


BMJ Open Accidental death during pregnancy and puerperium from 2009 to 2019 in Hunan, China: a cross-sectional study

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ABSTRACT

Objective Few studies have analysed accidental maternal deaths. This study analysed the basic situation and classification of maternal accidental deaths and compared the differences between urban and rural areas.

Design A cross-sectional study on accidental deaths during pregnancy and puerperium from 2009 to 2019 in Hunan Province.

Setting Hunan Province, with a population of 74 million, has an area of 210 000 km² and 123 counties/districts.

Participants A collection of 239 cases of accidental death during pregnancy and puerperium in Hunan Province from 2009 to 2019, including 181 cases of rural pregnancy and puerperium and 58 cases of urban pregnancy and puerperium.

Main outcome measure Classification of accidental mortality of pregnant women.

Results A total of 239 accidental deaths occurred in Hunan Province, with an accidental mortality rate of 2.8 per 100 000 live births. The accidental mortality rate in rural areas (3.2 per 100 000 live births) was higher than in urban areas (2.0 per 100 000 live births). The proportion of accidental deaths among pregnancy-related deaths showed an upward trend. The main types of accidental deaths were suicide (1.0 per 100 000 live births), traffic accidents (0.8 per 100 000 live births), accidental poisoning/overdose and assault/homicide (0.2 per 100 000 live births), and other accidents (0.6 per 100 000 live births). Maternal accidental deaths were mainly concentrated in low-income families, in rural areas and in those with low level of education. 74.5% of accidental deaths occurred before childbirth. 49.2% of pregnant women gave birth by caesarean section.

Conclusion In response to the different causes of accidental maternal death, public health programmes and policy interventions should pay special attention to maternal suicide and traffic injuries.

INTRODUCTION

Maternal mortality rate is an important indicator of maternal and infant safety.¹ Maternal mortality rate in some developed countries declined in 2015,² and in China decreased from 88.8 per 100 000 in 1990 to 17.8 per 100 000 in 2019.³ However, there are only few articles all over the world that have studied accidental deaths during pregnancy and

Strengths and limitations of this study

- There are few reports on accidental maternal deaths in China and this study fills this gap.
- The study sample includes all cases of accidental maternal deaths from 2009 to 2019, which is representative and persuasive.
- The diagnostic criteria for accidental maternal death did not change and the changing trend in accidental maternal death was seen more clearly.
- This study does not further analyse what causes the accidents.

puerperium. Reducing accidental death has become an important measure to ensure the safety of mothers and their infants.

According to the WHO⁴ and the China Maternal Mortality Monitoring Program,⁵ maternal mortality monitoring refers to monitoring of women during pregnancy or within 42 days after termination of pregnancy, excluding deaths due to accidents (car accidents, poisoning, etc). In China, there are almost no reports in the literature of maternal deaths due to injury. Maternal mortality, whether due to homicide, suicide or pregnancy-related causes, is equally tragic, may be preventable and deserves national attention.⁶ The outline of the Healthy China 2030 Plan issued by the Communist Party of China (CPC) Central Committee and the State Council⁷ calls for the establishment of a comprehensive injury monitoring system, the development of technical guidelines and standards for key injury intervention, and the prevention and reduction of suicide and accidental poisoning. An issue of concern in China and the rest of the world is the study of the changing rules governing maternal mortality and causes of death and the proposal of targeted interventions to effectively reduce maternal mortality.

The possibility of accidental or intentional injury causing major trauma during



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pregnancy is increasingly considered a major contributor to maternal and infant morbidity and mortality.^{8 9} Since more than half of all maternal deaths are considered preventable, public health interventions have the potential to enhance maternal health and other pregnancy outcomes.¹⁰ Accidental deaths are underestimated or excluded from maternal mortality reports, but have a significant impact on the ability of policymakers to understand potential social and family situations. Many countries have carried out targeted research on accidental maternal deaths. In Colorado, USA,¹¹ self-injury (suicide and overdose) is the most common cause of pregnancy-related death, and most deaths occur during the postpartum period. In New South Wales, Australia,¹² trauma, including suicides, accidental injuries, motor traffic accidents and homicides, accounts for 73% of all maternal deaths (early and late) annually. In Ontario, Canada,¹³ more than 60% of maternal injury-related deaths were due to self-harm, poisoning/overdose and homicide. There are no specific data to show the developmental trend of accidental deaths and the situation of accidental death throughout pregnancy.

