%)	—	527 (25.0%)
DRC	537 (88.6%)	21 (3.5%)	6 (0.9%)	31 (5.1%)	3 (0.5%)	1 (0.2%)	7 (1.2%)	—	—	606 (28.7%)
Total Deaths by Cause (% all deaths)	1320 (62.5%)	265 (12.5%)	157 (7.4%)	114 (5.4%)	86 (4.1%)	67 (3.2%)	57 (2.7%)	31 (1.5%)	15 (0.7%)	2112 (100%)

Table 2: Deaths by cause and country.

*Maternal deaths include direct and indirect causes.

*Maternal deaths include suicide during pregnancy and through the 12-month post-partum period as per the ICD-MM.

Category	Direct							Indirect				Total Maternal Deaths (% of all MD)		
	Abortion	Other/ Unspecified	Hemorrhage	Suicide While Pregnant	Suicide (<60 days postpartum)	Infection ^a	Hypertension	Suicide (2-12 mo. postpartum)	Total Direct MD Category	Unclassified/ other	HIV		Infection ^b	Total Indirect MD Category
Number of deaths (% of all maternal deaths within country)														
Brazil	1 (100%)	—	—	—	—	—	—	—	1 (100%)	—	—	—	—	1 (0.1%)
Angola	4 (66.7%)	1 (16.7%)	—	—	—	—	—	—	5 (83.3%)	1 (16.7%)	—	—	1 (16.7%)	6 (0.5%)
South Africa	14 (60.9%)	—	2 (8.7%)	3 (13.0%)	1 (4.3%)	—	—	1 (4.3%)	21 (91.3%)	1 (4.3%)	1 (4.3%)	—	2 (8.7%)	23 (1.7%)
Indonesia	4 (33.3%)	—	1 (8.3%)	3 (25.0%)	—	—	—	1 (8.3%)	9 (75.0%)	—	3 (25%)	—	3 (25.0%)	12 (0.9%)
India	19 (44.2%)	3 (7.0%)	2 (4.7%)	9 (20.9%)	2 (4.7%)	—	1 (2.3%)	—	36 (83.7%)	4 (9.3%)	1 (2.3%)	2 (4.7%)	7 (16.3%)	43 (3.3%)
Kenya	188 (60.3%)	46 (14.7%)	16 (5.1%)	25 (8.0%)	14 (4.5%)	1 (0.3%)	1 (0.3%)	13 (4.2%)	304 (97.4%)	6 (1.9%)	1 (0.3%)	1 (0.3%)	8 (2.6%)	312 (23.6%)
Nigeria	216 (56.0%)	74 (19.2%)	22 (5.7%)	23 (6.0%)	14 (3.6%)	6 (1.6%)	—	16 (4.1%)	371 (96.1%)	8 (2.1%)	4 (1.0%)	3 (0.8%)	15 (3.9%)	386 (29.2%)
DRC	304 (56.6%)	101 (18.8%)	69 (12.8%)	40 (7.4%)	4 (0.7%)	4 (0.7%)	1 (0.2%)	5 (0.9%)	528 (98.3%)	6 (1.1%)	—	3 (0.6%)	9 (1.7%)	537 (40.7%)
Total (% all MD)	750 (56.8%)	225 (17.0%)	112 (8.5%)	103 (7.8%)	35 (2.7%)	11 (0.8%)	3 (0.2%)	36 (2.7%)	1,275 (96.6%)	26 (2.0%)	10 (0.8%)	9 (0.7%)	45 (3.4%)	1,320 (100%)
% all deaths (N=2112)	35.5%	10.7%	5.3%	4.9%	1.7%	0.5%	0.1%	1.7%	60.4%	1.2%	0.5%	0.4%	2.1%	62.5%

Table 3: Maternal deaths (MD) by category, cause, and country.

^a Related to pregnancy or childbirth.

^b Not related to pregnancy or childbirth.

The largest number of non-maternal suicides was reported in Kenya.

