

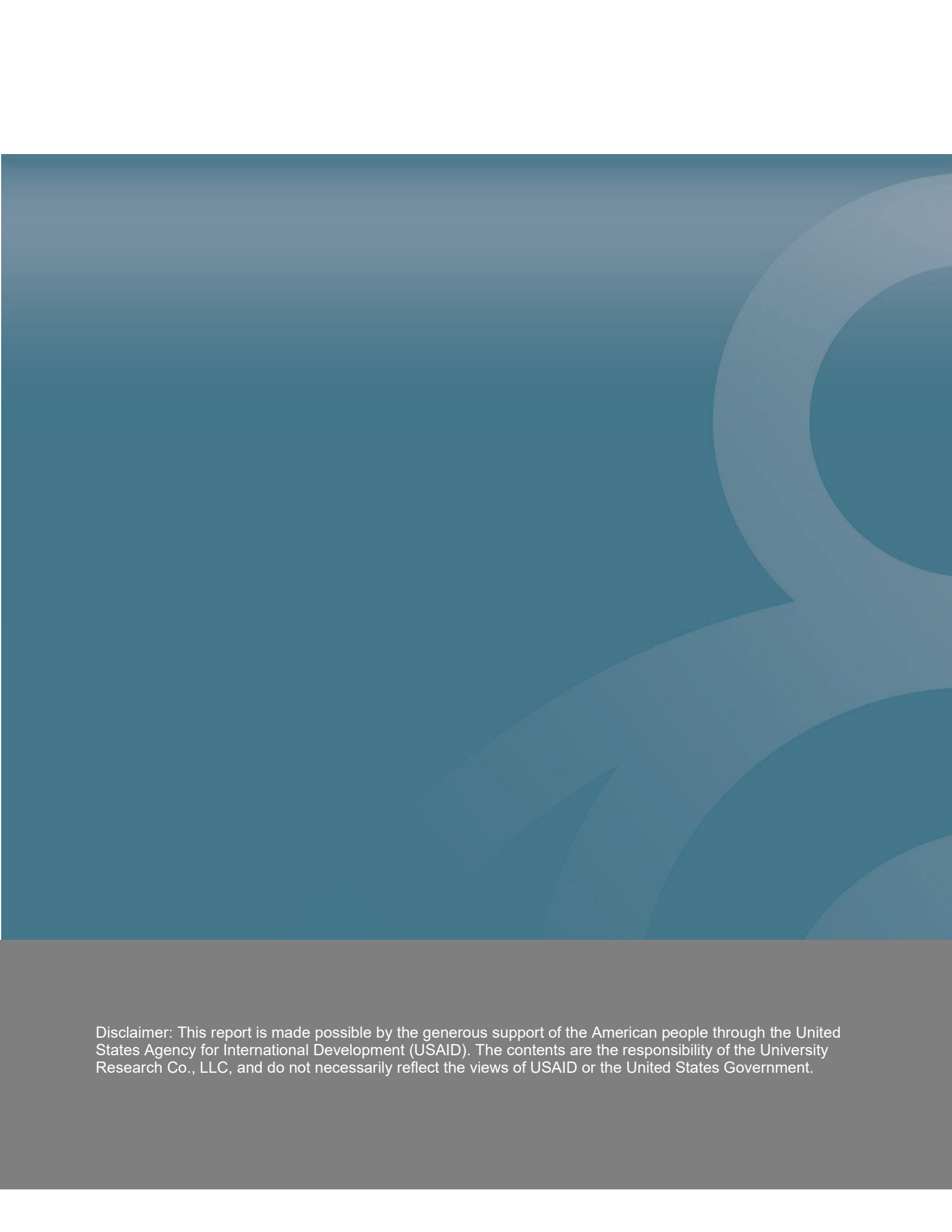
Jordan's National Maternal Mortality Report 2020

Jordan, towards eliminating preventable maternal deaths

This national report was developed by the Ministry of Health and the Maternal Mortality National Advisory Group with support from USAID Health Services Quality Accelerator. The data and findings presented in this report are drawn from Jordan's Maternal Mortality Surveillance and Response (JMMSR) system implemented by the Ministry of Health and launched with USAID support.

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ACRONYMS

ANC	Antenatal Care
BP	Blood Pressure
CS	Cesarean Section
COVID-19	Coronavirus Disease for 2019
DAG	Directorate Advisory Group
DHS	Department of Health Statistics
FMD(s)	Forensic Medicine Department(s)
HAD	Health Affairs Directorate
HELLP	Hemolysis, Elevated Liver enzymes, and Low Platelet count
ICD	International Classification of Diseases
ICD-MM	International Classification of Diseases -Maternal Mortality
ICU	Intensive Care Unit
JMMSR	Jordan's Maternal Mortality Surveillance and Response
JMMSR IS	Jordan's Maternal Mortality Surveillance and Response Information System
MDR	Maternal Death Review
MDSR	Maternal Death Surveillance and Response
MMR	Maternal Mortality Ratio
MOH	Ministry of Health
NAG	National Advisory Group
NCDD	Non-Communicable Diseases Directorate
RMS	Royal Medical Services
SDG	Sustainable Development Goal
USAID	United States Agency for International Development
WHO	World Health Organization

FORWARD

Since the start of Jordan's Maternal Mortality Surveillance and Response (JMMSR) system's implementation in 2018, the Ministry of Health (MOH) continued its collaboration with many crucial stakeholders from both the public and private health sectors, to ensure nationwide implementation and to secure compliance with JMMSR Bylaw No. 10. The JMMSR Information System intends to depict a clear picture of maternal mortality throughout the country of Jordan. This system is designed to guide appropriate decision-making, responses, and strategies to prevent maternal deaths in order to achieve health targets for Sustainable Development Goal 3 (ensure healthy lives and promote well-being for all at all ages).

Drawing on the data generated from the JMMSR system, this third annual report highlights several areas that requires attention and improvement to avert future maternal deaths.

The MOH will continue to lead efforts and influence change across all levels of Jordan's health sector through robust, practical, and evidence-based recommendations to be implemented jointly with relevant stakeholders.

The COVID-19 pandemic continues to cause harmful consequences on the health sector in almost every country, including Jordan. Worldwide, the COVID-19 pandemic has had a profound negative impact on healthcare systems and potentially on pregnancy outcomes. The health sector in Jordan applied all accessible measures to continue to provide high-quality maternal health services throughout all stages of the COVID-19 pandemic. Despite the efforts to prevent transmission, coronavirus continues to place a heavy burden on the healthcare system, requiring necessary coordinated nationwide efforts to prevent and manage COVID-19 with a special focus on pregnancy.

We would like to express our deepest gratitude to all the key players in the implementation of the JMMSR system. We dedicate a special note of appreciation to the National Advisory Group representing the MOH, Royal Medical Services, university hospitals and the private health sector, the Directorate Advisory Groups, the MOH Non-Communicable Diseases Directorate, the MOH Electronic Transformation, and Information Technology Directorate teams for their unwavering commitment to fulfilling all the system's implementation steps. We also extend sincerest gratitude to the United States Agency for International Development (USAID) for their generous support over the years to the Government of Jordan, especially for the development and implementation of this system. Moreover, we would like to thank the authors and contributors to Jordan's Maternal Mortality Report 2020 for their expertise and commitment to developing the third national report. We would like to acknowledge the women who died during their pregnancy, during labor, or after giving birth, where almost one fifth of deceased women succumb to COVID-19 infections. We are extending our acknowledgement to the loved ones they left behind, and the people who cared for them.

This report and the recommendations within it were made in hopes of preventing such deaths and improving the lives of all families in Jordan. Our heartfelt appreciation goes out to the families of these deceased women for providing valuable insights during the household surveys regarding circumstances surrounding the death, while grieving the loss of their loved ones.

Dr. Feras Hawari

Minister of Health

The Hashemite Kingdom of Jordan

Dr. Abdel-Manie' Al-Suleimat

Chairman of JMMSR National Advisory Group

The Hashemite Kingdom of Jordan

TERMS AND CONDITIONS

Avoidable Death: A maternal death can be classified as avoidable if it might have been avoided by a change in patient behavior, provider/institutional practices, or healthcare system policies. The determination of avoidability does not follow rigid criteria, and it is often open to interpretation.

Direct Obstetric Deaths: Maternal deaths resulting from obstetric complications of the pregnancy state (pregnancy, labor or puerperium), from interventions, omissions, or incorrect treatment, or from a chain of events resulting from any of the above.

Directorate Advisory Groups (DAG): A multidisciplinary committee of technical experts from all health sectors in each Health Affairs Directorate (HAD) formed by the Director of the HAD. There is one DAG committee for each HAD, making up the 14 DAGs for the JMMSR system implementation. Based on Article no.5 (Public Health Bylaw no. 10 of the year 2016), DAG members include:

- Head of the DAG: A gynecologist/obstetrician from the Ministry of Health (MOH) or any other public sector with 10 years of experience.
- DAG rapporteur: a public health physician.
- A gynecologist/obstetrician representing other health sectors (Royal Medical Services (RMS), University, and private if present).
- Head of the Maternal and Child Health Department in the HAD.
- Forensic physician.
- Experienced midwife.

Grand Multipara: A woman who has given birth to five to six infants beyond 24 weeks of gestation.

Great Grand Multipara: A woman who has given birth to seven or more infants beyond 24 weeks of gestation.

Health Facility: Any hospital or Forensic Medicine Department (FMD) in all health sectors (public and private). According to the JMMSR Bylaw 10 (described below) Article no. 4, all health facilities in Jordan are mandated to notify all deaths among women of reproductive age.

Health Facility Focal Point: A trained individual from the medical records department at any hospital or FMD in the public or private sectors responsible for the notification of all deaths among women of reproductive age to the relevant DAG in each HAD.

Indirect Obstetric Deaths: Maternal deaths resulting from previously existing disease or disease that developed during pregnancy. These deaths are not due to direct obstetric causes but are aggravated by the physiological effects of pregnancy.

JMMSR Bylaw: His Majesty King Abdullah II decreed the establishment of Bylaw no. 10 of the year 2016 of the Public Health Law (no. 47 of year 2008) mandates the notification of all deaths among women of reproductive age (15 – 49 years of age). The Bylaw calls on the MOH to establish, implement, and monitor a national maternal mortality surveillance and response system across all health sectors.

The JMMSR Guidelines for Implementation: A comprehensive reference providing a detailed description of the JMMSR system implementation steps and tools to guide implementers and managers throughout all stages and functions of the JMMSR system to achieve its overall objectives.

The JMMSR Policies and Procedures: A set of brief statements approved by the MOH describing the roles and responsibilities of stakeholders in standardizing the JMMSR system implementation.

Maternal Death: The death of a woman while pregnant, during labor, or within 42 days of the end of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management including self-harm, but not from accidental or incidental causes (accidents, homicide).

Maternal Death Surveillance and Response (MDSR) Technical Guidance: Published by the World Health Organization (WHO) in 2013, as a global framework for action to prevent maternal death. This publication introduces the critical concepts of MDSR, including goals, objectives, and specific instructions for implementing each surveillance component.

Maternal Mortality Ratio (MMR): The total number of maternal deaths per 100,000 live births in the same period.

- Numerator: Maternal deaths.
- Denominator: Live births.
- Multiplying by 100,000.

Multipara: A woman who has given birth more than once (2-4).

National Advisory Group (NAG): A national level technical advisory group representing all health sectors, formed according to a ministerial decree issued by the Minister of Health at the time of establishing the JMMSR system. It consists of senior obstetrics/gynecology specialists from all health sectors in Jordan. This group functions at the national level and includes the following members:

Chairman of the NAG: Head of Obstetrics and Gynecology Specialty at the MOH.

