Maternal Mortality and its Relationship to Age in North Darfur in 2022
A study in medical Geography

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Abstract

This study aims to investigate the relation between age and certain diseases that cause maternal mortality in North Darfur Province in Sudan during the reproductive age range of 14-49 years, encompassing the period of pregnancy, childbirth, and up to 42 days postpartum. The study is based on the analysis of demographic age groups and healthcare data, with special focus on blood pressure disorder, obstetric hemorrhaging, unsafe abortion, and sepsis among deceased mothers in hospitals within the study area in 2022. The study sample comprises a total of 180 cases, all the dead cases recorded in study area hospitals in 2022. Chi-square test was employed to assess the degree of independence between the age variable and the health variables associated with fatal diseases. The findings show that age is not an independent factor in the causes of death. The findings indicate a correlation between different age categories, various blood pressure abnormalities, obstetric hemorrhage, and unsafe abortion in deceased women, with a statistical significance level of 0.000. However, the statistical significance level between age and sepsis was found to be 0.002.

Keywords: Maternal death, Disease, Obstetrical hemorrhage, Unsafe Abortion, sepsis

Introduction

Maternal death, according to the International Classification of Diseases, is defined as death during pregnancy or within 42 days after the end of pregnancy, regardless of the place and duration of pregnancy, which is directly or indirectly related to pregnancy or childbirth but not from accidental causes or accidents and less than a year(Mishra & Rath, 2021).

The causes of maternal deaths can be categorized into direct and indirect factors. Direct factors typically arise due to complications during childbirth (Garland & Little, 2018) while indirect maternal mortality factors are primarily associated with pre-existing medical conditions that were aggravated by pregnancy. In this context, maternal mortality is not solely attributable to pregnancy itself (Goldman-Mellor & Margerison, 2019). There are various specific factors that contribute to maternal mortality, including complications related to childbirth, deaths resulting from drug use, suicide, sudden arrhythmia death syndrome (SADS), cardiomyopathy, and other cardiac causes (Krexi & Sheppard, 2017). Obstetric hemorrhage, hypertensive disorders, and sepsis are also prevalent causes of maternal mortality (Khan et al., 2006; Yanyan & Renying, 2014; Zhang & Ding, 1988). Other contributing factors to maternal mortality entail severe bleeding, infections, complications during childbirth, unsafe abortion, as well as diseases like malaria and HIV infection during pregnancy.

Recent United Nations reports reveal that 95% of all instances of maternal mortality occur within low- and lower-middle-income countries (WHO, 2010). As per the World Health Organization's findings in 2020, a woman lost her life every two minutes due to complications arising from pregnancy or during childbirth (WHO, 2023). The World Health Organization has provided an estimate of 287,000 maternal fatalities worldwide in the period 2000 -2020.

These reports have shed light on the fact that maternal deaths are predominantly concentrate in the most economically deprived regions of the globe, particularly those suffering from war conflicts. In 2020, approximately 70% of all maternal mortalities worldwide took place in sub-Saharan Africa.

In nine countries suffering from significant humanitarian crises (from highest to lowest: Yemen, Somalia, South Sudan, the Syrian Arab Republic, the Democratic Republic of the Congo, the Central African Republic, Chad, Sudan and Afghanistan), it has been observed that the rate of maternal deaths is double the global average (551 maternal deaths for every 100,000 live births as opposed to the worldwide figure of 223 cases)(WHO, 2023). Sudan is amongst those countries that experience humanitarian crises, which result in an upsurge in maternal deaths, particularly in the western provinces. The increase in the mortality rate is an indication of the worse economic and social circumstances in which women find themselves. Sudan western provinces have made efforts to decrease the rate of maternal mortality to less than 70 deaths for every 100,000 live births by 2023. On a global scale, no nation currently surpasses a maternal mortality rate of 140 deaths for every 100,000 live births (WHO, 2021). This endeavor is aligned with the pursuit of the United Nations' third sustainable development goal.

Previous studies:

Ammar (2018) studied the primary determinants and contributing factors of maternal mortality among women aged 15-49 in Algeria. The study was conducted at the specialized hospital for mother and child, Meriem Bouatoura-Batna, and specifically focused on women who experienced maternal mortality during the various stages of pregnancy (i.e., pregnancy, childbirth, and the postpartum period). The study concluded that the most

important causes of death are heart disease, high blood pressure, clogged arteries, and respiratory diseases.

