

Jordan's National Maternal Mortality Report 2021

Jordan, towards eliminating preventable maternal deaths

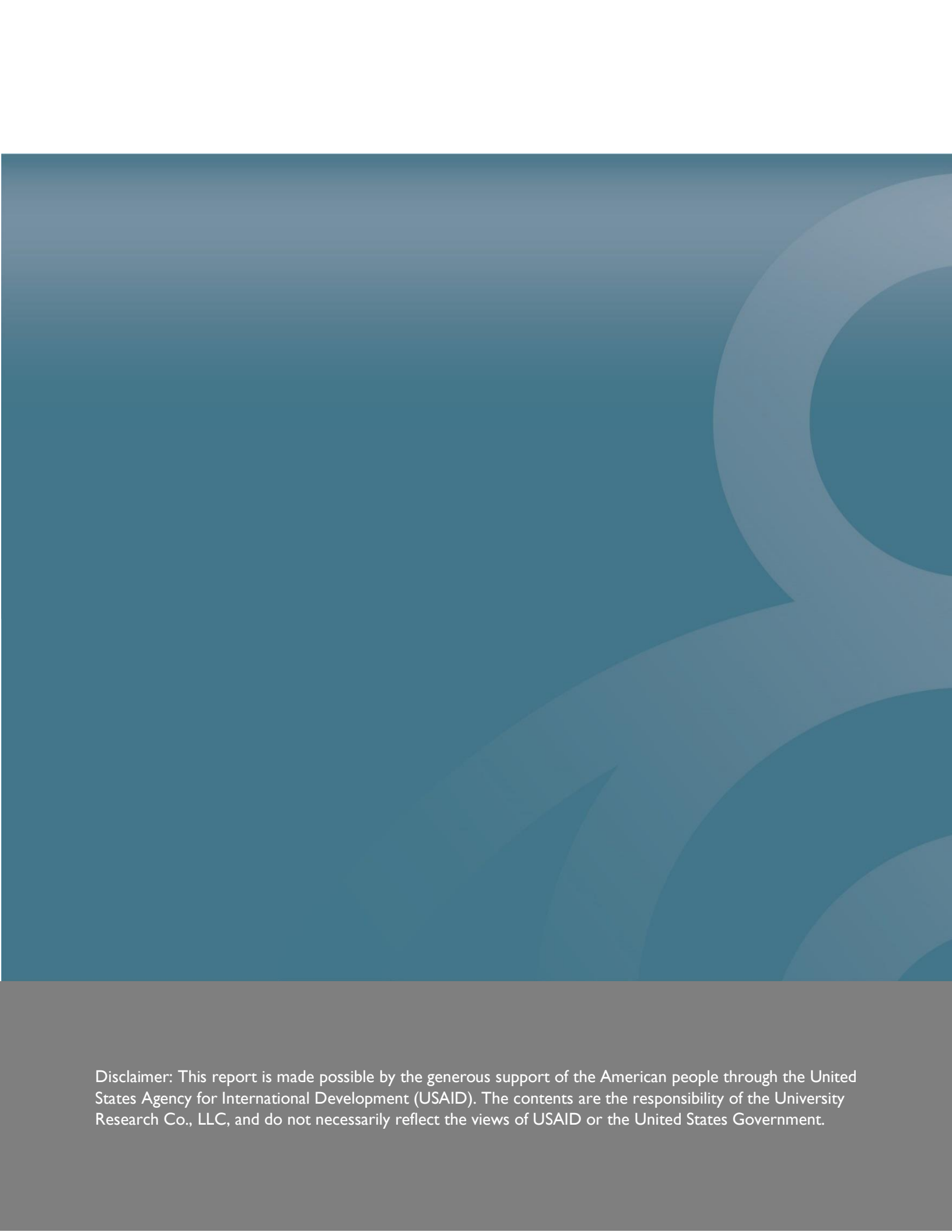
This national report was developed by the Ministry of Health and the Maternal Mortality National Advisory Group with support from USAID Health Services Quality Accelerator. The data and findings presented in this report are drawn from Jordan's Maternal Mortality Surveillance and Response (JMMSR) system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

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The National Maternal Mortality
Surveillance & Response System
النظام الوطني للرصد والاستجابة لوفيات الأمهات





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FOREWORD

Since the start of Jordan's Maternal Mortality Surveillance and Response (JMMSR) system implementation in 2018, the Ministry of Health (MOH) has collaborated with many 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 Jordan. This system is designed to guide appropriate decision-making, responses, and strategies to prevent maternal deaths to achieve the health targets of Sustainable Development Goal 3 (ensure healthy lives and promote well-being for all at every age).

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

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

In 2021, the COVID-19 pandemic continued to cause harmful consequences in 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. COVID-19 disease took its toll on maternal mortality, causing 65% of all maternal deaths in Jordan.

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 our 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 the JMMSR system. Moreover, we would like to thank the authors and contributors to Jordan's Maternal Mortality Report 2021 for their expertise and commitment to developing the Fourth national report. We would like to acknowledge the women who died during their pregnancy, during labor, or after giving birth, where almost two-thirds of deceased women succumbed to COVID-19 infections. We are extending our acknowledgment to the loved ones they left behind and the people who cared for them.

This report and the recommendations within it were made in the hope 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. Abdelmane' Al-Suleimat

Chairman of the JMMSR National Advisory Group and
Chief of Ob/Gyn Specialty at MOH

The Hashemite Kingdom of Jordan



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ACRONYMS

ANC Antenatal Care

BP	Blood Pressure
CS	Cesarean Section
CPR	Cardiopulmonary Resuscitation CSPD
DAG	Directorate Advisory Group
EmOC	Emergency Obstetric Care
FMD(s)	Forensic Medicine Department(s)
HAD	Health Affairs Directorate
ICD	International Classification of Diseases
ICD-MM	International Classification of Diseases -Maternal Mortality
IT	Information Technology
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
NGO	Non-Governmental Organization
RMS	Royal Medical Services
SDG	Sustainable Development Goal
UNFPA	United Nations Population Fund
USAID	United States Agency for International Development
WHO	World Health Organization

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
- Multiplier: 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 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.

Para I: 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: Examining 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 MOH, the RMS, and university hospitals (including the 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 managing 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 2021 is the fourth report on the raw data of maternal mortality in Jordan. It provides comprehensive information on each maternal death that took place during the reporting period (January-December 2021) and is based on the Jordan Maternal Mortality Surveillance and Response information system (JMMSR IS). This report is intended to 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, **1,871** deaths among women of reproductive age occurred, of which **160** maternal deaths were identified. COVID-19 infection caused 104 deaths out of the 160 reported deaths.

The total number of live births for the same period was **187,722**, and accordingly, the national Maternal Mortality Ratio (MMR) was estimated at **85.2 per 100,000 live births**. The 2021 MMR figure was about 2.2, 2.6, and 2.9 times higher than the MMRs in 2020, 2019, and 2018, respectively. COVID-19 disease was the only known factor behind this drastic increase in MMR in 2021. The non-COVID MMR for 2021 was **29.8 per 100,000 live births**. There was no statistical difference between the COVID MMR and the non-COVID MMR in the previous three reports, indicating stagnation in the non-COVID MMR over the years. Due to the transient nature of COVID-19 infections, non-COVID MMR for 2021 should serve as the basis for planning future interventions.

The MMR breakdown by social and demographic variables was limited to age, nationality, and place of residence, where the denominator in terms of live births was available. The MMR showed an obvious increasing trend with age, going up from 25.2 for the age group under 20 years old to 417 in the age group 40 years old and above. While the MMR for Jordanian women was 90 compared to 54.7 for non-Jordanians, the non-COVID MMR for Jordanian women was 27.8 compared to 43 for non-Jordanians as more COVID-19 deaths took place among Jordanian women. The non-COVID MMR varied widely by place of residence, with the lowest MMR being in Jerash and Amman at 14 and 17.9, respectively, and the highest in Tafila and Madaba at 166.1 and 96.3, respectively.

The 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 160 maternal death cases, the NAG assigned the main cause of death to 158 cases, while the cause of death could not be specified based on the available information for two cases.

The results showed that of the 160 deaths, 34 cases (21.3%) died of direct obstetric causes, and 124 cases (77.5%) died due to indirect maternal causes. Among the non-COVID deaths, the direct causes accounted for 60.7%, the indirect causes 35.7%, and the remaining two unidentified cases.

Obstetric hemorrhage was the leading cause of direct death, representing 13 cases (8.1%) of all maternal deaths and 23.2% of non-COVID deaths.

Other obstetric complications (obstetric embolism, venous complications, and puerperium-peripartum cardiomyopathy) were the second cause of direct maternal deaths, with 10 cases that were responsible for 6.3% of all deaths and 17.9% of non-COVID deaths. The obstetric embolism included six pulmonary embolism deaths and two amniotic fluid embolism deaths.

Other direct maternal deaths included: four deaths from hypertensive disorders in pregnancy presenting as pre-eclampsia, representing 4.5% of all deaths and 7.1% of non-COVID deaths; four cases of pregnancy aborted outcome; and three cases diagnosed as puerperal sepsis.

Diseases of the respiratory system dominated the list of indirect causes of death as well as the total number of deaths with 107 cases of which COVID-19 was encountered in 104 cases and pneumonia in three cases. COVID-19 was responsible for about 65% of all deaths reported during 2021.

Diseases of the circulatory system (myocardial infarction, cardiomyopathy, myocarditis, rupture aortic and splenic aneurysms) constituted seven cases corresponding to 4.4% of all deaths and 12.5 of non-COVID deaths. Three mortality events were caused by a ruptured aortic aneurysm, verified by autopsy.

Diseases of the central nervous system (cerebrovascular infarction, encephalitis, intracerebral and subdural hemorrhage) accounted for four cases representing 2.5% of total deaths and 7.1% of non-COVID deaths.

The remaining causes of indirect maternal death included: two cases of septic shock, and one case each of intestinal obstruction, fatty liver, diabetic ketoacidosis, and metastatic rectal carcinoma.

Thirty of the 160 cases underwent autopsy, representing 18.8% of all death cases and 51.8% of non-COVID deaths.

Of the 160 maternal death cases, 49 cases (30.6%) were identified as avoidable deaths, while 36 cases (64.3%) out of the 56 non-COVID deaths were identified as avoidable deaths. All 13 postpartum hemorrhage deaths were considered avoidable.

The NAG identified contributing factors that led to maternal deaths from the maternal death review (MDR) reports and case summaries. The most common contributing factors identified were presented using the “Three Delays Model.

DELAY I: Seeking Care, contributed to 18 cases representing 11.3% of all 160 maternal deaths and seven cases (12.5%) of non-COVID maternal deaths. Six cases had a combination of delays, and no delays were encountered in 109 cases representing 68.1% of all deaths. No delays among non-COVID deaths were present in 18 cases (32.1%).

DELAY III: Receiving Care, contributed to 25 cases representing 15.6% of the total 160 maternal deaths and 41.1% of non-COVID cases. All of the 13 postpartum hemorrhage deaths suffered from Delay III.

Despite the obvious impact of the COVID-19 pandemic on maternal mortality in 2021, the high incidence of direct maternal deaths, avoidable deaths, and delay in receiving care put immense responsibility on the providers of medical services for failing to prevent a considerable number of maternal deaths.

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 eliminating 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 guide the improvement of maternal health outcomes in Jordan.

The lessons learned throughout the fourth year of implementation require all stakeholders to continue improving the wide range of JMMSR system functions with a special emphasis on the response and especially at the facility level, 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 has made significant progress in improving the quality of safe motherhood services and maternal and child health outcomes. Jordan recognizes that maternal mortality constitutes a serious 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 the country. The system is mandated by law and ensures that every death of a woman of reproductive age is noted, and a maternal death review is conducted.

Since the launch of the JMMSR system in 2018, the Ministry of Health (MOH) has 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 the 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 a 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 three years of the JMMSR system's implementation, the MOH, in collaboration with national stakeholders and with technical assistance from the USAID Health Services Accelerator Activity, used the JMMSR data collected from January through December 2021 and used it to lead the efforts for the development and finalization of Jordan's Fourth National Maternal Mortality Report for 2021.

In August 2021, the U.S. Agency for International Development (USAID) awarded University Research Co., LLC (URC) a five-year flagship health activity in Jordan (Table 1). The USAID Health Services Quality Accelerator (HSQA) Activity (the Activity) aims to sustain and advance improvements in equitable reproductive, maternal, newborn, and child health (RMNCH) services, specifically targeting disadvantaged segments of the population (Table 2). The Activity supports innovative approaches to improve access to and quality of RMNCH services in the public and private sectors and to strengthen the Ministry of Health's (MOH's) capacity to act as a steward for improving the quality of RMNCH services. And the JMMSR system is one from the support provided to the MOH.

METHODOLOGY

Jordan's National Maternal Mortality Report 2021 is the fourth report that provides a comprehensive analysis of each maternal death that took place during the reporting period based on active surveillance through the JMMSR system. It offers the 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 based on a customization of the WHO Maternal Death Surveillance and Response Technical Guidance published in 2013¹ 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.

