



The Higher Population Council

Maternal Morbidity

In Jordan

(2007-2008)



The National Maternal Morbidity Study (2007-2008) was conducted by The Higher Population Council in collaboration with the Jordanian Health Sector.

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Foreword

Maternal Morbidity is a challenging social and health issue worldwide. All countries have been trying to identify and resolve maternal morbidities to promote better maternal health and prevent maternal mortality. The fact that each case of maternal death carries with it at least 16 cases of maternal morbidity makes it an important public health problem. Mother and child were given increased attention starting from ALMAATA Conference in 1978, whereby primary health care was the beginning of the journey, through Healthy People by 2000, to The Safe Motherhood Conference in Nairobi in 1987, the International Conference on Population and Development in Cairo 1994, and the 1995 Fourth World Conference on Women in Beijing. The focus on women's health was further reinforced in the 2000 Millennium Development Goals (MDG) in particular MDG5 which spells out an international commitment to reduce maternal mortality by two thirds between 1990 and 2015.

In developing countries, it is estimated that maternal morbidities are five times greater than that of developed ones. Jordan, which is one of the developing countries has been facing many challenges related to maternal morbidities. Studies on the contributing factors related to maternal morbidities are very rare. Realizing the importance of such a study, the Higher Population Council, with technical and financial support from UNFPA, initiated an explorative study on maternal morbidities in 2005, and followed up on its recommendation to conduct a more in-depth national Maternal Morbidity Study covering all governorates and health sectors. Hence the study at hand is an in-depth national study to assess the current situation of maternal morbidities in Jordan during pregnancy as well as the intrapartum and post partum periods. It also examines health related contributing factors, in addition to demographic and fertility related indicators such as multiple pregnancies and close parities and their impact on the mother's health. Furthermore, the study looks at indicators of the quality of services provided to women during their pregnancies, and intrapartum and post partum periods, not only to identify factors contributing to proper management of complications related to each stage, but also to detect areas for prevention.

The findings of this study are not limited to identifying the current situation and factors affecting maternal health status, but rather apply the findings to service delivery and provide guidance for improving the quality of care with regard to the various expected complications.

We hope this study is just the beginning for a future evidence-based planning and programming information base. The Higher Population Council is proud to have overseen the implementation and products of this effort. The support of Dr. Zuhair Al-Kayed, Former Secretary General of the Higher Population Council is highly recognized. In addition, the cooperation between all stakeholders in maternal health and the support of UNFPA are highly appreciated and acknowledged.

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Table of Contents

Foreword	III
Acknowledgments	IV
List of Contributors	V
List of Tables	IX
Executive Summary	XI
Background	1
Introduction	3
Methods	4
Study objectives	4
Study Design	4
Training	7
Ethical Considerations	7
Data management and statistical analysis	7
Operational definitions of the study variables	8
Results	8
Part I- Socio-Demographic characteristics, reproductive and general medical history	8
Part II- Morbidity during last pregnancy and labor	11
Part III- Morbidity during current pregnancy, labor, and post partum	12
Bivariate Analyses	33
Multivariate analyses using multivariate logistic regression	35
Discussion and conclusions	30
Strengths of the present study	30
Limitations of the study	35
Recommendations	36
References	37

List of Tables

- Table 1:** Study teams and their place of work
- Table 2:** Distribution of the sample by governorate
- Table 3:** Socio-demographic characteristics of the sample
- Table 4:** Reproductive Health History
- Table 5:** History of previous lifetime morbidity
- Table 6:** History of previous lifetime surgery
- Table 7:** History of morbidity during last pregnancy (before the current)
- Table 8:** History of morbidity during last labor and delivery (before the current)
- Table 9:** Gestational period at enrollment, number of follow up visits, and blood group of women (current pregnancy)
- Table 10:** Anemia in the current pregnancy based on hemoglobin measurement at the first visit
- Table 11:** Morbidity in current pregnancy
- Table 12:** Outcome of current pregnancy
- Table 13:** Information on current delivery
- Table 14:** Basis for calculating the figures about cesarean section probabilities
- Table 15:** Main reasons for cesarean section
- Table 16:** Intrapartum complications of current pregnancy (Stages 1 and 2)
- Table 17:** Intrapartum complications of current pregnancy (Stage 3)
- Table 18:** General complications of current labor and delivery
- Table 19:** Morbidity during post partum
- Table 20:** Summary of total morbidity of current pregnancy, labor, and post partum
- Table 21:** General status of women after the current birth
- Table 22:** Reason for admission to hospital for women who had pregnancy termination
- Table 23:** Complications of current miscarriage
- Table 24:** Comparison between different health sectors in any morbidity during current pregnancy, labor, and post partum
- Table 25:** Comparison between different health sectors in selected variables
- Table 26:** Comparison between different regions in any morbidity during current pregnancy, labor, and post partum
- Table 27:** Comparison between regions in selected variables
- Table 28:** Overall morbidity of current pregnancy, labor, and post partum by selected variables
- Table 29:** Factors independently related to overall morbidity of current pregnancy, labor, and post partum using multivariate logistic regression
- Table 30:** Factors independently related to current pregnancy morbidity using multivariate logistic regression