Through the maternal death reporting system in our province, it was found that the number of accidental deaths is increasing among pregnant women, which is a group that has not been fully studied. To more fully grasp the current situation of accidental maternal death in our province and to ensure the safety of mothers, this study included 239 cases of accidental deaths and analysed their distribution in urban and rural areas and the classification of causes of death. This study is the first to analyse the accidental deaths of pregnant women in China and is an important supplement to the study of accidental deaths of pregnant women in the country.

DATA AND METHODS

Data sources

Hunan Province is located in southeastern China, with an area of 21.18 km² and a population of 73 million. Since 1990, the province has been included in the maternal and child health surveillance system. The death surveillance data used in this study were taken from the maternal and child health surveillance system of Hunan Province, which is based on the national maternal and child health surveillance system and includes all pregnancy and puerperium in 123 counties (cities) of Hunan Province.

The maternal and child health surveillance system follows strict data collection, reporting, audit and quality control procedures, which help reduce the risk of under-reporting. This research is a cross-sectional survey of accidental maternal deaths in Hunan Province from 2009 to 2019. Monitoring data include information on the main cause of death, date and place of death, sex, and age. However, there is too much information missing on the gestational age of accidental deaths, which was not analysed in this study. The root causes of death were classified

according to the WHO International Classification of Diseases 10th Edition (ICD-10).^{14 15}

According to ICD-10,^{14 15} maternal death refers to the death of a woman during pregnancy or within 42 days after termination of pregnancy, regardless of the length of pregnancy and the location of pregnancy, due to any cause related to or aggravated by pregnancy or pregnancy management, but does not include deaths due to accidents (car accidents, poisoning, etc). The following conditions should also be reported as maternal deaths: maternal deaths due to anaesthetic accidents or drug allergies and maternal suicides caused by confirmed mental illness; and women with hydatidiform mole, including complete and partial hydatidiform mole, complications caused by hydatidiform mole and dying within 42 days after the last curettage, or hydatidiform mole developing into a trophoblastic tumour and causing death within 42 days after the last uterine curettage. All maternal deaths should be reported. Pregnancy-related death refers to the death of a woman during pregnancy or 42 days after termination of pregnancy, regardless of the cause of death. An accident refers to the death of a woman during pregnancy or puerperium caused by an accident not related to obstetrics. Pregnant women who die due to accidents are listed by subtypes of injury¹⁶: intentional self-harm, transportation accident, accidental poisoning/overdose, assault/homicide or others. Experts at all levels in China evaluate accidental deaths of pregnant women to determine the classification of cause of death. In addition, doctors must accurately describe injuries as intentional or accidental. In this paper, the accidental death of pregnant women refers to death not caused by pregnancy or pregnancy management, nor suicide caused by mental illness, as determined by experts.

Data collection methods

During the period from 1 January 2009 to 31 December 2019, all pregnant women who died within 42 days from the start of pregnancy to termination of pregnancy were monitored. All pregnancies, live births and maternal deaths were identified by trained certified professionals.

► After receiving report of maternal death, this is immediately reported by county-level maternal and child health institutions to the local health administrative department and to the municipal and state-level maternal and child health institutions within 24 hours. Within 3 days after maternal death, special personnel, as well as township and village-level maternal and child doctors, midwives or individual practitioners, are organised to investigate the woman's medical history related to her death and to investigate and understand the medical history related to death, including pregnancy, delivery, postpartum conditions, course of onset and death, and medical history. If maternal death occurs at home and there is no healthcare worker present, relevant informed personnel visit the woman's home to investigate the death process and medical history. The death report card is then filled

out and a summary of the medical record or of the death investigation is written down.

- ▶ The district, city and provincial levels respectively organise maternal death evaluation to determine the root cause of death, and one death evaluation occurs. After the provincial evaluation, the conclusion of the evaluation is written on the death report card. Once the review process is completed at all levels, the results are uploaded to the information system.

Data quality control

Data are collected and reported by experienced doctors and are checked for quality and accuracy at the county level by women's health institutions and by individuals. The community health service centre conducts quality inspections for service stations/neighbourhood committees and township health centres in villages using the monthly meeting system. The district, county, city and state organise a comprehensive quality inspection every quarter. The city and state conduct quality inspection and evaluation at least half a year. The provincial level monitors quality inspection and provides two reviews of monitored districts and counties every year. The districts and counties that do not meet the requirements will undergo a comprehensive leak investigation. Death data must be checked with the lists from civil affairs, public security, disease control and other entities to prevent under-reporting and misreporting.