Like the methodology followed for developing the first three National Maternal Mortality Reports of 2018, 2019, and 2020, 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 was 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 healthcare system levels 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 have been utilized to collect data to support the operations of the JMMSR system implementation steps, as follows:

1. Notification of All Deaths Among Women of Reproductive Age

This step was carried out by trained focal points at all reporting sites (125) from 30 MOH hospitals, 11 RMS hospitals, two university hospitals, 65 private hospitals, and 17 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.

2. Identification of Maternal Death Cases

Once deaths among women of reproductive age were noted, 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, and within 42 days of the end of pregnancy, excluding deaths due to incidental or accidental causes (accidents or homicide). Deaths due to suicide during pregnancy and within 42 days of the end of pregnancy were considered maternal deaths.

3. 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 involves two subsequent levels: the HAD level conducted by DAGs and followed by the national level conducted by the NAG. The DAG level review is comprised of two steps: 1) data collection and 2) MDR sessions analyzing collected maternal death data.

Data collection was carried out utilizing health facility and household surveys depending on the place of death and the availability of data sources. The questionnaires for these surveys 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 Completion of health facility reviews and surveys were required within 72 hours of a maternal death case identification and completion of household reviews was required within one month of identification. Delays in conducting health facility and household surveys were observed across most locations.

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 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 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 up to the time of death. In-depth household interviews were conducted to ask questions regarding the woman's health, how the death occurred, and to 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.

A. 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, the case was ready for review by the NAG.

B. National Advisory Group (NAG) Review

De-identified data on each maternal death was presented to NAG members. 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, NAG members completed the following tasks:

- Confirming the cause of death
- Determining whether it was due to a direct or indirect obstetric death
- Classifying maternal death as avoidable or unavoidable
- Identifying contributing factors that led to the maternal death
- Issuing 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

A monitoring and evaluation framework was developed and implemented to improve the timeliness, quality, and completeness of data collected through the JMMSR IS. This framework was used to monitor the system's main functions 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 promptly.

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 understand the problems that led to 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 2021 was obtained from the Civil Status and Passport Department (CSPD) to serve as the denominator of the MMR. The total number of maternal deaths, the background demographic, and clinical characteristics were obtained from the JMMSR IS. Stata 15 statistical package was used to perform the descriptive analyses of relevant variables.

Confidentiality and Ethical Considerations

The JMMSR Bylaw guaranteed that the information generated through the JMMSR system would 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 respondents of household surveys with contact details in case they had any questions.

RESULTS

The results presented in this section cover the reporting period from January 1, 2021, to December 31, 2021.

Maternal Mortality Ratio

During the reporting period, 1,871 deaths occurred among women of reproductive age, of which a total of 160 maternal deaths were identified. The JMMSR IS reported 1563 deaths among women of reproductive age and all the 160 maternal deaths. The remaining 308 deaths among women of reproductive age were obtained from the Civil Status and Passport Department (CSPD), of which none were identified as maternal deaths.

DAGs and the NAG conducted maternal death reviews for all maternal death cases at the HAD and national levels, respectively. The total number of live births for 2021 was **187,722⁴** which is considered higher than previous years and total number of maternal deaths during the same period was 160 deaths, corresponding to a maternal mortality ratio (MMR) of **85.2** per 100,000 live births (Table 1). Breakdown of MMR by age groups, governorate of residence and nationality are provided in relevant sections later in this report.

Table 1 demonstrates the contribution of COVID-19 to causes of maternal deaths over the last four years and presents the total MMR and the non-COVID MMR that excludes COVID-19 deaths. The MMR in 2021 was about 2.2, 2.6 and 2.9 times higher than the MMRs in 2020, 2019, and 2018, respectively. In contrast, the non-COVID MMR varied slightly from year to year. The MMR in 2021 was the same as that in 2018. Two-sample test of proportions showed no statistically significant difference between non-COVID MMR 2021 and MMR of the previous three years.

Studies are showing alarming results of increasing maternal mortality due to COVID-19 infections. Reviewed literature has been reflecting an increased MMR due to COVID-19 infections in many countries, but at much lower rates than the Jordanian figures in 2021. In one study in Mexico, the confirmed COVID-19 cases constituted about 23% of all maternal deaths leading to an increase of about 57% from the expected ratio.⁵ In another study in Bahia, Brazil, the MMR increased by over 59% than the expected ratio, where COVID-19 infection was reported in about 13% of deceased women.⁶ Moreover, a review of seven studies showed a documented increase in MMR due to COVID-19 infection in all studies, while statistical evidence was present in just four studies. Excess maternal mortality in these studies ranged from 8.5- 61.5%.⁷

Table 1: MMR and Non-COVID-19 MMR by Year

Year	Number of Live Births	Total Number of Deaths	Non COVID-19 Deaths	MMR	Non COVID-19 MMR
2018	207,917	62	62	29.8	29.8

Table 1: MMR and Non-COVID-19 MMR by Year

Year	Number of Live Births	Total Number of Deaths	Non COVID-19 Deaths	MMR	Non COVID-19 MMR
2019	194,643	63	63	32.4	32.4
2020	176,557	68	53	38.5	30.0
2021	187,722	160	56	85.2	29.8

p value comparing non-COVID MMR of 2021 with 2020, 2019 and 2018 was 1.00, 0.99 and 1.00, respectively.

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 and median of deceased women were 32.5 years, with a maximum age of 45 years old and a minimum age of 19 years old.

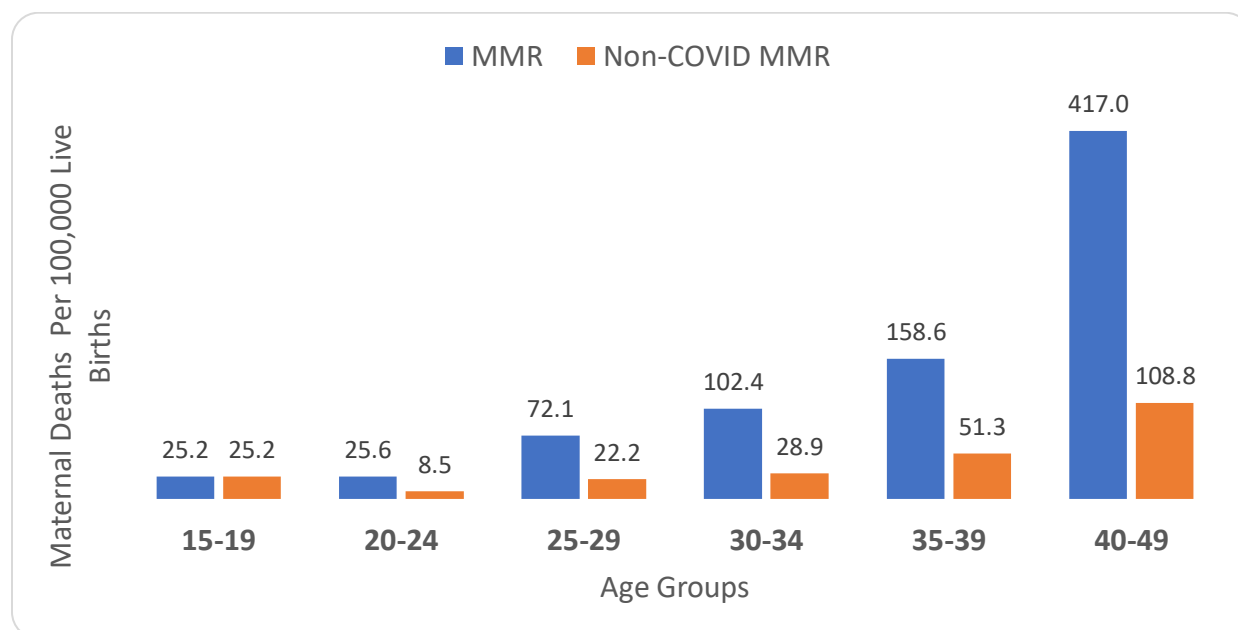
Table 2 shows that the share of maternal deaths was highest in women aged between 30-34 years old, accounting for (26.3%) of all deaths. The second and third largest share of deaths took place in women aged between 25-29 years old (25.6%) and 35-39 years old (25.0%). The lowest share of deaths (1.3%) was in the age group of 15-19 years. The latter can be explained by the fact that the median age at first birth in Jordan is about 25 years old.⁸

Table 2: Distribution of Maternal Deaths by Age Group		
Age Group	Number of Maternal Deaths	Percent
15-19	2	1.3
20-24	10	6.3
25-29	41	25.6
30-34	42	26.3
35-39	40	25.0
40-49	25	15.6
Total	160	100

The CSPD database does not provide the distribution of live births by age group of WRA for foreigners living in Jordan. Figure 1 shows the distribution of MMR by age group for Jordanians only. There was a striking increase in MMR with age being around 25 compared to the youngest two age groups and reaching 417 for women aged 40 years old and above.

There are several studies pointing to an increased probability of maternal death with age excluding young adolescents (10-14).^{9 10 11} In one study in the US, the rate for women aged 40 and over was 6.0 times higher than that for women under age 25.¹⁰ The MMR in this report for women aged 40 and over (417) is about 16 times more than that for women under 25 (25.5). The distribution of non-COVID MMR by age group shows that the MMR of women 40 years old and above was four times more than the MMR of women less than 25 years of age. This finding indicates that older pregnant women were not only a higher probability of dying pertinent to age, but also due to COVID-19 infection.

Figure 1: Distribution of MMR by Age Groups for Jordanians Only



Maternal Death by Nationality

Figure 2 demonstrates that of the 160 maternal deaths, 146 cases (91.3%) were Jordanian, while the remaining included seven Syrians (4.4%), four Palestinians (2.5%), and two Egyptian women (1.3%).

Figure 2: Maternal Deaths by Nationality

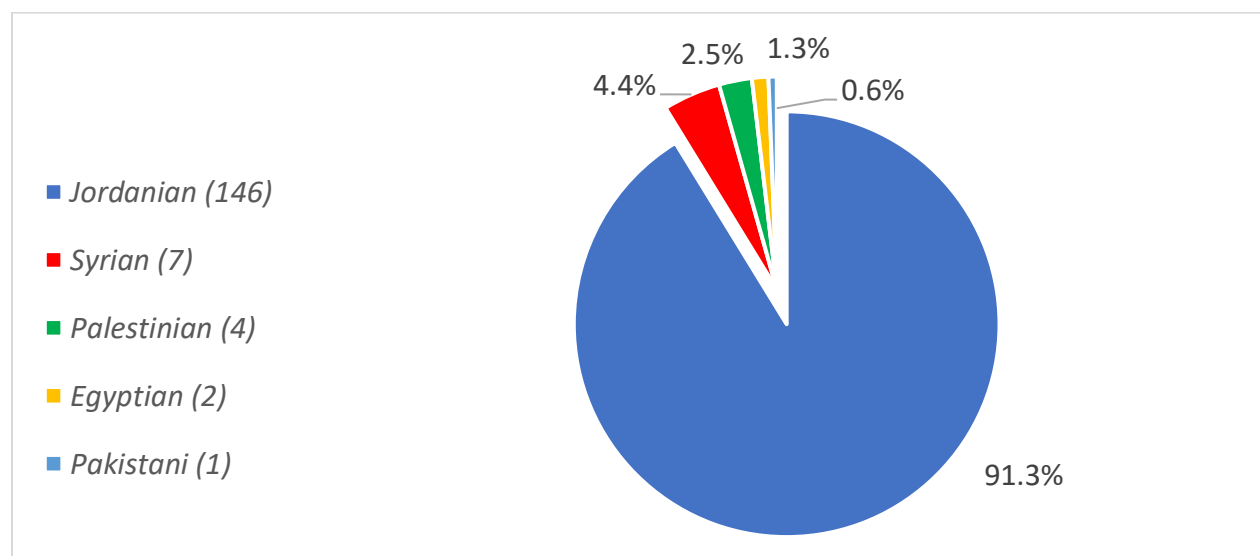
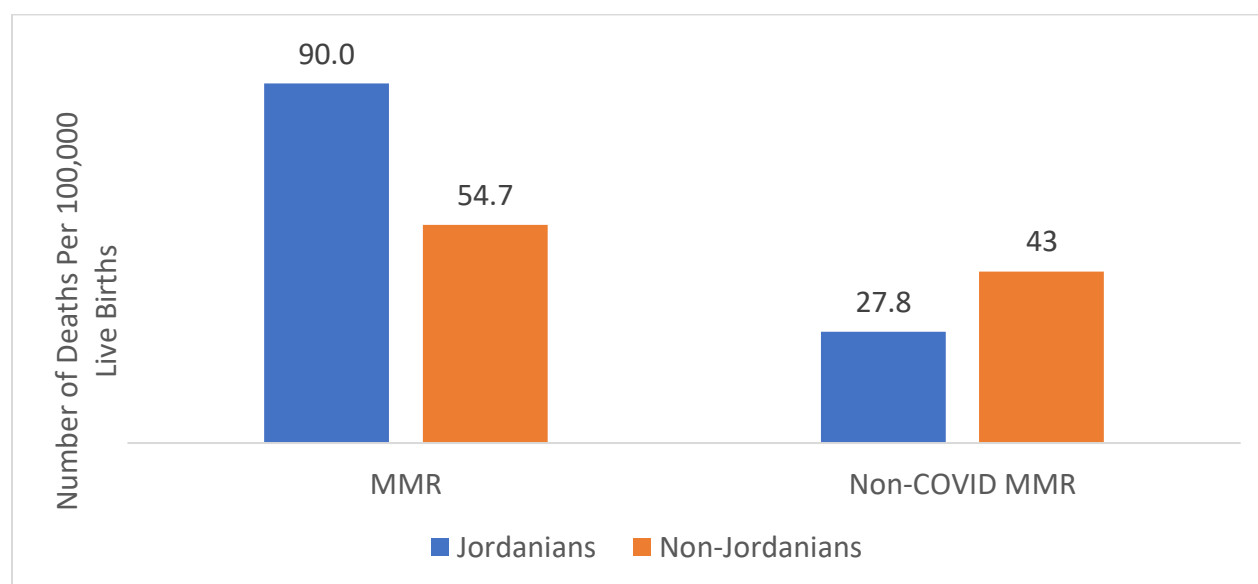


Figure 3 shows that the MMR for Jordanian women was 90 compared to 54.7 for women of non-Jordanian nationality. The main reason for over 1.6 times higher MMR among Jordanian women compared to non-Jordanian is explained by the fact that more Jordanian women died from COVID-19 than other nationalities. This reasoning is easily demonstrated when comparing the non-COVID MMR for Jordanian and non-Jordanian women at 27.8 and 43, respectively. Excluding COVID deaths, the MMR for non-Jordanian women was 1.5 times higher than the MMR for Jordanian women. This finding should be subject to further investigations to identify risk factors leading to maternal deaths among non-Jordanians.