Table 31: Factors independently related to intrapartum maternal morbidity of current pregnancy using multivariate logistic regression

Table 32: Factors independently related to puerperal maternal morbidity using multivariate logistic regression

Table 33: Overall morbidity of current pregnancy, labor, and post partum in relation to health sector using multivariate logistic regression analysis

Table 34: Morbidity of current pregnancy in relation to health sector using multivariate logistic regression analysis

Table 35: Morbidity of current labor in relation to health sector using multivariate logistic regression analysis

Table 36: Morbidity of current post partum in relation to health sector using multivariate logistic regression analysis

Table 37: Overall morbidity during current pregnancy, labor, and post partum in relation to selected morbidities using multivariate logistic regression analysis

Table 38: Genital infections in relation to selected variables using multivariate logistic regression analysis

Table 39: Genital infections during post partum in relation to health sector using multivariate logistic regression analysis

Executive Summary

The decline in maternal mortality has been associated with a growing interest in maternal morbidity over the past two decades. Maternal mortality is the tip of the iceberg of maternal morbidity. However, assessment of maternal morbidity is not easy and comparability of available studies is hampered by the different study designs, the lack of a uniform definition of what constitutes maternal morbidity, the variability in severity of individual morbidities, and the lack of a standard data collection tool.

In Jordan, there is limited information on maternal morbidity. The present study is the first comprehensive assessment of maternal morbidity at the national level and hopefully will be useful for policy development, planning, assessment of progress, and program evaluation.

Study Objectives:

- 1- To determine the overall incidence of maternal morbidity.
- 2- To identify the spectrum of maternal morbidity and the incidence of the main diseases and complications.
- 3- To identify possible discrepancies in maternal morbidity among the three regions and the different health sectors in Jordan.
- 4- To assess potential risk factors and predictors of maternal morbidity, such as parity, age, educational level, and employment status.
- 5- To explore potential limitations in offering high quality services to clients with maternal morbidity in various health care facilities.
- 6- To report on the incidence and complications of miscarriage.

Study Design:

A cohort design was used to achieve the above objectives. A national sample of pregnant women was enrolled before their twenty second week of gestation between January 15 and April 15, 2007 and followed up throughout pregnancy, labor, and post partum. A total of 4,501 women were finally included in the study (about 10% of the eligible pregnant women in the country during the period of recruitment) with a response rate over 81%. A structured questionnaire and data sheet were developed for the purpose of this study; and a group of experts in the field assessed the study instrument for content validity. A total of 80 physicians, 72 of whom were obstetricians from various health sectors and governorates, were responsible for completing the questionnaire and data sheet for their patients. The principal investigators visited the study sites and held meetings with the study teams of physicians. During these meetings, the principal investigators discussed relevant issues including the purpose of the study, the study protocol, the study instrument, data confidentiality, and the timeframe for reporting. Adherence to the study protocol, answering all questions, and encouraging the study teams to contact the study investigators for any inquiry or clarification were stressed and achieved. The principal investigators were actively involved in the monitoring progress through telephone calls and/or site visits as needed throughout the study period.

Results:

The study main findings indicated that the overall morbidity rate during all current pregnancy, labor, delivery, and post partum, was 60.8%. Morbidities ranged from mild conditions to severe life threatening complications.

- The total morbidity rate during current pregnancy was 41.3%.
- A total of 34.5% of women suffered from at least one morbidity during current labor and delivery.
- During current post partum, 18.7% of women suffered from one or more morbidities.
- The rate of cesarean sections was higher in this study (27.7%) compared to previous reports, and also the 2007 Jordan Population and Family Health Survey (18.5%).
- Prevalence rates of anemia (Hb <11 gm/dl) at enrollment and delivery were 20.1% and 26.3%, respectively. Although still high, these rates are well below previously reported national figures (about 35% in 2002, MOH) and suggest that progress has been achieved in this regard. The national flour fortification with iron and folic acid and the supplementation of pregnant women with iron and folic acid could among of contributing factors to this decline in anemia. It should be noted that most cases of anemia were mild anemia which means Hb between 10<12mg/dl with only 5.9% of women having hemoglobin levels less than 10 gm/dl.
- Urinary tract infections (20.2%) and genital infections (19.4%) were the commonest morbidities during current pregnancy.
- Compared to women from the middle region and after controlling for potential confounders using multivariate logistic regression, southern region women showed higher morbidity during pregnancy and post partum, while northern region women showed higher intrapartum morbidity.
- After controlling for potential confounders, intrapartum morbidity was lowest in the private sector, with no differences between various sectors in the study related to pregnancy or puerperal morbidity.
- Higher parity (>3) was independently related to increased morbidity during pregnancy and labor but not during post partum, after controlling for potential confounders.
- Among the encouraging findings in this study is the absence of any maternal mortality among this large cohort of pregnant women (4501 subjects), indicating that all serious morbidities and related complications have been successfully managed and did not lead to death. Furthermore, a significant low rate of serious obstetric complications such as severe genital lacerations and ruptured uterus was reported in the study (only one case of ruptured uterus).

