Strengthening Neonatal Mortality and Stillbirths Audits in Zaatari and Azraq Refugee Camps in Jordan

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Final Report

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Global Health Development (GHD) is a regional initiative created to support countries in the Eastern Mediterranean Region (EMR) and to strengthen their health systems to respond to public health challenges and threats. GHD was initiated to advance the work of the Eastern Mediterranean Public Health Network (EMPHNET) by building coordinating mechanisms with Ministries of Health, International Organizations and other institutions to improve population health outcomes. As an implementing arm to EMPHNET, GHD aligns its strategies with national policies and directions. Serving as a collaborative platform, GHD/EMPHNET is dedicated to serve the region by supporting national efforts to promote public health policies, strategic planning, sustainable financing, resource mobilization, public health programs, and other related services.

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Introduction

Neonatal mortality

Neonatal death is defined as any death that occurs in the first 28 days of life. Neonatal deaths account for approximately 44% of all deaths of children under five years in low-middle-income countries[1]. Neonatal mortality is a public health problem worldwide primarily in low- and middle-income countries. Although extensive progress has been achieved in reducing neonatal mortality over the last three decades, increased efforts to improve progress are still needed to achieve the 2030 SDG target (3.2) aiming to reduce neonatal mortality to at least as low as 12 deaths per 1,000 live births. [2] The neonatal death rate is calculated as the number of infant deaths that occur between 0-27 days of life divided by the number of live births, multiplied by 1000.

Stillbirths

The estimated average global stillbirth rate decreased from 24.7 per 1000 births in 2000 to 18.4 per 1000 births in 2015.[3] Although the last 15 years witnessed a 25.5% reduction in the global stillbirth rate, the progress in reducing the stillbirth burden remains slow and insufficient. An estimated 2.6 million stillbirths occur annually, of which 98% occur in low-income and middle-income countries. The stillbirth rate is the number of stillbirths (any fetal death after 22 weeks and/or ≥500 g) divided by the number of total births. Half of all stillbirths occur during labor and birth resulting from preventable causes such as maternal infections and obstetric complications. Antepartum stillbirths are those that occur before labor, while intrapartum stillbirths are those which occur after the onset of labor. Although congenital anomalies are one of the leading causes of stillbirths, some of these are also preventable.[4] Many factors play a role in stillbirths including complications during pregnancy and childbirth and women's characteristics such as age, socioeconomic status, nutritional status, and chronic diseases. Infant risk factors include gestational age, weight at birth, multiple births, sex, birth presentation, and congenital abnormalities.[5] Stillbirth rates appear to be linked to the economic status of the countries.[6] There is a wide gap in stillbirths between low- and high-income countries, which might be linked to the quality of antenatal, and delivery care and maternal

[1] UNHCR. Improving newborn and neonatal care- http://www.unhcr.org/57beb81e4.pdf

[2] Hug L, Alexander M, You D, Alkema L. National, regional, and global levels and trends in neonatal mortality between 1990 and 2017, with scenariobased projections to 2030: a systematic analysis. Lancet Glob Health. (2019) 7:e710–20.

3 Blencowe H, Cousens S, Jassir FB, et al. National, regional, and worldwide estimates of stillbirth rates in 2015, with trends from 2000: a systematic analysis. Lancet Glob Health. 2016;4:e98–ee108.

4 Lawn JE, Blencowe H, Pattinson R, et al. Stillbirths: where? When? Why? How to make the data count? Lancet. 2011;377:1448–1463

5 Liu LC, Wang YC, Yu MH, et al. Major risk factors for stillbirth in different trimesters of pregnancy – a systematic review. Taiwan J Obstet Gynecol. 2014;53: 141–145.

6 Aminu M, Unkels R, Mdegela M, et al. Causes of and factors associated with stillbirth in low- and middle income countries: a systematic literature review. BJOG. 2014; 121(Suppl 4):141–153.

services in these countries. The majority of stillbirths occurring annually are a result of poor maternal care or inadequate management of pregnancy-related care.[7]
The stillbirth rate is a sensitive marker of the quality of care in pregnancy and childbirth, and the strength of the health system. There is a paucity of quality information on the causes of stillbirth globally. Despite growing up research projects on maternal-child health, still, there is little effort has been made in developing countries to explore the causes of stillbirths. At the country level, accurate data on stillbirths are urgently needed to enable tracking of the quality of antenatal and intrapartum care and understand the causes of these deaths and thus identify areas for prevention.[8] Many countries in the region including Jordan do not include stillbirth in their vital statistics reporting system.

Neonatal death and stillbirth audits

Neonatal death and stillbirth audits are the processes of systematically capturing information on the number and causes of all neonatal deaths and stillbirths and the potentially avoidable factors linked to deaths, to provide data for decision-making and responding effectively to make changes.[9] These are conducted in a no-blame, interdisciplinary setting to improve the care provided to all mothers and babies. Neonatal deaths and stillbirth reviews provide opportunities to examine the circumstances surrounding, as well as the immediate and contributing factors leading to neonatal deaths and stillbirths and inform the delivery of health services and quality of health care for women and babies during pregnancy and delivery, and ultimately to prevent future morbidity and mortality.[10] Auditing neonatal deaths and stillbirths can encourage stakeholders to enhance the quality of care during the antenatal period and labor, thus improving birth outcomes. One way to accomplish this is through the recognition of modifiable risk factors and the development of initiatives to improve care. In specific, auditing provides a better understanding of root causes that allows the prevention of similar deaths in the future.