Statistical analysis

Statistical data were exported to Microsoft Excel V.2010. SPSS V.24.0 was used to analyse the ratios and proportions. χ^2 test was used to compare the differences in

accidental mortality between rural and urban areas. The Cochran-Armitage time trend test of mortality over time was carried out with SAS 9.4 software. P values were assessed as two-tailed and $p < 0.05$ was regarded as the level of statistical significance.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

RESULTS

Mortality trends related to accidental maternal deaths

From 2009 to 2019, a total of 8574584 live births were monitored in our province, including 1957 pregnancy-related maternal deaths, 1718 maternal deaths and 239 accidental deaths. The pregnancy-related mortality, maternal mortality and accidental mortality in our province were 22.6 ± 5.5 per 100 000, 19.8 ± 5.3 per 100 000 and 2.8 ± 0.7 per 100 000, respectively. The proportion of accidental deaths among pregnancy-related deaths was on the rise, accounting for an increase of 75.11% from 2009 to 2019 (see table 1).

Classification of causes of accidental deaths

Intentional self-harm accounted for 35.6% of accidental deaths (including 25 cases of taking drugs/pesticides, 16 cases of jumping from buildings, 30 cases of drowning, 4 cases of hanging oneself and 10 cases of other causes), with a mortality rate of 1.0 per 100 000. Transportation accidents accounted for 30.1% ($n=72$) of accidental deaths, with a mortality rate of 0.8 per 100 000. Accidental

Table 1 Maternal mortality in Hunan Province from 2009 to 2019

Year	Pregnancy-related mortality (per 100 000)	Maternal mortality (per 100 000)	Accidental deaths (n)	Accidental death rate (per 100 000)	Accidental death/pregnancy-related death (%)
2009	30.2	27.1	24	3.1	10.2
2010	33.0	30.2	22	2.8	8.4
2011	23.6	21.5	17	2.1	9.0
2012	24.1	21.8	19	2.3	9.4
2013	20.1	18.4	14	1.7	8.5
2014	24.1	20.4	29	3.7	15.4
2015	21.0	17.5	27	3.5	16.5
2016	22.6	18.9	30	3.8	16.7
2017	20.4	17.5	24	2.9	14.1
2018	17.9	15.0	20	2.8	15.9
2019	11.5	9.5	13	2.1	17.8
Total	22.8	20.0	239	2.8	12.2
Mean±SD	22.6±5.5	19.8±5.3		2.8±0.7	
Cochran-Armitage trend test Z value	-8.804	-9.5919		0.5242	
P value*	<0.001	<0.001		0.6001	

*P values were assessed as two-tailed.



Table 2 Classification of causes of accidental death during pregnancy and puerperium

Classification	n	%	Mortality rate (per 100 000)
Intentional self-harm	85	35.6	1.0
Taking poison/pesticide	25	10.5	0.3
Jump off a building	16	6.7	0.2
Jump into the river	30	12.6	0.3
Hang oneself	4	1.7	0.0
Others	10	4.2	0.1
Transportation accident	72	30.1	0.8
Accidental poisoning/overdose	19	7.9	0.2
Carbon monoxide, moderate	17	7.1	0.2
Food poisoning	1	0.4	0.0
Accidental use of pesticides	1	0.4	0.0
Assault/homicide	13	5.4	0.2
Others	50	20.9	0.6
Total	239	100	2.8

poisoning/overdose accounted for 7.9% (including 17 cases of carbon monoxide poisoning and 2 other cases), with a mortality rate of 0.2 per 100 000. Assault/homicide accounted for 5.4% of accidental deaths, with a mortality rate of 0.2 per 100 000, while other accidents accounted for 20.9% (n=50), with a mortality rate of 0.6 per 100 000 (see [table 2](#) for details).

Classification and comparison of accidental deaths

The accidental mortality rate in rural areas was higher than in urban areas. The types of accidental maternal deaths differed between urban and rural areas. Among

them, the mortality rates of intentional self-harm, ingestion of poisons/pesticides and traffic accidents in rural areas were higher than those in urban areas (see [tables 3 and 4](#) for details).