Recommendations:

Based on the results of the study, the following recommendations may be offered:

- The single most important finding of this study is the sharp rise of cesarean section. There is a need to conduct a thorough investigation of the underlying causes of this finding. The rise in cesarean delivery has accompanied the recent introduction of new technologies for fetal monitoring. Are there any deficiencies related to these technologies? Are they properly implemented? Are there clear unified criteria or guidelines to use? Are they known to all users? Was there any formal training for users? These are examples of possible questions related to this issue. The attitudes of obstetricians and their competence particularly in instrumental delivery are likely areas for inquiry. Are there any clinical audits as regards to cesarean delivery?
- Based on the observed lower intrapartum morbidity in the private sector and to an extent at the Royal Medical Services (RMS) in comparison with the MOH, it is recommended to study the circumstances and potential causes of this finding.
- There is also a need to study factors responsible for the observed higher intrapartum morbidity in the Northern region.
- As parity >3 was a significant predictor of pregnancy and intrapartum morbidity, efforts for making family planning services and information available and more accessible should be promoted.
- An in-depth study of urinary and genital infections during pregnancy is needed to elucidate the underlying causes, types, risk factors, and prevailing microorganisms and their sensitivities. The protocol for the detection and management of these infections should be examined for its appropriateness and applicability.
- Future studies should focus on well-defined maternal morbidities and differentiate these from preexisting medical conditions and conditions with a weak link to childbearing and childbirth. Severity of morbidities should be considered in such studies.

Background

Jordan is a country with limited resources. Its total surface area is 89,342 km², of which only about 5% is arable land. The total population was estimated at about 6 million by the end of 2008 (DOS, 2006). The annual per capita income in 2006 is about USD 1,530 (Department of Statistics, Jordan in Numbers, 2006), with 13% of the population below the poverty line (Expenditure and Family Income Survey/DOS 2006).

Despite the progress achieved in empowering women in the past few decades, there are still some discrepancies in education and participation in the work force, in addition to a number of social, economic, cultural and legislative impediments which are not primarily the subject of this report. According to the Employment and Unemployment Survey 2007, the illiteracy rate in Jordan was 7.9%, with female illiteracy (11.6%) higher than its male equivalent (4.3%). The participation of women in the work force was still low (about 16%).

The Higher Population Council (HPC) is mandated to develop policies and strategies to ensure balance between Jordan's population and its available resources. Among other population issues, reproductive health and promoting an informed reproductive behavior among married couples are at the top of the HPC's agenda. Commendable progress has been achieved in this regard but still much more is needed to reach the desired goals set in the National Population Strategy, the National Agenda, and other national instruments. The total fertility rate is still high at 3.6 (Population and Family Health Survey, 2007) and the growth rate is 2.3% (General Population Census/DOS 2004). According to the Department of Statistics 2006, the Jordanian population will double in 30 years (DOS 2006).

In 1996, the MOH stated that maternal mortality rate was 41/100000 live births (MOH, 1996). In 1992, complications of pregnancy and delivery in Jordan represented 4.6% of illnesses among women aged 15-44 years visiting health centers. About 20% of admissions to public hospitals and 10% of admissions to private hospitals were also due to maternal causes (Cammpel O, 1990, Eshaq M etal, 1994).

A study in five developing countries (Egypt, India, Ghana, Indonesia and Bangladesh) showed that 70% of the women reported at least one health problem related to pregnancy, labor or post partum. For each case of maternal mortality, there were 240–330 cases of maternal morbidity (UNFPA, 2005).

Complications of childbearing and childbirth account for 18% of diseases among females in developing countries and are considered the second leading cause of lost years of healthy life among women of reproductive age after HIV/AIDS, accounting for nearly 31 million disability-adjusted life years lost (DALYs) annually (UNFPA, 2004).

A recent study was conducted in one public and two private hospitals (Al-Bashir, Jordan, and Islamic Hospitals). Data showed that the maternal morbidity rate among interviewed subjects for at least one health problem was 62.3%, 58% and 29% in the three hospitals, respectively (Ameen S, Badraneh A, 2004).

An exploratory study conducted by the HPC in 2005 pointed out to the need for a national study of maternal morbidity in Jordan (HPC, 2005). The HPC was instrumental to developing the idea for the present national maternal morbidity study, providing the technical expertise, and playing a leading role in coordinating between the different parties. This role is consistent with HPC's mandate in providing solid evidence-based information necessary for policy formulation, effective planning, and appropriate interventions. Technical and financial support to the study was provided by the UNFPA/ Amman Office as part of its cooperation with the HPC.

Introduction

Attention to maternal morbidity is a proper approach to prevent maternal mortality, which is a widely used indicator of safe motherhood, as well as the social and economic development of countries. But maternal mortality is just the tip of the iceberg of maternal morbidity, which refers to any ill health resulting from or aggravated by pregnancy, labor, and post partum. Maternal morbidity includes all illnesses and complications associated with child bearing short of death. Many of these conditions are trivial and transient but some are potentially fatal. Apart of the acute complications of child bearing, serious long-term consequences may happen such as vesico-vaginal fistulas, uterine prolapse, and renal failure.