Neonatal mortality and stillbirth audits are particularly important as care often falls short between different providers and even between different departments or units. However, audits alone cannot improve the quality of care and outcomes; unless the recommendations contained within the audit process are effectively implemented, maternal and neonatal outcomes will not improve. [11,12]

7 Reinebrant HE, Leisher SH, Coory M, et al. Making stillbirths visible: a systematic review of globally reported causes of stillbirth. BJOG. 2018;125:212–224.
8 Lawn JE, Blencowe H, Waiswa P, et al. Stillbirths: rates, risk factors, and acceleration towards 2030. Lancet. 2016;387:587–603.
9 Kerber et al. BMC Pregnancy and Childbirth 2015, 15(Suppl. 2): S9 Counting every stillbirth and neonatal death through mortality audit to improve quality of care for every pregnant woman and her baby. http://www.biomedcentral.com/1471-2393/15/S2/S9
10 http://www.who.int/pmnch/knowledge/publications/summaries/ks27/en/
11 Pattinson R1, Kerber K, et. al. Perinatal mortality audit: counting, accountability, and overcoming challenges in scaling up in low- and middle-income countries. Int J Gynecology Obstet.2009 Oct;107 Suppl 1: S113-21, S121-2.
12 EJ Buchmann. Towards greater effectiveness of perinatal death audit in low- and middle-income countries. BJOG. Volume 121, Issue Supplement s4, pages 134–136, September 2014

Neonatal death and stillbirth audits in Syrian camps

Collectively, Zaatari and Azraq camps host approximately 113,752 refugees; 76878 live in Zaatari camp and 36874 live in Azraq camp. Pregnant women receive regular checkups in the camps' clinics throughout their pregnancy. They usually deliver their babies in camp hospitals. However, complicated cases are referred to other health facilities based on defined criteria depending primarily on the facilities capacities. In line with The United Nations High Commissioner for Refugees (UNHCR)'s global strategy, UNHCR Jordan has established a neonatal death audit system in camps in collaboration with the Centers for Disease Control and Prevention (CDC). EMPHNET started to conduct audits in the Zaatari camp in June 2016 and in the Azraq camp in April 2016. Stillbirth audits started in July 2018. The audit form was pilot tested and reviewed by EMPHNET, UNHCR, and The United Nations Population Fund (UNFPA). They agreed upon a new audit form for stillbirth to be used starting from 1 January 2019. Revision of the audit forms took place in late 2019 to capture more significant data; questions were added to highlight the challenges in transportation for the mother in addition to the baby. More questions were added to specify treatment protocols used for anemia during pregnancy. In June 2020, EMPHNET was selected by Blumont through a tendering process to start conducting the audits in Zaatari and Azraq camps.

The main purpose of death auditing is to decrease neonatal mortalities and stillbirths, among Syrian refugees by conducting the following activities:

- Conduct periodic review meetings with stakeholders about the findings and recommendations in a manner that is acceptable to all.
- Investigate possible causes of death/ and factors affecting the coverage and quality of babies' care.
- Improve neonatal care in refugee camps and prioritize action to save the lives of babies.

Rate and causes of neonatal mortality

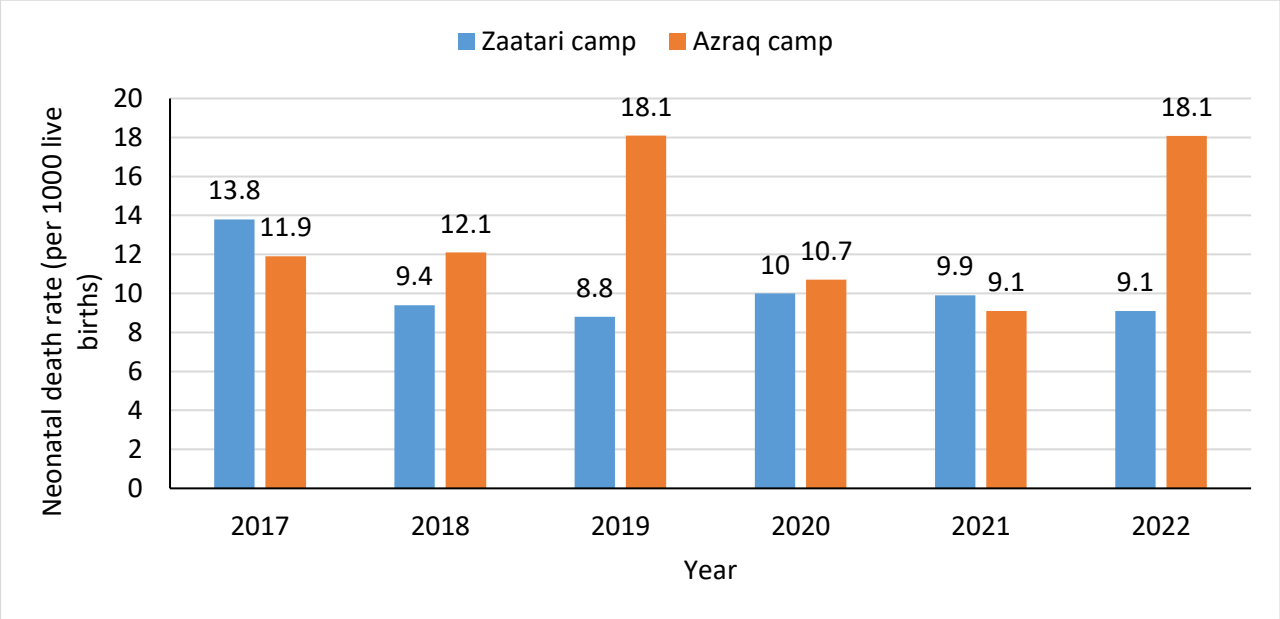
According to the Jordan Perinatal and Neonatal Mortality study in 2016,[13] the neonatal mortality rate in Jordan was 14.9 per 1,000 live births. The overall neonatal mortality rate in 2020 was 14.1 per 1,000 live births. Of neonatal deaths, 76% were early neonatal deaths and 24% were late neonatal deaths.[14]

[13] Batieha A, Khader Y, Berdzuli N, Chua-Oon C, Badran E, Al-Sheyab N, et al. Level, causes and risk factors of neonatal mortality, in jordan: results of a national prospective study. Matern Child Health J. (2016) 20:1061–71.

[14] Al-Sheyab NA, Khader YS, Shattnawi KK, Alyahya MS, Batieha A. Rate, Risk Factors, and Causes of Neonatal Deaths in Jordan: Analysis of Data From Jordan Stillbirth and Neonatal Surveillance System (JSANDS). Front Public Health. 2020 Oct 30;8:595379.

Figure 1 shows the neonatal mortality rate per 1000 live births in Zaatari and Azraq Camps by year. In 2022, the neonatal mortality rates were 9.1 and 18.1 per 1000 live births in the Zaatari camp and Azraq camp, respectively. These estimates were close to those in 2019.