Figure 3: MMR and Non-COVID MMR by Nationality



Maternal Deaths by Educational Level

Of the 160 maternal deaths, 139 records had information on educational level. Information on 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 4: Maternal Deaths by Educational Level

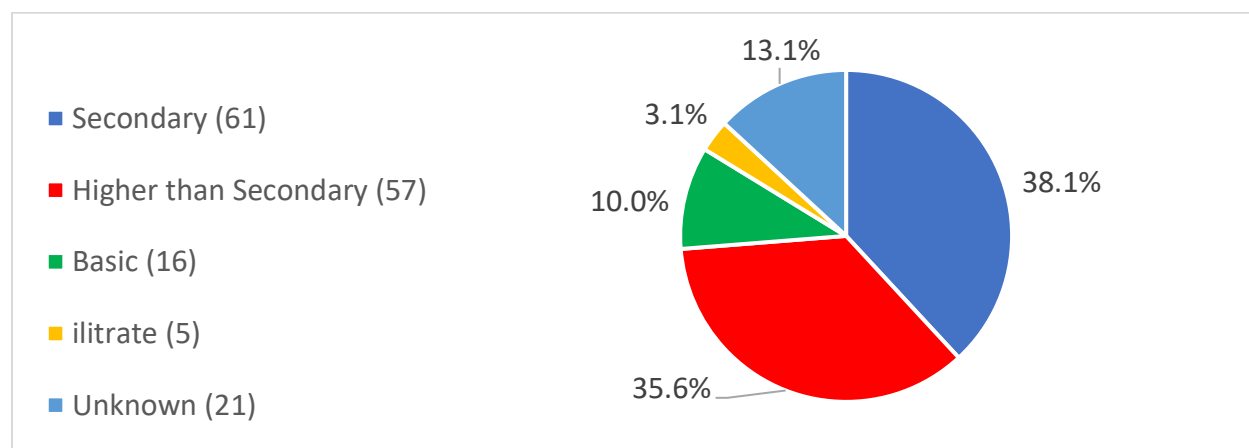
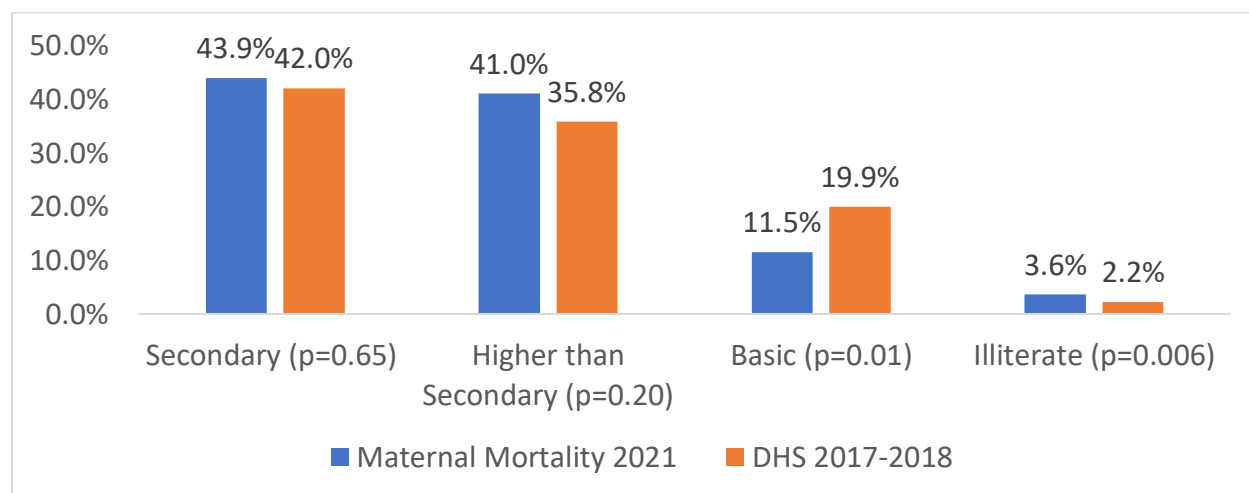


Figure 4 shows that the majority (38.1%) had a secondary educational level followed by higher than secondary level (35.6%), basic education (10%), and illiteracy level (3.1%). The reported level of education of the deceased women closely resembles the percent distribution of educational level of ever-married women of reproductive age in the Jordan Population and Family Health Survey (2017-18).⁸ The two-sample proportion test showed a p-value less than 0.05 for all categories, but the illiterate group (Figure 5). This finding confirms the absence of statistical difference in the distribution of educational level among diseased women and women in the general population in Jordan, except for the illiterate.

Figure 5: Comparison of Educational level of Deceased Women and DHS 2017-2018

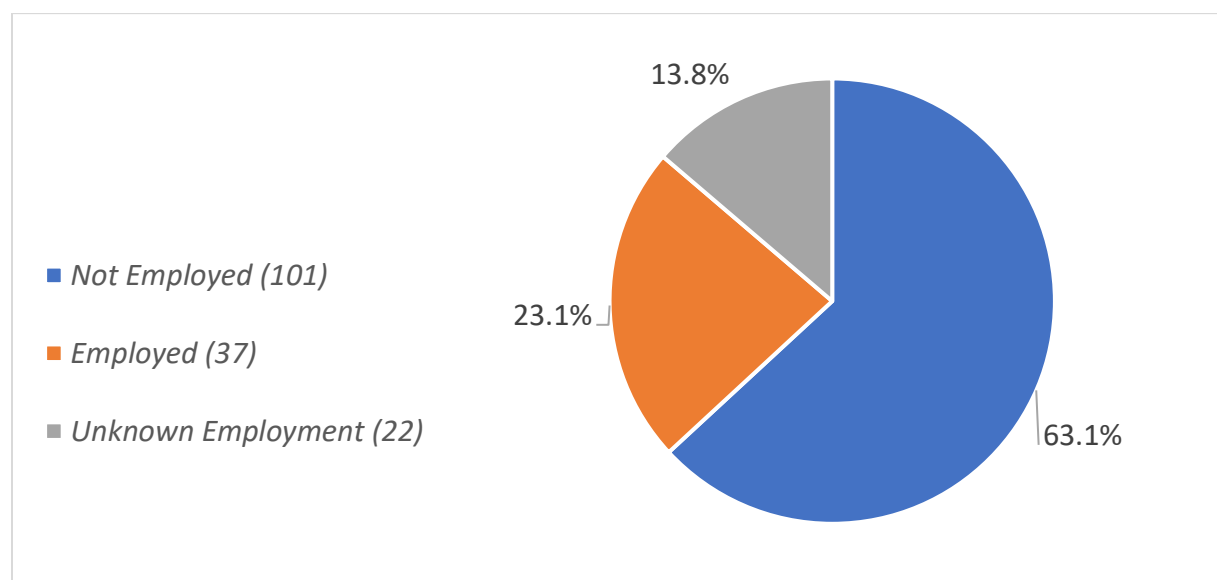


Maternal Death by Employment

Information on employment status was captured for 138 cases. The majority, 63.1%, of all deaths corresponding to 73.2% of deaths with known employment were unemployed (Figure 6). The Jordan Population and Family Health Survey (2017-18) also showed that the majority of ever-married women (85.5%) have never been employed.⁸ Comparing the two proportions

yielded a p-value of <0.001 denoting that unemployment among deceased women was statistically significantly lower than among women in the population.

Figure 6: Distribution of 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 3 presents the percent distribution of maternal death cases according to the place of residence and place of death.

About 85% of maternal deaths took place in the largest four governorates of Amman, Irbid, Zarqa and Balqa. While 33.1% of deceased women resided in Amman, 55% 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.

Table 3: Distribution of Maternal Deaths by Place of Residence and Place of Death

Governorate	Place of Residence Number (Percent)	Place of Death Number (Percent)
Ajloun	2 (1.3)	2 (1.3)
Amman	53 (33.1)	88 (55.0)
Aqaba	8 (5.0)	7 (4.4)
Balqa	11 (6.9)	6 (3.8)
Irbid	39 (24.4)	36 (22.5)
Jerash	2 (1.3)	0 (0)
Karak	3 (1.9)	2 (1.3)
Maan	2 (1.3)	1 (0.6)
Madaba	7 (4.4)	2 (1.3)
Mafraq	10 (6.3)	5 (3.1)
Tafilah	8 (5.0)	5 (3.1)
Zarqa	15 (9.4)	6 (3.8)
Total	160 (100.0)	160 (100.0)

Table 4 shows that 40% of deaths that took place in Amman governorate were residing in other nine governorates.

Table 4: Maternal Deaths Reported in Amman According to Place of Residence		
Governorate	Place of Residence	Percent
Amman	53	60.2
Balqa	5	5.7
Irbid	4	4.6
Jarash	1	1.1
Karak	1	1.1
Maan	1	1.1
Madaba	5	5.7
Mafraq	5	5.7
Tafilah	4	4.6
Zarqa	9	10.2
Total	88	100

Table 5 shows the MMR and the non-COVID MMR by the governorate of residence. The highest MMR and non-COVID MMR was reported from the Tafila governorate, which was about four times higher than the national MMR and more than five times higher than the non-COVID MMR. Madaba, Aqaba, Mafraq, and Irbid governorates showed values higher than the national figure for both MMR and non-COVID MMR. This finding should alert the NAG, the DAGs, and the MOH to focus on the above governorates to ensure the appropriate obstetric practices in the hospitals of these governorates.

Table 5: Distribution of MMR and Non-COVID MMR by Governorate of Residence

Governorate	Number of Live Births	Number of Maternal Deaths	Number of Non-COVID Deaths	MMR	Non-COVID MMR
Ajloun	5,285	2	2	37.8	37.8
Amman	78,298	53	14	67.7	17.9
Aqaba	4,462	8	2	179.3	44.8
Balqa	11,095	11	3	99.1	27.0
Irbid	34,021	39	13	114.6	38.2
Jerash	7,159	2	1	27.9	14.0
Karak	7,311	3	2	41.0	27.4
Maan	2,883	2	1	69.4	34.7
Madaba	5,192	7	5	134.8	96.3
Mafraq	11,686	10	4	85.6	34.2
Tafila	2,408	8	4	332.2	166.1
Zarqa	17,922	15	5	83.7	27.9
Total	187,722	160	56	85.2	29.8

Figures in red are above the national totals.

Reproductive and 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 6 clearly indicates that most deceased women (51.3%) were multiparous (2-4). Grand and great grand multi-parity were reported in 19.4% and 4.4% of maternal deaths, respectively. Eight women (5%) were never pregnant beyond 24 weeks before (nulliparous), while 18.8% of deceased women were para one. The nulliparous women were distributed all over the age groups.

Table 6: Distribution of Maternal Deaths by Parity

Parity	Number of Maternal Deaths	Percent
Nulliparous (0 parity)	8	5.0
Para one	30	18.8
Multipara (2-4)	82	51.3
Grand Multipara (5-6)	31	19.4
Great grand multipara (≥ 7)	7	4.4
Unknown	2	1.25
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 (75%) of maternal deaths took place during the postpartum period. Death during pregnancy was reported in 19.4% of events, while death due to abortions and post-miscarriage was observed in 5.6% of mortalities (Figure 7).