The substantial decline in maternal mortality over the past few decades, particularly in developed countries, has triggered a growing interest in maternal morbidity. Assessment of maternal morbidity is important for three main reasons. First, assessment of the size of the problem in terms of incidence and prevalence is needed for planning purposes which involve priority setting and allocation of resources in the form of financial and human resources, health facilities, supplies, etc. Second, assessment of morbidity at baseline is necessary to monitor progress and assess the effectiveness of interventions and programs targeting this public health problem. Third, identifying the underlying causes and risk factors of maternal morbidity in a community is critical for the design of appropriate programs.

However, studies to assess maternal morbidity may be difficult to undertake in developing countries, where they are mostly needed, because of limited resources; poor health infrastructure; a lack of well-developed information systems; and a large proportion of women delivering at home with no contact with the health system throughout pregnancy, labor, and post partum. Another difficulty arises from the lack of agreement on what constitutes a maternal morbidity. This may differ from one investigator to another leading to lack of comparability among studies.

In Jordan, over 98% of deliveries take place in medical facilities; but data on maternal morbidity are scarce. Limited data are available either from Jordan Population and Family Health Surveys or from few other small scale studies. The present study is an attempt to assess maternal morbidity in a comprehensive way for the first time at the national level. A prospective design was used in which a cohort of pregnant women was followed by their own physicians for the development of any illnesses or complications related to pregnancy, labor, and post partum. The study sheds light on the magnitude and pattern of maternal morbidity in Jordan and, hopefully, will be useful by health planners in their efforts to promote safe motherhood and progress toward the MDGs, whereby reduction of maternal mortality by two thirds within the period of 1990- 2015 must be achieved.

Methods

Study Objectives:

The overall objective of the study is to assess the magnitude and pattern of maternal morbidity in Jordan. Maternal morbidity refers to any disease or ill health resulting from or aggravated by pregnancy, labor, or post partum. Specific objectives include:

- 1- To determine the overall incidence of maternal morbidity.
- 2- To identify the spectrum of maternal morbidity and the incidence of the main diseases and complications.
- 3- To identify possible discrepancies in maternal morbidity among the three regions and in different health sectors.
- 4- To assess potential risk factors and predictors of maternal morbidity such as:
 - a. Parity
 - b. Age
 - c. Educational level
 - d. Employment status
- 5- To explore potential limitations in health care delivery
- 6- To report on the incidence and complications of miscarriage

Study Design:

A prospective cohort design was used to achieve the above objectives. A cohort of pregnant women (up to 21 weeks gestational period) was assessed at recruitment and followed up throughout pregnancy, labor, and post partum. The outcome of interest was any sort of maternal morbidity as defined earlier.

Target Population:

All pregnant women in Jordan before their 22 weeks of gestation during the period January 15 to April 15, 2007 were eligible for inclusion in the study.

Study Population:

The study aimed at selecting a nationally representative sample of the target population. The DOS was involved in selecting the sample, which aimed at representing different health sectors and governorates. The sampling technique was discussed with the UNFPA- CST advisor on surveys and data collection. Through a multistage sampling technique, a number of health facilities (hospitals, health centers, and private clinics) were initially selected. Obstetricians working in selected hospitals and clinics, who agreed to participate in the study, were included in the study field work teams. Similarly, physicians working in the selected MOH health centers were also included. After that, eligible women attending the selected health facilities and seen by the study teams during the recruitment period, were invited to participate in the study.

A fixed number of women from each facility were predetermined according to the workload, the geographic distribution of the population, and the health sector. Recruitment of women continued until the required number was reached. An informed consent was obtained from all participants. Study teams were responsible for providing all required data about subjects in the study starting by the initial visit and ending 6 weeks after delivery.

The intention was to recruit a total of 5,000 women representing 10% of the number of expected eligible women in Jordan during the study period. To account for anticipated nonparticipation, a total of 5,500 women were approached. Of these, 88.5% agreed to participate. The data forms were not satisfactory for about 7% of those women; therefore, they were excluded from the analysis. The final sample included a total of 4,501 women (81.5% of the approached women).

Table 1 summarizes the distribution of the study teams and their place of work. A total of 80 physicians were responsible for the implementation of the study protocol and provide all the required data on their patients. Private obstetricians work in their clinics and perform deliveries at different hospitals. Other obstetricians perform deliveries only at the hospital in which they work. As no deliveries are conducted at the Maternal Child Health (MCH) centers at the MOH or UNRWA, involved physicians from these facilities (10 physicians) were responsible for obtaining data on current labor and delivery of their patients from the attending obstetricians.