Another study conducted by Abdo (Abdo,٢٠٢١) regarding the causes of maternal deaths in the Nile River Province, Sudan. The study revealed that bleeding is considered one of the biggest problems that lead to maternal deaths. The highest death rate in River Nile Province was due to blood clots at 30.5%. Most maternal deaths occurred in the hospital, only 3 cases died at home. The study revealed that the majority of maternal deaths occurred between the ages of 26 and 35, at a rate of 12%.

Albashir (2018) , who conducted a study on the socioeconomic characteristics and their impact on maternal mortality in the White Nile province in Sudan, stated that economic, social, demographic, and health characteristics and the impact of social and economic situation and that of the poor health conditions of the deceased mothers on the increase or decrease in mortality rate being among the most important objectives of the study. The study also found that far distances from the health unit center, lack of education among girls and marriage of the underage girls, lack of sufficient training for midwives, spread of direct diseases such as blood pressure disorder and postnatal bleeding and complications of pregnancy such as pressure and diabetes have contributed significantly to the increase in maternal mortality rates.

Asamoah et al. (2011) conducted an assessment and analysis of the determinants of maternal mortality based on socio-demographic factors in Ghana, specifically examining age, educational level, rural/urban residence status, and marital status. The findings of the study indicated that hemorrhage emerged as the primary cause of maternal mortality, particularly among married women in comparison to their unmarried counterparts. Conversely, married women exhibited a significantly reduced risk of mortality due to abortion when compared to single

women. Furthermore, women aged 35-39 years were found to have a significantly higher risk of mortality from hemorrhage, while they were at a lower risk of mortality from abortion in comparison to younger women. Moreover, the risk of maternal death resulting from infectious diseases declined as maternal age increased, whereas the risk of mortality from miscellaneous causes increased with advancing age.

Nahed and Rashid (2019) studied factors affecting the phenomenon of maternal mortality in Iraq and concluded that type of pregnancy, birth delivery type, number of pregnancies, place of delivery, grandmother intervention, health care are the main factors affecting maternal mortality. While in Rwanda, sepsis is a prominent cause of maternal deaths, underscoring the necessity for infection prevention, early diagnosis, and effective management of sepsis (Benimana et al., 2018). Likewise, Mishra and Rath (2021) revealed that hemorrhaging and high blood pressure induced by pregnancy are significant culprits behind maternal deaths in India.

Thus, the primary factors contributing to the maternal mortality encompass postpartum hemorrhage, convulsions, sepsis, and disorders associated with high blood pressure. These causes can be averted through various measures, such as regular prenatal examinations, timely detection, the presence of skilled midwives, and convenient access to healthcare facilities. It is crucial, therefor, to identify these death factors during prenatal care in order to reduce the deaths for both the mother and fetus.

Research problem

Maternal mortality in North Darfur province, western Sudan, is a pressing problem that requires urgent attention (Haggaz et al., 2007). The latest data indicated that the region has the highest maternal mortality rates in Sudan (Haggaz et al., 2007). Several factors were contributed to this, namely the lack of qualified specialists, insufficient infrastructure, and some cultural practices and beliefs prevailing in the region (Macleod et al., 2019).

Therefore, the problem of the study is crystallized in the following two main questions:

1. What are the health causes leading to maternal deaths in the study area?
2. Does age of the deceased mother have a relationship to the health causes leading to death?

Research hypothesis:

1 There is a relationship between age and blood pressure disorders in deceased women

2. There is a relationship between age and sepsis among deceased women

3. There is a relationship between age and unsafe abortion among deceased women

4. There is a relationship between age and obstetric bleeding in deceased women

Research objectives

The main objective of this study is to identify the relationship of age to some diseases that cause maternal deaths in North Darfur State

Study area

Spatially this study is limited to North Darfur Province in western Sudan which is located between latitudes 12.25 and 14.55 north and longitudes 25.25 and 27.35 east (Ibrahim: 1984:52). It research is conducted in the boundaries include the year 2022. See fig.1.