Other causes of death ($n=86$, 10.9% of all non-MD, 4.1% of all deaths) included heart disease, yellow fever, asthma, diabetes, and one death from a snake bite. Deaths from accidents ($n=67$, 8.5% of all non-MD, 3.2% of all deaths) were primarily due to vehicle accidents and includes the trauma-related death of 5 pregnant FSW. Tuberculosis (TB) resulted in 57 non-MD (7.2% of all non-MD, 2.7% of all deaths) across the study sites, however, the single largest number of TB-related deaths were reported in Kenya ($n=36$, 63.2%) where TB was responsible for 6.8% of all country deaths. Of the 31 drug overdose deaths (3.9% of all non-MD, 1.5% of all deaths), 9 (29.0%) were reported in Brazil where they accounted for 23.1% of all country deaths. Finally, deaths due to cancer ($n=15$, 1.9% of all non-MD, 0.7% of all deaths) included breast and cervical cancer.

Age-specific causes of death

Ages of deceased FSW ranged from 13 to 60 years and causes of death varied with age (Table 4). The largest proportion of deaths were among FSW aged 20-29 years ($n=1,209$, 57.2%) followed by FSW aged 30-39 years ($n=504$, 23.9%) and FSW aged 11-19 years ($n=283$, 13.4%). Among deaths due to abortion, women ages 20-29 years comprised the largest number of reported deaths ($n=468$, 62.4%). Abortion was also the reported cause of death in a majority of deaths among 11-19 year-old FSW ($n=147$, 51.9%).

Locations where maternal deaths occurred

Location of death was reported for 1059 deaths (Table 5). Detailed reports of maternal deaths included the specific location for 931 (87.9%) of the 1320 reported MD. Of the maternal deaths for which locations were reported, more than half occurred where the women lived or worked ($n=556$, 59.7%) as compared to deaths in hospitals ($n=278$, 29.9%) or on the way to the hospital ($n=48$, 5.1%). Details of the specific location where women died from non-maternal causes were reported for 128 (16.2%) of the 792 non-MD reported in the study.

Children left motherless

Of the 2112 FSW reported deceased, 1629 (77.1%) FSW had at least one child at the time of death. A total of 3,659 children were left without mothers as a result of these deaths.

Discussion

The current study is the first multi-country study on FSW mortality and is the single largest study of FSW deaths ever reported. The findings of this study address

Age Group	Number of deaths (% of deaths by age group)										Total Deaths by Age (% all deaths)
	Maternal Deaths ^a	Abortion	Murder	HIV/AIDS	Suicide	Other/Unknown/ Cancer	Accident	TB	OD		
11-19 years	79 (27.9%)	147 (51.9%)	24 (8.5%)	7 (2.5%)	8 (2.8%)	6 (2.1%)	4 (1.4%)	4 (1.4%)	4 (1.4%)	4 (1.4%)	283 (13.4%)
20-29 years	361 (29.9%)	468 (38.7%)	148 (12.2%)	57 (4.7%)	70 (5.8%)	29 (2.4%)	45 (3.7%)	18 (1.5%)	13 (1.1%)	13 (1.1%)	1,209 (57.2%)
30-39 years	116 (23%)	123 (24.4%)	77 (15.3%)	67 (13.3%)	30 (6%)	40 (7.9%)	14 (2.8%)	27 (5.4%)	10 (2%)	10 (2%)	504 (23.9%)
40-49 years	13 (12.9%)	10 (9.9%)	15 (14.9%)	25 (24.8%)	5 (5%)	18 (17.8%)	4 (4%)	7 (6.9%)	4 (4%)	4 (4%)	101 (4.8%)
50-60 years	-	-	1 (8.3%)	1 (8.3%)	1 (8.3%)	8 (66.7%)	-	1 (8.3%)	-	-	12 (0.6%)
Not reported	1 (33.3%)	2 (66.7%)	-	-	-	-	-	-	-	-	3 (0.1%)
Total Deaths by Cause (% all deaths)	570 (27.0%)	750 (35.5%)	265 (12.5%)	157 (7.4%)	114 (5.4%)	101 (4.8%)	67 (3.2%)	57 (2.7%)	31 (1.5%)	31 (1.5%)	2,112 (100%)

Table 4: Causes of deaths by age group.
^a Excluding abortion; TB = tuberculosis; OD = overdose.