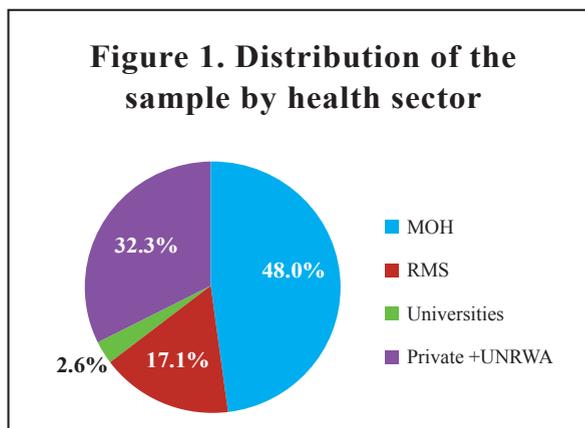
Table 1: Study teams and their place of work

Health sector	Study teams	Number of physicians
Ministry of Health:		
- Hospitals	9	35 obstetricians
- Maternal & Child Health centers	8	8 physicians
RMS	6	18 obstetricians
Jordan University Hospital	1	2 obstetricians
Private sector	15	15 obstetricians
UNRWA	1	2 obstetricians
Total	40 study teams	80 physicians

The distribution of the sample by governorate and health sector is summarized in Table 2 and Figure 1, respectively. The distribution of the sample generally reflects the distribution of the population at large with more than one third of the women in the study from the capital Amman, followed by Zarqa (20%) and Irbid (16%). Slightly less than half of the sample was from the MOH and about one third from the private sector.

Table 2: Distribution of the sample by governorate

Governorate	Frequency	Percent
Amman	1744	38.7
Balqa	215	4.8
Zarqa	909	20.2
Irbid	724	16.1
Mafraq	121	2.7
Karak	416	9.2
Tafilah	194	4.3
Maan	49	1.1
Aqaba	129	2.9
Total	4501	100



Data collection:

The following data were collected from each participant:

- 1- Sociodemographic data, reproductive history, and previous morbidities were obtained from each woman in the study at enrollment by interview using a structured questionnaire prepared for the purpose of the study.
- 2- Relevant data on maternal morbidity during the last and previous pregnancies using the above mentioned structured questionnaire.
- 3- Follow up data regarding maternal morbidity of the current pregnancy starting from enrollment till the end of post partum, 6 weeks after delivery.
- 4- Routine laboratory tests, including blood group and hemoglobin level at enrollment and labor.

Questionnaire and follow up data form:

A structured questionnaire was prepared for the purpose of the study by the principal investigators. It was based on a thorough review of pertinent literature and the knowledge of the population by the investigators. Content validity was assessed by a group of prominent experts in the field. The questionnaire was pilot tested and modified accordingly before its actual use. Interviews were conducted by the attending physicians involved in the study (80 physicians).

The follow up data form collected relevant information on each visit, as well as data on labor and post partum. The obtained data were categorized under nine sections. Sections 1-4 gather relevant data from each woman at enrollment, including sociodemographic data, reproductive history, history on previous morbidity, and data on maternal morbidity related to the last (before the current) and previous pregnancies, respectively. Sections 5-8 pertain to data on current pregnancy, labor, and post partum. The last section is devoted to data on miscarriage; thus, it was completed only for women whose current pregnancy ended in miscarriage.

Follow-up of women in the study:

Each woman was followed up for the development of any maternal morbidity, from enrollment to the end of post partum (6 weeks after delivery). The period of follow up ranged from 21 to 32 weeks depending on the gestational period at enrollment. Follow up of enrolled women was carried out by their corresponding physicians, whether during their routine antenatal visits or as required by the physician. Each physician was required to complete all data items for his/her patient including the questionnaire and the data collection form.

Laboratory data:

Blood group and hemoglobin level for each woman in the study (at enrollment and during labor) were obtained. These tests are routinely performed for all women. Other laboratory tests which may have been requested by the attending physicians for specific reasons were of no interest to the current study and were not recorded.

Training:

The principal investigators visited the study sites and held meetings with the study teams of physicians. During these meetings, the principal investigators discussed relevant issues including the purpose of the study, the study protocol, the study instrument, data confidentiality, and the timeframe for reporting. They stressed the need for strict adherence to the study protocol, answered all questions, and encouraged the study teams to contact them for any inquiry or clarification. The principal investigators were actively involved in monitoring progress through telephone calls and/or site visits as needed throughout the study period.

Ethical Considerations:

The study is consistent with the ethical code of research on human subjects. The study protocol was approved by the MOH and the HPC. The information obtained is highly needed by health planners and policy makers and will be used for the benefit of participating women as well as the population at large. The data obtained are mostly routine data collected in the course of good medical care. Identifying information was not recorded on the study forms and the data were kept confidential with access only for the concerned researchers. No stigma or harm to subjects in the study is expected. Participation was voluntary and women in the study had the right to withdraw from the study at any time, without any penalty.

Data management and statistical analysis:

The Statistical Package for Social Sciences (SPSS) software was used for data entry and data analysis. The data were checked for data entry errors by performing range and logical checks. Analysis focused on obtaining the incidence of the different morbidities during the current and last pregnancy. Incidence rates of different maternal complications during labor and post partum up to six weeks after delivery were obtained.

Different morbidities were combined during the current pregnancy, labor, and post partum to obtain an overall summary measure of maternal morbidity. Regional as well as health sector specific incidence rates were obtained in an attempt to elucidate any potential discrepancies.