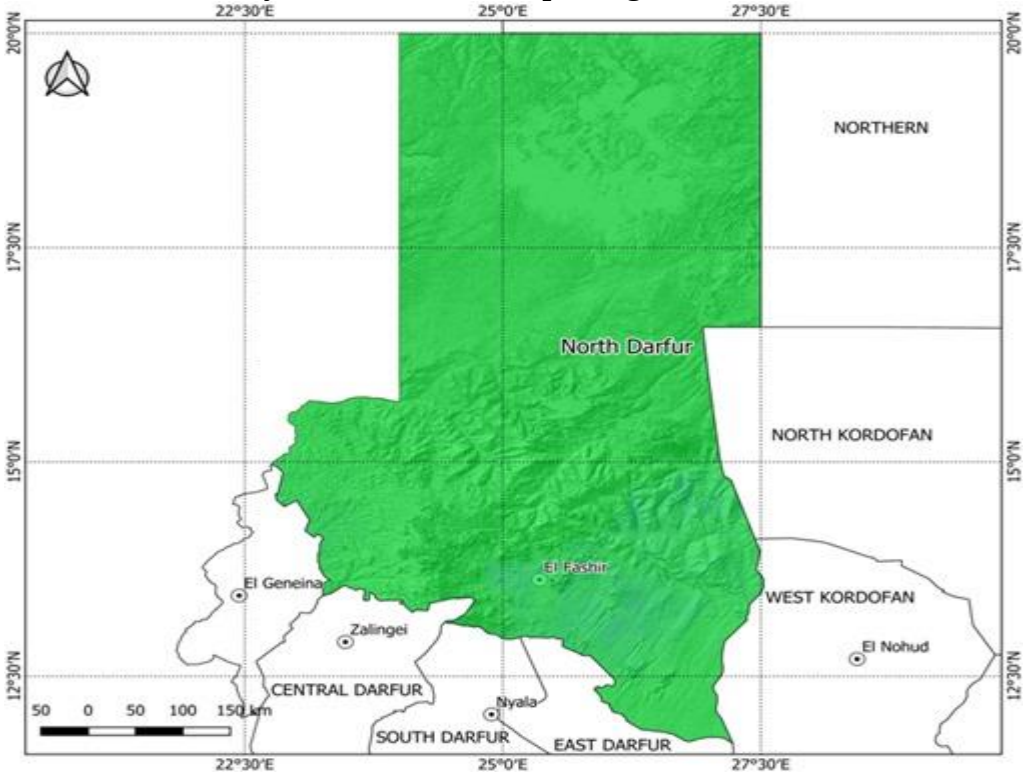

Fig.1 Geographical location of North Darfur Province (https://susis.sd/north-darfur-0-30/#single/0)

Methodology

Data Collection

Data were collected from sources based on maternal death records in North Darfur hospitals, the study area in 2022 (Alfashir Females Specialist Hospital, El Fasher South Hospital, El Fasher Teaching Hospital), and health reports from the Sudan Federal Ministry of Health in order to ensure the accuracy and reliability of the results, which will allow a greater understanding of the problem of maternal mortality in the study area. The total number of dead mothers were 180 cases. All cases were taken.

Data Analysis

Statistical analysis was performed using SPSS software (version 23). The descriptive statistics was used to analyse that

data. Results were presented in frequency tables. Chi-squire Test is also used to determine if there is a significant relationship between the variables

Results *and* Discussion

Data from Sudan Federal Ministry of Health indicate that the maternal mortality rate in Sudan reached 1231 per 100,000 live births in 2017. The death rate in 2017 is higher than it was in the year 2019 in all Sudan provinces (1112 per 100,000 live births). In addition to the fact that the Corona pandemic in 2020, affected maternal health, as Covid-19 infection increases the risks during pregnancy and effective prenatal care. As for the study area, it suffered from war for a period of time, and it is obvious that political conflicts and instability in fragile and conflict-affected regions affect the demographic and health aspects of the population (Shoko & Naidu, 2020).

Causes of maternal deaths in North Darfur in 2022

North Darfur Province state is among the provinces that have been affected by the burden of maternal and newborn mortality. According to reports from the Sudan Federal Ministry of Health (2020), a significant number (30 %) of deaths occur among individuals in the young age group of 15-19 years. Additionally, there are instances of childbirth occurring within the home setting, particularly in villages where medical assistance and hospital facilities are scarce. The implications of this situation on maternal and child mortality have been clearly observed, particularly in light of various social, economic, security, and cultural factors, as well as the limited availability of medical care and hospital resources. The incidence of maternal deaths increases in 2020 to reach 1206 per 100,00 live births when juxtaposed with the preceding year of 2019. In an endeavor to attain the third objective of the sustainable development goals, which endeavors to diminish the maternal mortality rate worldwide to less than 70 per 10,000 live births by the year 2030, the competent authorities embarked upon this mission, ensuring

that no nation surpasses a maternal mortality rate of 140 per 10,000 live births (Havea & Mohanty, 2020). The province under investigation pertains to one of the Darfur provinces, where maternal mortality persists as a consequence of the aforementioned reasons, compounded by the repercussions of warfare. These reasons encompass:

a. Blood pressure disorder:

High blood pressure in pregnant women may lead to a number of complications, such as placental abruption, elevated liver enzymes, preeclampsia, stroke, impaired growth of the fetus, and fetal demise. If the pregnant woman does not receive appropriate treatment, it may lead to the death of the mother (Tranquilli et al., 2014).The death rate from blood pressure disorders in Sudan reached 15.8 (Awadalla et al., 2018) whereas the death rate in North Darfur Province reached 6.14% of the total deaths in Sudan (Sudan Federal Ministry of Health, 2020). The maternal mortality rate in North Darfur Province for this reason alone raised to 47.36% of the total deaths in 2020 (Sudan Federal Ministry of Health: 2020: 22). Data presented in this study revealed that the percentage of women who died from corresponding blood pressure disorders reached 32.7% of the total of maternal deaths in North Darfur. See Table (1)

b. Obstetrical hemorrhage

This term refers to any heavy bleeding during pregnancy or after childbirth. The cause of obstetrical hemorrhage is usually related to pregnancy or spontaneous abortion, but some types of obstetrical hemorrhage may result from other diseases (Carter, 1999; Johnsen & MacKinnon, 2022). Obstetric hemorrhage is considered the direct cause of maternal deaths, not only in North Darfur province, but in all provinces of Sudan. One of the most important causes of obstetrical hemorrhage is uterine prolapse, rupture, placenta previa, previa, or rupture of the uterus and placenta together. What makes the matter worse is the failure of blood transfusion to mothers for cases of bleeding due to the lack

of a blood bank, the lack of blood in blood banks, or the lack of donors at the appropriate time. The percentage of women who died from obstetrical hemorrhage in North Darfur province reached 2.09% of the total cases of death from hemorrhage in Sudan (Federal Ministry of Health: 2020: 19). This study, it was found that the percentage of women who died from this obstetrical hemorrhage had reached 37.3%. See Table (1)

Table (1) Causes of Maternal Deaths in North Darfur in 2022

Age group	Cause of Death							
	Blood pressure disorder		Obstetrical hemorrhage		Unsafe abortion		Sepsis	
	N	%	N	%	N	%	N	%
15-19	9	5	13	7.2	7	3.9	11	6.1
20-24	7	3.9	1	0.6	0	0	10	5.6
25-29	6	3.3	13	7.2	20	11	2	1.1
30-34	3	1.7	12	6.7	28	16	21	12
35-39	13	7.2	6	3.3	17	9.4	13	7.2
40-44	13	7.2	12	6.7	10	5.6	3	1.7
45-49	8	4.4	10	5.6	4	2.2	5	2.8
Total	59	32.7	67	37.3	86	48.1	65	36.5

c. Unsafe Abortion

Unsafe abortion is defined as the termination of a pregnancy which is performed by untrained individuals using dangerous techniques in an environment that does not meet the minimum medical requirements. Such practices often lead to maternal health complications and consequently deaths (Lim & Singh, 2014; Mishra & Rath, 2021). According to World Health Organization reports, there are about 47,000 deaths annually occur due to unsafe abortion. From data collected from more than one hundred countries, encompassing over ninety percent of the global population, Francome (2016) stated that a woman dies every 11 minutes due to unsafe abortion.

In the study area, unsafe abortion occurs as a result of mothers' low educational level, the lack of skilled medical staff. In addition to prevailing cultural beliefs and poor health infrastructure. Federal Ministry of Health data indicated that the death rate due to unsafe abortion in North Darfur Province in 2020 was 13.1% (Federal Ministry of Health). Data collected for this study proves that the percentage of mothers who underwent unsafe abortion reached 48.1%. There may be multiple causes leading to maternal death in some of these cases. The study area ranks second in Sudan in terms of maternal deaths due to unsafe abortion after East Darfur Province (Federal Ministry of Health: 2020:22). The causes of abortion in the study area include physical violence when the mother is subjected to beatings or rape, especially since the study area witnesses a lack of security instability, or the practitioner of the unsafe abortion uses potentially toxic substances to get rid of the unwanted pregnancy, which consequently leads to death. See Table (1)

d. Sepsis

Sepsis occurs when a type of Streptococcus pyogenes is transmitted. It is the most common causative agent of maternal sepsis, followed by other pathogens such as Chlamydia and Mycobacterium tuberculosis, which is a major cause of maternal mortality worldwide(Amararatne & Vidanapathirana, 2019) . Studies indicate that sepsis the most common cause of maternal deaths among Pakistani mothers; it is the second leading cause of maternal death in the United States (Fakharunnisa et al., 2022; Hensley et al., 2019). It is worth noting that the rate of maternal deaths due to sepsis in Sudan raised to 12.8% of the total cases reported to the Federal Ministry of Health: 2020:21. The rate of maternal deaths due to Sepsis in North Darfur state raised to 36.5% of the total cases of the study. See Table (1).