Figure 1. Neonatal Mortality Rate Per 1000 live births in Zaatari and Azraq Camps, 2017-2021



In low- and middle-income countries, the majority of neonatal deaths occur without a clear cause of death (i.e., pre-maturity). [15] Data on causes of neonatal deaths and the timing around neonatal deaths are often sparse and less reliable than all-cause mortality data, and using these data can result in uncertain estimates, which poses substantial challenges to the generation of evidence-based interventions to prevent neonatal deaths. Improved data on where and when neonatal deaths occur and what causes delays in seeking care is a key factor for developing context-specific strategies for vulnerable communities and for the provision of health care.

The main causes of neonatal deaths in Jordan occurring pre-discharge include respiratory and cardiovascular disorders (43%) and low birth weight and pre-term (33%). The main maternal conditions attributing to these deaths include complications of the placenta and cord, complications of pregnancy, and medical and surgical conditions.[16] The main causes of neonatal deaths occurring post-discharge were low birth weight and pre-term deliveries (42%).

In 2021, 35 neonatal deaths (24 in Zaatari camp and 11 in Azraq camp) were reviewed. Of all neonatal deaths, 21 (60.0%) were early neonatal deaths (8 in Azraq camp and 13 in Zaatari camp) and 14 (40.0%) were late neonatal deaths (3 in Azraq camp and 11 in Zaatari camp). Of

15 Goldenberg RL, Muhe L, Saleem S, Dhaded S, Goudar SS, Patterson J, et al. Criteria for assigning cause of death for stillbirths and neonatal deaths in research studies in low-middle income countries. J Matern Fetal Neonatal Med. (2019) 32:1915–23.
16 Al-Sheyab NA, Khader YS, Shattnawi KK, Alyahya MS, Batieha A. Rate, Risk Factors, and Causes of Neonatal Deaths in Jordan: Analysis of Data From Jordan Stillbirth and Neonatal Surveillance System (JSANDS). Front Public Health. 2020 Oct 30;8:595379.

all stillbirths, 4 (22.2%) were intrapartum stillbirths (3 in Azraq camp and 1 in Zaatari camp) and 14 (77.8%) were antepartum stillbirths (11 in Azraq camp and 3 in Zaatari camp). The total number of perinatal deaths was 39 deaths (22 in Azraq and 17 in Zaatari). The immediate causes of neonatal death, as documented by the attending physician, were cardiopulmonary arrest for 33 (94.3%) deaths and asphyxiation for 2 (6.1%) deaths (Table 13). The main underlying causes of death were prematurity (74.3%), low birth weight (57.1%), and congenital anomalies (34.3%).

Rate and causes of stillbirths

The rate of stillbirth in Jordan is 9.9 per 1000 total births. The main contributing fetal conditions of antepartum stillbirths were antepartum death of unspecified cause (33.7%), acute antepartum event (hypoxia) (33.7%), congenital malformations and chromosomal abnormalities (13.3%), and disorders related to the length of gestation and fetal growth (10.8%).[17] The main contributing maternal conditions of antepartum stillbirths included complications of the placental cord and membranes (48.7%), maternal complications of pregnancy (23.1%), and maternal medical and surgical conditions (23.1%).

In 2021, 18 stillbirths (14 in Azraq camp and 4 in Zaatari camp) born to Syrian parents were reviewed. The immediate cause of stillbirth was cardiopulmonary arrest for 7 (38.9%) deaths. For 61.1% of stillbirths, the cause of death was unknown or determined as IUFD by the attending physician. The main underlying causes of death were prematurity (72.2%), low birth weight (50.0%), and congenital anomalies (16.7%).

Delays associated with neonatal deaths and stillbirths

In 2021, delay in problem recognition and deciding to seek care outside the home (Delay 1) was the greatest contributor to deaths in Zaatari and Azraq camps. The most frequent factors that affected women's problem recognition/ decision to seek care outside the home were low socio-economic status and lack of knowledge. Almost half (49.1%) of women had low socioeconomic status and 50.9% had inadequate knowledge and poor understanding of complications and risks associated with pregnancy and when to seek medical help. Women's poor compliance (not following medical advice or non-compliance to routine ANC visits or non-compliance to medications/ supplements) was the second (20.8%, n = 11) frequent contributing factor to stillbirths and neonatal deaths followed by not using family planning methods by at-high risk women or by young women to delay first pregnancy (17.0%, n = 9). All delays were more frequent among women living in Zaatari camp compared to those living in Azraq camp.

The second major contributor to stillbirths and neonatal deaths was delays in receiving adequate and quality care at the health facility (Delay 3). The main problems identified were clinician non-adherence to standards of care (15.1%, n = 8), not receiving optimal health care

17 Shattnawi KK, Khader YS, Alyahya MS, Al-Sheyab N, Batieha A. Rate, determinants, and causes of stillbirth in Jordan: Findings from the Jordan Stillbirth and Neonatal Deaths Surveillance (JSANDS) system. BMC Pregnancy Childbirth. 2020 Sep 29;20(1):571

during the ANC period (11.3%, n = 6), inadequate management of women's and babies' medical conditions (11.4%, n = 6) and poor management of high-risk pregnancies, inadequate follow up, and not referring high-risk pregnancies in the right time (7.4%, n = 4). These factors contributed more to deaths in Zaatari camp compared to those in Azraq camp.

Delays related to reaching an appropriate source of care included poor emergency services (unavailable ambulance) or delays in ambulance transportation in three cases, mainly in Zaatari camp (10.7%). Not respecting patients' rights by the ambulance service providers was reported by mothers of 8 deaths (15.1%; 3 deaths in Azraq and 5 deaths in Zaatari).

Methods

All stillbirths (fetal deaths after 22 weeks of gestation and/or birth weight >500g) and neonatal deaths (any infant death within the first 28 completed days of life) in Zaatari and Azraq camps occurring during the reporting period between January 1 and December 2022 were investigated by EMPHNET group. Neonatal mortality and stillbirth cases were reported to EMPHNET from the International Medical Corps (IMC) in Zaatari and Azraq camps. Whenever EMPHNET was alerted about a new case of neonatal mortality or stillbirth, the EMPHNET team conducted the death audit within 72 hours of the reported death.