Bivariate analyses were used to identify potential correlates of maternal morbidity such as gravidity, education, employment, etc. Multivariate Logistic Regression (Wald Forward Stepwise Technique) was used to assess the independent effect of a given variable after controlling for the effect of potential confounders. Different logistic regression models were developed. Outcome variables examined included overall maternal morbidity as well as maternal morbidity during current pregnancy, labor, and post partum, separately. Because most subjects from the private sector came from the middle region, followed by the northern region and, to a lesser extent, the southern region, these variables were examined in separate regression models.

Operational definitions of the study variables:

While data on previous morbidities were based on self reports from participants, data on current pregnancy, labor, and post partum were based on the clinical judgment of the attending physicians, the vast majority of whom were obstetricians. Therefore, standard clinical diagnostic criteria are assumed to have been used in recording different morbidities. However, a degree of inter-observer bias cannot be ruled out because of insufficient unified formal training of physicians and lack of strict operational definitions of the study variables.

Results

Part I - Socio-Demographic characteristics, reproductive and general medical history

Tables 3 and 4 show the sociodemographic characteristics and reproductive history of subjects included in the study. All were married except for 6 divorced and 1 separated women with a mean age of 28.1 years (SD=6). The mean period of marriage was 6.3 years (SD=5.6) with about half of the women married for < 5 years. Only 2.6% of the women were illiterate and close to 80% not employed. Slightly more husbands were illiterate (2.9%) and less had secondary education or more compared to their wives. About 8% of women were married to men who had another wife. About 60% lived in houses they owned. The average parity was 2, reflecting well the declining trend of parity in the country over the past few decades. About 38% ever had a miscarriage and another 5.7% had history of a still birth. History of a previous cesarean section was 26.4%, while history of vacuum or forceps delivery seemed to be as low as 3.8%.

Previous morbidities were relatively low when compared to the general population; but the low rates of diabetes and hypertension are consistent with the relatively younger age of the women in the study, mostly below 40 years (Table 5). The most common surgery for which women were subjected was appendectomy followed by ovarian cyst and gall bladder. Cervical circlage, usually performed for women with cervical incompetence leading to repeated miscarriage, was performed for 1.8% of women (Table 6).

Table 3: Socio-Demographic characteristics of the sample

Variable	N	Percent
Marital status		
- Married	4494	99.8
- Divorced	6	0.1
- Separated	1	0
Age (Mean = 28.1, SD = 6.0)		
15 – 20	277	6.2
20 – 29	2447	54.9
30 – 39	1567	35.1
40 – 49	168	3.8
Period of marriage (Mean = 6.3, SD = 5.6)		
< 5	2024	47.3
5 – 14	1828	42.7
15 +	425	9.9
Women's education		
Illiterate	119	2.7
Less than secondary	1476	33
Secondary +	2881	64.4
Employment		
Yes	974	21.6
No	3527	78.4
Husband education		
Illiterate	129	2.9
Less than secondary	1718	38.4
Secondary +	2626	58.7
Polygamy		
Yes	343	7.9
No	3997	92.1
Residence		
Owned	2636	59
Rented	1731	38.8
Others	98	2.2

Table 4: Reproductive health history

Variable	N	Percent
Number of pregnancies (Mean = 3.6, SD = 2.5)		
1	1105	24.6
2 – 3	1447	32.2
4-6	1396	31.0
7 +	553	12.3
Number of live births (Mean = 2.0, SD = 2.0)		
0	1310	29.2
1 – 3	2304	51.3
4 +	873	19.5
History of still births	255	5.7
History of miscarriage	1715	38.3
All births (Mean = 2.0, SD = 2.0)		
0	1337	29.8
1 – 3	2235	49.8
4 +	915	20.4
History of previous caesarean deliveries	839	26.4
History of previous vacuum or forceps deliveries	122	3.8
History of previous breech deliveries	72	2.3

Table 5: History of previous lifetime morbidity of the sample

Disease	N	Percent
Anemia	255	5.7
Hypertension	180	4.0
Diabetes	99	2.2
Others	377	6.9

Table 6: History of previous lifetime surgery

Procedure	N	Percent
Appendix	249	5.5
Ovarian cyst	109	2.4
Gall bladder	87	1.9
Cervical circlage	83	1.8
Breast tumor	34	0.8
Bartholin's Glands	13	0.3
Others	627	13.9

Part II - Morbidity during last pregnancy and labor

About half of the women reported history of one or more illnesses during the last pregnancy (before the current). The most common of which were urinary (22.6%) and genital infections (22.1%) (Table 7).

A total of 7.7% of women reported a complication during the last labor and delivery (Table 8), most of which were potentially serious, including hemorrhage (5.7%), pre-eclampsia, septicemia, or rupture of the uterus. It is possible that the cause is that women ignored milder complications.