- The NAG Deputy Chairman and Rapporteur/Head of the National Registry of Maternal Mortality (NRMM) at the NCDD/MOH.
- Head of the National Registry of Deaths at the NCDD/MOH.
- An obstetrics and gynecology specialist from the RMS.
- Two obstetrics and gynecology specialists from the private sector.
- An obstetrics and gynecology specialist from each of Jordan University Hospital and King Abdullah University Hospital.
- The Director of the National Center for Forensic Medicine.
- Director of the Woman and Child Health Directorate at the MOH.

Nullipara: A woman who has not given birth previously.

Primipara: A woman who has given birth once.

Parity: The number of previous pregnancies carried to a viable gestational age (24 weeks and above) and resulting in live births or stillbirths, including the pregnancy that led to the woman's death.

Postmortem Autopsy: The examination of a body after death to determine the cause of death.

Probable Maternal Death: Any death among women of reproductive age during pregnancy, labor, or within 42 days of the end of pregnancy.

Public Sector: One of the main service providers in Jordan that are owned and operated by the government. This includes the Ministry Of Health (MOH), the RMS and university hospitals (including University of Jordan Hospital and King Abdullah University Hospital).

Suspected Maternal Death: Any death among women of reproductive age.

Three Delays Model: A framework developed by Thaddeus, S. and Maine, D. in 1994 that helps identify the points at which delays can occur in the management of obstetric complications. The model proposes that pregnancy-related mortality is often due to the following delays:

- Delay in seeking care
- Delay in reaching care
- Delay in receiving care

Women of Reproductive Age: Women aged between 15-49 years old.

EXECUTIVE SUMMARY

Jordan's National Maternal Mortality Report 2020 is the third in row report for Jordan. It provides comprehensive information about each maternal death that took place during the reporting period (January-December 2020) and is based on the Jordan Maternal Mortality Surveillance and Response information system (JMMSR IS). The contents of this report provide an opportunity to strengthen the Jordanian health system, with the aim of eliminating preventable maternal deaths and improving maternal health outcomes.

During the reporting period, **1,245** deaths among women of reproductive age occurred, of which a total of **68** maternal deaths were identified. The total number of live births for the same period was **176,557** resulted in national Maternal Mortality Ratio (MMR) of **38.5 per 100,000 live births**. In 2019 Jordan's MMR was 32.4 per 100,000 live births. The reduction of live births in Jordan in 2020 by about 18,000 births compared to 2019, and the consequences of the COVID-19 pandemic that led to more maternal deaths played a role in the observed increase in MMR.

Directorate Advisory Groups (DAGs) at the Health Affairs Directorate (HAD) level and the national level National Advisory Group (NAG) conducted reviews for all maternal death cases. Of the 68 maternal death cases, the NAG assigned the main cause of death to 64 cases, while the cause of death could not be specified based on available information for four cases. Of the 64 maternal death cases with a specified cause of death, 44 cases (68.8%) were identified as avoidable deaths.

The results also showed that of the 64 deaths, 34 cases (53.1%) died of direct obstetric causes and 30 cases, (46.9%) died due to indirect maternal causes.

Obstetric complications (obstetric embolism, venous complications, and puerperium-peripartum cardiomyopathy) were the leading causes of death at 28.1%, followed by the diseases of respiratory system at 25%, obstetric hemorrhage at 9.4% and diseases of the circulatory system and neoplasm at 7.8% each.

Obstetric embolism was observed in 12 (18.8%) of all mortality events and 35% of direct maternal deaths. Two diseases were identified in this category: nine cases with pulmonary embolism and three cases with amniotic fluid embolism. An autopsy was performed for nine (75%) of obstetric embolism cases to obtain a deeper and more detailed explanation of what occurred.

COVID-19 infection was the most common respiratory illness and accounted for 13 cases (20.3%), being the most common disease specific entity leading to maternal deaths in 2020.

Postpartum hemorrhage was responsible for only six (9.4%) deaths from the data collected in 2020, a significant reduction from being approximately half of the reported deaths in 2019. All the six postpartum hemorrhage deaths were considered avoidable. While three mortality events were caused by having a ruptured aortic aneurysm, verified by autopsy.

The NAG identified contributing factors that led to maternal deaths from Maternal Death Review (MDR) reports and case summaries. The most common contributing factors identified were presented using the "Three Delays Model". DELAY III: Receiving Care, contributed to **24 of the maternal death cases (35.3%)**. DELAY I: Seeking Care, contributed to **11 of the maternal death cases (16.2%)**. Eight cases (11.8%) had combinations of DELAY I and DELAY III. One of the deaths encountered all the three types of delay, while **22 cases (32.4%) had no delays**.

Causes of, and contributing factors to, maternal deaths can only be identified and understood through the maternal mortality surveillance and review processes. Thus, the great importance of the MDR. Improving and standardizing maternal mortality surveillance, continuing to improve the understanding of causes and contributing factors impacting maternal deaths, and continuing the work towards prevention are crucial to eliminate preventable maternal deaths in Jordan.

The JMMSR system is enabling Jordan to get the most accurate calculation of the national MMR and assisting in the identification of the leading causes and contributing factors for each maternal death. The figures provided in this report will continue to guide the improvement of maternal health outcomes in Jordan.

The lessons learned throughout the third year of implementation require all stakeholders to continue improving the wide range of JMMSR system functions with a special emphasis on the response, to prevent maternal deaths. Emphasis will be placed on strengthening the existing continuum of maternal care and working collaboratively on sustainable improvements for the provision of accessible high quality maternal care through the public and private health sectors.

INTRODUCTION

Over the past two decades, Jordan made significant progress in improving the quality of safe motherhood services and maternal and child health outcomes. Jordan recognizes that maternal mortality constitutes a grave public health problem and has been adopting and implementing evidence-based policies, programs and interventions to reduce maternal deaths. One of these interventions is the JMMSR system, currently implemented in Jordan. The system is mandated by law and ensures that every death of a woman of reproductive age is notified, and a maternal death review is conducted.

Since the launch of the JMMSR system in 2018, the Ministry of Health (MOH) continued its collaboration with stakeholders from the public and private health sectors to ensure a nationwide implementation of this system and its responses. This included improving the quality of JMMSR data and strengthening central and Health Affairs Directorate (HAD) levels' capacity in systematic collection analysis, and interpretation of maternal death data.

The JMMSR system is designed to track all deaths among women of reproductive age in Jordan, identify each maternal death, conduct review at the facility and household levels, analyze data to assign a primary cause of death and contributing factors, as well as stimulate a response aimed at preventing similar deaths from occurring in the future. A detailed description of the JMMSR system is available in the first National Maternal Mortality Report for 2018.

Building on the momentum achieved and lessons learned during the first two years of the JMMSR system's implementation, the MOH in collaboration with national stakeholders and with technical assistance from the USAID supported projects, used the JMMSR data collected from January through December 2020 and led the efforts for the development and finalization of Jordan's Third National Maternal Mortality Report for 2020.

METHODOLOGY

Jordan's National Maternal Mortality Report 2020 is the third report for Jordan that provides comprehensive information about each maternal death that took place during the reporting period based on active surveillance through the JMMSR system. It provides an opportunity to strengthen the health system in Jordan, with the aim of eliminating preventable maternal deaths and improving maternal health outcomes.

The JMMSR system is designed as a customization of the WHO Maternal Death Surveillance and Response Technical Guidance published in 2013 with the primary goal of eliminating preventable maternal mortality by obtaining information on each maternal death to guide public health actions and monitor their impact.¹

Similar to the methodology followed for the development of the first two National Maternal Mortality Reports of 2018 and 2019, the findings presented in this report were drawn from the JMMSR IS after intensive reviews at different levels by trained multidisciplinary teams of healthcare providers and managers. The JMMSR IS is designed as a secure web-based application to standardize and facilitate the different stages of maternal death data collection, analysis, and reporting. Data is collected at different levels of the healthcare system to support the implementation and monitoring of different functions of the JMMSR system

DATA COLLECTION AND FLOW

To standardize the data collection process and improve its efficiency, IT equipment and portable tablet devices are utilized to collect data to support the operations of the JMMSR system implementation steps, as follows:

Notification of All Deaths Among Women of Reproductive Age

This step was carried out by trained focal points at all reporting sites (126) from public and private sectors MOH hospitals, RMS hospitals, university hospitals, private hospitals and forensic medicine departments (FMDs). This was done through completing an electronic death notification form in the JMMSR IS within 24 hours of the time of death. Focal points were also responsible for submitting zero reporting through the JMMSR IS at the start of each week on Sundays if no deaths occurred in the previous week.

Identification of Maternal Death Cases

Once deaths among women of reproductive age are notified, the second step of the JMMSR system requires DAG users to identify which deaths were maternal. Identified maternal deaths included all deaths that occurred during pregnancy, labor, within 42 days of the end of pregnancy, excluding deaths due to incidental or accidental causes (accidents or homicide). Death due to suicide during pregnancy and within 42 days of the end of pregnancy are considered maternal deaths.

Review of Maternal Death Cases

Once a case was identified as a maternal death case, the next step was to conduct the maternal death review (MDR). This involved in-depth investigations of the causes and contributing factors that led to death. MDR occurs at two subsequent levels: the HAD level by DAGs and then the national level by the NAG. The DAG level review comprises of two steps: data collection and MDR sessions analyzing collected maternal death data.

Data collection was carried out through the completion of the health facility and household questionnaires depending on the place of death and the availability of data sources. These questionnaires were adapted and customized from the WHO Maternal Death Surveillance and Response Technical Guidance to establish a framework for an accurate assessment of maternal mortality.¹ Health facility reviews and questionnaires were conducted within 72 hours of a maternal death case identification and household reviews were conducted within one month of identification.

At the health facility level, the main sources of information were the attending physicians, midwives, and nurses who provided healthcare services to the deceased woman. Medical staff were interviewed and asked to give full details of each woman's medical condition from admission to death. The health facility questionnaire comprised of questions on reproductive history, the pregnancy that led to death, antenatal care (ANC), main complaints, provisional diagnosis, cause of death, autopsy reports, and contributing factors associated with the maternal death.

At the household level, the main sources of information were close relatives of the deceased woman and those who accompanied her during the time of her illness and up to the time of death. In-depth household interviews were conducted to ask questions regarding the woman's health and how the death occurred and obtain additional relevant information that was not available during the health facility review.

Data linkages between the health facility and household reviews allowed for obtaining a better picture of the circumstances and contributing factors surrounding maternal deaths.

Directorate Advisory Group (DAG) Review

Following the completion of the health facility and household questionnaires, DAGs reviewed collected maternal death data during an MDR session to:

- Assign the main cause of the death
- Identify contributing factors that led to maternal death
- Classify the maternal death as avoidable or unavoidable
- Issue specific recommendations (immediate and short-term responses) to address avoidable cases

DAG members completed a DAG worksheet for each reviewed maternal death case through the JMMSR IS. The worksheet included the following components:

- A case summary
- Information on ANC
- Information on the pregnancy
- Information on delivery
- Information on the postpartum period
- The DAG decision on the cause of death, contributing factors, avoidability, and recommendations

Once the DAG worksheet was completed on the JMMSR IS, then, the case was ready for review by the NAG.

National Advisory Group (NAG) Review

De-identified data on each maternal death was presented to NAG members whereby the NAG rapporteur presented the DAG worksheets and health facility and household questionnaires to the NAG for review. Whenever needed, the NAG was able to return the case to the DAG to request additional information. At the end of their review of each maternal death case, the NAG members completed the following tasks:

- Confirm the cause of death
- Determine whether it was due to a direct or indirect obstetric death
- Classify the maternal death as avoidable or unavoidable
- Identify contributing factors that led to the maternal death
- Issue specific recommendations related to the maternal death case

To improve data comparability, standardized cause of death aggregations were applied from the WHO Application of ICD-10 to Deaths during Pregnancy, Childbirth and the Puerperium: ICD-MM.² The NAG rapporteur then completed the NAG worksheet on the JMMSR IS with decisions on the above. Once completed, the individual maternal death case was closed.