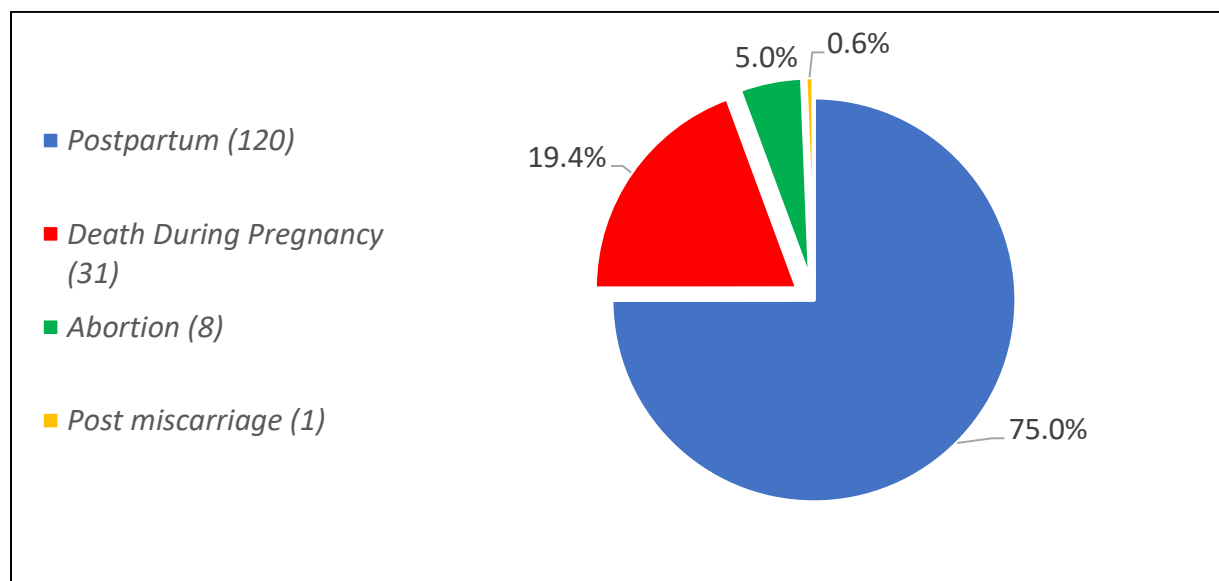
Figure 7: Postpartum Time of Death

Table 7 presents the distribution of the timing of postpartum death broken down by COVID and non-COVID deaths. While deaths taking place in less than 24 hours after delivery constituted 22.5% of all deaths, they were 51.1% of non-COVID deaths. The latter finding might raise concerns about hospital obstetric care. About one-third of cases (30%) died during one to seven days after delivery, and this figure was halved for non-COVID deaths. Those who died

during the period from eight to 42 days after delivery represented about half (47.5%) of all deaths and one-third (33.1%) of non-COVID deaths.

Table 7: Distribution of Timing of Postpartum Maternal Deaths			
Time of Death after Delivery	COVID Deaths (Percent)	Non-COVID Deaths (Percent)	Total (Percent)
Less than 24 hours	10 (11.5)	17 (51.5)	27 (22.5)
Between 1 to 7 days	31 (35.6)	5 (15.2)	36 (30)
Between 8 to 42 days	46 (52.9)	11 (33.3)	57 (47.5)
Total	87 (100)	33 (100)	120 (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 contributes to the reduction of maternal deaths, but the magnitude of the reduction depends on how well healthcare providers screen and manage high-risk pregnancy cases. Extreme precaution needs to be taken in interpreting the following results as they do not reflect the quality of provided ANC on maternal health outcomes.

The mean of antenatal care visits was 5.5, and the median was five, ranging from zero to 20 visits.

Table 8 shows that ANC visits were received by 128 (80%) cases. Over half of all women's deaths (50.6%) received between four and seven visits, 15.6% had eight or more visits, and only 13.1% had between one and three ANC visits. The relative percent distribution for women with a known number of ANC visits did not change much.

Out of the total 32 cases of unknown ANC visits, four cases arrived dead with no documented medical history. The lack of data on antenatal care in the medical files is a major issue that requires immediate intervention.

Table 8: Distribution of Maternal Deaths by Antenatal Care Visits

Antenatal Care Visits	Number of Maternal Deaths	Percent	Percent Out of Known ANC Visits
No Antenatal Visits	1	0.6	0.8
1-3 Visits	21	13.1	16.4
4-7 Visits	81	50.6	63.3
≥8 Visits	25	15.6	19.5
Unknown	32	20.0	-
Total	160	100	100

The sector of provision of ANC was verified for 135 cases. The missing values are those that had either unknown antenatal care visits or no visits and constituted 15.6%. Based on the known sector of ANC visits, Table 9 shows that most deceased women (63%) had received ANC services from private sector facilities, 33.3% from public facilities, and 3.7 % from both private and public sectors.

Table 9: Maternal Deaths by Place of Antenatal Care

Place of Antenatal Care	Number of Maternal Deaths	Percent	Percent Excluding Unknown Visits
Private Sector	85	53.1	63.0
Public Sector	45	28.1	33.3
Mixed Public/Private	5	3.1	3.7
No ANC or Unknown	25	15.6	-
Total	160	100	100

Table 10 shows that physicians provided approximately 92% of ANC services with known providers. The contribution of midwives in the provision of ANC care was minimal.

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 along with proper documentation.

Table 10: Maternal Deaths by Type of Provider of Antenatal Care			
Provider of Antenatal Care	Number of Maternal Deaths	Percent	Percent Excluding Unknown Provider
Doctor	124	77.5	91.9
Doctor + Midwife	9	5.6	6.7
Midwife	2	1.3	1.5
Unknown	25	15.6	-
Total	160	100	100

Maternal Death by Mode of Delivery

Table 11 shows that most deaths cases (63.8%) underwent a cesarean delivery. Emergency and elective cesarean were observed in 58.1% and 5.6% of reported maternal deaths, respectively. Vaginal deliveries constituted 11.9% of maternal deaths, while 12.5% of deceased women had no deliveries. Comparison of the cesarean and vaginal deliveries shows that cesarean section deliveries constituted 83.6% compared to 16.4% were vaginal deliveries.

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.¹² 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.^{13 14 15}

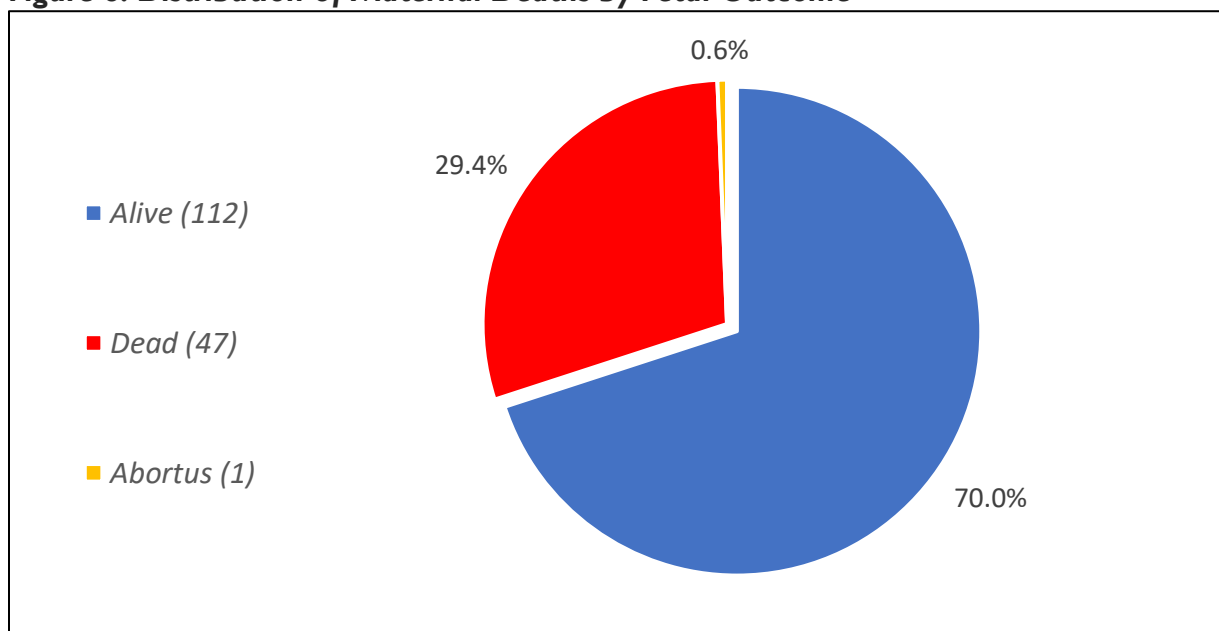
Table 11: Distribution of Maternal Deaths by Mode of Delivery

Mode of Delivery	Number of Maternal Deaths	Percent	Percent of Deliveries
Cesarean Section	102	63.8	83.6
Emergency Cesarean	93	58.1	76.2
Elective Cesarean	9	5.6	7.4
Postmortem Cesarean	7	4.4	-
Vaginal Delivery	19	11.9	15.6
Miscarriage	11	6.9	-
Vacuum Delivery	1	0.6	0.8
No Delivery	20	12.5	-
Total	160	100	100

Maternal Death by Fetal Outcome

Figure 8 presents the distribution of maternal deaths by the fetal outcome. Of the 160 maternal deaths, 70% of cases had live birth neonates, and the remaining 30% had a deadly outcome.

Figure 8: Distribution of Maternal Deaths by Fetal Outcome



Maternal Death and Anemia

Hemoglobin values were obtained on admission for 147 cases, while the remaining 13 cases were diagnosed dead on arrival, and no further lab testing was performed. Table 12 shows that 46.9% of cases with known hemoglobin had no anemia, 33.3% had mild anemia, and 19% had moderate. Only one woman suffered from severe anemia on admission.

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.¹⁶ Therefore, the WHO global targets call for a 50% reduction in anemia in women of reproductive age by 2025.¹⁷

Table 12: Distribution of Maternal Death According to Anemia Status on Admission

Anemia Status	Number of Maternal Deaths	Percent	Percent of Recorded Hb Values
No-Anemia	69	43.1	46.9
Mild	49	30.6	33.3
Moderate	28	17.5	19.0
Severe	1	0.6	0.7
Arrived Dead	13	8.1	-
Total	160	100	100

Underlying Causes of Maternal Death

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

Of the 160 maternal death cases, the NAG assigned the main cause of death to 158 cases, while the cause of death could not be specified for the remaining two cases. An autopsy was performed in 18.8% of all deaths and 51.8% of non-COVID deaths (Table 13).

Table 13: Distribution of Autopsy by COVID Cause of Death			
Autopsy Performed	COVID-19 Being Cause of Death (Percent)		Total (Percent)
	Yes	No	
Yes	1 (0.96)	29 (51.8)	30 (18.8)
No	103 (99.04)	27 (48.2)	130 (81.2)
Total	104 (100)	56 (100)	160 (100)

Table 14 provides a quick overview of the distribution of underlying causes of death, while a detailed description will be presented in the following section. Table 14 indicates that almost two-thirds (65%) of deaths were due to COVID-19 infection. Postpartum hemorrhage stood in the second place, constituting 7.5% of all deaths and over one-fifth (21.4%) of non-COVID deaths. Pulmonary embolism came third, comprising 3.8% of all deaths and 10.7% of non-COVID deaths. Preeclampsia and Proposed abortion were ranked in the fourth place, with 2.5% of total deaths and 7.1% of non-COVID deaths for each category.

Table 14: Distribution of Cause-Specific Maternal Mortality			
Cause of Death	Number	Percent	Percent Excluding COVID
COVID-19	104	65.0	-
Postpartum Hemorrhage	12	7.5	21.4
Pulmonary Embolism	6	3.8	10.7
Preeclampsia	4	2.5	7.1
Proposed Abortion	4	2.5	7.1
Myocardial Infarction	3	1.9	5.4
Pneumonia	3	1.9	5.4
Puerperal Sepsis	3	1.9	5.4
Amniotic Fluid Embolism	2	1.3	3.6
Severe Sepsis with Septic Shock	2	1.3	3.6
Antepartum Hemorrhage	1	0.6	1.8
Cardiomyopathy	1	0.6	1.8

Table 14: Distribution of Cause-Specific Maternal Mortality			
Cause of Death	Number	Percent	Percent Excluding COVID
Cerebrovascular Infarction	1	0.6	1.8
Diabetic Ketoacidosis	1	0.6	1.8
Encephalitis	1	0.6	1.8
Fatty Liver	1	0.6	1.8
Intestinal Obstruction	1	0.6	1.8
Intracerebral Hemorrhage	1	0.6	1.8
Metastatic Rectal Carcinoma	1	0.6	1.8
Myocarditis	1	0.6	1.8
Peripartum Cardiomyopathy	1	0.6	1.8
Ruptured Aortic Aneurysm	1	0.6	1.8
Ruptured Splenic Aneurysm	1	0.6	1.8
Sagittal Sinus Thrombosis	1	0.6	1.8
Subdural Hemorrhage	1	0.6	1.8
Unspecified	2	1.3	3.6
Total	160	100	-
Total Non-COVID	56	-	100

Types of Causes of Maternal Mortality (Direct Versus Indirect)

According to the WHO definition, direct causes of death are those “resulting from obstetric complications of the pregnant state (pregnancy, labor, and puerperium), and from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above”. Indirect maternal deaths are those maternal deaths “resulting from previous existing disease or disease that developed during pregnancy and not due to direct obstetric causes but were aggravated by the physiologic effects of pregnancy”.¹⁸

Table 15 presents a detailed distribution of causes in terms of ICD 10 groups and underlying causes according to the type of causes of maternal death. The table also presents the percentage distribution based on all deaths and based on non-COVID deaths. COVID-19 infection has been only a transient cause of death, and the focus on non-COVID causes will assist in designing sustainable appropriate recommendations. Nevertheless, Jordan must

consider lessons learned from the COVID-19 pandemic and their effect on pregnancy outcomes.