1. The relationship between age and maternal mortality in North Darfur Province in 2022

Chi-square test of independence was used to determine the relationship between age and of maternal deaths causes among 180 deaths cases. The test was applied to childbearing groups (15-49 years) and the main health causes of maternal death (Blood pressure disorder, Obstetrical hemorrhage, unsafe abortion, and Sepsis). The following results were found:

a. The relationship between age, blood pressure disorder and maternal deaths.

Table 1. Chi-square test between age, blood pressure disorder and maternal deaths in 2022

			Blood pressure disorder			X2
			YES	NO	Total	
Age categories	15-19	Count	9	10	19	.000
		% within Age categories	47.4%	52.6%	100.0%	
		% of Total	5.0%	5.6%	10.6%	
	20-24	Count	7	13	20	
		% within Age categories	35.0%	65.0%	100.0%	
		% of Total	3.9%	7.2%	11.1%	
	25-29	Count	6	27	33	
		% within Age categories	18.2%	81.8%	100.0%	
		% of Total	3.3%	15.0%	18.3%	
	30-34	Count	3	47	50	
		% within Age categories	6.0%	94.0%	100.0%	
		% of Total	1.7%	26.1%	27.8%	
	35-39	Count	13	21	34	
		% within Age categories	38.2%	61.8%	100.0%	
		% of Total	7.2%	11.7%	18.9%	
	40-44	Count	13	1	14	
		% within Age categories	92.9%	7.1%	100.0%	
		% of Total	7.2%	0.6%	7.8%	
	45-49	Count	8	2	10	
		% within Age categories	80.0%	20.0%	100.0%	
		% of Total	4.4%	1.1%	5.6%	
Total		Count	59	121	180	
		% within Age categories	32.8%	67.2%	100.0%	
		% of Total	32.8%	67.2%	100.0%	

Table (2) reveals that there is a relationship between age and blood pressure disorder among women who died from this disease, as the significance value was equal to 0.000, which is less than 0.05. Therefore, we reject the null hypothesis that the two variables are independent and accept the alternative hypothesis that the two variables are not independent, but rather there is a relationship between them, which is the explanation. This disease is associated with elder age groups, while it decreases among younger ages.

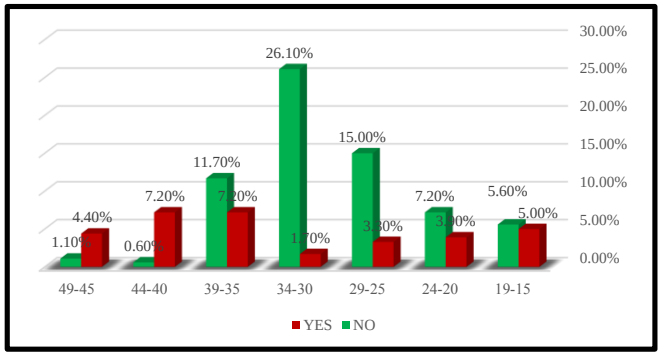

Fig.2: Deaths due to blood pressure disorder according to age

Relationship between age, obstetric bleeding and maternal deaths

It is clear from Table (3) that there is a relationship between age level and obstetric bleeding among women who died from this disease, as the significance value was equal to 0.000, which is less than 0.05. Therefore, we reject the null hypothesis that the two variables are independent. Thus, the alternative hypothesis is accepted. The variables are not independent, but rather there is a relationship between them, which explains the correlation. This disease affects all age groups.

Table 3. Chi-2 test between age, obstetric bleeding and maternal deaths in 2022

			Obstetric bleeding			X2
			YES	NO	Total	
Age categories	15-19	Count	13	6	19	.000
		% within Age categories	68.4%	31.6%	100.0%	
		% of Total	7.2%	3.3%	10.6%	
	20-24	Count	1	19	20	
		% within Age categories	5.0%	95.0%	100.0%	
		% of Total	0.6%	10.6%	11.1%	
	25-29	Count	13	20	33	
		% within Age categories	39.4%	60.6%	100.0%	
		% of Total	7.2%	11.1%	18.3%	
	30-34	Count	12	38	50	
		% within Age categories	24.0%	76.0%	100.0%	
		% of Total	6.7%	21.1%	27.8%	
	35-39	Count	6	28	34	
		% within Age categories	17.6%	82.4%	100.0%	
		% of Total	3.3%	15.6%	18.9%	
	40-44	Count	12	2	14	
		% within Age categories	85.7%	14.3%	100.0%	
		% of Total	6.7%	1.1%	7.8%	
	45-49	Count	10	0	10	
		% within Age categories	100.0%	0.0%	100.0%	
		% of Total	5.6%	0.0%	5.6%	
Total		Count	67	113	180	
		% within Age categories	37.2%	62.8%	100.0%	
		% of Total	37.2%	62.8%	100.0%	