Death audits were conducted by physicians and midwives. During the visit, the team filled out the death audit form. The audit form was designed to collect data quantitatively and qualitatively by interviewing caregivers/mothers, reviewing the medical files of the newborn and mother, reviewing the mother's ANC card, and meeting with the attending physician/midwife.

Once the forms were completed, they were sent to a consultant who reviews the full information on the cases, verifies the accuracy of the data, identifies information on the modifiable risk factor and delays, and suggests relevant recommendations. After that, the completed forms were submitted electronically to UNHCR who provided their feedback and comments. All UNHCR comments were addressed and the forms were revised before they are entered into the Excel sheet. All the information in the audit form is kept confidential. Any reported neonatal death or stillbirth that is found under primary investigation to be living outside the camps but reported to the camp for covering delivery services was excluded.

For data analysis, the data in an Excel sheet were exported to IBM SPSS version 24. Data were mainly analyzed using descriptive statistics. Data were stratified by the camp.

Results

Number of neonatal deaths and stillbirths, 2022

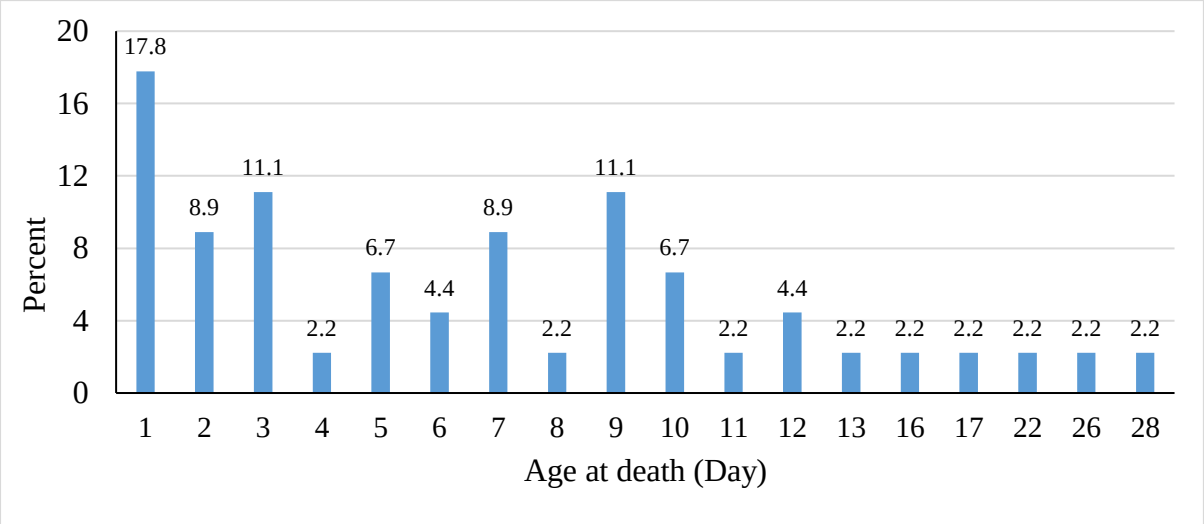
A total of 45 neonatal deaths (25 in Zaatari camp and 20 in Azraq camp) and 6 stillbirths (all in Azraq camp) born to Syrian parents in 2022 were reviewed. Of all neonatal deaths, 27 (60.0%) were early neonatal deaths (12 in Azraq camp and 15 in Zaatari camp) and 18 (40.0%) were late neonatal deaths (8 in Azraq camp and 10 in Zaatari camp). All stillbirths were

antepartum stillbirths. The total number of perinatal deaths was 33 deaths (18 in Azraq and 15 in Zaatari).

For neonatal deaths, 42 (93.3%) deaths occurred in the referral facility, 2 (4.4%) at home and one death (2.2%) occurred in the camp health facility. Of the six stillbirths, 5 (83.3%) occurred in the referral facility.

A total of 25 (11.1%) neonatal deaths occurred during the morning time, 15 (33.3%) in the afternoon, and 5 (11.1%) at night. Almost 17.8% of neonatal deaths occurred on the first day of life and 60.0% occurred in the first week of life. Figure 2 shows the distribution of neonatal deaths according to age at death in days.

Figure 2. The distribution of 45 neonatal deaths occurred in 2022 according to age at death (day).



Newborns' clinical characteristics

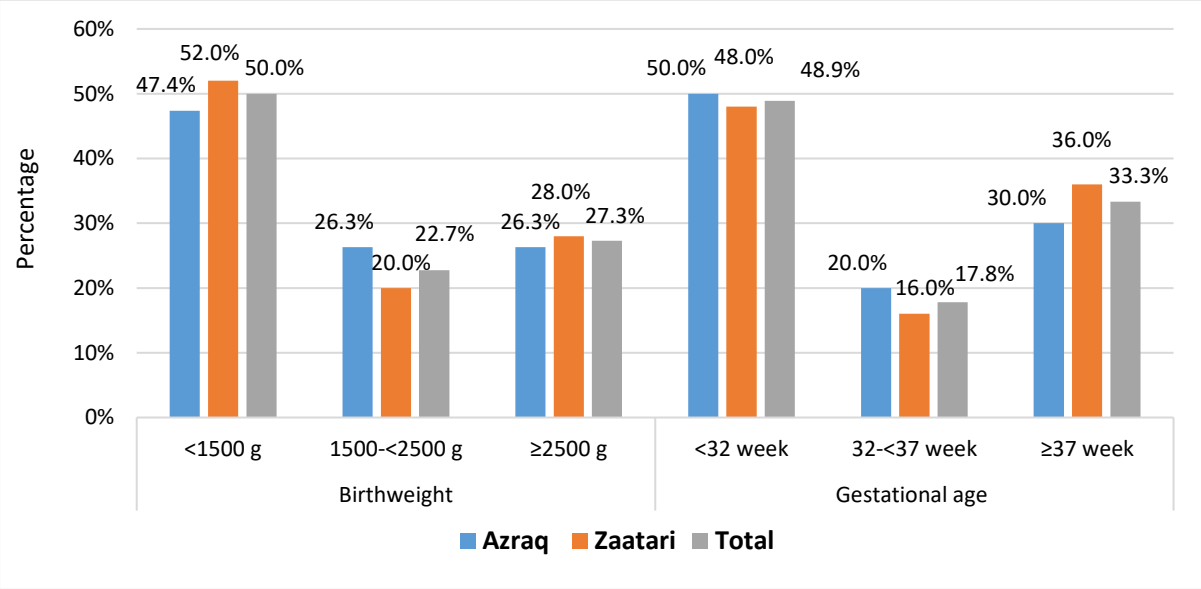
Almost two thirds (66.7%) of babies who died in the neonatal period and 4 (66.7%) stillbirths were delivered preterm (<37 weeks). Birth weight was missing for one neonatal death (For neonatal deaths whose birthweights were registered, 72.7% weighed less than 2500 grams. Their birthweight ranged from 600 to 4750 g (mean = 1895.1 g). For stillbirths whose birthweights were registered, 2 (40%) weighed less than 2500. The majority of stillbirths (83.3%) at the time of delivery were macerated stillbirths. Table 1 shows the demographic and clinical characteristics of neonatal deaths in each camp. Figure 3 shows the birthweight and gestational age of neonatal deaths in Azraq and Zaatari camps.