While the direct causes of death accounted for 21.3% of all deaths, it was causing 60.7% of non-COVID deaths. The indirect causes constituted 77.5% of all maternal deaths and 35.7% of non-COVID causes of death. The cause of death was not identified for the two cases. To reduce maternal mortality, the focus should be on direct causes of death, which outweigh the indirect causes in non-COVID deaths by 1.7 times.

1.1 Direct Causes of Maternal Deaths

Obstetric hemorrhage was the leading cause of direct maternal death, accounting for 8.1% of all deaths and 23.2% of non-COVID deaths. Other obstetric complications (obstetric embolism, venous complications, and puerperium-peripartum cardiomyopathy) were the second cause, responsible for 6.3% of all deaths and 17.9% of non-COVID deaths, followed by the hypertensive shouldering 4.4% and 7.1% of all deaths and non-COVID deaths, respectively. Pregnancy with an abortive outcome came fourth, representing 2.5% of all deaths and 7.1% non-COVID deaths. Finally, pregnancy-related infections accounted for 1.9% and 5.4% of all deaths and non-COVID deaths, respectively.

Obstetric Hemorrhage accounted for 13 cases (23.2%) of non-COVID maternal deaths, which is more than double the contribution of obstetric hemorrhage to maternal deaths in 2020. NAG identified all the 13 obstetric deaths as avoidable. Over three-quarters of cases (77%) died less than 24 hours after delivery. About two-thirds of cases (61.5%) underwent a cesarean section.

Postpartum hemorrhage is known to be the leading cause of maternal deaths worldwide.¹⁹ More than two-thirds of reported obstetric hemorrhage deaths globally are due to postpartum hemorrhage.²⁰ A significantly high proportion (72–90%) of the morbidity of obstetric hemorrhage cases are considered to be avoidable.²¹ In this report, 100% of cases were considered avoidable. 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.^{22 23} Despite improvements in management, early postpartum hemorrhage remains a significant cause of maternal morbidity and mortality in developing countries.²⁴

One of the ways to prevent postpartum hemorrhage is the “Active Management of the Third Stage of Labor”. It is considered to be the gold standard in reducing the incidence of postpartum hemorrhage.^{25 26 27} During the last several years, with the support of USAID-led interventions, the public hospitals in Jordan introduced and adopted the Active Management of the Third Stage of Labor (AMTSL) to decrease the incidence of cases with atonic postpartum hemorrhage. Failure to abide by the AMTSL clinical pathway, along with weakened supervision, might have contributed to the obvious increase of postpartum hemorrhage in 2021 compared to 2020. Future interventions should be aimed at improving AMTSL as well as clinical case management during the fourth stage of labor (first two hours after delivery).

Other obstetric complications accounted for 10 (17.9%) of non-COVID maternal deaths with eight cases of obstetric embolism, and one case for each sagittal sinus thrombosis and puerperium peripartum cardiomyopathy.

Of the 56 non-COVID maternal deaths, obstetric embolism was responsible for eight deaths (14.3%) of cases with six deaths due to pulmonary embolism and two deaths due to amniotic fluid embolism. Of the eight obstetric embolism cases, the diagnosis was based on autopsy in four cases with pulmonary embolism (66.7%) and two cases with amniotic fluid embolism (100%). This finding raises concerns about the accuracy of diagnosing two death cases of pulmonary embolism based on the clinical picture alone. Mortalities caused by embolism were observed across the parity, from nullipara to great grand multipara. Five out of the eight deaths took place during the postpartum period, while three died during pregnancy.

The cause of death for one death was identified as sagittal sinus thrombosis, which was not confirmed by autopsy. Another death was diagnosed with puerperium-peripartum cardiomyopathy that was subject to autopsy.

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.²⁸

The incidence of venous thrombosis, pulmonary embolism, and subsequent maternal death can be significantly reduced by embracing prophylactic measures, which 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 an unpredictable and unpreventable event with an unknown cause.^{29 30} It often presents as sudden onset of cardiovascular collapse, respiratory compromise, and disseminated intravascular coagulation.

Peripartum cardiomyopathy is a rare form of unexplained cardiac failure of unknown origin, unique to the pregnant woman, with highly variable outcomes associated with high morbidity and mortality.³¹

As countries continue to work towards reducing their maternal mortality, conditions such as amniotic fluid embolism are likely to become more prominent.

Hypertensive Disorders in Pregnancy, Childbirth, and the Puerperium accounted for four (7.1%) of the 56 non-COVID deaths, which is just one case more than what was reported in 2020. All the four cases suffered from severe preeclampsia and died during the postpartum period. One case was para one, two cases were para 2-4, and one case was 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.²⁰

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.³²

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. Administration of magnesium sulfate to preeclampsia/eclampsia cases should also be adopted by the private sector.

Pregnancy with Abortive outcomes included four deaths of Proposed Abortion complicated by delayed or excessive hemorrhage, which constituted 7.1% of non-COVID deaths. Cases took place during the period from 13 to 21 weeks of gestation and were distributed across the age groups from 25 to 49 years. The cases were equally distributed among Jordanians and non-Jordanians, which implies that abortion as a cause of maternal death is more common among non-Jordanians considering that Jordanian live births were over six times those of non-Jordanians.

Since the beginning of history, abortion and miscarriage have been known causes of maternal mortality. The WHO estimates that there are approximately 20 million abortions performed each year, and estimates of maternal deaths as a result of abortion range between 60,000 and 100,000 per year, and other estimates go up to 200,000 deaths.^{33 34}

Pregnancy-Related Infections accounted for three cases (5.4%) of non-COVID causes of death, all of which 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.^{20 35}

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.

1.2 Indirect Causes of Death

The indirect (non-obstetric) causes of death were attributable to 124 deaths, corresponding to 77.5% of all deaths. It also contributed to 35.7% of non-COVID deaths. Diseases of the respiratory system dominated the indirect causes of all maternal deaths, followed by circulatory, central nervous, digestive, other maternal, and endocrine diseases and neoplasms (Table 15).

Diseases of the respiratory system accounted for 107 cases, corresponding to about 70% of all maternal deaths, with 104 cases of COVID-19 and four cases of pneumonia. After excluding deaths due to COVID-19, respiratory system diseases accounted for 5.4% of non-COVID maternal deaths.

All the 104 COVID-19 cases representing 65% of all maternal deaths, received a diagnosis of SARS-CoV-2 infection by reverse transcription polymerase chain reaction (PCR) testing. Of the 104 COVID-19 cases, 11 cases (10.6%) received the first dose, and eight cases received the second dose of the COVID-19 vaccine. Of the 56 non-COVID death, only one case (1.8%) received COVID-19 vaccination. This finding indicates that COVID-19 vaccination among pregnant women was not widely practiced in Jordan. Avoiding vaccination might have been related to the fact that the COVID-19 vaccine was not considered safe at the beginning of the pandemic in 2020, which triggered fear of getting it later. Lack of data and safety concerns contributed to initially lower uptake of COVID-19 vaccination among pregnant women in other countries.³⁶

One COVID-19 death underwent autopsy. The mean number of antenatal visits for COVID-19 deaths was 5.7 visits with a median of five that was not different from the rest of the reported maternal deaths. Seventy-seven cases, corresponding to 74% of COVID-19 deaths, underwent cesarean. Eighty-seven COVID-19 cases (83.7%) died during the postpartum period, and the remaining cases died during pregnancy or after abortion. A majority of COVID-19 deceased women (77.9%) delivered alive neonates (81 out of 104), compared to 62% of live neonates for non-COVID deaths, indicating a more or less favorable outcome of COVID-19 infections 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 increased risk of adverse outcomes, including maternal death.^{37 38}

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 study in Peru demonstrated a sharp increase of 75% in maternal deaths 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 2020.³⁹ A review of seven studies showed increased levels of maternal mortality due to COVID-19 infection in all studies. In comparison, statistical evidence was present in just four studies, where excess maternal mortality ranged from 8.5% to 61.5%.⁷

No study or report has shown the immense effect of COVID-19 infection on maternal mortality in Jordan in 2021, where the 2021 MMR was about 2.2, 2.6, and 2.9 times higher than the MMRs in 2020, 2019, and 2018. This finding raises a concern related to the actual cause of

death regarding women with a positive COVID-19 PCR test result, some of whom would have died from other reasons.

Pneumonia that occurs during pregnancy is known to carry an increased risk of adverse outcomes 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.⁴⁰

Diseases of the circulatory system were the second most common indirect causes of maternal deaths. Of the 160 maternal deaths, seven cases (4.4%), corresponding to 12.5% of non-COVID deaths, died due to circulatory system complications. Three died of myocardial infarction and one case of each: cardiomyopathy, myocarditis, ruptured aortic aneurysm, and rupture of splenic artery aneurysm. All cases of circulatory system deaths underwent autopsy, but myocarditis cases.

Myocardial Infarction (MI) was the most common cause among circulatory system diseases, accounting for 1.9% of all deaths and 5.4% of non-COVID deaths. The three deaths were aged 30, 34, and 37 years and their gestational age were 6, 34, and 37 weeks of pregnancy, respectively. One case died after abortion, one during pregnancy, and one during the postpartum period. One of the MI cases arrived dead in the emergency room. All three cases underwent autopsy to confirm the diagnosis.

Cardiac disease is one of the leading causes of indirect maternal death, and myocardial infarction (MI) is one of its most common causes.^{41 42} Pregnancy increases the risk of MI by three to four folds.⁴³ Pregnant women with known cardiomyopathy are at increased risk of maternal mortality and often, they are advised not to conceive.⁴⁴

It is assumed that myocarditis is more common during pregnancy because of the altered immune response during pregnancy that leads to decreased humoral and cellular immunity, which propagates viral replication, causing a greater likelihood of myocarditis.⁴⁵

The risk of aortic dissection or rupture is elevated during pregnancy and the postpartum period.⁴⁶ Splenic artery aneurysm is an uncommon pathology with a potential for rupture. Rupture of splenic artery aneurysms is associated with a high mortality rate. This increases disproportionately to 75% among pregnant women with fetal mortality of 95%.⁴⁷

Diseases of the Central Nervous System accounted for four cases (2.5%) of all deaths and 7.1% of non-COVID deaths. These diseases included cerebrovascular infarction, encephalitis, intracerebral hemorrhage, and subdural hemorrhage as one death per each underlying cause.

Pregnancy-associated stroke has been known to increase the risk of maternal mortality. The pregnant body undergoes physiological changes to promote the growth of the fetus and to prepare for delivery. Many of these changes may render the woman more vulnerable to thromboembolism and cardiovascular events.⁴⁸

Intracranial hemorrhage, including subdural, is a rare, yet potentially harmful event in pregnancy leading to an increased risk of maternal mortality.^{49 50}

Diseases of the Digestive System were responsible for one death due to intestinal obstruction and one death due to acute puerperium fatty liver.

Intestinal obstruction is a rare but severe complication of pregnancy with significant maternal mortality. A literature review revealed that intestinal obstruction is a relatively rare event with a maximum incidence at 1:1500 pregnancies.^{51 52}

Acute fatty liver during pregnancy is an obstetric emergency characterized by maternal liver dysfunction and/or failure that can lead to maternal and fetal complications, including death.⁵³

Other specified maternal diseases caused two deaths of severe sepsis with septic shock that comprised 1.3% of total maternal deaths and 3.6% of non-COVID deaths. The age of the deceased women was 26 and 34 years. The gestational age was 30 and 38 weeks, and one underwent a cesarean section while the other woman had a vaginal delivery. Fetal death was reported for one of the two cases.

Pregnancies complicated by severe sepsis and septic shock are correlated with increased rates of preterm labor, fetal infection, and preterm delivery.^{54 55}

Endocrine, nutritional, and metabolic diseases included one case of diabetic ketoacidosis in a 27-year-old woman with a gestational age of 28 weeks and a dead fetus. Poor clinical management and/or late seeking of care might have led to this death.

Diabetic Ketoacidosis is a well-known cause for increased risk of perinatal mortality and to a lesser degree, maternal mortality.^{56 57}

Neoplasms accounted for one case of metastatic rectal carcinoma. Symptoms of neoplasms can mimic those of physiological pregnancy changes, which leads to a delay in accurate diagnosis.⁵⁸ 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 a potential threat to 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.^{59 60} This finding should encourage further assessment of the frequencies of neoplasms among women of reproductive age in general and pregnant women.