MONITORING AND EVALUATION

To improve the timeliness, quality, and completeness of data collected through the JMMSR IS, a monitoring and evaluation framework was developed and implemented. This framework was used to evaluate the main functions of the system and ensure that its major steps were functioning adequately. The monitoring was primarily carried out at the national level by the National Registry of Maternal Mortality (NRMM) at the MOH Non-Communicable Diseases Directorate (NCDD). At the HAD level, DAG rapporteurs were also able to monitor and supervise the health facilities pertaining to their respective HAD through the system.

The JMMSR IS indicators allowed users to monitor the progress of each maternal death case as it went through all the implementation steps. They enabled DAG rapporteurs to follow up with specific health facilities to ensure data collection was being carried out in a timely manner.

At the national level, the JMMSR IS served as a data source for indicators of the JMMSR system implementation, allowing users to monitor and evaluate each step individually. The NRMM at the MOH NCDD monitored data quality and completeness by comparing data collected through the JMMSR IS with other data sources such as health facility records and the Civil Status and Passport Department (CSPD) for validation purposes.

DATA ANALYSIS

1. Qualitative Analysis

Maternal death case summaries were developed and analyzed by DAGs and NAG to gain an understanding of the problems that led to a maternal death. The course of the mother's pregnancy and descriptions of where and how care was provided were carefully studied. Moreover, essential interventions that took place at all levels and any problems that may have contributed to the mother's death were explored.

This qualitative analysis was used to analyze the main causes of maternal deaths, contributing factors and avoidability. As part of the qualitative analysis, the DAGs and NAG deployed the

Three Delays Model framework to help identify common delays associated with three components,³ seeking care, reaching care and receiving care.

2. Quantitative Analysis

The number of registered live births for the year 2020 was obtained by the Jordan's Department of Statistics based on data from the Civil Status and Passport Department (CSPD) to serve as the denominator to calculate the MMR. The total number of maternal deaths was obtained from the JMMSR IS. Stata 15 statistical package was used to perform the descriptive analyses.

CONFIDENTIALITY AND ETHICAL CONSIDERATIONS

The JMMSR Bylaw guaranteed that the information generated through the JMMSR system will not be used for litigation purposes. The JMMSR IS deployed high security protocols to preserve the confidentiality of the collected and processed information at all levels. When conducting household reviews, family members were contacted ahead of time to arrange for the visit. During the visit, the main interviewer explained the purpose of the interview, voluntary participation, and confidentiality of collected information. In the event of refusal to participate, the reason for refusal was captured. The data collection team also provided the household questionnaire respondents with contact details in case they had any questions.

RESULTS

The results presented in this section are described for the reporting period from January 1, 2020 to December 31, 2020.

MATERNAL MORTALITY RATIO

During the reporting period, 1,245 deaths among women of reproductive age occurred, of which a total of **68 maternal deaths** were identified. Out of the total reported maternal death cases, 13 deaths were attributed to COVID-19 infections corresponding to over 19% of all maternal deaths.

MDRs were conducted for all maternal death cases at the HAD and national levels through DAGs and the NAG respectively. The total number of live births for the same period was **176,557** and Jordan's MMR was calculated at **38.5** per 100,000 live births.⁴ In 2019 Jordan's MMR was 32.4 per 100,000 live births. The reduction of live births in Jordan in 2020 by about 18,000 births and the consequences of the COVID-19 pandemic are behind this increase.

Most studies on the effects of COVID 19 infection did not include pregnant women. Nevertheless, some studies have shown alarming increases of maternal mortality due to COVID 19 infections. This increase could eliminate the last few decades of progress in reducing maternal mortality. In one study in Mexico, the confirmed COVID-19 cases constituted about 23% of all maternal deaths, leading to an increase by about 57% from the expected ratio.⁵ In another study in Bahia, Brazil, the maternal mortality ratio increased by about 59% over the expected ratio, where COVID 19 infection was reported in about 13% of deceased women.⁶

DEMOGRAPHIC CHARACTERISTICS OF MATERNAL DEATHS

The analysis presented in this section is based on descriptive statistics that describe certain characteristics of deceased women but cannot establish inference of association or causal inference. Nevertheless, understanding the demographic characteristics of maternal death cases may assist in explaining certain aspects of maternal mortality. Moreover, the collected data around demographic characteristics may be used for appropriate planning of services and responses.

Maternal Death by Age at Death

The average age of maternal deaths was approximately 33 years, with the highest age being 47 years and the lowest being 19 years.

Table 1 shows that number of maternal deaths was highest in women aged between 30-34 years accounting for 27.9% of all deaths. The second and third largest proportion of deaths took place in women aged between 35-39 years (22.1%) and 25-29 years (20.6%). The lowest percent of deaths (1.5%) took place in the age group of 15-19 years. The relatively lower maternal death in the younger age groups can be attributed to the fact that the median age at first birth in Jordan is 24.6.⁷

When comparing the percent distribution of deceased women by age groups with the distribution of pregnant women in 2017-2018 DHS sample, there is an obvious increase of death by age. While only 1.5% of deaths took place in the age group 15-19, the percent of pregnant women in this age group was over 8%. Similarly, 10.3% of deceased women were in

the age group 20-24, while they represented 26% of pregnant women in the DHS sample. In contrast, the two oldest age groups showed higher mortality compared to their share in the DHS sample. There was only 3.4% of women aged 40 years and above in the DHS sample, while 17.7% of deaths took place in this age group.

There are several studies pointing to increased probability of maternal death with age excluding the young adolescents (10-14).^{8 9 10}

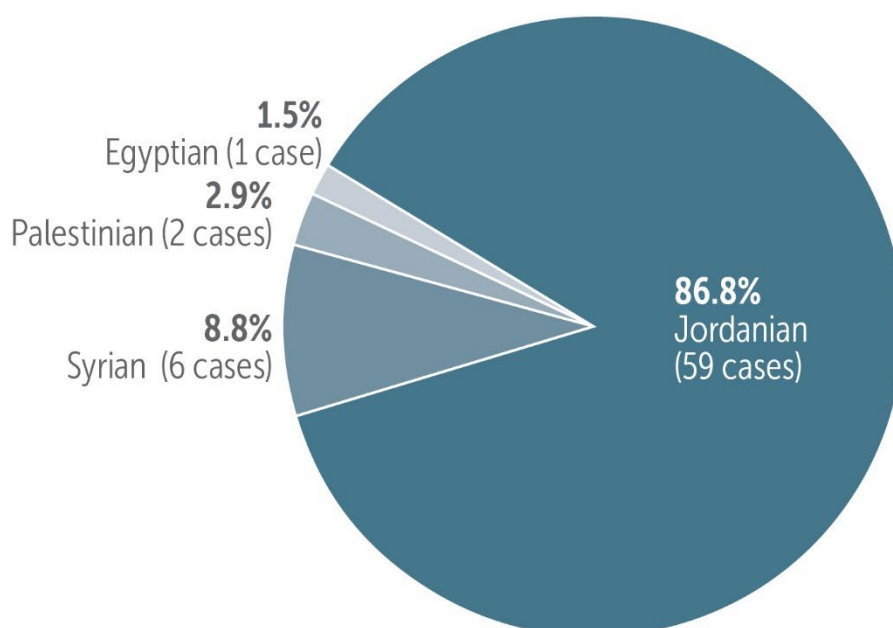
Table 1: Maternal Deaths by Age Group

Age Group	Number of Maternal Deaths	Percent	Percent of Pregnant Women in 2017-2018 DHS Sample
15-19	1	1.5	8.3
20-24	7	10.3	26.0
25-29	14	20.6	28.6
30-34	19	27.9	22.9
35-39	15	22.1	10.8
40-49	12	17.7	3.4
Total	68	100	100

Maternal Death by Nationality

Figure 1 demonstrates that of the 68 maternal deaths, 59 cases (86.8%) were Jordanian, while the remaining included six Syrians (8.8%), two Palestinians (2.9%) and one Egyptian (3.2%).

Figure 1: Maternal Deaths by Nationality Figure



Maternal Deaths by Educational Level

Of the 68 maternal deaths, 62 had information on educational level. Information on the level of education was difficult to ascertain due to discrepancies between the health facility and

household reviews. It was decided to rely more on the household information when discrepancies arose.

Figure 2 showed the absence of illiterate individuals among the deceased women, with the majority (43.5%) having had secondary level education followed by higher than secondary level (35.5%) and only (17.7%) had a basic education. Figure 3 shows that the level of education reported for the deceased women, closely resembles the present distribution of ever-married women by highest level of schooling attended or completed in the Jordan Population and Family Health Survey (2017-18).⁷

Figure 2: Maternal Deaths by Educational Level

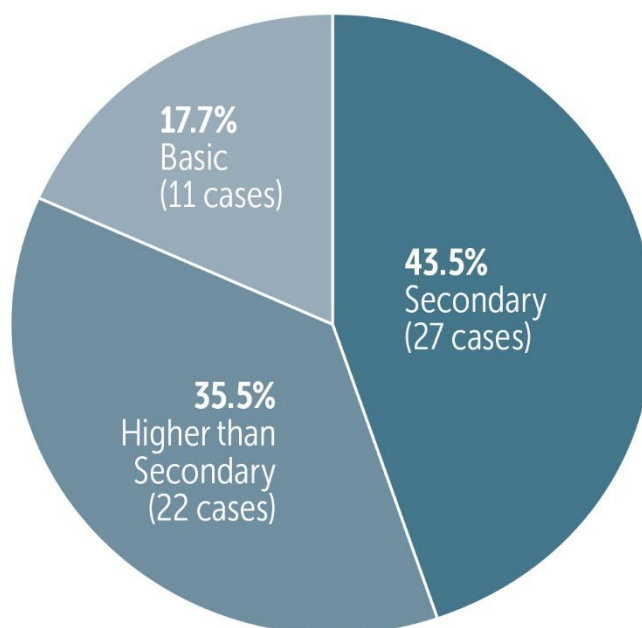
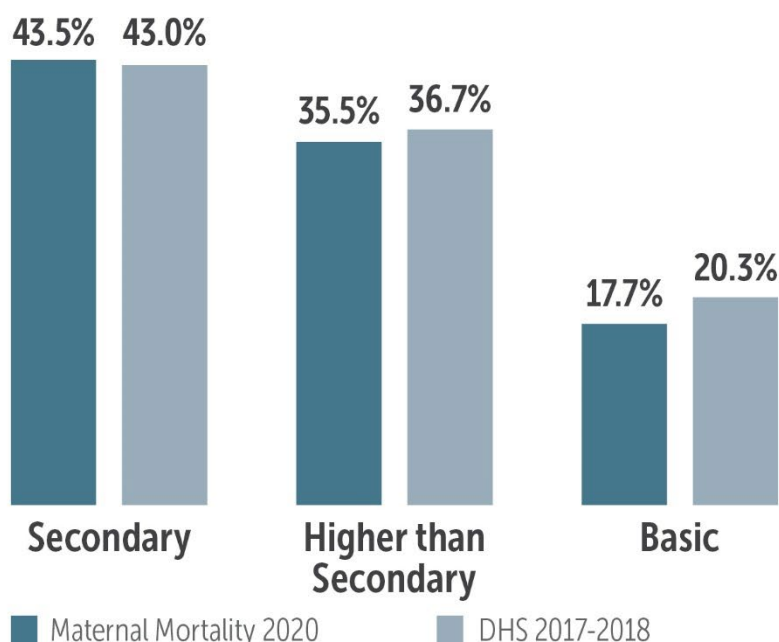