Table 1. The demographic and clinical characteristics of neonatal deaths in each camp

Variable	Azraq (n = 20)		Zaatari (n = 25)		Total (N = 45)	
	n	%	n	%	N	%

Sex						
Female	7	35.0	14	56.0	21	46.7
Male	13	65.0	11	44.0	24	53.3
Time of neonatal death						
Early neonatal death	12	60.0	15	60.0	27	60.0
Late neonatal death	8	40.0	10	40.0	18	40.0
Birth weight (gram)*						
<1500	9	47.4	13	52.0	22	50.0
1500-<2500	5	26.3	5	20.0	10	22.7
≥2500	5	26.3	7	28.0	12	27.3
Gestational age (week)						
<32	10	50.0	12	48.0	22	48.9
32-<37	4	20.0	4	16.0	8	17.8
≥37	6	30.0	9	36.0	15	33.3
Neonatal resuscitation required	17	89.5	23	64.0	33	75.0
*Birth weight was missing for 1 baby						

Figure 3. The birthweight and gestational age of neonatal deaths in Azraq and Zaatari camps.



Mothers' characteristics

The 45 neonatal deaths were born for 44 women (one woman had lost her twins in the neonatal period). Women aged between 17 and 45 years (Mean (SD) = 28.0 (7.5) years). Eight women (18.2%) aged <20 years and 8 women (18.2%) aged >35 years. A total of 32 (70.4%) women had 4 or more pregnancies and 20 (45.5%) women gave birth to 4 babies or more. Almost 95.5% of pregnancies were singletons. Table 2 shows the characteristics of the 45 mothers whose newborns died during the neonatal period.

Table 2. The characteristics of 45 mothers whose newborns died during the neonatal period.

	Azraq		Zaatari		Total	
Variable	(N =19)		(N = 25)		(N = 44)	
	n	%	n	%	N	%
Age of mother (year)						
<20	2	10.5	6	24.0	8	18.2
20-35	14	73.7	14	56.0	28	63.6
>35	3	15.8	5	20.0	8	18.2
Gravida (number of pregnancies)						
<4	4	21.1	9	36.0	13	29.5
4-6	6	31.6	7	28.0	13	29.5
>6	9	47.4	9	36.0	18	40.9
Parity (number of births)						
<4	10	52.6	14	56.0	24	54.5
4-6	7	36.8	8	32.0	15	34.1
>6	2	10.5	3	12.0	5	11.4
Type of pregnancy						
Singleton	17	89.5	25	100.0	42	95.5
Twin	2	10.5	0	0.0	2	4.5

The mothers who delivered stillbirths aged between 21 and 39 years (Mean (SD) = 32.7 (6.4) years). One woman aged <20 years and 3 women aged >35 years. Five women (83.3%) had primary education or less. A total of 5 (83.3%) women had 4 or more pregnancies and 2 (33.4%) women gave birth to 4 babies or more.

Antenatal care

All mothers of neonatal deaths received antenatal care (ANC) before delivery. Table 3 shows the ANC utilization, pregnancy danger signs identified during the antenatal period, and interventions applied after danger signs were identified. The number of ANC visits varied according to the gestational age and women's conditions. Almost half of women (43.2%) visited the health facility 7 times or less.

Compared to 2021, the percentage of women who received tetanus toxoid, iron supplement, and folic acid in 2022 has increased. About 75.0% (48.5% in 2021) of women received tetanus toxoid, 95.5% received iron supplements (90.0% in 2021), and 90.9% received folic acid (84.8% in 2021). The vast majority (98%) of women had at least one pregnancy danger sign. The most common pregnancy danger sign was abdominal pain (90.9%). The most common intervention received was referral (77.3%). During the antenatal period, all women received the following services: blood pressure measurement, blood sugar measurement, checking fetal heart, and blood group and RH factor.

Table 3. Antenatal care utilization, pregnancy danger signs identified during the antenatal period and interventions applied after danger signs identified for mothers of neonatal deaths

	Azraq		Zaatari		Total	
Variable	(N =19)		(N = 25)		(N = 44)	
	n	%	n	%	N	%
Received ANC	19	100.0	25	100.0	44	100.0
Number of ANC visits ≤7	5	26.3	14	56.0	19	43.2
Medications received during the antenatal period						
Tetanus toxoid	14	73.7	19	76.0	33	75.0
Iron supplement	17	89.5	25	100.0	42	95.5
Folic Acid	15	78.9	25	100.0	40	90.9
Pregnancy danger signs identified during the antenatal period						
Fever	3	15.8	5	20.0	8	18.2
Abdominal pain	17	89.5	23	92.0	40	90.9
Blurred vision	4	21.1	3	12.0	7	15.9
Vaginal bleeding	5	26.3	6	24.0	11	25.0
Elevated blood pressure	3	15.8	2	8.0	5	11.4
Interventions applied after danger signs identified						
Referral	14	73.7	20	80.0	34	77.3
Anti-hypertensive medication	3	15.8	2	8.0	5	11.4
Antibiotics	8	42.1	8	32.0	16	36.4

All women who delivered stillbirths received antenatal care before delivery. Four women (66.7%) received folic acid, 5 (83.3%) women received the iron supplement, and 5 (83.3%) women received folic acid. Almost all women had their blood pressure and blood sugar measured. The most common danger sign identified during ANC was decreased/no fetal movement (100%, n = 6) followed by abdominal pain (50.0%). A total of 5 (83.3%) women were referred. Antibiotics were given to 33.3% of women. Two women were diagnosed with anemia and one woman had hypertension. The majority of women (83.3%, n = 5) did not use family planning methods.