Table 15: Maternal Deaths by Direct and Indirect Causes of Death

Cause of Death	Number	Percent	Non-COVID Percent*
Direct Causes of Death	34	21.3	60.7
Obstetric hemorrhage	13	8.1	23.2

Table 15: Maternal Deaths by Direct and Indirect Causes of Death

Cause of Death	Number	Percent	Non-COVID Percent*
• Postpartum hemorrhage	12	7.5	21.4
• Antepartum Hemorrhage (Abruptio Placenta)	1	0.6	1.8
Other obstetric complications	10	6.3	17.9
• Obstetric embolism	8	5.0	14.3
○ Pulmonary Embolism	6	3.8	10.7
○ Amniotic Fluid Embolism	2	1.3	3.6
• Venous complications in pregnancy- Sagittal Sinus Thrombosis	1	0.6	1.8
• Complications of the puerperium- peripartum cardiomyopathy	1	0.6	1.8
Hypertensive disorders in pregnancy, childbirth, and the puerperium	4	4.5	7.1
• Eclampsia/Preeclampsia	4	2.5	7.1
Pregnancy with abortive outcome	4	2.5	7.1
• Proposed Abortion	4	2.5	7.1
Pregnancy-related infection	3	4.7	5.4
• Puerperal sepsis	3	1.9	5.4
Indirect Causes of Death	124	77.5	35.7
Disease of the respiratory system	107	66.9	5.4
• COVID-19	104	65	-
• Pneumonia	3	1.9	5.4
Diseases of the circulatory system	7	4.4	12.5
• Myocardial Infarction	3	1.9	5.4
• Cardiomyopathy	1	0.6	1.8
• Myocarditis	1	0.6	1.8
• Rupture aortic aneurysm	1	0.6	1.8
• Rupture splenic artery aneurysm	1	0.6	1.8
Diseases of the Central Nervous system	4	2.5	7.1

Table 15: Maternal Deaths by Direct and Indirect Causes of Death

Cause of Death	Number	Percent	Non-COVID Percent*
• Cerebrovascular Infarction	1	0.6	1.8
• Encephalitis	1	0.6	1.8
• Intracerebral Hemorrhage	1	0.6	1.8
• Subdural Hemorrhage	1	0.6	1.8
Diseases of the Digestive System	2	1.3	3.6
• Intestinal Obstruction	1	0.6	1.8
• Diseases of the digestive system, puerperium fatty liver	1	0.6	1.8
Other Maternal Diseases	2	1.3	3.6
• Severe sepsis with septic shock	2	1.3	3.6
Endocrine, nutritional, and metabolic diseases	1	0.6	1.8
• Diabetic Ketoacidosis	1	0.6	1.8
Neoplasms	1	0.6	1.8
• Metastatic Rectal Carcinoma	1	0.6	1.8
Unspecified	2	1.3	3.6
Grand Total	160	100	100

* Based on the 56 Non-Covid Maternal Deaths

1.3 Unspecified Causes of Maternal Death

NAG was unable to assign the cause of death for two out of the 160 reported maternal deaths due to an insufficiency of information from all sources.

Contributing Factors to Maternal Death

The NAG identified contributing factors that led to maternal deaths from MDR reports and case summaries. Table 16 shows that of the 160 maternal death cases, 49 cases (30.6%) were identified as avoidable deaths, with 17.7% of indirect causes identified as avoidable. Out of the 34 direct causes of death, 27 cases (79.4%) were identified as avoidable (Table 16)

Table 16: Avoidability of Death by All Direct and Indirect Causes of Death					
Avoidability	Direct Cause (Percent)	Indirect Cause (Percent)	Unspecified (Percent)	Total	Percent
Yes	27 (79.4)	22 (17.7)	0 (0)	49	30.6
No	7 (20.6)	102 (82.3)	0 (0)	109	68.1
Unspecified	0 (0)	0 (0)	2 (100)	2	1.3
Total	34 (100)	124 (100)	2 (100)	160	100.0

Table 17 presents the avoidability data for non-COVID deaths only, which is more comparable to the data in previous years than the data in the prior table. COVID-19 distorts the analysis of avoidability as most cases are labeled as not avoidable, and COVID-19 was a transient event.

About two-thirds of non-COVID deaths (64.3%) are considered avoidable. While the avoidability of direct causes of death remains the same at 79.4%, the value for indirect causes of death increased to 50%. The data on avoidability did not change over the 2020 report, which indicates the absence of response efforts to avoid preventable causes of death.

Table 17: Avoidability of Death by Direct and Indirect Non-COVID Causes of Death					
Avoidability	Direct Cause	Indirect Cause	Unspecified	Total	Percent
Yes	27 (79.4)	9 (45)	0 (0)	36	64.3
No	7 (20.6)	11 (55)	0 (0)	18	32.1
Unspecified	0 (0)	0 (0)	2 (100)	2	3.6
Total	34 (100)	20 (100)	2 (100)	56	100.0

The most common contributing factors identified are described in Table 18 using the “Three Delays Model” by Thaddeus and Maine (1994).³ Overall, about two-thirds of all deaths (68.1%) showed no delays. Delay I pertinent to seeking care was observed in 18 cases (11.3%), and Delay III of receiving the care was observed in 25 cases (15.6%), thus being the most encountered type of delay. A combination of Delays I and III was observed in 5 cases (3.1%), while one case had a combined delay of seeking and reaching.

Table 18: Maternal Deaths by Level of Delay for All Deaths		
Level Delay	Number	Percent
Delay in Seeking Care: Delay I	18	11.3
Delay in Receiving Care: Delay III	25	15.6
Delay in Seeking and Receiving Care: Delays I&III	5	3.1
Delay in Seeking, Reaching, and Receiving Care: Delays I+II	1	0.6
No Delay	109	68.1
Unspecified	2	1.3
Total	160	100

Table 19 presents the delay models for non-COVID cases only, where the no delays went down from 68.1% for all deaths to 32.1%, which is almost the same as the figure in the 2020 report. Delay in seeking care did not change much, changing from 11.3% to 12.5%, while delay in receiving care rose to 41.1% compared to 15.6% for all cases. This finding highlights the gap in providing medical care that leads to fatal outcomes.

Table 19: Maternal Deaths by Level of Delay for Non-COVID Deaths		
Level Delay	Number	Percent
Delay in Seeking Care: Delay I	7	12.5
Delay in Receiving Care: Delay III	23	41.1
Delay in Seeking and Receiving Care: Delays I&III	5	8.9
Delay in Seeking, Reaching, and Receiving Care: Delays I+II	1	1.8
No Delay	18	32.1
Unspecified	2	3.6
Total	56	100

Note: No Delays were reported in about 88% of COVID cases

DATA LIMITATIONS

This report is limited to a descriptive analysis of the 160 maternal deaths that took place in 2021. The JMMSR system does not collect data on appropriate controls that have different survival outcomes. Thus, the descriptive analysis performed did not allow for exploring sound statistical associations or establishing causality. Accordingly, the presented results that hint at 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 potential risk factors leading to maternal deaths.

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 the 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 before their deaths could 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 and variation of documentation among different health care sectors in Jordan, especially from medical files, was behind the inability of NAG to assign a cause of death for four cases.

All the above limitations have been consistent throughout the last four years of implementation, and little has changed, especially in terms of filling the medical files and documenting all relevant pieces of information.

RECOMMENDATIONS

Achieving the determined targets and goals of averting preventable maternal deaths will require urgent acceleration of progress actions. Ending Preventable Maternal Mortalities involves collaborative efforts from all stakeholders to take action and increase sustained commitment and investment to improve maternal and newborn survival and well-being. This will require context-specific actions at national and sub-national levels.

The following points are recommendations extracted from the JMMSR system implementation challenges and data limitations found:

- Prepare Rapid Response Teams to control maternal complications at each directorate in Jordan as needed, either by virtual consultations or other types of support. The rapid response teams include Ob/Gyn consultants, senior midwives and other professional obstetric team members needed.
- Develop a facility-based response; this is a new paradigm of averting preventable deaths at a health facility level, which could support the rapid response action plans for each maternal death in specific.
- Create a unified focus response action plan that addresses the Maternal Mortality Report's key findings. For instance, focusing on the postpartum hemorrhage review for the near miss or to consider developing national guideline protocols for postpartum hemorrhage for Jordan this year.
- Base the response action plan and use data from the maternal mortality report in decision making by developing an evidence-based practice approach. This could be done through conducting research on the maternal mortality trend or time series analysis for the maternal mortality ratio, risk factors of maternal deaths, most contributing cause specific maternal deaths, perception of women toward CS deliveries as a risk for maternal deaths, and many other factors that could affect the obstetric care practice in the Jordanian context towards best evidence-based practices.
- Review the maternal mortality report from social stratification and social determinants challenges.

MATERNAL MORTALITY RESPONSE

Understanding the causes of maternal deaths is important for developing interventions to 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 maternal mortality can be prevented. Therefore, MOH, with the 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 strengthen the 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.

The JMMSR 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 leads the development, implementation, and monitoring of immediate and short-term responses. The NAG recommended that MOH assign response coordinators to facilitate the adoption of the proposed strategies at the facility level in all health sectors.

Based on the findings of the maternal mortality report for 2021, the NAG, in collaboration with national stakeholders, prioritized a specific strategy that could have a tangible impact on reducing preventable maternal mortality, as mentioned below. This is in addition to working more on the facility-based response action plan for each maternal death in the health facilities.

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

Based on the maternal mortality findings (2021), the JMMSR NAG proposed five national response strategies that apply across the continuum of health care and throughout the pregnancy, childbirth, and postnatal period and even preconception. These national strategies will be implemented at the facility level, focusing on ensuring that national guidelines in emergency care are updated and used nationally, that COVID-19 response is integrated within the RMNCH continuum of care; and that guidelines to reduce unnecessary Cesarean section are followed. Adopting Strategies for Quality ANC includes High-Risk Pregnancy Management at the primary and secondary care level, and an increase in the uptake of quality family planning methods.

Enhance the Quality of 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 emergency obstetric care.

Emergency obstetric care requires teamwork, increasing awareness of the problem and anticipatory clinical practice, to prevent the occurrence of complications, so as not to delay the right decision at the right time and in the right way. The Fourth national mortality report for 2021 shows that delay in receiving care contributed to about half for non-COVID-19 cause deaths. 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 obstetrics 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 partners need to update, implement, and monitor national guidelines and protocols to provide high quality care.

USAID Health Services Quality Accelerator Activity equipped the MOH and King Abdullah University Hospital with Advance Life Obstetric (ALSO) labs and will establish a core group of certified trainers to build the capacity of health care workers (Ob/Gyn physicians, nurses, and midwives) on basic obstetric emergencies by implementing the ALSO course Training at the national level.

Strengthen Jordan's COVID-19 Response in Obstetrics

Based on the current maternal mortality data for 2021, COVID-19 infection is classified as the most common cause of death with 66.9% of all cases. The MOH, in collaboration with

stakeholders, will increase the awareness of all women at reproductive age on vaccination against COVID-19, during pregnancy or the postnatal period.

Supporting Vaginal Births and Reducing Unnecessary Primary CS Deliveries

A disproportionately 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 a Cesarean 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 vaginal delivery.

In early 2020, MOH and a group of 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 Quality ANC including High-Risk Pregnancy Management at the primary and secondary care levels

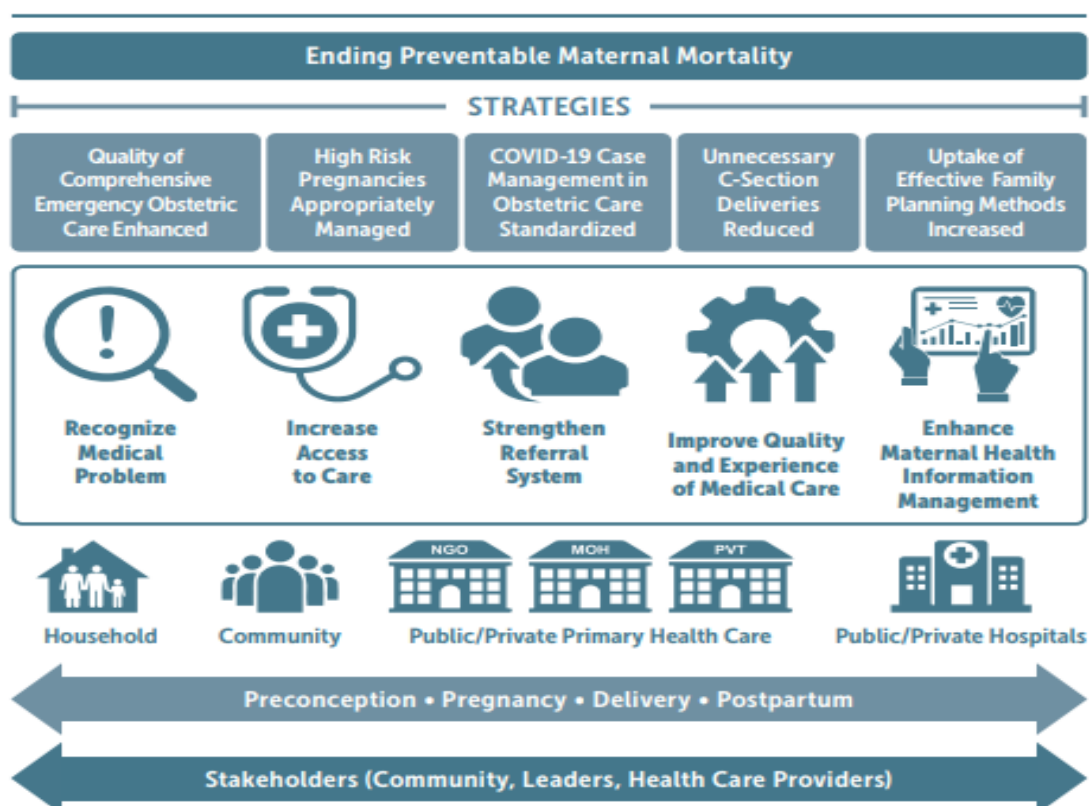
The early detection of pregnant women at risk of developing complications is an essential component of antenatal care in preventing maternal death. Primary Health care providers need to be guided in the early detection and referral of women based on reasonable objectives set of criteria for high-risk factors throughout pregnancy. Risk 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 screening, assessment, and management for specific common conditions not limited to venous thromboembolism, postpartum hemorrhage, and maternal sepsis. Also, it is very important to have a referral system between hospitals, directorates, and all health care centers.