Table 7: History of morbidity during last pregnancy (before the current)

Morbidity	N	Percent
Urinary Tract Infections	767	22.6
Vaginal infections	750	22.1
Anemia	301	8.9
Hypertension	248	7.3
Gestational Diabetes	113	3.3
Pre-eclampsia	86	2.5
Intrauterine Fetal Death	74	2.2
Antepartum Hemorrhage	68	2.0
Multiple Pregnancy	45	1.3
Deep Vein Thrombosis	21	0.6
Others	635	18.7
Any Morbidity	1641	48.3

Table 8: History of morbidity during last labor and delivery (before the current)

Morbidity	N	Percent
Hemorrhage	193	5.7
Before delivery	70	2.1
During delivery	55	1.6
After delivery	114	3.4
Pre-eclampsia	26	0.8
Rupture of uterus	9	0.3
Serious infections or septicemia	7	0.2
Others	40	1.2
Any morbidity	262	7.7

Part III - Morbidity during current pregnancy, labor, and post partum

A. General characteristics:

Based on the eligibility criteria, all women in the study were within 21 weeks of gestation whereby the majority were within 8-15 weeks. Table 9 shows also the number of follow up visits (mean=5.6, SD=2.7) during the current pregnancy as well as the blood group of women. The commonest blood groups were O+ and A+, and accounting for more than one third each. Only about 10% of women were Rh negative.

Table 9: Gestational period at enrollment, number of follow up visits, and blood group of women (current pregnancy)

Variable	N	Percent
Gestational period (Weeks) (Mean = 13.2, SD = 4.6)		
< 8	674	15
8 – 15	2125	47.2
16 – 21	1702	37.8
Number of follow up visits (Mean = 5.6, SD = 2.7)		
< 4	1171	26
4 +	3330	74
Blood group		
A+	1439	33.8
B+	661	15.5
AB+	277	6.5
O+	1466	34.4
A-	149	3.5
B-	61	1.4
AB-	28	0.7
O-	182	4.3

B. Morbidity during current pregnancy:

It is routine in Jordan to measure hemoglobin level at the first antenatal visit. Using the WHO recommended cutoff value (<11 gm/dl), over one fifth of women in the study suffered from anemia (Table 10). This rate was much lower using a slightly lower cutoff point (<10 gm/dl), indicating that most of anemic women in the sample had mild anemia. A national study of anemia conducted by the MOH in 2002 reported a rate of anemia (Hb <11 gm/dl) of about 33% among women of reproductive age, irrespective of their pregnancy status (Ishaq A., 2003). Knowing that pregnant women are likely to have lower hemoglobin levels women of reproductive age who are not pregnant, such a low rate of anemia observed among women in this study (2007) suggests a welcoming progress during this relatively short period. The fortification of flour with iron and folic acid, which started a few years ago, may offer an explanation for this observation which, if confirmed, may be considered a clear success for the program. Pregnant women also are prescribed iron and folic acid routinely in their antenatal visits. Improved supply of clinics with these medications and better compliance of women may have also contributed to this finding.

Table 10: Anemia in the current pregnancy based on hemoglobin measurement at the first visit

Anemia	N	Percent
Hb < 11gm/dl	779	20.1
Hb < 10gm/dl	229	5.9

The range of morbidities that occurred during the current pregnancy is shown in Table 11. Some of these conditions are clearly linked to pregnancy such as pre-eclampsia, gestational diabetes, and bleeding. Whether multiple pregnancies can be considered an illness or not may be debatable, but it is even more difficult to consider other conditions such as kidney disease and thyroid disorders as part of maternal morbidity in the absence of enough information regarding the onset of these diseases and their severity before and after the current pregnancy. More than 40% of the women had one or more of the conditions listed in Table 11 during their current pregnancy.

The current pregnancy ended in miscarriage in 7.9% of the women and in stillbirth in 1.7% (Table 12). It is well known that miscarriage is more likely early in pregnancy. Consequently, the rate of miscarriage is likely to be an underestimate because the gestational period at enrollment was late for a large proportion of women.

Table 11: Morbidity in current pregnancy

Morbidity	N	Percent
Urinary tract infections	908	20.2
Vaginal infections	872	19.4
Anemia	492	10.9
Early bleeding	268	6
Hypertension	264	5.9
Gestational diabetes	136	3
Pre-eclampsia	118	2.6
Late bleeding	78	1.7
Multiple pregnancy	72	1.6
Kidney diseases	57	1.3
Thyroid disorders	38	0.8
Disseminated intravascular coagulopathy	30	0.7
Heart Disease	13	0.3
Others	93	2.1
Any morbidity	1861	41.3

Table 12: Outcome of current pregnancy

Outcomes	N	Percent
Live birth	3972	90.4
Still birth	74	1.7
Miscarriage	349	7.9

C. Morbidity and other relevant information on current labor:

The public health sector was the place of delivery for the majority of women, while close to one forth delivered in private hospitals (Table 13). As expected, anemia based on hemoglobin level measured at delivery was higher than that at enrollment (26.3%); but it was still low compared to the national figure. The rate of cesarean section was very high (27.7%). History of repeated cesarean section is widely accepted as an indication for a current cesarean section. However, Table 14 shows that only about one fourth of cesarean sections in the current pregnancy had been carried out because of previous cesarean sections; the rest had been performed for other reasons. Considering the findings of the study as regards cesarean section, namely that 26.4% of women had a history of previous cesarean (Table 4), 27.7% of women delivered by cesarean in the current pregnancy, and only 27.7% of these cesareans were because of a previous cesarean, it may be possible to draw the following conclusions:

- 1- About 63% (528 out of 839) of women in the study with one or more previous cesareans have currently delivered vaginally. This figure seems high and may be risky. It suggests a highly conservative attitude of the obstetricians involved in this study toward women with history of previous cesarean.
- 2- About 72% of cesareans were new, i.e. performed on women with no history of cesarean sections.
- 3- The probability of current cesarean delivery for women with no history of cesarean section (including primigravidas) was 25.3% (810 out of from 3,207 cases).