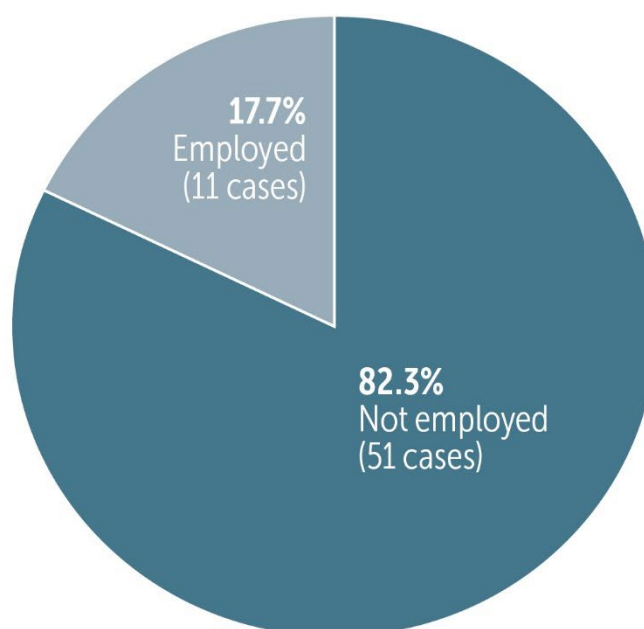
Figure 3: Comparison of Educational level of Deceased Women and DHS 2017-2018



Maternal Death by Employment

Information on employment status was captured for 62 cases, and the vast majority (82.3%) of deceased women were unemployed (Figure 4). The Jordan Population and Family Health Survey (2017-18) also showed that the majority of ever-married women (85.5%) have never been employed.⁷

Figure 4: Maternal Deaths by Employment Status



Maternal Death by Place of Residence and Place of Death

Information on the place of residence and place of death of the deceased women was collected from both the health facility and household questionnaires. Table 2 presents the percent distribution of maternal death cases according to the place of residence and place of death.

Observing the number of deceased women by governorate including both place of residence and place of death increased with increasing population size, where 87% of maternal deaths occurring in the largest four governorates: Amman, Irbid, Zarqa and Balqa. While only 30.9% of deceased women resided in Amman, 42.7% of maternal deaths took place in the same governorate. Amman, the most populated governorate representing 42% of Jordan's population had the largest number of referral public and private hospitals leading to an influx of referred complicated cases from all over the country. The three governorates of Madaba, Karak and Maan (not shown in the table) did not report any maternal deaths.

Table 2: Maternal Deaths by Place of Residence and Place of Death

Governorate	Place of Residence Number (Percent)	Place of Death Number (Percent)
Amman	21 (30.9)	29 (42.7)
Zarqa	19 (27.9)	17 (25.0)
Irbid	12 (17.7)	12 (17.7)
Balqa	7 (10.3)	3 (4.4)

Mafrq	3 (4.4)	3 (4.4)
Ajloun	2 (2.9)	1 (1.5)
Aqaba	1 (1.5)	1 (1.5)
Jerash	1 (1.5)	1 (1.5)
Tafilah	2 (2.9)	1 (1.5)
Total	68 (100.0)	68 (100.0)

CLINICAL CHARACTERISTICS OF MATERNAL DEATHS

Maternal Deaths by Parity

Parity was defined in this report as the number of previous pregnancies carried to a viable gestational age (24 weeks and above) resulting in live births or stillbirths, including the pregnancy that led to death. Data presented in Table 3 clearly indicates that most deceased women (42.7%) were multiparous (2-4). Grand and great grand multi-parity was reported in 16.2% and 5.9% of maternal deaths, respectively. Seven women (10.3%) were never pregnant beyond 24 weeks before (nulliparous), while one quarter of women (25%) were primipara. The majority of nulliparous (three out of seven) were in the age group 30-34 years.

Table 3: Maternal Deaths by Parity

Parity	Number of Maternal Deaths	Percent
Nulliparous (0 parity)	7	10.3
Primipara	17	25.0
Multipara (2-4)	29	42.7
Grand Multipara (5-6)	11	16.2
Great Grand Multipara (≥7)	4	5.9
Total	68	100

Maternal Deaths by Time of Death

The NAG relied on the health facility and household questionnaires, in addition to their clinical expertise to determine the time of a woman's death in relation to pregnancy. The majority (61.8%) of maternal deaths took place during the postpartum period. Death during pregnancy was reported in 29.4% of events, while death during delivery and post-miscarriage was observed in 4.4% of mortalities (Figure 5).

Figure 5: Postpartum Time of Death

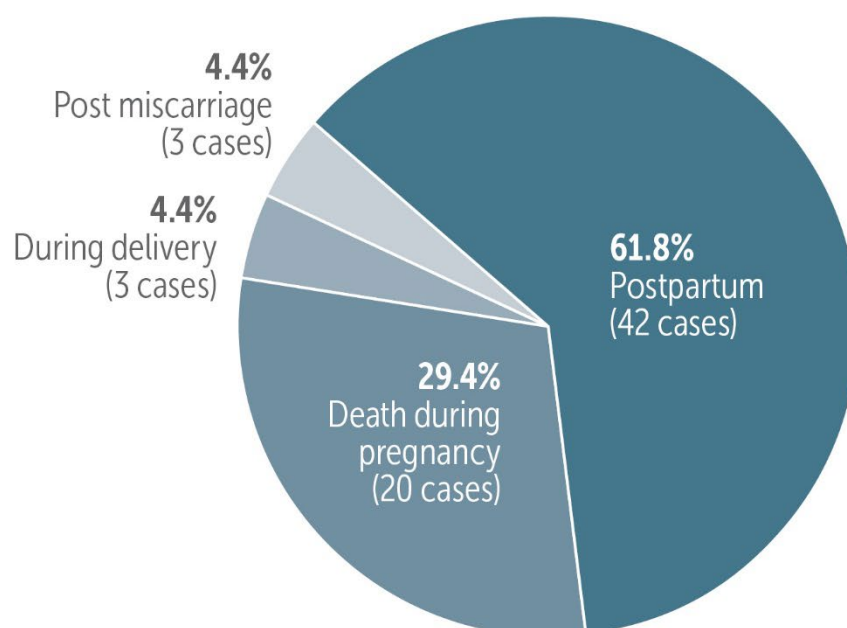


Table 4 presents the timing of postpartum death (within 42 days after delivery), where one third (33.3%) of women died within less than 24 hours of delivery and almost one third (31.0%) died within one week of delivery and the rest died after eight days of delivery.

Table 4: Timing of Postpartum Maternal Deaths

Time of Death	Number of Maternal Deaths	Percent
Less than 24 Hours	14	33.3
Between 1 To 7 Days	13	31.0
Between 8 and 42 Days	15	35.7
Total	42	100

Maternal Deaths by Antenatal Care

A top priority service shown to be extremely impactful in reducing maternal mortality is universal access to quality antenatal care (ANC). Access to ANC services contribute to the reduction of maternal deaths, but the magnitude of reduction depends on how well healthcare providers screen and manage cases of high-risk pregnancy. Extreme precaution needs to be taken in interpreting the following results as they do not assess the quality of provided ANC on maternal health outcomes.

Table 5 shows that most of the maternal death cases received ANC services during the last pregnancy that led to death. Of the 68 maternal deaths, the number of ANC visits was recorded for 56 (82.4%) of them. Table 5 shows that 17.9% of deaths had 1-3 ANC visits, 35.7% had 4-7 visits and 44.6 % had 8 and above visits. The mean number of ANC visits was 6.6 with a median of seven, a minimum of zero and a maximum of 20 visits.

Table 5: Maternal Deaths by Antenatal Care Visits

Antenatal Care Visits	Number of Maternal Deaths	Percent
No Antenatal Visits	1	1.8
1-3 Visits	10	17.9
4-7 Visits	20	35.7
≥8 Visits	25	44.6
Total	56	100

The sector of provision of ANC could be verified only for 55 cases. The missing values are those that had either missing antenatal care visits or no visits. Table 6 shows that most deceased women (65.5%) had received ANC services from private sector facilities, 25.5% from public facilities and 9.1 % from both private and public sector.

Table 6: Maternal Deaths by Place of Antenatal Care

Place of Antenatal Care	Number of Maternal Deaths	Percent
Private Sector	36	65.5
Public Sector	14	25.5
Mixed Public/Private	5	9.1
Total	55	100

Approximately 95% of ANC data collected showed that physicians provided the ANC services. From the data collected, it was reported that there was only one instance where a midwife served as the sole ANC provider (Table 7).

The above results should not indicate that ANC programs are failing to save the lives of mothers; however, they indicate the need for compliance with the quality-of-care parameters when providing services.

Table 7: Maternal Deaths by Type of Provider of Antenatal Care

Provider of Antenatal Care	Number of Maternal Deaths	Percent
Doctor	52	94.5
Doctor + Midwife	2	3.6
Midwife	1	1.8
Total	55	100

Maternal Death by Mode of Delivery

Table 8 shows that most cases (57.4%) had a cesarean delivery. Emergency cesarean was observed in 42.7% of reported maternal deaths, while postpartum and elective cesarean accounted for 8.8% and 5.9%, respectively. Vaginal deliveries constituted 14.7% of maternal deaths, while 22.1% of deceased women had no deliveries. The cesarean sections in this report are over nine percentage points lower than those stated in the National Maternal Mortality Report for 2019.

A cesarean section is a major surgical procedure that can save the lives of both fetuses and mothers. However, a medically unnecessary cesarean section is associated with a higher risk of perinatal and maternal mortality compared to a vaginal delivery.¹¹ Due to rising trend of cesarean section deliveries in Jordan, there is an urgent need to foster the national program for reducing unnecessary cesarean section deliveries.^{12 13 14}

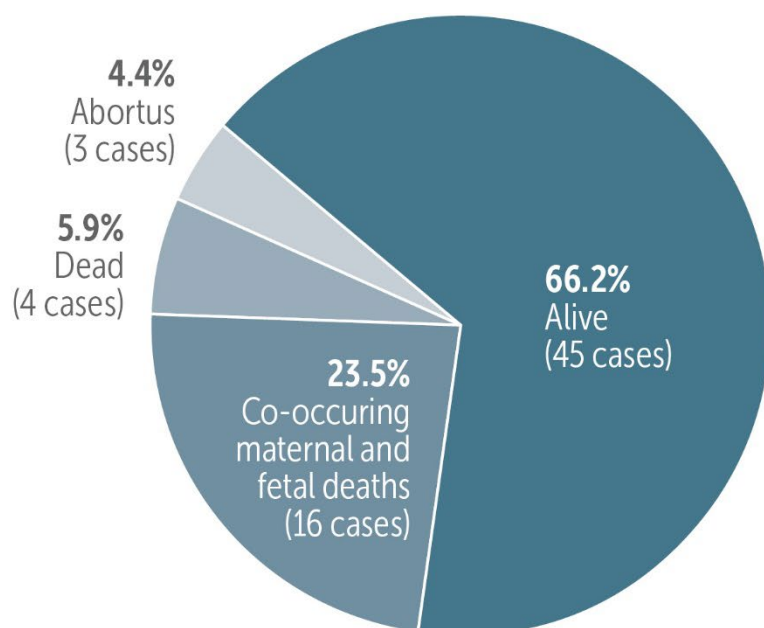
Table 8: Maternal Deaths by Mode of Delivery

Mode of Delivery	Number of Maternal Deaths	Percent
Cesarean Section	39	57.4
Emergency Cesarean	29	42.7
Postmortem Cesarean	6	8.8
Elective Cesarean	4	5.9
No Delivery	15	22.1
Vaginal Delivery	10	14.7
Miscarriage	3	4.4
Forceps Delivery	1	1.5
Total	68	100

Maternal Death by Fetal Outcome

Figure 6 presents the distribution of maternal deaths by fetal outcome. Of the 68 maternal deaths, 66.2% of cases had live birth neonates, 5.9% had dead neonates, 3.3% had a gestational age less than 24 weeks (abortion) and 23.5% died while pregnant with co-occurring maternal and fetal deaths.