Increase the uptake of quality family planning methods.

FP reduces maternal and child morbidity and mortality by preventing unintended pregnancies and unsafe abortions. Enabling birth spacing, ultimately reduces mother and child mortality, while it enhances the nutritional status of both the mother and child.⁵⁵ MOH will continue working on equipping healthcare facilities with qualified Healthcare providers and the necessary tools to provide a high-quality FP service and emphasizing high-quality FP counselling. A joint effort is required to mobilize the community and raise its awareness on the risks of multiparity and short pregnancy spacing and the importance of FP and screening for the high-risk pregnancy cases.

The figure below illustrates the strategies for ending preventable maternal mortality.



CONTRIBUTORS

Central Ministry of Health

Dr. Reyad Al Sheyyab	<i>Director of Primary Health Administration</i>
Dr. Anas Al Mohtaseb	<i>Director of Non-Communicable Diseases Directorate</i>
Ms. Fatima Hammad	<i>Former Director of E-transformation and Information Technology Directorate</i>
Eng. Mahmoud Saleh	<i>Director of E-transformation and Information Technology Directorate</i>
Dr. Tayseer Al Saheb	<i>Former Head of National Deaths Registries Department / Non-Communicable Diseases Directorate</i>
Dr. Saed Assaf	<i>Head of National Deaths Registries Department / Non-Communicable Diseases Directorate</i>
Ms. Waddah Saleh	<i>Head of the National Maternal Mortality registry /Non-Communicable Diseases Directorate</i>
Ms. Arab Al Masri	<i>Former Head of the National Registry of Maternal Mortality/Non-Communicable Diseases Directorate</i>

Royal Medical Services

Brig. Gen Dr Maher Maaita	<i>Chief of Ob/Gyn Department at the Central Directorate of Royal Medical Services</i>
Brig. Gen Dr. Amer Gharaibeh	<i>Technical Director and Chief of Ob/Gyn Department at Al-Hussein Hospital in King Hussein Medical Center / Royal Medical Services-National Advisory Group Member</i>

National Advisory Group

Dr. AbdelMane' Al Suleimat	<i>Chief of Ob/Gyn Specialty and Chairman of the JMMSR National Advisory Group / Ministry of Health</i>
Dr. Hadeel Al Saeh	<i>Director of the Woman and Child Health Directorate / Ministry of Health</i>
Dr. Raed Al Momani	<i>Former Director of National Center for Forensic Medicine / Ministry of Health</i>
Dr. Shawqi Saleh	<i>Professor of Ob/Gyn/ Jordan University Hospital</i>
Dr. Hasan Rawashdeh	<i>Assistant Professor/Ob/Gyn Specialist / King Abdullah University Hospital</i>
Dr. Mhanna Khattab	<i>Ob/Gyn Consultant / Jordan Medical Association Representative / The Jordanian Society of Obstetrics and Gynecology</i>
Dr. Mazen EL Zibdeh	<i>Ob/Gyn Consultant / Private Clinic and a Fellow of the Royal College of Obstetrics and Gynecology in London (FRCOG)</i>
Dr. Majeda Jallad	<i>Ob/Gyn Consultant / Private Clinic</i>
Dr. Maisa Al Haj Ibrahim	<i>Ob/gyn specialist/ JMMSR NAG Focal point</i>

USAID/Jordan

Dr. Nagham Abu Shaqra	<i>Senior Population and Health Advisor / Project Management Specialist, Office of Population and Family Health / USAID/Jordan</i>
-----------------------	--

USAID Health Services Quality Accelerator

Inna Sacci	<i>Vice President and Regional Team Leader/ Asia, MENA Programs</i>
Dr. Issam Adawi	<i>Chief of Party</i>
Dr. Ali Arbaji	<i>Senior Data Analyst consultant</i>
Bruce Marshall	<i>Deputy Chief of Party</i>
Dr. Sawsan Majali	<i>Senior Health System Strengthening Advisor</i>
Dr. Raja Khater	<i>Senior Service Delivery Advisor-Team Lead</i>
Heba AboShindi	<i>Surveillance, Data Management, and MMSR Advisor</i>
Dr. Ahmad Abdulla	<i>RMNCH/FP Clinical QI specialist/ Ob/Gyn Specialist</i>
Ms. Zoya Shehadeh	<i>Communication Advisor</i>

REFERENCES

1. The World Health Organization. *Maternal Death Surveillance and Response Technical Guidance*; 2013. doi:10.1145/1023663.1023695
2. The World Health Organization. The WHO Application of ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-MM. *WHO Libr.* 2012;129(1):30-33. doi:10.1016/j.clinph.2004.07.025
3. Thaddeus S, Maine D. Too far to walk: maternal mortality in context. *Soc Sci Med.* 1994;38(8):1091-1110.
4. Civil Status and Passport Department. Registered Live Births by Governorate. *Dep Stat Amman, Jordan*.
http://www.dos.gov.jo/dos_home_a/main/vitality/Births_and_deaths/2020/live_Births2.pdf
5. Mendez-Dominguez N, Santos-Zaldívar K, Gomez-Carro S, Datta-Banik S, Carrillo G. Maternal mortality during the COVID-19 pandemic in Mexico: a preliminary analysis during the first year. *BMC Public Health.* 2021;21(1). doi:10.1186/S12889-021-11325-3
6. RCO de C-S, MDCN C, MG T, et al. Impact of COVID-19 pandemic on time series of maternal mortality ratio in Bahia, Brazil: analysis of period 2011-2020. *BMC Pregnancy Childbirth.* 2021;21(1). doi:10.1186/S12884-021-03899-Y
7. Calvert C, John J, Nzvere FP, et al. Maternal mortality in the covid-19 pandemic: findings from a rapid systematic review. *Glob Health Action.* 2021;14(sup1). doi:10.1080/16549716.2021.1974677
8. Department of Statistics Amman, The DHS Program - ICF. Jordan Population and Family Health Survey 2017-18. Published online 2019:1-345.
9. Restrepo-Méndez MC, Victora CG. Maternal mortality by age: who is most at risk? *Lancet Glob Heal.* 2014;2(3):e120-e121. doi:10.1016/S2214-109X(14)70007-5
10. Hoyert DL. Maternal Mortality Rates in the United States, 2019. Published online 2019. doi:10.15620/cdc:103855
11. Bomela NJ. Maternal mortality by socio-demographic characteristics and cause of death in South Africa: 2007-2015. *BMC Public Health.* 2020;20(1):1-20. doi:10.1186/S12889-020-8179-X/TABLES/5
12. Lumbiganon P, Laopaiboon M, Gülmezoglu AM, et al. Method of delivery and pregnancy outcomes in Asia: the WHO global survey on maternal and perinatal health 2007-08. *Lancet.* 2010;375(9713):490-499. doi:10.1016/S0140-6736(09)61870-5
13. Al Rifai R. Rising cesarean deliveries among apparently low-risk mothers at university teaching hospitals in Jordan: Analysis of population survey data, 2002-2012. *Glob Heal Sci Pract.* 2014;2(2):195-209. doi:10.9745/GHSP-D-14-00027
14. AM B, SA AD, YS K, et al. Cesarean Section: Incidence, Causes, Associated Factors and Outcomes: A National Prospective Study from Jordan. *Gynecol Obstet Case Rep.*

- 2017;03(03):1-11. doi:10.21767/2471-8165.1000055
15. Abdel-Fattah Salem. Caesarean section trends in Jordan: A cross sectional study of 2.5 million births over 33 years. 2019;2026:1-19.
 16. Daru J, Zamora J, Fernández-Félix BM, et al. Risk of maternal mortality in women with severe anaemia during pregnancy and post partum: a multilevel analysis. *Lancet Glob Heal*. 2018;6(5):e548-e554. doi:10.1016/S2214-109X(18)30078-0
 17. The World Health Organization. Global nutrition targets 2025: anaemia policy brief (WHO/NMH/NHD/14.4). Published online 2014.
 18. Maternal deaths. Accessed October 18, 2022. <https://www.who.int/data/gho/indicator-metadata-registry/imr-details/4622>
 19. Khan KS, Wojdyla D, Say L, Gülmezoglu AM, Van Look PF. WHO analysis of causes of maternal death: a systematic review. *Lancet*. 2006;367(9516):1066-1074. doi:10.1016/S0140-6736(06)68397-9
 20. Say L, Chou D, Gemmill A, et al. Global causes of maternal death: A WHO systematic analysis. *Lancet Glob Heal*. 2014;2(6):323-333. doi:10.1016/S2214-109X(14)70227-X
 21. Woiski MD, van Vugt HC, Dijkman A, et al. From Postpartum Haemorrhage Guideline to Local Protocol: A Study of Protocol Quality. *Matern Child Health J*. 2016;20(10):2160-2168. doi:10.1007/s10995-016-2050-9
 22. Bouvier-Colle MH, Ould El Joud D, Varnoux N, et al. Evaluation of the quality of care for severe obstetrical haemorrhage in three French regions. *Br J Obstet Gynaecol*. 2001;108(9):898-903. doi:10.1016/S0306-5456(01)00224-8
 23. Berg CJ, Harper MA, Atkinson SM, et al. Preventability of Pregnancy-Related Deaths. *Obstet Gynecol*. 2005;106(6):1228-1234. doi:10.1097/01.aog.0000187894.71913.e8
 24. Kumar N. Postpartum Hemorrhage; a Major Killer of Woman: Review of Current Scenario. *Obstet Gynecol Int J*. 2016;4(4). doi:10.15406/ogij.2016.04.00116
 25. WHO, USAID, CHIP. ACTIVE MANAGEMENT OF THE THIRD STAGE OF LABOUR: New WHO Recommendations Help to Focus Implementation. *Rhr*. 2013;6736(12):14-18. doi:10.1016/S0140-6736(12)60206-2.2013
 26. Engelbrecht S, Armbruster D. The management of the third stage of labor. *South Med J*. 1941;34(6):604-610.
 27. The World Health Organization. *Managing Complications in Pregnancy and Childbirth: A Guide for Midwives and Doctors*.; 2014. doi:10.4159/harvard.9780674592827.c8
 28. Devis P, Knuttinen MG. Deep venous thrombosis in pregnancy: Incidence, pathogenesis and endovascular management. *Cardiovasc Diagn Ther*. 2017;7(Suppl 3):S300-S319. doi:10.21037/cdt.2017.10.08
 29. Mu Y, McDonnell N, Li Z, et al. Amniotic fluid embolism as a cause of maternal mortality in China between 1996 and 2013: A population-based retrospective study. *BMC*