Delivery characteristics

Almost two thirds of women (59.1%, n = 26) delivered via cesarean section, and 18 (40.9%) via vaginal delivery (skilled birth attendant. Table 4 shows the delivery and other relevant characteristics for mothers who had their babies died during the neonatal period. The majority of women (70.5%, n = 31) were delivered at the referral hospitals, 11 (25.0%) in the camp hospital, and 1 (2.3%) in the clinic/health center. One woman delivered on her way to the hospital. The majority (86.4%) of deliveries were attended by a gynecologist and 13.6% were attended by a midwife. All delivered women were alive at the time of home visits.

Table 4. Delivery characteristics for mothers of neonatal deaths

	Azraq		Zaatari		Total	
Variable	(N =19)		(N = 25)		(N = 44)	
	n	%	n	%	N	%
Mode of delivery						
Caesarean section	12	63.2	14	56.0	26	59.1
Vaginal delivery (skilled birth attendant)	7	36.8	11	44.0	18	40.9
Delivery location						
Camp hospital (clinic)	7	36.8	4	16.0	11	25.0
Clinic/health center	0	0.0	1	4.0	1	2.3
On the way to health facility	0	0.0	1	4.0	1	2.3
Referral hospital	12	63.2	19	76.0	31	70.5
Birth attendant						
Gynecologist	18	94.7	20	80.0	38	86.4
Midwife	1	5.3	5	20.0	6	13.6

For women with stillbirths, almost one third (33.3%, n = 2) were delivered via cesarean section and 4 (66.7%) women were delivered via vaginal delivery (skilled birth attendant). Five (83.3%) women were delivered at the referral hospitals and one woman was in the camp hospital. Half of the deliveries were attended by a gynecologist and the other half of the deliveries were attended by a midwife.

Mothers' and babies' transportation to the health facility

For mothers of neonatal deaths, 11 (25.0%) women were delivered in the camp, 30 (68.2%) women were transferred by ambulance and 3 (6.8%) women were transferred by private car (18.2% transferred by private care in 2021). Almost one third (34.1%, n= 15) of women who were transferred by ambulance had faced problems with transportation, mainly a complaint of not allowing relatives to accompany them (57.1% in 2021). For 2 (4.2%) women, it took them more than 2 hours to get to the nearest health facility/hospital. Seven (15.9%) women encountered challenges in the health facility; one woman complained of no beds were available. Table 5 shows the transportation to the health facility for mothers of neonatal deaths.

Table 5. The transportation to the health facility for mothers of neonatal deaths

	Azraq		Zaatari		Total	
Variable	(N =19)		(N = 25)		(N = 44)	
	n	%	n	%	N	%
Mothers' transportation to the health facility						
Ambulance	11	57.9	19	76.0	30	68.2
NA (delivered in the camp)	6	31.6	5	20.0	11	25.0
Private taxi	2	10.5	1	4.0	3	6.8
Experienced problems with transportation to the health facility (Not allowing any family member to go with the patient to the referred hospital)	2	10.5	13	52.0	15	34.1
Encountered challenges in the health facility	5	26.3	2	8.0	7	15.9
Took more than 2 hours to get to the nearest health facility/hospital	1	5.3	1	4.0	2	4.5

For mothers of stillbirths, 2 (33.3%) women were transferred by ambulance and 3 (50.0%) women were transferred by private car. Three women (50%) stated that they have faced problems with transportation to the health facility, mainly complaining of having no companion, and three women (50.0%) encountered challenges in the health facility; one complained of taking her phone away, one complained of poor care by nursing staff, and one complained of not allowing her family members to visit her.

Prophylaxis and interventions administered to newborns

Table 6 shows the prophylaxis administered at birth and interventions provided to newborns. Of all newborns who died in the neonatal period, 97.8% (n = 44) and 93.3% (n = 42) received Vitamin K and Antibiotic eye ointment/drops as prophylaxis at birth, respectively. This is compared to 88.6% and 85.7% who received Vitamin K and Antibiotic eye ointment/drops in 2021 as prophylaxis at birth, respectively. Almost 26.7% of babies needed oxygen, reflecting their critical conditions. The most common interventions provided to newborns included IV fluids (91.1%) and parenteral antibiotics (88.9%).

Table 6. The prophylaxis administered at birth and interventions provided to newborn

	Azraq		Zaatari		Total (N = 45)	
Variable	(n = 20)		(n = 25)			
	n	%	n	%	N	%
Prophylaxis administered at birth						
Vitamin K	19	95.0	25	100.0	44	97.8
Antibiotic eye ointment/drops	17	85.0	25	100.0	42	93.3
Interventions provided to newborn						
Oxygen	6	30.0	6	24.0	12	26.7
Parenteral antibiotics	17	85.0	23	92.0	40	88.9

IV fluids	18	90.0	23	92.0	41	91.1
Parenteral anticonvulsants	0	0.0	2	8.0	2	4.4
Phototherapy	6	30.0	4	16.0	10	22.2
Blood transfusion	2	10.0	13	52.0	15	33.3
CPAP or Mechanical Ventilator	18	90.0	20	80.0	38	84.4
Operation for illness	1	5.0	3	12.0	4	8.9

Reasons for admission

Table 7 shows the reasons for the admission of newborns who died in the neonatal period. All babies were critically ill on admission. The main reasons for admission were dyspnea (73.3%), prematurity (64.4%), and low birth weight (68.9%).