Epidemiological study on accidental deaths during pregnancy and puerperium

The sociodemographic and obstetric characteristics of women experiencing maternal death due to accidents and suicides are summarised in [table 5](#).

- ▶ Age distribution: pregnant women experiencing accidental death in the province were between 16 and 45 years old, with the largest number of deaths (36.8%) occurring among women between 25 and 29 years old, followed by women between 30 and 34 years old (22.6%). The proportion of accidental deaths among pregnant women of advanced age (≥ 35 years old) was more than 10%.
- ▶ Economic level: 28.9% of accidental maternal deaths occurred in families with a per capita income of more than ¥8000 (approximately US\$1200) and 58.6% of accidental maternal deaths occurred in families with an income of less than ¥8000 (approximately US\$1200). Accidental maternal deaths were mainly concentrated in low-income families.
- ▶ Household registration distribution: maternal deaths were mainly concentrated in rural areas, reaching 74.9%.
- ▶ Educational level: the educational level of women experiencing accidental death was generally low: 50.2% with junior high school education, 9.6% with college and above, and 16.7% with primary school and illiterate background.
- ▶ Delivery: 74.5% of pregnant women experiencing accidental death did not give birth and 25.5% gave birth. Of the pregnant women, 49.2% delivered by caesarean section and 39.3% by natural delivery. A

Table 3 Accident occurrence during pregnancy and puerperium in urban and rural areas

Year	Urban live birth	Rural live birth	Urban		Rural	
			Accidental deaths (n)	Accidental death rate (per 100 000)	Accidental deaths (n)	Accidental death rate (per 100 000)
2009	255 649	525 377	5	2.0	19	3.6
2010	263 350	534 552	7	2.7	15	2.8
2011	267 356	538 004	2	0.7	15	2.8
2012	279 088	559 886	5	1.8	14	2.5
2013	272 312	549 043	4	1.5	10	1.8
2014	266 739	513 835	5	1.9	24	4.7
2015	274 312	506 754	6	2.2	21	4.1
2016	280 271	515 128	7	2.5	23	4.5
2017	304 202	530 753	8	2.6	16	3.0
2018	258 183	447 341	7	2.7	13	2.9
2019	248 782	383 679	2	0.8	11	2.9
Total	2 970 244	5 604 352	58	2.0	181	3.2

Table 4 Composition of causes of accidental death during pregnancy and puerperium in Hunan Province from 2009 to 2019

Classification	Urban		Rural	
	Accidental deaths (n)	Accidental death rate (per 100 000)	Accidental deaths (n)	Accidental death rate (per 100 000)
Intentional self-harm	21	0.7	64	1.1
Taking poison/pesticide	2	0.1	23	0.4
Jump off a building	7	0.2	9	0.2
Jump into the river	8	0.3	22	0.4
Hang oneself	0	0.0	4	0.1
Others	4	0.1	6	0.1
Transportation accident	14	0.5	58	1.0
Accidental poisoning/overdose	2	0.1	17	0.3
Carbon monoxide, moderate	2	0.1	15	0.3
Food poisoning	0	0.0	1	0.0
Accidental use of pesticides	0	0.0	1	0.0
Assault/homicide	3	0.1	10	0.2
Others	18	0.6	32	0.6
Total	58	2.0	179*	3.2

*There were 3 cases of accidental deaths in rural areas. The classification of accidental deaths is not clear.

total of 9.8% of pregnant women who had delivered had less than five antenatal examinations and 73.8% had more than five antenatal examinations.

- ▶ Diagnostic basis of cause of death: a total of 51.5% of deaths were diagnosed on a clinical basis and 44.4% were inferred.

DISCUSSION

To the best of our knowledge, this is the first study to analyse the characteristics of accidental maternal deaths in China. The main findings of our research are as follows: (1) the proportion of accidental deaths in pregnancy-related deaths is on the rise; (2) the main types of accidental deaths are suicide, traffic accidents, accidental poisoning/overdose, injury/homicide and other accidents; (3) maternal accidental deaths are mainly concentrated in low-income families, in rural areas and in those with low level of education; and (4) 74.5% of accidental deaths occur before childbirth.