- Pregnancy Childbirth*. 2016;16(1):1-8. doi:10.1186/s12884-016-1106-6
30. Nawaz N, Buksh AR. Amniotic Fluid Embolism. *J Coll Physicians Surg Pak*. 2018;28(6):S107-S109. doi:10.29271/jcpsp.2018.06.S107
 31. Okeke T. Peripartum Cardiomyopathy. *Ann Med Health Sci Res*. 3. doi:10.4103/2141-9248.117925
 32. Lelia D, Metin GA, J HD, Doris C, Doris C. Magnesium Sulphate and Other Anticonvulsants for Women With Pre- Eclampsia. 2013;(11). doi:10.1002/14651858.C
 33. Kwast BE. Abortion: its contribution to maternal mortality. *Midwifery*. 1992;8(1):8-11. doi:10.1016/S0266-6138(05)80061-0
 34. Bernstein PS, Rosenfield A. Abortion and maternal health. *Int J Gynaecol Obstet*. 1998;63 Suppl 1(SUPPL. 1). doi:10.1016/S0020-7292(98)00193-3
 35. Black RE, Walker N, Laxminarayan R, Temmerman M. Reproductive, Maternal, Newborn, and Child Health: An Overview. *Dis Control Priorities, Third Ed (Volume 2) Reprod Matern Newborn, Child Heal*. Published online 2016:1-23. doi:10.1596/978-1-4648-0348-2_ch1
 36. Razzaghi H, Yankey D, Vashist K, et al. COVID-19 vaccination coverage and intent among women aged 18–49 years by pregnancy status, United States, April–November 2021. *Vaccine*. 2022;40(32):4554-4563. doi:10.1016/j.vaccine.2022.06.029
 37. Villar J, Ariff S, Gunier RB, et al. Maternal and Neonatal Morbidity and Mortality Among Pregnant Women With and Without COVID-19 Infection: The INTERCOVID Multinational Cohort Study. *JAMA Pediatr*. 2021;175(8):817-826. doi:10.1001/JAMAPEDIATRICS.2021.1050
 38. M Z, O A. Maternal and perinatal outcomes with COVID-19: A systematic review of 108 pregnancies. *Acta Obstet Gynecol Scand*. 2020;99(7):823-829. doi:10.1111/AOGS.13867
 39. Gianella C, Ruiz-Cabrejos J, Villacorta P, Castro A, Carrasco-Escobar G. Reverting five years of progress: Impact of COVID-19 on maternal mortality in Peru. *C Br*. 2021;2021:1. Accessed October 30, 2021. <https://www.cmi.no/publications/7445-reverting-five-years-of-progress-impact-of-covid-19-on-maternal-mortality-in-peru>
 40. Goodnight W, Soper D. Pneumonia in pregnancy. *Clin Obstet Gynecol*. 2010;53(2):329-336. doi:10.1097/GRF.0b013e3181de8a6f
 41. Smilowitz NR, Gupta N, Guo Y, et al. Acute Myocardial Infarction During Pregnancy and the Puerperium in the United States. *Mayo Clin Proc*. 2018;93(10):1404-1414. doi:10.1016/j.MAYOCP.2018.04.019
 42. Gibson P, Narous M, Firoz T, et al. Incidence of myocardial infarction in pregnancy: a systematic review and meta-analysis of population-based studies. *Eur Hear J - Qual Care Clin Outcomes*. 2017;3(3):198-207. doi:10.1093/EHJQCCO/QCW060
 43. James AH, Jamison MG, Biswas MS, Brancazio LR, Swamy GK, Myers ER. Acute Myocardial Infarction in Pregnancy. *Circulation*. 2006;113(12):1564-1571.

doi:10.1161/CIRCULATIONAHA.105.576751

44. Pregnancy in women with known cardiomyopathy | UKOSS | NPEU. Accessed October 15, 2022. <https://www.npeu.ox.ac.uk/ukoss/current-surveillance/pregnancy-in-women-with-known-cardiomyopathy>
45. Diagnosis and Treatment of Myocarditis - Google Books. Accessed October 15, 2022. https://books.google.jo/books?hl=en&lr=&id=7XKfDwAAQBAJ&oi=fnd&pg=PA135&dq=%22myocarditis%22+and+maternal+mortality&ots=5aRm1ZK2ce&sig=XVcAts0Vtv-kc-FNnv3zSqifNSQ&redir_esc=y#v=onepage&q=%22myocarditis%22+and+maternal+mortality&f=false
46. Kamel H, Roman MJ, Pitcher A, Devereux RB. Pregnancy and the Risk of Aortic Dissection or Rupture. *Circulation*. 2016;134(7):527-533. doi:10.1161/CIRCULATIONAHA.116.021594
47. U S, O D, S W, K V. Splenic artery aneurysms in pregnancy--a systematic review. *Int J Surg*. 2008;6(3):261-265. doi:10.1016/j.ijssu.2007.08.002
48. Ijäs P. Trends in the Incidence and Risk Factors of Pregnancy-Associated Stroke. *Front Neurol*. 2022;13:726. doi:10.3389/FNEUR.2022.833215/BIBTEX
49. H K, T M, R N, J Y, H I-U, K I. Subarachnoid hemorrhage from intracranial aneurysms during pregnancy and the puerperium. *Neurol Med Chir (Tokyo)*. 2013;53(8):549-554. doi:10.2176/NMC.53.549
50. Fairhall JM, Stoodley MA. Intracranial haemorrhage in pregnancy. *Obstet Med*. 2009;2(4):142. doi:10.1258/OM.2009.090030
51. Maciej S, Wiesław Janusz K, Mirosław D, et al. Intestinal obstruction during pregnancy. *Ginekol Pol*. 2013;84(2):137-141. doi:10.17772/GP/1554
52. Perdue PW, Johnson HW, Stafford PW. Intestinal obstruction complicating pregnancy. *Am J Surg*. 1992;164(4):384-388. doi:10.1016/S0002-9610(05)80910-9
53. Acute fatty liver of pregnancy - UpToDate. Accessed October 30, 2021. <https://www.uptodate.com/contents/acute-fatty-liver-of-pregnancy>
54. Barton JR, Sibai BM. Severe sepsis and septic shock in pregnancy. *Obstet Gynecol*. 2012;120(3):689-706. doi:10.1097/AOG.0B013E318263A52D
55. Snyder CC, Barton JR, Habli M, Sibai BM. Severe sepsis and septic shock in pregnancy: indications for delivery and maternal and perinatal outcomes. <http://dx.doi.org/10.3109/147670582012739221>. 2012;26(5):503-506. doi:10.3109/14767058.2012.739221
56. Schneider MB, Umpierrez GE, Ramsey RD, Mabie WC, Bennett KA. Pregnancy Complicated by Diabetic Ketoacidosis Maternal and fetal outcomes. *Diabetes Care*. 2003;26(3):958-959. doi:10.2337/DIACARE.26.3.958
57. Ramin KD. DIABETIC KETOACIDOSIS IN PREGNANCY. *Obstet Gynecol Clin North Am*. 1999;26(3):481-488. doi:10.1016/S0889-8545(05)70092-9

58. de Haan J, Vandecaveye V, Han SN, Van de Vijver KK AF. Difficulties with diagnosis of malignancies in pregnancy. *Best Pract Res Clin Obstet Gynaecol.* 2016;33:19-32.
59. Lee YY, Roberts CL, Dobbins T, et al. Incidence and outcomes of pregnancy-associated cancer in Australia, 1994-2008: A population-based linkage study. *BJOG An Int J Obstet Gynaecol.* 2012;119(13):1572-1582. doi:10.1111/j.1471-0528.2012.03475.x
60. Stensheim H, Møller B, Van Dijk T, Fosså SD. Cause-specific survival for women diagnosed with cancer during pregnancy or lactation: A registry-based cohort study. *J Clin Oncol.* 2009;27(1):45-51. doi:10.1200/JCO.2008.17.4110

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 مشاهبة. 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 2021 رابع 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 2021، 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 1,871 وفاة لنساء في سن الإنجاب خلال عام 2021، كان منها 160 وفاة أمهات، في حين بلغ إجمالي عدد المواليد الأحياء 187,722 خلال نفس الفترة وعلى يكون معدل وفيات الأمهات في الأردن 85.4 لكل 100,000 مولود حي. وهذا الرقم يبلغ 2.2، 2.6 و 2.9 مرة أكثر من معدل وفيات الأمهات في أعوام 2020، 2019 و 2018 على التوالي.

من أصل 160 وفاة للأمهات، كان هناك 104 وفيات ناجمة عن الإصابة بمرض كورونا و 56 وفاة ناجمة عن امراض أخرى وعلى فإن معدل وفيات الأمهات غير الناجمة عن مرض كورونا كانت 28.9 وفاة لكل 100,000 مولود حي. ويعتبر معدل وفيات الأمهات هذا من ناحية إحصائية غير مختلف عن السنوات السابقة حيث كانت النتائج بعد استثناء الإصابة بمرض كورونا 30.0، 32.4 و 28.9 وفاة لكل 100,000 مولود حي للأعوام 2020، 2019 و 2018 على التوالي. لقد بلغت نسبة التطعيم ضد مرض كورونا بين السيدات اللواتي توفين من كورونا 10.6%، في حين كانت نسبة التطعيم لدى الوفيات غير الناجمة عن مرض كورونا أقل من 2%.

من مجموع 160 حالة وفاة للأمهات، تمكنت اللجنة الوطنية من تحديد السبب الرئيسي للوفاة في 158 حالة، بينما لم يتم تحديد سبب الوفاة لحالي وفاة نتيجة نقص في البيانات. من ضمن 160 حالة وفاة، بينت اللجنة الوطنية أن 49 حالة وفاة (30.6%) كان من الممكن تجنب حدوثها. ولكن كانت النسبة التي من الممكن تجنب حدوثها بين الوفيات غير الناجمة عن كورونا 64.3%. وقد توفيت 34 حالة من مجموع الوفيات (21.3%) نتيجة أسباب متعلقة مباشرة بالحمل والولادة، بينما كان هناك 124 حالة وفاة (77.5%) ناجمة عن أسباب غير مباشرة. وبالعودة للوفيات غير الناجمة عن مرض كورونا فإن نسبة الوفيات الناجمة عن الأسباب المباشرة كانت 60.7% مقابل 35.7% للأسباب غير المباشرة والنسبة المتبقية هي للحالات غير معروفة السبب.

وتصدرت امراض نزيف الحمل قائمة الأسباب المباشرة ب 13 حالة وفاة مشكلة من نسبته 8.1% من مجموع الوفيات و23.2% من الوفيات غير الناجمة عن مرض كورونا، وكانت جميع الوفيات الناجمة عن نزيف الولادة من الممكن تجنبها. المضاعفات الأخرى للولادة (التخثر المرتبط بالولادة، المضاعفات الوريدية للولادة، واعتلال عضلة القلب ما بعد الولادة) احتلت المرتبة الثانية للأسباب المباشرة للوفاة مسجلة 10 وفيات ومشكلة ما نسبته 6.3% من مجموع الوفيات و17.9% من الوفيات غير الناجمة عن مرض كورونا. وقد بلغت وفيات التخثر المرتبط بالولادة 8، وشملت على 6 حالات انسداد بالشريان الرئوي و2 حالة انسداد بالسائل الأمنيوسي (السلوى). وقد تم تعزيز التشخيص عن طريق تشريح الجثة في 6 وفيات ناجمة عن التخثر.

وقد حلت أمراض ارتفاع ضغط الدم المرتبطة بالحمل في المرتبة الثالثة للأسباب المباشرة، حيث سجلت 4 حالات وفاة ناجمة عن مقدمات الارتعاج مشكلة ما نسبته 4.5% من مجموع الوفيات و7.1% من الوفيات غير الناجمة عن مرض كورونا. وسجلت مضاعفات الإجهاض 4 وفيات، في حين كان تسمم الدم ما بعد الولادة مسؤولاً عن 3 حالات وفاة.

وتصدرت أمراض الجهاز التنفسي قائمة الوفيات غير المباشرة ومجموع الوفيات مسجلة 107 وفاة، كان منها 104 وفيات ناجمة عن مرض كورونا و3 وفيات ناجمة عن الالتهاب الرئوي، حيث شكلت الوفيات الناجمة عن كورونا ما نسبته حوالي 65% من مجمل الوفيات.

وقد تلتها في قائمة الأسباب غير المباشرة أمراض الجهاز الدوري (احتشاء عضلة القلب، اعتلال عضلة القلب، التهاب عضلة القلب، تفجر أم الدم البهرية وتفجر أم الدم في الطحال). وشكلت هذه الأمراض ما نسبته 4.4% من مجموع الوفيات و12.5% من الوفيات غير الناجمة عن مرض كورونا.

وقد شكلت أمراض الجهاز العصبي المركزي (احتشاء دماغي، التهاب في الدماغ، ونزيف في الدماغ) ما نسبته 2.5% من مجموع الوفيات و7.1% من الوفيات غير الناجمة عن مرض كورونا.

أما ما تبقى من الأسباب غير المباشرة للوفاة فتضمن حالتين من الصدمة الإنتانية وحالة واحدة من كل من انسداد الأمعاء، مرض تدهن الكبد، الحمض الكيتوني السكري، وسرطان المستقيم النقيلي.

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 25 حالة وفاة مما شكل 15.6% من مجموع الوفيات و41.1% من الوفيات غير الناجمة عن مرض كورونا. واعتبرت جميع وفيات النزف المتعلق بالولادة ال 13 متعلقة بالتأخر بتقديم الرعاية الطبية. بينما تبين أن التأخر في طلب الرعاية الصحية (التأخر الأول) قد ساهم في 18 حالة من وفيات الأمهات مما شكل 11.3% من مجموع الوفيات. وفي 6 وفيات كان هناك مزيج من التأخر في طلب الرعاية الصحية والتأخر في تلقي الرعاية المناسبة، بينما لم يكن هناك تأخير في 109 وفيات أي ما يعادل 68.1% من مجموع الوفيات، ولكن عدم وجود تأخير في الوفيات غير الناجمة عن كورونا كانت نسبته 32.1%.

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.