Table 7. Reasons for admission of newborns who died in the neonatal period

	Azraq		Zaatari		Total	
Reason for admission	(n = 20)		(n = 25)		(N = 45)	
	n		n		N	
Birth asphyxia	1	5.0	0	0.0	1	2.2
Prematurity	13	65.0	16	64.0	29	64.4
Fever	1	5.0	1	4.0	2	4.4
Refusal to suck	1	5.0	2	8.0	3	6.7
Neonatal sepsis	1	5.0	1	4.0	2	4.4
Low birth weight	15	75.0	16	64.0	31	68.9
Congenital anomaly	3	15.0	2	8.0	5	11.1
Jaundice	2	10.0	2	8.0	4	8.9
Dyspnea	16	80.0	17	68.0	33	73.3

Causes of death

The immediate causes of neonatal death, as documented by the attending physician, were cardiopulmonary arrest for all deaths (Table 8). The main underlying causes of death were prematurity (53.3%) and congenital anomalies (15.6%). For stillbirths, the cause of death was unknown or determined as IUFD by the attending physician.

Table 8. The immediate and underlying causes of neonatal deaths

	Azraq		Zaatari		Total	
Cause of Death	(n = 20)		(n = 25)		(N = 45)	
	n	%	n	%	N	%
The immediate cause of death						
Cardiopulmonary arrest	20	100.0	25	100.0	45	100.0
Underlying cause of death						
Birth asphyxia	1	5.0	0	0.0	1	2.2
Prematurity	13	65.0	11	44.0	24	53.3
Congenital anomalies	2	10.0	5	20.0	7	15.6
Intestinal obstruction	1	5.0	1	4.0	2	4.4
Milk aspiration	0	0.0	1	4.0	1	2.2
Sepsis	2	10.0	3	12.0	5	11.1
Severe hydrocephalus	1	5.0	1	4.0	2	4.4
Renal failure	0	0.0	1	4.0	1	2.2
Severe Necrotizing Enterocolitis (NEC)	0	0.0	1	4.0	1	2.2

Delays contributed to neonatal deaths and stillbirths

Delay in problem recognition and deciding to seek care outside the home (Delay 1) was the greatest contributor to neonatal deaths. The most frequent factors that affected women's problem recognition/ decision to seek care outside the home were low socio-economic status and lack of knowledge. Almost half (60.0%) of women had low socioeconomic status and 100% had inadequate knowledge and poor understanding of complications and risks associated with pregnancy and when to seek medical help. Other frequent delays were not using family planning methods by at-high-risk women or by young women to delay their first pregnancy (42.2%), not recognizing the risk associated with early marriage/ teenage pregnancy (35.6%), and women's poor compliance (not following medical advice or non-compliance to routine ANC visits or non-compliance to medications/ supplements) (35.6%). Other delays (for neonatal deaths) related to the recognition of danger signs and the decision to seek care are shown in Table 9. Most delays were more frequent among women living in Azraq camp compared to those living in the Zaatari camp.

Table 9. Delays related to recognition of danger signs and decision to seek care (Delay 1)

Delays	Azraq (n = 20)		Zaatari (n = 25)		Total (N = 45)	
	n	%	n	%	N	%
Delay in seeking ANC services	5	25.0	3	12.0	8	17.8
Low socioeconomic status	13	65.0	14	56.0	27	60.0
Patient/family lack of knowledge	20	100.0	25	100.0	45	100.0
Not recognizing the risk associated with early marriage/ teenage pregnancy	5	25.0	11	44.0	16	35.6
Not using family planning methods by high risk women or to delay first pregnancy	7	35.0	12	48.0	19	42.2
Not following medical advice, not compliant with routine ANC visits, not compliant with medications/supplements	9	45.0	7	28.0	16	35.6
Delay recognizing the need for care	5	25.0	1	4.0	6	13.3
Poor feeding practices	0	0.0	1	4.0	1	2.2
Receiving ANC from different facilities (no continuity of ANC)	6	30.0	2	8.0	8	17.8

The second major contributor to neonatal deaths was delays in receiving adequate and quality care at the health facility (Delay 3). Table 10 shows the various delays related to receiving adequate and quality care at the health facility. The main problems identified were not receiving optimal health care during the ANC period (68.9%), inadequate investigations for women with past history of frequent miscarries (60.0%), poor investigation of past obstetric history (66.7%), and poor management of high-risk pregnancies, inadequate follow up, and not referring high-risk pregnancies in the right time (66.7%). Other less frequent problems included poor staff attitude/ negligence/ not respecting patients' rights (44.4%), inadequate assessment of the condition of the neonate and delay in the diagnosis of neonates' medical problems (35.6%), and clinician non-adherence to standards of care (31.1%). These factors contributed more to deaths in Azraq camp compared to those in Zaatari camp.

Table 10. Delays related to receiving adequate and quality care at the health facility

Delays	Azraq (n = 20)		Zaatari (n = 25)		Total (N = 45)	
	n	%	n	%	N	%
Clinician non-adherence to standards of care	9	45.0	5	20.0	14	31.1
Not receiving optimal health care during the ANC period	14	70.0	17	68.0	31	68.9
Poor management of high-risk pregnancies, inadequate follow-up, and not referring high-risk pregnancies at the right time	15	75.0	15	60.0	30	66.7
Inadequate management of uncontrolled gestational diabetes	1	5.0	1	4.0	2	4.4

Poor management of UTI/ Vaginitis	1	5.0	1	4.0	2	4.4
Inadequate management of Jaundice	1	5.0	1	4.0	2	4.4
Not provide women with folic acid	5	25.0	0	0.0	5	11.1
Inadequate counseling during ANC	3	15.0	4	16.0	7	15.6
Inadequate assessment of the condition of the neonate and delay in the diagnosis of neonates' medical problems	7	35.0	9	36.0	16	35.6
Inadequate investigations for women with the past history of frequent miscarries	12	60.0	15	60.0	27	60.0
Poor investigation of past obstetric history	12	60.0	18	72.0	30	66.7
Delay in referral/ poor coordination and arrangement between the referral sites	5	25.0	3	12.0	8	17.8
Delay in receiving adequate care in the hospital when a facility is reached	2	10.0	3	12.0	5	11.1
Poor staff attitude/ negligence/ not respecting patients' rights	5	25.0	15	60.0	20	44.4

For delays related to reaching an appropriate source of care, almost one third (34.1%, n= 15) of women who were transferred by ambulance had faced problems with transportation, mainly a complaint of not allowing relatives to accompany them (57.1% in 2021). For 2 (4.2%) women, it took them more than 2 hours to get to the nearest health facility/hospital.