Location of death	Maternal (n=1,360)			Non-maternal (n=792)	Total (%)
	Abortion (n=750)	Peripartum (n=316)	Other maternal (n=254)		
Home/work	430 (57.3%)	111 (35.1%)	15 (5.9%)	68 (8.6%)	624 (29.5%)
Public/government hospital	164 (21.9%)	110 (34.8%)	4 (1.6%)	2 (0.3%)	280 (13.3%)
Other locations (including at the quack)	27 (3.5%)	21 (6.6%)	1 (0.4%)	58 (7.3%)	107 (5.1%)
En route to the hospital	30 (4.0%)	17 (5.4%)	1 (0.4%)	0 (0.0%)	48 (2.3%)
Total deaths for which location is reported	651 (86.8%)	259 (82.0%)	21 (8.3%)	128 (15.2%)	1059 (50.1%)
Total deaths for which location is not reported	99 (13.2%)	57 (18.0%)	233 (91.7%)	664 (84.8%)	1,053 (49.9%)
Total deaths	750 (100%)	316 (100%)	254 (100%)	792 (100%)	2112 (100%)

Table 5: Location of death by cause/type of death.

a knowledge gap about causes of mortality among FSW and underscores the urgent need for country-specific programs to prevent FSW deaths.

With approximately two-thirds of reported deaths meeting maternal death classification, maternal mortality was the overall leading cause of death among FSW in this study. Moreover, a significant proportion of maternal deaths ($n=1264$, 95.7%) were clustered in the five sub-Saharan African countries included in this study (Angola, South Africa, Kenya, Nigeria, and the DRC), consistent with the large burden of global maternal mortality reported in this region.²⁸

Despite research on abortion among FSW in sub-Saharan Africa,²⁹ abortion-related mortality remains poorly documented. The World Health Organization estimates that unsafe abortion in sub-Saharan Africa results in 10% of all maternal deaths.²⁹ By contrast, this study found that abortion represented 57.4% of all maternal deaths reported in sub-Saharan Africa (726 of 1,264 deaths), making abortion the largest single contributor of maternal mortality in this region. Additionally, 96.8% of all abortions reported occurred in sub-Saharan Africa. Data from across all eight countries indicate that the majority of abortion-related deaths (62.4%) occurred in women aged 20-29 and nearly one-fifth (19.6%) occurred in girls aged 11-19 years. Considering the toll of unsafe abortion on FSW documented in the current study, access to safe and affordable contraception is critical to preventing unplanned pregnancies among FSW and, for FSW who terminate pregnancies, access to safe abortions and post-abortion care is critical to preventing abortion-related deaths.

Although many studies report on suicidal ideation and non-fatal suicide attempts among FSW,⁸ this study is the first to report completed suicides in this population ($n=288$; 13.6% of all deaths). Moreover, reports of death by suicide among all pregnant women is relatively rare globally. A recent systematic review and meta-analysis found suicide during pregnancy resulted in 1% of maternal deaths in LMIC.³⁰ By contrast, in addition to post-partum suicides accounting for 5.4% of all maternal deaths, our study found that 7.8% of all maternal

deaths were due to suicide among pregnant FSW, representing the highest percentage of deaths from suicide among pregnant women that has been reported in the literature.

Murder was the most reported non-maternal cause of death among FSW, accounting for 12.5% of all deaths. Deaths from murder ranged from 3.5% of all deaths (or 30.4% of non-maternal deaths) in the DRC to 44.4% of all deaths (or 51.4% of non-maternal deaths) in South Africa.

HIV/AIDS was the reported cause of death, maternal and non-maternal, in 7.9% of deaths in this study. Considering the high prevalence of HIV/AIDS reported among FSW in LMIC,¹ this finding was much lower than we expected. However, given that the rate of direct maternal mortality in HIV-infected women is 5.2 times the rate of direct maternal mortality among HIV-uninfected women,³¹ it is possible that undiagnosed and undisclosed HIV infections may have contributed to more maternal deaths than were reported by FSW in this study. Alternatively, increased access to HIV treatment programs for FSW could have significantly reduced HIV prevalence and morbidity,³² thus explaining the low percentage of HIV/AIDS-related deaths in the current study. Similarly, given the risk for TB coinfection,³³ TB-related deaths were also lower than expected. The highest percentage of TB-related deaths, 6.8%, was in Kenya. It is possible that the FSW who died from other reported causes were also infected with HIV and/or TB but that infection itself was not the primary cause of death.