Trend of accidental deaths during pregnancy and puerperium

Many years ago, most women died of complications caused by pregnancy and childbirth, such as bleeding, infection and pregnancy-induced hypertension, and maternal mortality is usually associated with factors that are directly connected to pregnancy and childbirth.¹⁷ With improvements in medical standards and increase in people's health awareness, death of pregnant women in many countries has been controlled at a relatively low level. By 2019, the maternal mortality rate in Hunan Province continued to decline. According to the narrow definition provided by the WHO, the maternal mortality rate in 2019 was 9.5 per 100 000, which was already of low level. Although the accidental mortality rate shows

a fluctuating downward trend, the proportion of accidental deaths in pregnancy-related deaths increased from 10.17% in 2009 to 17.81% in 2019, reflecting an increase of 75.11%. Because the number of deaths of pregnant women in our province is declining. The number of accidental deaths has not been well controlled, resulting in an increase in accidental mortality. At present, there are only a few studies on accidental deaths during pregnancy and puerperium in the world and we do not have relevant data from other countries. However, the accidental death during pregnancy and puerperium requires more care and attention from the society.

Differences in accidental maternal mortality between urban and rural areas

In this study, the self-harm rate during pregnancy and puerperium in urban areas is higher than other categories of accidental death.

The accidental mortality rate in rural areas was higher than in urban areas. In particular, mortality due to maternal self-mutilation, traffic accidents and poisons/pesticides in rural areas was higher than in urban areas. This is consistent with the trend showing that maternal mortality rate in the rural areas of China¹⁸ was higher than in urban areas during the same period. The possible explanation is the accessibility of drug crops, which are widely used in rural areas, making it easier for people to commit suicide.¹⁹ The educational level of rural women is generally not high and they tend to go extremes after conflicts with their families and neighbours.²⁰ In addition, complex roads and poor infrastructure in rural areas as well as poor rural healthcare systems²¹ also increase the risk of death due to injuries.

Table 5 Demographic and obstetric characteristics of accidental deaths during pregnancy and puerperium in Hunan Province from 2009 to 2019

Demographic characteristics					
Characteristics	n	%	Project	n	%
Age in years			Degree of education		
≤19	8	3.4	College or above	23	9.6
20–24	60	25.1	High school or technical secondary school	49	20.5
25–29	88	36.8	Junior middle school	120	50.2
30–34	54	22.6	Primary school	21	8.8
35–39	22	9.2	Illiterate	19	8
>40	6	2.5	Unknown	7	2.9
Unknown	1	0.4	Annual per capita income of family (¥)		
Urban and rural areas			<1000	9	3.8
Urban	58	24.3	1000~	14	5.9
Rural	179	74.9	2000~	46	19.2
Unknown	2	0.8	4000~	71	29.6
			8000~	69	28.9
			Unknown	30	12.6
Obstetric characteristics					
Project	n	%	Project	n	%
Whether or not to give birth			Number of antenatal examinations of parturients who have given birth		
Undelivered	178	74.5	<5	6	9.8
Delivery	61	25.5	≥5	45	73.8
Delivery mode			No antenatal examination	1	1.6
Natural birth	24	39.3	Unknown	9	14.8
Caesarean section	30	49.2	Diagnostic basis of cause of death		
Unknown	7	11.5	Clinical	123	51.5
Gestational week for first examination			Inference	106	44.4
Within 12 weeks	178	74.5	Case autopsy	7	2.8
13–27 weeks	17	7.1	Unknown	3	1.3
No antenatal examination	4	1.7			
Unknown	40	16.7			

Demographic characteristics

The level of education obtained is an important indicator of early living conditions,²² and it may influence people's behaviour. Some studies²³ have found that the level of education of a pregnant woman reflects her social status and is inversely proportional to maternal death; that is, the lower the level of maternal education, the less healthcare knowledge a woman has and the deeper the influence of old customs.²⁴ In this research, the educational level of pregnant women who had accidental deaths was largely of low level, with the highest proportion of women having a junior high school education (50.2%) and a primary school and illiterate background (16.7%). Economic characteristics are also an important factor that affects maternal mortality. The practice of reducing maternal mortality in China shows that poverty is an important factor that affects maternal mortality.²⁵ In this study, 58.6% of families experiencing accidental death had a per capita annual income of less than ¥8000

(approximately US\$1200). Accidental deaths were more concentrated in low-income families.