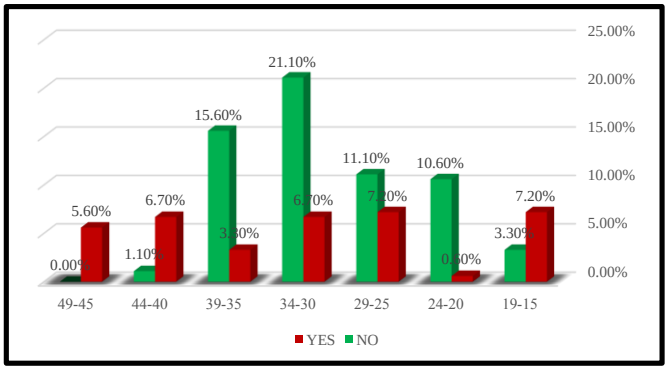

Fig.3: Deaths due to obstetric bleeding according to age

b. Relationship between age, to unsafe abortion and maternal deaths

It is clear from Table (4) that there is a relationship between age and unsafe abortion among women who died from unsafe abortion, as the significance value was equal to 0.000, which is less than 0.05. Therefore, the null hypothesis rejected. The two variables are independent alternative hypothesis is accepted. The two variables are not independent, but rather there is a relationship between them, which is the explanation. Unsafe abortion is related to age groups.

Table (4) Chi-2 Test between age, unsafe abortion and maternal deaths in 2022

			Unsafe abortion			X2
			YES	NO	Total	
Age categories	15-19	Count	7	12	19	.000
		% within Age categories	36.8%	63.2%	100.0%	
		% of Total	3.9%	6.7%	10.6%	
	20-24	Count	0	20	20	
		% within Age categories	0.0%	100.0%	100.0%	
		% of Total	0.0%	11.1%	11.1%	
	25-29	Count	20	13	33	
		% within Age categories	60.6%	39.4%	100.0%	
		% of Total	11.1%	7.2%	18.3%	
	30-34	Count	28	22	50	
		% within Age categories	56.0%	44.0%	100.0%	
		% of Total	15.6%	12.2%	27.8%	
	35-39	Count	17	17	34	
		% within Age categories	50.0%	50.0%	100.0%	
		% of Total	9.4%	9.4%	18.9%	
	40-44	Count	10	4	14	
		% within Age categories	71.4%	28.6%	100.0%	
		% of Total	5.6%	2.2%	7.8%	
	45-49	Count	4	6	10	
		% within Age categories	40.0%	60.0%	100.0%	
		% of Total	2.2%	3.3%	5.6%	
Total		Count	86	94	180	
		% within Age categories	47.8%	52.2%	100.0%	
		% of Total	47.8%	52.2%	100.0%	

Fig.4: Deaths due to unsafe abortion by age

c. Relationship between age, sepsis and maternal mortality

It is clear from Table (5) that there is a relationship between age level and infection among women who died of this disease, as the significance value was equal to 0.002, which is less than 0.05. Therefore, we reject the null hypothesis that the two variables are independent and accept the alternative hypothesis that the two variables are not independent, but rather there is a relationship between them, which explains the association of this. Disease by age groups

Table (5) Chi-2 Test between age and infection for maternal deaths in 2022

			Sepsis			X2
			YES	NO	Total	
Age categories	15-19	Count	11	8	19	.002
		% within Age categories	57.9%	42.1%	100.0%	
		% of Total	6.1%	4.4%	10.6%	
	20-24	Count	10	10	20	
		% within Age categories	50.0%	50.0%	100.0%	
		% of Total	5.6%	5.6%	11.1%	
	25-29	Count	2	31	33	
		% within Age categories	6.1%	93.9%	100.0%	
		% of Total	1.1%	17.2%	18.3%	
	30-34	Count	21	29	50	
		% within Age categories	42.0%	58.0%	100.0%	
		% of Total	11.7%	16.1%	27.8%	
	35-39	Count	13	21	34	
		% within Age categories	38.2%	61.8%	100.0%	
		% of Total	7.2%	11.7%	18.9%	
	40-44	Count	3	11	14	
		% within Age categories	21.4%	78.6%	100.0%	
		% of Total	1.7%	6.1%	7.8%	
	45-49	Count	5	5	10	
		% within Age categories	50.0%	50.0%	100.0%	
		% of Total	2.8%	2.8%	5.6%	
Total		Count	65	115	180	
		% within Age categories	36.1%	63.9%	100.0%	
		% of Total	36.1%	63.9%	100.0%	

The above-mentioned relationship becomes clear in the following figure, as infection is related to age in all groups and reaches its maximum in the age group (25-29). Then begins to decrease until it reaches its lowest cases in the age group (45-49). It is expected that this is related to reproductive behavior as in the figure (5).