Although this study did not include an economic analysis of using the CKA or validate its use to identify all causes of death among FSW, the CKA is reported to be a less expensive and faster alternative to labor-intensive household surveys while also being highly sensitive.²⁶ In addition, other studies confirm that community informants can reliably report maternal deaths at a lower cost than other more labor intensive methods.²⁰

While there are other methods for identifying maternal deaths, including the Maternal Death Surveillance

and Response (MDSR) system, civil registration, household surveys, Reproductive Age Mortality Studies (RAMOS), and the sisterhood methodology, all available methodologies have limitations, such as accuracy, comprehensiveness, and cost, that may make them unsuitable for identifying deaths of FSW by local governments and NGOs.³⁴ Considering these limitations, the CKA may be a good option for local SWOs and other NGOs that work with FSW to identify deaths among communities of FSW in near-real time given recall bias favors more recent deaths.

Without data from CRVS systems on FSW deaths, identifying causes of death among FSW requires an innovative approach to tracking local mortality data. Timely collection of local data on deaths of FSW would allow governments and NGOs to focus on preventing the leading causes of FSW deaths in their communities. Furthermore, local mortality data on FSW collected regularly over time would permit local, national, and global programs to pivot and modify interventions in near-real time based on changing mortality patterns.

Finally, studies early in the COVID-19 pandemic reported an increase in maternal deaths related to compromised access to health services resulting from lockdowns, disruption of clinical care, and fear of being infected with the virus at health care facilities.³⁵ Subsequent studies have reported increased maternal mortality among unvaccinated women infected with SARS-CoV-2 during pregnancy.³⁶ While no data are available on maternal deaths specifically among FSW during the pandemic, these studies underscore not only the importance of ensuring all FSW have access to the Covid-19 vaccine and quality maternal health care, but also the urgent need to develop alternative methodologies for mortality data surveillance among hard-to-reach vulnerable populations in LMIC.

Methodologies for collecting information on deaths where there are no CRVS systems, including the CKA, have strengths and limitations. For example, the CKA can be used where women, including FSW, die outside of medical facilities. However, collecting this information through community groups, as in this study, may introduce recall bias. In addition, time constraints may prohibit fully exhausting the collective memory of peer deaths.

In the CKA study from Bangladesh, deaths of women reported by community groups was compared with records of those deaths in local health facilities to determine the accuracy of those reports.²⁶ In contrast, our study was unable to compare reported deaths of FSW from the community with health facility documentation of the deaths as many FSW die outside of medical facilities. In our study, when the specific location of death was reported, only 280 deaths (13.3%) occurred at the hospital. In addition, even when FSW die in a medical facility, medical staff may not be aware that the women were sex workers or, if they are aware, there is

nowhere to record this information to allow database extraction.

The CKA has been shown to be highly sensitive for identifying maternal and all-causes of deaths among adult women by other women in the community.²⁶ Although the CKA validation study may have included women who would have identified as sex workers if asked, the CKA methodology has not been specifically validated to identify deaths among FSW and, therefore, the same sensitivity cannot be assumed in the current study.

While we could not verify the reported deaths, we have a high level of confidence in the reports based on (a) the details of the deaths reported by the participants, many of whom personally knew the deceased women, and (b) the proximity of the reports to the occurrence of the deaths, many of which had occurred in the days or weeks preceding the reports. Additionally, since the participants were not reporting sensitive information about themselves, the probability of response bias may be reduced.

In this study, the majority of deaths (80.8%) were reported to have occurred in 2018 and 2019. Recall bias may favor the report of more recent deaths such that a single administration of the CKA methodology cannot be used to determine if mortality causes among FSW in these communities have changed over time. However, data on the most recent causes of deaths can inform resource allocation decisions and guide programs and policies.

Finally, the number of deaths reported in this study does not reflect the total number of deaths among FSW in these countries, as data collection was limited to a few cities in each country and information was gathered during short timeframes (i.e., 60 min group sessions) rather than collected until theoretical exhaustion. Additionally, study participants were primarily recruited from urban FSW communities where our local partners work and engage with the FSW community and where the majority of FSW live and work. Thus, these results are not representative samples from each country but rather convenience samples and that may not be generalizable to all FSW in any country, whether urban- or rural-based. These limitations preclude our ability to meaningfully compare frequencies of deaths within countries and across countries and years; to identify any potential differences in the mortality pattern in urban versus rural FSW; and to interpret them as a complete representation of all FSW deaths.