Figure 6: Maternal Deaths by Fetal Outcome



Maternal Death and Anemia

Hemoglobin values were captured for only for 55 cases. In 13 cases of the deceased mothers (19.1%) had data showing that the anemia status could not be verified. The main reason behind not capturing anemia status was that the women were already deceased when they arrived at the hospital. Out of the 13 who did not have hemoglobin values, 11 (84.6%) were announced dead upon arrival at the hospital. About half (52.7%) did not have anemia diagnoses, 27.3% had moderate anemia, and 18.2% had mild anemia. Only 1 woman suffered from severe anemia before death (Table 9).

The average number of ANC visits for anemic death cases was 7.1 compared to 6.6 visits for non-anemic women which was statistically insignificant ($t= 0.6251$, $p= 0.5352$).

Anemia in pregnancy is associated with severe maternal morbidity and is an indirect cause of maternal death in both low-income and high-income settings. Studies consistently reaffirm the association of maternal anemia with maternal mortality, emphasizing the need to reduce anemia during pregnancy and the postpartum period.¹⁵ Therefore, the WHO global targets call for a 50% reduction in anemia in women of reproductive age by 2025.¹⁶

Table 9: Maternal Death and Anemia

Anemia Status	Number of Maternal Deaths	Percent
No Anemia	29	52.7%
Moderate	15	27.3%
Mild	10	18.2%
Severe	1	1.8%
Total	55	100

CAUSES OF MATERNAL DEATH

Understanding the causes of and contributing factors to maternal deaths is critically important for the development of interventions to reduce maternal mortality in Jordan. NAG used mainly the International Classification of Diseases ICD 10 in assigning cause of death.² The NAG utilized the information obtained through the health facility and household questionnaires to agree on classification of causes of death to the levels of type and group.

Of the 68 maternal death cases, the NAG assigned the main cause of death to 64 cases, while the cause of death could not be specified for the remaining four cases. Autopsy was performed in about 37% of all deaths. The denominator for all proportions in this section will be limited to the 64 identified causes of death.

Table 10 shows that exactly half of the causes of death were allocated to four diagnoses. COVID-19 infection led the cause of death with 13 (20.3%) cases followed by pulmonary embolism with nine cases (14.1%), postpartum hemorrhage with six cases (9.4%), and puerperium- peripartum cardiomyopathy with four (6.3%) cases. Details of the causes of death will be presented in the following section.

Table 10: Distribution of Cause-Specific Maternal Mortality

Cause of Death	Number	(Percent)
COVID-19	13	20.3
Pulmonary embolism	9	14.1
Postpartum hemorrhage	6	9.4
Complications of the puerperium- peripartum cardiomyopathy	4	6.3
Amniotic fluid embolism	3	4.7
Puerperal sepsis	3	4.7
Pneumonia	3	4.7
Rupture aortic aneurysm	3	4.7
Venous complications in pregnancy - cerebral venous thrombosis	2	3.1
Eclampsia	2	3.1
Intentional self-harm (Suicide)	2	3.1
Gestational hypertension with significant proteinuria (HELLP Syndrome)	1	1.6
Complications of anesthesia during labor and delivery	1	1.6
Unspecified abortion	1	1.6
Heart valve mechanical prosthesis	1	1.6
Rupture splenic artery aneurysm	1	1.6
Ductal carcinoma	1	1.6
Invasive ductal carcinoma	1	1.6
Malignant neoplasm of nipple and areola	1	1.6
Neoplasm of uncertain behavior of brain	1	1.6
Myxofibrosarcoma with lung metastasis	1	1.6
Malformation of brain vessels	1	1.6
Non-traumatic intracranial hemorrhage	1	1.6
Diseases of the digestive system puerperium fatty liver	1	1.6
Severe sepsis with septic shock	1	1.6
Total	64	100*

* The total in this table is a rounding error (100.6%) due to summation of multiple rounding of individual disease entities.

Direct and Indirect Causes of Maternal Mortality

Table 11 presents a detailed distribution of causes of maternal mortality according to ICD 10 categories and direct vs. indirect causes. The results show almost similar distribution of direct and indirect causes of maternal mortality at about 53% and 47%, respectively.

Direct Causes

Other obstetric complications (obstetric embolism, venous complications and puerperium-peripartum cardiomyopathy) were leading the cause of death at 28.1%, followed by the diseases of the respiratory system at 25%, obstetric hemorrhage at 9.4% and diseases of the circulatory system and neoplasm at 7.8% each.

Other obstetric complications accounted for 18 (28.1%) of all maternal deaths with 12 cases of obstetric embolism, two cases with cerebral venous thrombosis and four cases of puerperium peripartum cardiomyopathy.

Of the 64 maternal deaths, obstetric embolism was responsible for 12 deaths (18.8%) of cases, nine deaths due to pulmonary embolism and three with amniotic fluid embolism. The diagnosis of obstetric embolism was based on autopsy in nine (75%) out of the 12 cases. All the three cases of amniotic fluid embolism had autopsy performed, while only six out of the nine pulmonary embolism deaths underwent autopsy. Mortalities caused by embolism were observed across the parity, from nullipara to great grand multipara. Four cases were multiparous, three cases were Primipara, two cases for each category of grand multiparity and great grand multiparity, and one case was nullipara. Seven out of the 12 cases took place during the postpartum period while five died during pregnancy.

Venous thromboembolism is a leading cause of severe maternal morbidity and mortality. Pregnancy and the postpartum period are very high-risk periods for thromboembolic events, the most common of which is pulmonary embolism. Pulmonary embolism is the leading cause of direct maternal deaths in developed countries worldwide.¹⁷

The incidence of venous thrombosis, pulmonary embolism and subsequent maternal death can be significantly reduced by embracing prophylactic measures, that should be implemented at both the primary healthcare and hospital levels.

Amniotic fluid embolism is a rare complication of pregnancy with a comparatively high mortality rate. It is considered to be an unpredictable and unpreventable event with an unknown cause.¹⁸ It often presents as sudden onset of cardiovascular collapse, respiratory compromise, and disseminated intravascular coagulation.¹⁹

As countries continue to work towards reducing their maternal mortality, conditions such as amniotic fluid embolism are likely to become more prominent, as might be the case for Jordan.

Obstetric Hemorrhage accounted for only six cases (9.4%) of maternal deaths, which was reported as a cause of maternal death in almost half of the mortalities in 2019. All the six cases died less than 24 hours after delivery. Five cases had caesarean section and only one woman had a vaginal delivery.

Postpartum hemorrhage is known to be the leading cause of maternal deaths worldwide.²⁰ More than two thirds of reported obstetric hemorrhage deaths globally are classified as postpartum hemorrhage.²¹ A significantly high proportion (72–90%) of the morbidity of obstetric hemorrhage cases are considered to be preventable.²² This is correlated to adequate management of the condition, through early recognition and then by selecting the most appropriate choices of therapy and adequate interventions, particularly in the early stages.^{23 24}

Obstetric interventions, such as augmentation and induction of labor, instrumental vaginal delivery, and cesarean delivery are all associated with postpartum hemorrhage. Despite improvements in management, early postpartum hemorrhage still remains a significant cause of maternal morbidity and mortality in developing countries.²⁵

One of the ways to prevent postpartum hemorrhage is the “Active Management of Third Stage of Labor”. It is considered to be the gold standard in reducing the incidence of postpartum hemorrhage.^{26 27 28} During the last several years with the support of USAID led interventions, the public sector hospitals in Jordan introduced and adopted the Active Management of Third Stage of Labor to decrease the incidence of cases with atonic postpartum hemorrhage. These

efforts might have contributed to the obvious reduction of postpartum hemorrhage in 2020 compared to 2019, and they should continue to scale-up this practice to all public and private hospitals. Also, progress should be aimed to improve the clinical case management during the fourth stage of labor (first two hours after delivery).

Hypertensive Disorders in Pregnancy, Childbirth, and the Puerperium accounted for only three (4.7%) of the 64 specified direct causes of death, which is exactly half of the reported maternal hypertensive disorders in the 2019 Mortality Report. Two cases suffered from severe eclampsia, and one case had HELLP syndrome. Two of the three cases died in the postpartum period, while one passed away during pregnancy. The three cases were either multiparous or great grand multiparous.

Hypertensive disorders of pregnancy are one of the most common complications during pregnancy, significantly contributing to maternal mortality. The WHO reported that (14%) of global maternal deaths are attributed to hypertensive disorders of pregnancy.²¹

Magnesium sulfate helps prevent eclamptic fits in pregnant women who are at increased risk. It reduces approximately half the risk of eclampsia and probably reduces the risk of maternal death.²⁹

With USAID's support, the public healthcare system in Jordan took the initiative to implement and adopt the administration of magnesium sulfate for severe pre-eclampsia cases, reflecting a potential reduction of pregnancy induced hypertension. Nevertheless, it is still crucial to make an early diagnosis of mild pre-eclampsia and refer these women to the appropriate care for comprehensive case management to decrease the probability of severity and complications.

Pregnancy-Related Infection accounted for three cases (4.7%) of causes of death, where all were due to puerperal sepsis.

Sepsis is a life-threatening condition that arises when the body's response to infection causes injury to its own tissues and organs. Despite being highly preventable, maternal sepsis continues to be a major cause of death and morbidity for pregnant or recently pregnant women.^{21 30}

With technical assistance from USAID, the Jordanian Ministry of Health and Royal Medical Services took the initiative to adopt the clinical practice guidelines for the use of prophylactic antibiotics for cesarean section deliveries, a practice that needs to be institutionalized in all hospitals in Jordan.

Other direct causes included two cases of suicide, one case of complication of anesthesia during labor and delivery and another case of abortive pregnancy outcome with unspecified abortion.

Both deaths due to self-harm took place during pregnancy and not during the postpartum period. The presence of previous mental illnesses could not be verified for both cases. World-wide maternal self-harm is more prevalent during the postpartum period due to mental changes associated with this phase.³¹ Deaths caused by drugs and suicide are considered a major contributor to maternal mortality during pregnancy and in the postpartum period and requires increased clinical attention.^{32 33}

Indirect Causes of Death

Diseases of respiratory system accounted for 16 cases corresponding to one quarter of maternal death causes, with 13 cases of COVID-19 and three cases of pneumonia.

All the 13 COVID-19 cases (20.3%) received a diagnosis of SARS-CoV-2 infection by reverse transcription polymerase chain reaction (PCR) testing. None of these cases underwent autopsy. The mean number of antenatal visits for COVID-19 deaths was 6.3 visits with a median of seven that was not different from the rest of the reported maternal deaths. Ten cases representing over three fourth (76.9%) of COVID-19 deaths underwent emergency cesarean. Twelve cases died during the postpartum period and the remaining case died during pregnancy. The majority of COVID-19 deceased women delivered alive neonates (11 out of 13) indicating a more or less favorable outcome for the newborns.