Table 11 shows the delays associated with the six stillbirths. The most frequent delays were patient/family lack of knowledge, not recognizing the risk associated with early marriage/ teenage pregnancy, and poor investigation of past obstetric history.

Table 11. Delays associated with the six stillbirths

Delay	**n**	**%**
Delay in seeking ANC services	2	33.3
Low socioeconomic status	3	50.0
Patient/family lack of knowledge	6	100.0
Not recognizing the risk associated with early marriage/ teenage pregnancy	5	83.3
Not following medical advice, not compliant to routine ANC visits, not compliant to medications/supplements	4	66.7
Delay recognizing the need for care	2	33.3
Receiving ANC from different facilities (no continuity of ANC)	2	33.3
Not receiving optimal health care during the ANC period	3	50.0
Poor management of high-risk pregnancies, inadequate follow-up, and not referring high-risk pregnancies at the right time	3	50.0
Inadequate management of uncontrolled gestational diabetes	1	16.7
Not providing women with folic acid	1	16.7
Inadequate investigations for women with a history of frequent miscarries	4	66.7

Poor investigation of past obstetric history	5	83.3
Poor staff attitude/ negligence/ not respecting patients' rights	3	50.0

Recommendations

Effective community engagement and mobilization is key to the success of any health program. The purpose of community-based intervention is to generate and sustain the community's interest in the services offered by the healthcare delivery system and to improve their health-seeking behaviors. Healthcare delivery systems in parallel should meet the essential health services delivery standards to ensure the delivery of health services of optimal quality. The below recommendations are based on the findings of death auditing in Zaatari and Azraq camps in 2021-2022 and guided by the three delay model:

A. Delay in the decision to seek care

A1. Community-level

- Increase the awareness of the refugee population on information on pregnancy, childbirth, and newborn healthcare to improve their health-seeking behavior for accessing the available services on time
- Increase the awareness of the refugee population about the risks of early marriage and teenage pregnancies and the importance and benefits of family planning
- Address the barriers to modern family planning methods use in the refugee population and strengthen these services
- Involve male members of the family in the awareness interventions related to pregnancy, childbirth and newborn healthcare, early marriage, teenage pregnancies, and family planning
- Examine beliefs and traditional practices related to postnatal care and feeding practices of the infants thoroughly and increase awareness of the identified issues in a targeted manner
- Raise awareness on the availability of the services offered at the PHC facilities and the camp secondary level health facility (hospital) to ensure that the communities are well informed and oriented about the availability of services offered at these facilities including services offered to adolescents
- Inform communities about the availability of TT vaccination at the health facilities in the camps to improve the utilization of these services
- Community health volunteers can have a strong role through the systematic implementation of the maternal newborn community health toolkit on timely referral for cases for ANC, awareness raising on the risks of danger signs during pregnancy, and timely referral. The role of community health volunteers should be further strengthened to perform these functions by providing them with the appropriate training.
- Facilitate income generation schemes for women to enable them to improve their financial status.

A2. Individual-level

- Provide non-financial incentives for women to encourage them to seek care
- Improve the communication and linkages with a source of care to encourage women to seek services. In some cases, disrespect of women, violation of human rights (such as not using a phone), and not allowing relatives to accompany women during transfer via ambulance were reported. These aspects might deter women from seeking care in the future.

A3. Health System level

- Strengthening the counseling services during antenatal and postnatal care to:
    - raise knowledge and awareness of women about danger signs during pregnancy,
    - available venues to access services,
    - feeding practices for newborns and infants, compliance with the treatment offered,
    - adherence to the supplements and medications prescribed during the early stages of the pregnancy,
    - importance of family planning, and
    - early marriages

B. Delay in reaching care

- Improve ambulance services and make these services more timely and friendly. Challenges have been identified in the transportation of the cases accompanied by a husband or an attendant while referring the cases to the appropriate level of health care facilities to receive the required services. Remedial actions shall be taken led by the UNHCR public health focal point for the camp with the involvement of relevant agencies to address the transportation issues.

C. Delay in receiving adequate health care

- Improve staff capacity and attitudes through training and supervision. Training the healthcare workers is needed on standards care related to:
    - Referral of high-risk pregnancies
    - Management of high-risk pregnancies in the hospitals
    - Policies and guidelines for postdate pregnancies
    - Proper documentation of information and findings
    - Providing high-quality antenatal care services especially the early detection of medical problems and danger signs.
- Ensure adherence of health professionals to evidence-based practices such as folic acid supplements provision and regular monitoring of adherence to the essential standards

- Ensure facilities are suitably equipped with all the essential equipment and supplies to provide services of optimal quality and as per the acceptable standards on par with the national and international standards
- Further strengthening the referral systems between PHC facilities and hospitals especially for high-risk pregnancies
- Evaluate the quality of ANC services and improve adherence to the essential standards on par with national and international standards. Quality of the ANC services should be regularly monitored to ensure adherence to the acceptable standards
- Raise the awareness of medical staff and ambulance services staff on issues related to patient's respect, dignity, and rights
- Strengthen family planning services, especially for adolescents. Training of the community health workers to provide family planning by using the newly developed family planning App (developed for Jordanians) in camps should be considered
- Women with a history of miscarriages should be investigated for the possibility of identifying the etiology (up to 50% of cases of recurrent losses are expected to have a clearly defined etiology)
- Monitoring and accountability systems for RH services, in general, should be further strengthened by the agencies involved in the delivery of RH services in the camp. Any issues related to the RH service delivery should be included in the agenda of RH coordination and general health coordination forms and tangible actions should be agreed upon by all the relevant agencies to address the identified issues.
- Ensure facilities are suitably equipped to provide safe deliveries
- Pregnant people should be counseled about the increased risk for severe disease from SARS-CoV-2 infection and receive recommendations on ways to protect themselves and their families from infection.
- Ensure discharge notes are properly filled in with details with clear guidance on the follow-ups needed.
- Re-enforce the implementation of the policy on vital signs measurements by the midwives and pediatric nurses to be able to identify critically ill patients to ensure a timely referral.