This is the largest and the first multi-country study to document causes of death among FSW. Our findings show that abortion ($n=750$, 35.5%) was the largest single cause of FSW death, and that suicide ($n=288$, 13.6%) and murder ($n=265$, 12.5%) were also significant causes of deaths. It is vital that SWOs, NGOs, and local governments develop and implement interventions that target these specific causes of death.

Additionally, for those deaths where the specific location was provided, more than twice as many deaths occurred outside of hospitals as did deaths in hospitals. This study suggests that increasing access to maternal health, contraception, safe abortion, and post-abortion care, are of paramount importance to reducing maternal mortality among FSW. Furthermore, due to the increased number of maternal deaths globally during the COVID-19 pandemic, it is of greater urgency that these services be implemented.

Although we did not conduct either a cost analysis or validation of the CKA as a means of identifying FSW deaths, the CKA methodology is reported to be a less expensive and faster alternative to labor intensive household surveys while also being highly sensitive in identifying maternal and all-cause mortality. The current study demonstrates that the CKA can be used by local and national SWOs and NGOs to identify deaths among FSW. However, our study also underscores the need for better mortality surveillance systems to generate the critical data needed to inform policies and guide programs to reduce FSW mortality.

Ultimately, data on deaths among FSW should be collected locally, nationally, and regionally, and addressed at a global level as is done for HIV/AIDS, to address the many causes of mortality among FSW. Identifying and preventing these deaths require the financial commitment of governments, UN organizations, and foundations.

Contributors

BW was responsible for study conceptualization, research methodology, funding acquisition, project administration, and data collection and curation. EP led data curation, analysis, and visualization. MF and HT assisted with data curation and analysis. SW assisted with investigation and data curation, analysis, and visualization. WMK assisted with investigation and data analysis, and visualization. BW led the writing of the original draft and WMK led the reviewing and editing for critical content and final draft preparation. All authors contributed to data interpretation and drafting and editing the manuscript. All authors had full access to study data and take responsibility for the final publication submission.

Data sharing statement

Deidentified aggregate data used for this analysis can be requested from the corresponding author after publication at bwillis@globalhealthpromise.org. No other documents will be made available. Access permission will be considered based on the following criteria: (a) request should be for the purpose of partnering on research on female sex workers; or (b) for inclusion in curriculum for educational purposes; or (c) for

providing services to female sex workers by governmental organizations, SWOs, and NGOs. Request for one of these purposes will be considered from governmental organizations, SWOs, or NGOs providing support to FSW, or researchers from recognized institutions.

Declaration of interests

HT has received honoraria from Bayer to speak about IUDs for abnormal uterine bleeding; contraception, and is a Global Health Promise board member. BW, EP, MF, SW, and WMK have no conflicts to report.

Acknowledgement

This study was supported by New Venture Fund. We would like to thank all the women who participated in the study and our local partners, including: Oswaldo Cruz Foundation (Brazil); Acção de Solidariedade e Saúde Comunitária (ASSC; Angola); Mothers for the Future and Sex Worker Empowerment and Advocacy Taskforce (SWEAT; South Africa); Organisasi Perubahan Sosial Indonesia (OPSI; Indonesia); Swasti (India); Bar Hostess Empowerment and Support Programme (BHESP; Kenya); SWOP Ambassadors (Kenya); Coast Sex Workers Alliance (COSWA; Kenya); Kisumu Sex Workers Alliance (KISWA; Kenya); Nigeria Sex Workers Association (NSWA; Nigeria); Sex Workers Outreach Program Kenya and Partners For Health and Development in Africa (PHDA) Action Humanitaire pour la Santé et le Développement Communautaire (AHUSA-DEC; DRC); Cadre de Récupération et d'Encadrement pour l'Epanouissement Intégral des Jeunes (CREEIJ; DRC); and the Association pour le Soutien, l'Éducation, la Promotion de la Vie et des Initiatives Communautaires (ASEPROVIC; DRC); Mary Oswald, MSW, Ph.D., Associate Research Professor, Portland State University, School of Social Work, Regional Research Institute for Human Services, Co-PI, and Eunbyoer "Sophie" Yang, Ph.D. student, Portland State University, who entered the data.

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