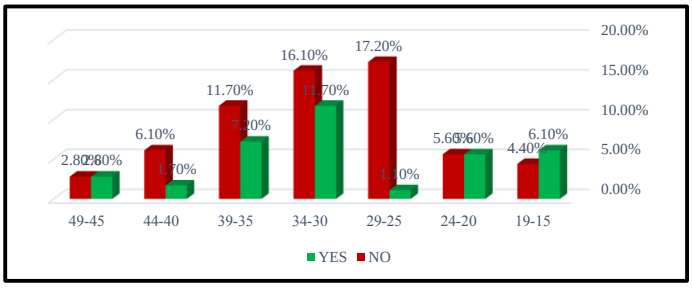

Fig.5: Deaths due to Sepsis by age

Conclusion

1. There is a relationship between age and blood pressure disorder among women who died from this disease, as the significance value was equal to 0.000, which is less than 0.05.
2. There is a relationship between age and infection among women who died of this disease, as the significance value was equal to 0.002, which is less than 0.05.
3. There is a relationship between age and unsafe abortion among women who died from this disease, as the significance value was equal to 0.000, which is less than 0.05.
4. There is a relationship between age and obstetric bleeding among women who died from this disease, as the significance value was equal to 0.000, which is less than 0.05.

Recommendations

Maternal death in North Darfur is unacceptably high. Humanitarian crises, war conflict and post-war conflicts critically impede reducing maternal mortality. The majority of maternal death can be avoided, given the well-established healthcare interventions to prevent and manage complications leading to maternal death. In order to prevent maternal deaths, it is crucial to prevent unintended pregnancies. Woman, including adolescents, need access to safe abortion services in accordance with the legal framework, and high-quality post-abortion care. There the study recommends:

1. spreading culture and awareness of the dangers of unsafe abortion. This requires studies that look for the relationship of the low level of education among women to reproductive age and exposure to unsafe abortion in the study area;
2. providing integrated health care to reduce diseases that cause maternal deaths;
3. providing security in war-affected areas in the study area and observing laws protecting mothers; and,
4. reducing poverty among mothers in the study area.

References:

Amararatne, R., & Vidanapathirana, M. (2019). Maternal Death due to Viral Sepsis. *Medico-Legal Journal of Sri Lanka*, *7*(2).

Asamoah, B. O., Moussa, K. M., Stafström, M., & Musinguzi, G. (2011). Distribution of causes of maternal mortality among different socio-demographic groups in Ghana; a descriptive study. *BMC public health*, *11*(1), 1-10.

Awadalla, H., Elmak, N. E., El-Sayed, E. F., Almobarak, A. O., Elmadhoun, W. M., Osman, M., Noor, S. K., & Ahmed, M. H. (2018). Hypertension in Sudanese individuals and associated risk factors: the critical intersection between salt and sugar intake. *Cardiovascular diagnosis and therapy*, *8*(4), 432.

Benimana, C., Small, M., & Rulisa, S. (2018). Preventability of maternal near miss and mortality in Rwanda: A case series from the University Teaching Hospital of Kigali (CHUK). *PLoS One*, *13*(6), e0195711. https://doi.org/10.1371/journal.pone.0195711

Carter, S. (1999). Overview of common obstetric bleeding disorders. *The Nurse Practitioner*, *24*(3), 50-73.

Fakharunnisa, Q. M., Zaheer, S. M., & Waqarunnissa Ahmed, F. P. (2022). Relative Rate of Maternal Deaths in Pakistani Population due to sepsis. *Pakistan Journal of Medical & Health Sciences*, *16*(04), 192-192.

Francome, C. (2016). *Unsafe Abortion and Women's Health: Change and Liberalization*. Routledge.

Garland, J., & Little, D. (2018). Maternal death and its investigation. *Academic forensic pathology*, *8*(4), 894-911.

Goldman-Mellor, S., & Margerison, C. E. (2019). Maternal drug-related death and suicide are leading causes of postpartum death in California. *American journal of obstetrics and gynecology*, *221*(5), 489. e481-489. e489.