Globally, the COVID-19 pandemic has disrupted health care before, during, and immediately after childbirth. Current evidence suggests the possibility of severe maternal morbidity and indicates a consistent association between pregnant women with COVID-19 diagnosis and higher rates of adverse outcomes, including maternal mortality.^{34 35}

Some studies clearly indicate alarming results of maternal mortality due to COVID 19 infections. This increase could eliminate the last few decades of progress in reducing maternal mortality. In one study in Mexico, the confirmed COVID 19 cases constituted about 23% of all maternal deaths leading to an increase by about 57% over the expected ratio.⁵ In another study in Bahia, Brazil, the maternal mortality ratio increased by over 59% above the expected ratio where COVID 19 infection was reported in about 13% of deceased women.⁶ A third study in Peru demonstrated a sharp increase of 75% of maternal death in 2020 compared to 2019 leading to doubling of the MMR from 17 per 100,000 live births in 2019 to 34 per 100,000 live births in 2020.³⁶

Pneumonia that occurs during pregnancy is known to carry an increased risk of adverse outcomes when compared to pneumonia in non-pregnant women. There are major factors predisposing pregnant women to severe pneumonic infections such as alteration in the immune and hormonal status and the decreased ability of pregnant women to clear respiratory secretions due to some anatomical changes which occur in the chest during pregnancy.³⁷

Diseases of the circulatory system were the second most common indirect causes of maternal deaths. Of the 64 maternal deaths, five cases (7.8%) died due to circulatory system complications. Three died of rupture aortic aneurysm, one of rupture of splenic artery aneurysm and one due to complication of heart valve mechanical prosthesis. The diagnosis of aortic aneurysm was supported by postmortem examination in all of the three cases.

The risk of aortic dissection or rupture is elevated during pregnancy and the postpartum period.³⁸ Splenic artery aneurysm is an uncommon pathology, with a potential for rupture. Rupture of splenic artery aneurysms are associated with a high mortality rate. This increases disproportionately to 75% among pregnant women with fetal mortality of 95%.³⁹

Data based on historical cohorts of women with mechanical valve prostheses in pregnancy suggests an increased risk of maternal cardiovascular events, obstetric morbidity and mortality.⁴⁰

Neoplasms accounted for five (7.8%) of all causes of death. Three cases were breast cancer, one with brain cancer and another one case with lung cancer. Symptoms of neoplasms can mimic those of physiological pregnancy changes which leads to a delay in accurate diagnosis.⁴¹ This delay can lead to a more advanced stage of the disease, resulting in higher mortality. Neoplasms during pregnancy are relatively rare, but they are considered as a potential threat for both maternal and fetal well-being. Globally, the incidence of cancer during pregnancy has been estimated to occur in 1 in 1,000 pregnancies; however, the incidence is rising globally due to increasing maternal age and the increasing incidence of risk factors for cancer.^{42 43} This finding

should encourage further assessment of the frequencies of neoplasms among women of reproductive age in general and pregnant women in specific.

Other specified maternal diseases include the remaining four cases of maternal deaths, two due to vascular events in the central nervous system, one of acute puerperium fatty liver and one case of sepsis with septic shock.

The mortality caused by malformation of brain vessels occurred on the 40th week of gestation. The intracranial hemorrhage mortality took place during the postpartum period. The risk of intracranial hemorrhage increases during the third trimester and is greatest during birth and the puerperium.⁴⁴

Acute fatty liver of pregnancy is an obstetric emergency characterized by maternal liver dysfunction and/or failure that can lead to maternal and fetal complications, including death.⁴⁵

Table 11: Maternal Deaths by Direct and Indirect Causes of Death

Cause of Death	Number (Percent)
Direct Causes of Death	34 (53.1)
Other obstetric complications	18 (28.1)
Obstetric embolism	12 (18.8)
Pulmonary embolism	9 (14.1)
Amniotic fluid embolism	3 (4.7)
Venous complications in pregnancy - cerebral venous thrombosis	2 (3.1)
Complications of the puerperium- peripartum cardiomyopathy	4 (6.3)
Obstetric hemorrhage	6 (9.4)
Postpartum hemorrhage	6 (9.4)
Hypertensive disorders in pregnancy, childbirth, and the puerperium	3 (4.7)
Eclampsia	2 (3.1)
Gestational hypertension with significant proteinuria (HELLP Syndrome)	1 (1.6)
Pregnancy related infection	3 (4.7)
Puerperal sepsis	3 (4.7)
Intentional Self Harm	2 (3.1)
Intentional self-harm (Suicide)	2 (3.1)
Unanticipated complications of management	1 (1.6)
Complications of anesthesia during labor and delivery	1 (1.6)
Pregnancy with abortive outcome	1 (1.6)
Unspecified abortion	1 (1.6)
Indirect Causes of Death	30 (46.9)
Disease of respiratory system	16 (25.0)
COVID-19	13 (20.3)
Pneumonia	3 (4.7)
Diseases of the circulatory system	5 (7.8)
Heart valve mechanical prosthesis	1 (1.6)

Rupture aortic aneurysm	3 (4.7)
Rupture splenic artery aneurysm	1 (1.6)
Neoplasms	5 (7.8)
Ductal carcinoma	1 (1.6)
Invasive ductal carcinoma	1 (1.6)
Malignant neoplasm of nipple and areola	1 (1.6)
Neoplasm of uncertain behavior of brain	1 (1.6)
Myxofibrosarcoma with lung metastasis	1 (1.6)
Diseases of the Central Nervous system	2 (3.1)
Malformation of brain vessels	1 (1.6)
Non-traumatic intracranial hemorrhage	1 (1.6)
Diseases of the Digestive System	1 (1.6)
Diseases of the digestive system puerperium fatty liver	1 (1.6)
Other Maternal Diseases	1 (1.6)
Severe sepsis with septic shock	1 (1.6)
Grand Total	64 (100) *

* The total in this table is a rounding error (100.6%) due to summation of multiple rounding of individual disease entities

CONTRIBUTING FACTORS TO MATERNAL DEATH

The NAG identified contributing factors that led to maternal deaths from MDR reports and case summaries. Of the 64 maternal death cases with a specified cause of death, 44 cases (68.8%) were identified as avoidable deaths. The most common contributing factors identified are described in Table 12 using the “Three Delays Model” by Thaddeus and Maine (1994).³ Overall, about one third of identified death cases (32.4%) did not show any delays. Delay I pertinent to seeking care was observed in 11 cases (16.2%), delay III of receiving care was observed in 24 (35.3%) and thus being the most encountered type of delay. A combination of delays I and III was observed in 8 (11.8%) cases, while in one case, all the three delays were present in terms of seeking, reaching and receiving care.

Table 12: Maternal Deaths by Level of Delay

Level Delay	Number	Percent
Delay in Seeking Care: Delay I	11	16.2
Delay in Receiving Care: Delay III	24	35.3
Delay in Seeking and Receiving Care: Delays I&III	8	11.8
Delay in Seeking, Reaching and Receiving Care: Delays I+II+III	1	1.5
No Delay	22	32.4
Total	64	100

The following Case Study 1 demonstrates an obvious delay in seeking care. This and alike deaths require high quality ANC services to coach pregnant women to recognize risk factors and timely seek medical care.

Case Study 1: COVID-19 Infection Representing Delay I

A 28 years old gravida one presented at 31 weeks of gestation complaining of severe labor pain and watery vaginal discharge. Laboratory results were unremarkable. On vaginal examination cervix was dilated 5cm. Labor progressed without complications and two hours later she had a spontaneous vertex delivery to a live infant, and she was discharged the following day in a stable condition.

Five days after delivery, while she was at home, she started to complain of shortness of breathing and tachypnea. She tested positive on COVID-19 PCR testing, and was started on antibiotics by her family without medical consultation. Her condition started to deteriorate on the sixth day after delivery and she was brought to the emergency department complaining of severe dyspnea and was admitted to the Intensive Care Unit (ICU). Arterial blood gases confirmed the presence of metabolic acidosis. Two weeks later, she passed away due to respiratory failure.

The following Case Study 2 demonstrates how a combination of all three delays led to a fatal outcome. There was a delay in seeking medical care during the antenatal period, given that the deceased woman was experiencing a high-risk pregnancy. The delay in reaching the facility was mainly related to COVID-19 restrictions, where the ambulance system was overburdened. Finally, and most importantly was the delay in receiving the appropriate care during the antenatal period and upon arrival to hospital.

Case Study 2: Intracranial Hemorrhage Representing Delay I, II and III

40-year-old 24-week pregnant woman, gravida six, para four +, with known history of idiopathic thrombocytopenia purpura on dexamethasone tablet 5 mg trice daily for the last 13 years. She had three antenatal care visits and took baby aspirin once every three days. Two weeks prior to her admission, she reported numerous bruising over her extremities and suffered from recurrent episodes of epistaxis but did not seek medical care.

On April 17, she complained of sudden onset weakness in the left side of the body with epistaxis. Her family called the ambulance service and there was a delay in ambulance arrival due to the country-wide shutdown imposed by the COVID-19 pandemic. On admission to the hospital, physical examination revealed weakness of the left arm and leg. BP was 101/69 mmHg, pulse was 104 beats/minute, temperature was 37.0, RR was 18 breaths/minute. Laboratory tests revealed hemoglobin of 9.4 g/dl; platelets of $15 \times 10^9/L$; D-dimers 2962 ng/ml; and troponin I 0.43 ng/ml (reference value <1.50 ng/ml). Urine protein was +1 and ketones +1. Treating physician took the decision to admit the patient to the medical floor.

On the second day of admission, the patient developed transient expressive aphasia followed by decreased level of consciousness. Brain CT scan showed intracranial hemorrhage with ischemic changes. Her condition rapidly deteriorated and she was transferred to the intensive care unit and put on mechanical ventilation.

Over the following week her condition continued to deteriorate and on April 25, the patient passed away.

The following Case Study 3 clearly demonstrates the medical mismanagement that ultimately led to death. This and alike cases could have been prevented with timely and proper care.

management. These and similar cases raise the flag for urgent need of strengthening capacity building on case management at primary and secondary levels especially for staff working in obstetric department in private and public hospitals.

Case Study 3: Postpartum Hemorrhage Representing Delay III

A 25-year-old woman was admitted to a hospital at a gestational age of 35 weeks twins' pregnancy for preterm labor pain and anemia. She was a gravida three, para 1+ and she attended eight antenatal care visits during the current pregnancy. She had no history of pre-existing medical conditions and no previous admissions to hospital during the course of the current pregnancy that led to her death.

On examination, her vital signs were stable and laboratory investigations showed Hb of 8.1g/dl. She was in active labor with a cervical dilation of 4cm. Ultrasound showed twin pregnancy with the first cephalic and the second breech presentation. She received two units of packed RBCs and the labor progressed with 7cm dilation, but fetal distress was noticed. She underwent an emergency CS delivery and gave birth to two alive male newborns (3.025kg and 2.850kg). Immediately after surgery, the patient started to complain of vaginal bleeding, uterine massage was applied, 30 IU oxytocin drip started, bakery balloon was placed, 4 rectal cytotic tabs were inserted that led to stabilization of the vital sign. After 2 hours of surgery, vaginal bleeding stopped and abdominal ultrasound revealed no free fluid with clear contracted uterus and the bakery balloon was deflated.

Six hours later, the woman's condition started to deteriorate: BP 60/30 mmhg and pulse 40 beats/min, O2 sat 79%. She started to suffer from excessive vaginal bleeding with clots and uterus was lax on physical examination. Blood transfusion of 6 units PRBCs, six units of plasma, six units of platelets, 28 vials of eptacog alpha, and three liters of hydration fluid were received. Meanwhile, the women underwent a total abdominal hysterectomy and internal iliac ligation. She arrested three times during surgery with fluctuating blood pressure. Postoperatively, she was transferred to the ICU with remarkable lab investigations showing Hb 8.5g/dl, WBCs 15.5mm³ creatinine 1.5mmol/l, INR: 3.22. Finally, on the postpartum 22 hour she passed away.