In 2000, more than 67% of women experiencing maternal deaths in China had fewer than five antenatal check-ups or no antenatal check-ups. By 2013, the proportion had declined but remained as high as 50%.²⁶ In this study, 74.5% of pregnant women who had accidental deaths underwent antenatal examinations in the early stage of pregnancy. Among the parturients who had given birth, 73.8% had undergone more than five antenatal examinations. This also reminds us that, in the process of prenatal check-ups, medical staff should pay more attention to the life and psychological health of pregnant women and teach more health education knowledge and that the society offer more help to women to avoid some accidental deaths. In the next step, we will continue to improve data collection to provide more convincing data on prenatal examinations.

A total of 74.5% of accidental deaths in this research occurred prenatally; however, in Colorado,¹¹ approximately 90% of self-harm deaths occurred post partum, with most of these women suffering from substance abuse and mental disorders. In New South Wales (2000–2006),¹² 67% of deceased pregnant women had mental health diagnoses and/or mental health problems related to drug abuse. Among Australian women²⁷ who gave birth, the proportion diagnosed with postpartum depression ranged from 10% to 20%. In this study, we did not collect data on maternal mental and drug abuse, so the data cannot be compared directly; however, the data also suggest that we should strengthen the screening of and interventions for maternal emotional and mental health in a later study.

Major types of accidental deaths

Among rural residents, ingesting poison, hanging oneself, jumping into the river and electrocution are the main methods of committing suicide.²⁸ In addition to mental illness and psychological distress, the causes of suicide are very complex, including collapse of social order, disintegration of families, misfortune in marriage, financial constraints, domestic violence, despair due to serious illness and other factors.²⁹ Another risk factor is the universal accessibility of pesticides. According to the report ‘Suicide and Suicide Prevention in Asia’,³⁰ the most common suicide tool used by farmers in China is pesticides, used in 62 out of every 100 suicides. In this study, the top three methods of suicide in rural areas were ingesting poisons, falling from buildings and drowning oneself in water. Similar to the situation in China, suicide is also a common cause of death among young people in the community abroad and is related to alcohol and drug abuse.^{11 31 32}

Motor vehicle accidents are the leading cause of maternal mortality related to injury.^{33 34} China^{35 36} has the largest number of road traffic fatalities in the world. In this research, 30.1% of pregnant women died in traffic accidents, which is the second leading cause of death. China’s rural areas have complex topography, lack road safety measures, and have an increasing number of vehicles and drivers with low awareness of traffic signs and rules, all of which can easily lead to all kinds of traffic accidents. Abiding by traffic rules has always formed the basis for road safety education in our country. The use of seat belts can reduce the risk of adverse maternal and fetal outcomes.³⁷

There were 19 cases of accidental poisoning in this study, of which 17 cases were due to carbon monoxide poisoning, most by natural gas in the bath. Some poisonings occurred in rural areas and were caused by poor ventilation due to carbon heating in winter and the tight closing of doors and windows. Other accidental deaths include house collapse due to landslides, deaths caused by fires, bee venom and accidental falls, and so on.

Limitations

Our research results should be interpreted carefully considering some limitations. First of all, accident-related causes of death depend on the memories of family members and may be biased. However, after data quality control at the provincial, municipal and county levels and review of death cases with the public security and civil affairs departments, data quality and reliability are acceptable. Second, there are no data collected on the details of family background or on the urban and rural environment. Third, we were unable to obtain data on gestational age of accidental death among pregnant women. This is the next step we will focus on to improve the data we collect.

CONCLUSION

From 2009 to 2019, the proportion of accidental deaths in pregnancy-related deaths showed an upward trend, and differences between urban and rural areas still exist. The proportion is higher in rural areas than in urban areas, which is related to the underdevelopment of the social economy in rural areas. Self-harm and traffic accidents remain the main causes of accidental maternal death, with ingesting pesticides, jumping from buildings and falling into the river being the main methods of maternal self-harm. Therefore, accidental maternal mortality remains a public health problem that has not been deeply studied. Safety education and infrastructure should be strengthened to reduce accident-related deaths, and policies and programme such as safety education and psychological interventions should target the more vulnerable populations.

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Contributors FK drafted the initial manuscript and reviewed and revised the manuscript. AW, JH, LX, DX and JS designed the data collection instruments, collected the data, carried out the initial analyses, and reviewed and revised the manuscript. ZL and XS conceptualised and designed the study, coordinated and supervised the data collection, and critically reviewed the manuscript for important intellectual content. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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