Haggaz, A. A., Radi, E. A., & Adam, I. (2007). High maternal mortality in Darfur, Sudan. *Int J Gynaecol Obstet*, *98*(3), 252-253. https://doi.org/10.1016/j.ijgo.2007.04.003

Havea, P. H., & Mohanty, M. (2020). Professional development and sustainable development goals. In. Springer Nature.

Hensley, M. K., Bauer, M. E., Admon, L. K., & Prescott, H. C. (2019). Incidence of maternal sepsis and sepsis-related maternal deaths in the United States. *Jama*, *322*(9), 890-892.

Johnsen, J. M., & MacKinnon, H. J. (2022). JTH in Clinic-Obstetric bleeding: VWD and other inherited bleeding disorders. *Journal of Thrombosis and Haemostasis*, *20*(7), 1568-1575.

Khan, K. S., Wojdyla, D., Say, L., Gülmezoglu, A. M., & Van Look, P. F. (2006). WHO analysis of causes of maternal death: a systematic review. *The lancet*, *367*(9516), 1066-1074.

Krexi, D., & Sheppard, M. N. (2017). Cardiovascular causes of maternal sudden death. Sudden arrhythmic death syndrome is leading cause in UK. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, *212*, 155-159.

Lim, L. M., & Singh, K. (2014). Termination of pregnancy and unsafe abortion. *Best Practice & Research Clinical Obstetrics & Gynaecology*, *28*(6), 859-869.

Macleod, C. K., Binnawi, K. H., Elshafie, B. E., Sadig, H. E., Hassan, A., Cocks, N., Willis, R., Chu, B., & Solomon, A. W. (2019). Unimproved water sources and open defecation are associated with active trachoma in children in internally displaced persons camps in the Darfur States of Sudan. *Trans R Soc Trop Med Hyg*, *113*(10), 599-609. https://doi.org/10.1093/trstmh/trz042

Mishra, S., & Rath, S. K. (2021). Unsafe abortion: Combating the silent menace. *Indian Journal of Obstetrics and Gynecology Research*, *8*(2), 146-149.

Nahed, Z. K., & Rashid, H. A.-R. (2019). Study the factors affecting maternal mortality in Iraq. *Journal of Administration and Economics*(122).

Shoko, E., & Naidu, M. (2020). Political conflict and community health in Zimbabwe: Health professionals' perspectives. *Africa's Public Service Delivery & Performance Review*, *8*(1), 8.

Tranquilli, A., Dekker, G., Magee, L., Roberts, J., Sibai, B., Steyn, W., Zeeman, G., & Brown, M. (2014). The classification, diagnosis and management of the hypertensive disorders of pregnancy: a revised statement from the ISSHP. In (Vol. 4, pp. 97-104): Elsevier.

WHO. (2010). Trends in maternal mortality: 1990 to 2008.

WHO. (2021). New global targets to prevent maternal deaths. *Access to a 'continuum of care'needed, before, during and after pregnancy and childbirth. Online verfügbar unter https://www. who. int/news/item/05-10-2021-new-global-targets-to-prevent-maternal-deaths*.

WHO. (2023). Trends in maternal mortality 2000 to 2020: estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division: executive summary.

Yanyan, W., & Renying, H. (2014). Analysis of causes of maternal death. *Chinese Journal of Maternal and Child Clinical Medicine (electronic version)*, *10*(3), 367-369. https://doi.org/10.3877/cma.j.issn.1673-5250.2014.03.023

Zhang, L. M., & Ding, H. (1988). Analysis of the causes of maternal death in China. *Bull World Health Organ*, *66*(3), 387-390.

البشير، إ. ع. ا. (٢٠١٨). الخصائص الاجتماعية والاقتصادية وأثرها على وفيات الأمهات بولاية النيل الأبيض (٢٠١٦ - ١٩٩٠). ٠٠٠ http://search.mandumah.com/Record/962872 (011).

عبده، إ. م. إ. (٢٠٢١). الكشف عن المتغيرات المؤثرة في وفيات الأمهات باستخدام التوزيع التكراري: دراسة حالة لولاية نهر النيل. المجلة العلمية المركزية ، جامعة الزعيم الازهري(٢١)، 21 - 38.

عمار، ن. ب. (٢٠١٨). أسباب وفيات الأمهات: دراسة ميدانية في المؤسسة الاستشفائية المتخصصة الأم والطفل مريم بوعتورة - باتنة [أسباب وفيات الأمهات: دراسة ميدانية في المؤسسة الاستشفائية المتخصصة الأم والطفل مريم بوعتورة - باتنة

]. *Journal of Social Sciences Université Amar Telidji, Laghouat*(28), 179 - 196.