DATA LIMITATIONS

This report is limited to a descriptive analysis of the 68 maternal deaths that took place during 2020. The JMMSR system does not collect data on appropriate controls that have a different outcome in terms of death. Thus, the descriptive analysis performed did not allow to test for sound statistical associations or to establish causality. Accordingly, the presented results that hint to some probable associations with maternal deaths should be interpreted with caution. Further in-depth analysis of the JMMSR data by Jordanian scholars will better elucidate the important risk factors leading to maternal death.

Through the JMMSR system implementation, the MDRs relied on the collected information obtained through verbal autopsies, healthcare provider interviews and medical record reviews. The lack of documentation in medical records related to risk factors and exact timing of death prevented the NAG from defining and analyzing all risk factors associated with maternal deaths. The inconsistent documentation in medical records related to operative details following surgical interventions, ANC, level of education, and employment status also constituted a challenge for the NAG to present a complete analysis of these variables.

Although women prior to their deaths were able to access multiple healthcare providers in the public and private sectors, the lack of linkage between these sectors and the inability to exchange patients' information about ANC resulted in inadequate data related to the ANC services provided to the deceased women. Moreover, it was difficult for the NAG to comment on the quality of ANC provided.

Lack of sufficient data especially from medical files was behind the inability of NAG to assign a cause of death for four cases.

MATERNAL MORTALITY RESPONSE

Understanding the causes of maternal deaths is critically important for developing interventions that avert maternal mortality. Maternal deaths occur due to complications during pregnancy, childbirth, and the postpartum period. Most of these complications develop during pregnancy, while others may exist before pregnancy, but become aggravated by the pregnancy. All women need access to high quality care provided by competent skilled healthcare professionals during pregnancy, childbirth, and the postpartum period since most of the maternal mortality could be prevented. Therefore, MOH with support of USAID and other stakeholders will continue to lead efforts and influence change across all levels of Jordan's health sector through robust, practical, and evidence-based recommendations to be implemented jointly with relevant stakeholders and achieve the goal of eliminating preventable maternal mortality in Jordan.

MOH with all stakeholders' support will translate the JMMSR system's responses into an action plan that aims at averting further maternal deaths. This will include interventions to enhance the JMMSR Information system's operation and strengthening capacities of all DAGs to take the lead in the implementation and monitoring of the response action plan at their respective health facilities to assist in further averting maternal deaths and improve maternal health outcomes in Jordan.

WHO strategies towards ending preventable maternal mortality (2015) suggested a national strategy to reach the proposed average global maternal mortality ratio of less than 70 maternal deaths per 100,000 live births by 2030.

These proposed five strategies include addressing inequities in access to and quality of reproductive, maternal, and newborn health care; addressing all causes of maternal mortality, reproductive and maternal morbidities, and related disabilities; strengthening health systems to respond to the needs and priorities of maternal mortality; and ensuring accountability to improve quality of care and equity.

Along with implementing these strategies at the national level, WHO highlighted the guiding principles for policy and program planning which include empowering women, families and communities; enhancing leadership and supportive legal, regulatory and financial mechanisms; applying a human rights framework to ensure that high-quality reproductive, maternal and newborn health care is accessible; improving measurement systems, and prioritizing adequate resources and effective health-care financing .

MOH with support from all stakeholders will adopt the WHO strategies in their programmatic strategies and strengthen the health care system in providing safe and respectful maternity care.

The NAG recommended responses to address the entire country, and will work with a multidisciplinary team from MOH, Royal Medical Services (RMS), Universities, private health sectors and other stakeholders in planning and promoting implementation and acting as advocates for change. The MOH Non-Communicable Diseases Directorate lead the development, implementation, and monitoring of immediate and short-term responses. The NAG recommended MOH to assign response coordinators to facilitate the adoption of the proposed strategies at the facility levels in all health sectors.

Based on the findings of maternal mortality report of (2020), the NAG in collaboration with stakeholders prioritized a specific strategy which could have the tangible impact on reducing preventable maternal mortality, as per mentioned below.

Proposed National Strategies Toward Ending Preventable Maternal Mortality

Response is the most important step in the reduction of preventable maternal deaths, which includes taking actions, publication and dissemination of reports and results. Taking action to reduce preventable maternal deaths is the primary objective of the JMMSR system. Findings from reviews should lead to immediate actions to prevent similar maternal deaths at health facilities and in the households. In addition, responses may also be short-term actions (immediate) or long-term. Recognizing patterns of problems contributing to maternal deaths should result in more comprehensive responses.

The MOH will take the lead in advocating for policies to ensure that RMNCH services are equitable, that there are sufficient funds allocations and financing mechanisms for obstetric and newborn services. In addition, MOH will ensure accountability to improve quality of care and equity of RMNCH services.

Based on the maternal mortality findings (2020), the **NAG** proposed 5 national response strategies that apply across the continuum of health care and throughout the pregnancy, childbirth, and the postpartum period and even preconception. These national strategies will be implemented at the facility level which will focus on ensuring that national guidelines in emergency care are updated and are in use nationally, that COVID-19 response is integrated within the RMNCH continuum of care, guidelines to reduce unnecessary cesarean section are adhered, Adopting Strategies for the Quality ANC including High-Risk Pregnancy Management at primary and secondary care level, Increase the uptake of quality family planning methods.

Enhance the Quality of Comprehensive Emergency Obstetric Care

An important component of reducing maternal mortality and morbidity and intrapartum-related neonatal deaths is to ensure that health facilities have adequate capacity to provide comprehensive emergency obstetric care.

Emergency obstetric care requires teamwork, increasing the awareness of the problem, and anticipatory clinical practice to prevent the occurrence of complications or not to delay the right decision at the right time and in the right way. The third national mortality report (2020) shows that delay in receiving care contributed to about half (48.6%) of the cases with known cause of death. All deaths due to delays in receiving care were classified as avoidable deaths. Obstetric hemorrhage, pregnancy induced hypertension, thromboembolic diseases and pregnancy related infections are largely preventable diseases.

Emergency care in obstetric is a process accompanied by challenges that require an approach with multiple partners forming an effective partnership. The roles and responsibilities of each partner should be agreed upon in a clear working framework at the HAD and national levels. To decrease avoidable deaths, the MOH and patterners need to update, implement and monitor national guidelines and protocols to provide high quality.

Strengthen Jordan's COVID-19 Response in Obstetric Care

Based on the current maternal mortality data published in 2021, COVID-19 infection classified as the most common cause of death with one fifth (20.3%) of all cases.

The MOH, in collaboration with stakeholders, will update the clinical guidance and protocols for COVID-19 case management during pregnancy, childbirth and the immediate postpartum period. The proposed guidance should be based on the best available evidence and latest recommendations regarding management and vaccination of women during pregnancy, childbirth and postpartum.

Supporting Vaginal Births and Reducing Unnecessary Primary CS Deliveries

The proportionately high number of women who delivered by CS was observed among maternal deaths throughout the three maternal mortality reports of 2018, 2019 and 2020. WHO recommends that caesarean section should be used only in the presence of medical indications. Unnecessary CS is associated with a higher risk of perinatal and maternal mortality compared to a vaginal.

In early 2020, MOH and a group from public and private stakeholders with USAID support developed and disseminated "National Guidelines to Support Vaginal Births and Reduce Primary Cesarean Section Deliveries". MOH with support from USAID and partners will continue to roll-out capacity building for obstetricians and midwives working in public and private hospitals aiming to reduce unnecessary primary cesarean section deliveries in Jordan.

Adopting Strategies for the Quality ANC including High-Risk Pregnancy Management at primary and secondary care level

The early detection of pregnant women at risk of developing complications is an essential component of antenatal care in preventing maternal death. P primary care providers need to be guided in early detection and referral of women based on a reasonably objective set of criteria for high-risk factors. Risk is also had to be assessed during or shortly after labor and at any time that events may modify risk status.

Detailed guidelines are needed for risk assessment and management for specific common conditions not limited to venous thromboembolism, postpartum hemorrhage, and maternal sepsis.

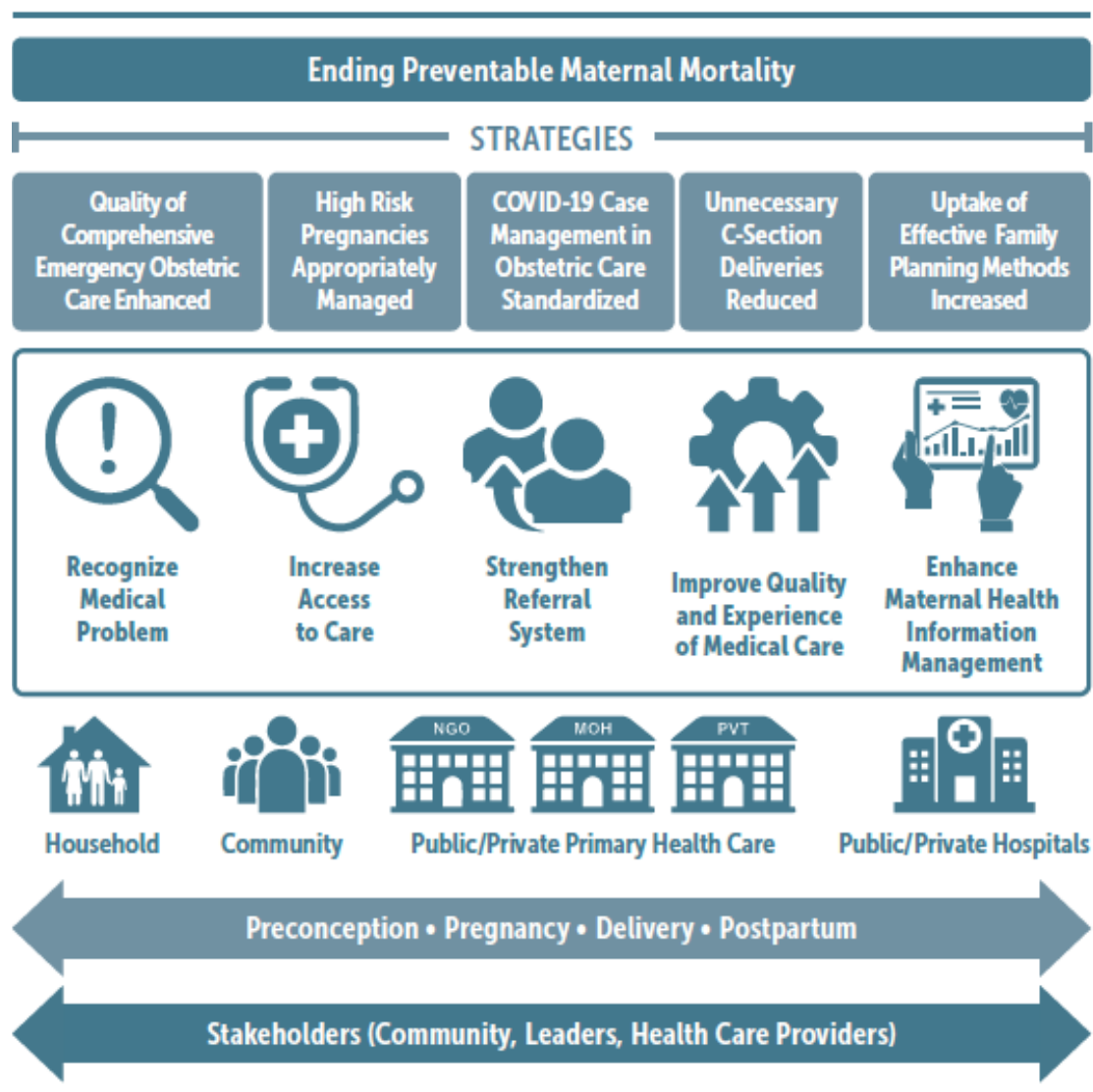
Increase the Uptake of Effective Family Planning Methods.

FP reduces maternal and child morbidity and mortality by preventing unintended pregnancies and unsafe abortions. Enabling birth spacing, ultimately reduces child mortality, while it enhances the nutritional status of both the mother and child⁴⁶.

MOH will continue working on equipping healthcare facilities with modern FP methods and necessary tools to provide high-quality FP services in addition to training relevant healthcare providers on the provision of quality FP counselling and modern contraceptive methods, including IUDs and implants. A joint effort is required to mobilize the community and raise its awareness on the risks of multiparty and short pregnancy spacing and the importance of FP, high risk pregnancy cases.

Figure 7 illustrates the proposed strategies for ending preventable maternal mortality

Figure 7: Proposed strategies toward ending preventable maternal mortality



CONTRIBUTORS

Central Ministry of Health

Dr. Ghazi Sharkas

Former Assistant to HE the Secretary General for Primary Health Care

Dr. Nashat Taani

Former Director of Non-Communicable Diseases Directorate

Ms. Fatima Hammad

Director of Electronic Transformation and Information Technology Directorate

Ms. Arab Al Masri

Head of the National Registry of Maternal Mortality/Non-Communicable Diseases Directorate

Royal Medical Services

Brig. Gen Dr. Maher Ma'ayta

Chief of Ob/Gyn Department at the Central Directorate of Royal Medical Services

Brig. Gen Dr. Amer Gharaibeh

Technical Director and Chief of Ob/Gyn Department at Al-Hussein Hospital in King Hussein Medical Center / Royal Medical Services- National Advisory Group Member

National Advisory Group

Dr. Abdel-Manie' Al Suleimat

Chief of Ob/Gyn Specialty and Chairman of the JMMSR National Advisory Group / Ministry of Health

Dr. Hadeel Al Saeh

Director of the Woman and Child Health Directorate / Ministry of Health

Dr. Hassan Huwwari

Director of National Center for Forensic Medicine / Ministry of Health

Dr. Shawqi Saleh

Professor of Ob/Gyn/ Jordan University Hospital

Dr. Hasan Rawashdeh

Assistant Professor/Ob/Gyn Specialist / King Abdullah University Hospital

Dr. Mhanna Khattab

Ob/Gyn Consultant / Jordan Medical Association

Representative / The Jordanian Society of Obstetrics and Gynecology

Dr. Mazen Al Zibdeh

Ob/Gyn Consultant / Private Clinic

USAID/Jordan

Dr. Nagham Abu Shaqra

Senior Population and Health Advisor / Project Management Specialist, Office of Population and Family Health, USAID/Jordan

Former USAID Health Service Delivery Activity

Professor Sabry Hamza	<i>Former USAID Health Service Delivery Activity Chief of Party</i>
Dr. Suhail Abu Ata	<i>Former JMMSR Specialist</i>
Jumana Nabulsi	<i>Former JMMSR Coordinator</i>

USAID Health Services Quality Accelerator

Dr. Hala AL Mossawi	<i>Vice President and Regional Team Leader/ Asia, MENA Programs</i>
Anne Fiedler	<i>Chief of Party</i>
Dr. Ju'far AbuTaleb	<i>Deputy Chief of Party</i>
Dr. Ali Arbaji	<i>Health Services Quality Accelerator Consultant</i>
Dr. Raja Khater	<i>Senior Service Delivery Advisor-Team Lead</i>
Dr. Sawsan AL Majali	<i>Senior Health System Strengthening Advisor</i>
Waleed Ziadeh	<i>Clinical Quality Improvement Advisor</i>
Heba AboShindi	<i>Quality Improvement Health Facility Officer</i>
Zoya Shehadeh	<i>Senior Communication, KM & CLA Specialist</i>

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ملخص تنفيذي

لقد حقق الأردن خلال العقدین الماضیین تقدماً ملموساً في تحسين المخرجات الصحية للأمومة الآمنة وصحة المرأة والطفل. وقد أدرك الأردن مدى تأثير وفيات الأمهات على الصحة العامة وبدأ بتطوير وتطبيق مجموعة من السياسات المبنية على أدلة وبرامج ومداخلات تهدف إلى التقليل من وفيات الأمهات وتمكين الحكومة الأردنية من تحقيق أهدافها المتعلقة بالتنمية المستدامة. وكان إنشاء النظام الوطني للرصد والاستجابة لوفيات الأمهات أهم هذه البرامج حيث يتم رصد جميع وفيات النساء في سن الإنجاب فور حدوثها وحصر وفيات الأمهات في المملكة، وتحديد أسبابها، والاستجابة المناسبة لها لمنع حدوث حالات وفاة مشابهة. وقد تم إنشاء هذا النظام بعد تعديل قانون الصحة العامة الذي يفرض تشكيل النظام الوطني للرصد والاستجابة لوفيات الأمهات ويلزم جميع القطاعات الصحية بالتبليغ عن كل حالة وفاة للنساء في سن الإنجاب.

لقد دأبت وزارة الصحة ومنذ إطلاق النظام الوطني للرصد والاستجابة لوفيات الأمهات عام 2018 وبالتعاون مع جميع الشركاء في القطاع الصحي العام والخاص على التأكد من تطبيق هذا النظام في جميع أنحاء المملكة بما في ذلك الاستجابة لمخرجات هذا النظام بما يضمن عدم حدوث وفيات الأمهات التي من الممكن تجنبها. وفي هذا السياق عملت الوزارة على رفع كفاءة العاملين على النظام على مستوى الوزارة المركزي وعلى مستوى مديريات الشؤون الصحية في المحافظات بهدف تحسين نوعية البيانات المجموعة وتحليلها.

ويعتبر هذا التقرير لوفيات الأمهات عن عام 2020 ثالث تقرير سنوي على التوالي. اعتماداً على بيانات نظام المعلومات الإلكتروني للنظام الوطني للرصد والاستجابة لوفيات الأمهات، يوفر هذا التقرير معلومات مفصلة عن كل حالة وفاة أمهات حدثت في الفترة من بداية كانون الثاني وحتى نهاية كانون الأول من عام 2020 مما يساهم في دعم النظام الصحي في الأردن بهدف التخلص من وفيات الأمهات التي من الممكن تجنبها وبالتالي تحسين مخرجات صحة الأم.

وقد مرت بيانات نظام المعلومات الإلكتروني للنظام الوطني للرصد والاستجابة لوفيات الأمهات بمراحل تدقيق مختلفة وعلى أكثر من مستوى من قبل فرق متعددة التخصصات. لقد تم التبليغ عن 1,245 وفاة لنساء في سن الإنجاب خلال عام 2020، كان منها 68 وفاة أمهات، في حين بلغ إجمالي عدد المواليد الأحياء 176,557 خلال نفس الفترة وعليه يكون معدل وفيات الأمهات في الأردن 38.5 كل 100,000 مولود حي.

من مجموع 68 حالة وفاة للأمهات، تمكنت اللجنة الوطنية من تحديد السبب الرئيسي للوفاة في 64 حالة، بينما لم يتم تحديد سبب الوفاة لأربع حالات وفاة نتيجة نقص في البيانات. من ضمن 64 حالة وفاة معروفة السبب، بينت اللجنة الوطنية أن 44 حالة وفاة (68.7%) كان من الممكن تجنب حدوثها. وقد توفيت 34 حالة (53.7%) نتيجة أسباب متعلقة مباشرة بالحمل والولادة، بينما كان هناك 30 حالة وفاة ناجمة عن أسباب غير مباشرة (46.9%).

وتصدرت قائمة المضاعفات الأخرى للولادة (التخثر المرتبط بالولادة، المضاعفات الوريدية للولادة ومضاعفات ما بعد الولادة، واعتلال عضلة القلب ما بعد الولادة) الأسباب المباشرة للوفاة، حيث كانت هناك حالة وفاة، في حين حلت أمراض الجهاز التنفسي في المركز الثاني مسجلة 16 (25%) (28.1%) 18

حالة، وقد تلتها أمراض النزيف بعد الولادة حيث كانت هناك 6 (9.4%) حالات وفاة، وسجلت أمراض الجهاز الوعائي والأورام خمس (7.8%) إصابات لكل منها.

وقد شكلت أمراض التخثر المرتبط بالولادة 12 (18.8%) حالة، وشملت على 9 حالات انسداد بالشريان الرئوي و3 حالات انسداد بالسائل الأمنيوسي (السلوى). (وقد تم تعزيز التشخيص عن طريق تشريح الجثة في 9) 75% من حالات التخثر.

لقد شكلت الإصابات بكوفيد-19 الغالبية العظمى من أمراض الجهاز التنفسي، حيث تم تسجيل 13 إصابة بهذا المرض مشكلة حوالي خمس جميع حالات الوفاة معروفة السبب.

ومن بين أمراض الجهاز الدوراني، برز بشكل ملفت تفجر أم الدم الأبهرية حيث سجلت 3 حالات من هذا المرض وقدمت تعزيز هذا التشخيص عن طريق تشريح الجثة في جميع الحالات.

لقد قامت اللجنة الوطنية بتحديد العوامل المساهمة التي أدت إلى وفيات الأمهات من خلال مراجعة تقارير حالات وفيات الأمهات وملخصات هذه الحالات. تم عرض العوامل المساهمة للوفيات الأكثر شيوعاً باستخدام نموذج التأخيرات الثلاثة والتي تضم التأخر في طلب الرعاية الصحية والتأخر في الوصول إلى الرعاية الصحية والتأخر المتعلق بتلقي الرعاية الصحية الملائمة. حيث تبين أن التأخر الثالث المتعلق بتلقي الرعاية، ساهم في 24 (35.3%) من حالات وفيات الأمهات واعتبرت جميع وفيات النزف بعد الولادة الست بسبب التأخر بتقديم الرعاية الطبية. بينما تبين أن التأخر في طلب الرعاية الصحية (التأخر الأول) (قد ساهم في 11) 16.2% حالة من وفيات الأمهات. وفي ثمانى (11.8%) حالات كان هناك مزيج من التأخر في طلب الرعاية الصحية والتأخر في تلقي الرعاية المناسبة. وقد عانت حالة وفاة واحدة من التأخيرات الثلاث مجتمعة، بينما لم يكن هناك تأخير في 22 حالة (32.4%).

لقد بينت نتائج وفيات الأمهات الواردة في هذا التقرير الإشكاليات المتعلقة بوفيات الأمهات، وكذلك العوامل الاجتماعية والصحية التي تساهم في حدوث هذه الوفيات. بالرغم من أن مراجعة تقارير وفيات الأمهات عملية معقدة وتتطلب كثيراً من الجهد والوقت، إلا أن التعرف على أسباب وفيات الأمهات والعوامل المساهمة في حدوثها لا يمكن أن يتم بطريقة علمية وشاملة إلا من خلال رصد ودراسة وفيات الأمهات بالطريقة المعمول بها حالياً. ويعتبر تحسين وتطوير النظام الوطني للرصد والاستجابة لوفيات الأمهات والاستمرار في تطوير مفهومنا لأسباب وفيات الأمهات والعوامل المساهمة في حدوثها حجر الأساس في التخلص من وفيات الأمهات التي من الممكن تجنبها. ويعتبر الالتزام الرسمي بتخفيض وفيات الأمهات من أهم العوامل لديمومة وتحسين النظام الوطني للرصد والاستجابة لوفيات الأمهات. وعلينا استخلاص الدروس من عمل النظام في عامه الثالث مع التأكيد على ضرورة تحسين صحة الأم على جميع مستويات الرعاية والعمل الجماعي لتقديم رعاية صحية عالية الجودة للأم الحامل في كل من القطاعين العام والخاص.