The basis for these calculations is explained in more detail in Table 14.

Table 13: Information on current delivery

Variable	N	Percent
Type of hospital		
Public	3057	75.6
Private	933	23.1
Others	56	1.4
Anemia (measured hemoglobin at labor)		
Hb < 11 gm/dl	859	26.3
Hb < 10 gm/dl	188	5.8
Method of delivery		
Spontaneous vaginal	2802	69.3
Vacuum or forceps	123	3
Caesarean	1121	27.7

Table 14: Basis for calculating the figures about cesarean section probabilities

		Current delivery		Total
		Cesarean	Not cesarean	
History of cesarean in previous deliveries	Yes	311	528	839
	No	810	2397	3207
	Total	1121	2925	4046

* **Note:** Explanation of the numbers in the table: 311 was obtained from table 15; 839 was obtained from table 4; 528=839-311; 1121 was obtained from table 15; 810=1121-311, 4046 is the total number of women with relevant data; 2925=4046-1121; 3207=4046-839; 2397=3207-810. Data on cesarean were not applicable for 349 miscarriages and missing for 106 women.

Table 15: Main reason for cesarean section

Main reason	N	Percent
More than one previous Cesarean Section	311	27.7
Malpresentation	202	18
Fetal Distress	153	13.6
Failure of progress in labor	115	10.3
Multiple pregnancy	57	5.1
Pre-Eclampsia	52	4.6
Post-date pregnancy	35	3.1
Cephalopelvic Disproportion	25	2.2
Antepartum Hemorrhage	17	1.5
Prolapsed Umbilical Cord	15	1.3
Large baby	14	1.2
Placenta Previa	10	0.9
Patient request	10	0.9
Early separation of the placenta	8	0.7
Previous Myomectomy	6	0.5
Others	61	5.4
Missing	30	2.7
Total	1121	100

It may be noted that many of the reasons provided for cesarean delivery in the current pregnancies are, to varying degrees, dependent on the judgment of the obstetrician (Table 15). Intrapartum complications during first and second stages of labor are shown in Table 16. The most common was hemorrhage followed by hypertension. Seizure and coma, probably indicating a complication of pre-eclampsia, occurred in 6 women and ruptured uterus in a single woman. Table 17 shows the complications that occurred in the third stage of labor. Hemorrhage is the most common (4.7%) and the rest were relatively rare. Serious vaginal lacerations which may be considered an indicator of poor obstetric practice occurred in less than 1% of women.

Table 16: Intrapartum complications of current pregnancy (Stages 1 and 2)

Variable	First stage		Second stage		Either stage	
	N	Percent	N	Percent	N	Percent
Hypertension	137	3.4	89	2.2	145	3.6
Uterine hemorrhage	90	2.2	32	0.8	99	2.4
Seizure and coma	4	0.1	3	0.1	6	0.1
Uterine rupture	1	0.0	0	0.0	1	0.0
Others	19	0.5	6	0.1	22	0.5

Table 17: Intrapartum complications of current pregnancy (Stage 3)

Variable	N	Percent
Uterine hemorrhage	191	4.7
Retained placenta	52	1.3
Serious vaginal lacerations	33	0.8
Urinary injury	9	0.2
Others	13	0.3

In addition to the previously mentioned intrapartum complications (Tables 16 and 17), other general morbidities occurred, the most common of which were pre-eclampsia and severe anemia necessitating blood transfusion as shown in Table 18.

Table 18: General complications of current labor and delivery

Variable	N	Percent
Pre-eclampsia	102	2.5
Severe anemia	94	2.3
Clotting disorder	9	0.2
Deep vein thrombosis	7	0.2
Pulmonary thrombosis	5	0.1
Renal failure	1	0.0
Liver Failure	1	0.0
Others	23	0.6

D. Morbidity during current post partum:

The list of morbidities during post partum of current pregnancy is shown in Table 19. About 19% of women developed one or more of these conditions. It is surprising that psychological problems were small (1.3%), a finding not consistent with previous reports from Jordan (Hadidi R. 2007) and may be explained by varying definitions of psychological problems. It is possible that mild conditions were not considered in this study. According to the study of Hadidi R, about 26% of women in the study in the Balqa governorate suffered from blues, 4.5% from depression, and 0.6% from psychosis.

Table 19: Morbidity during post partum

Morbidity	N	Percent
Anemia	313	7.7
Gynecological inflammations	269	6.6
Breast engorgement	247	6.1
Hypertension	122	3
Bleeding	84	2.1
Psychological problems	54	1.3
Deep vein thrombosis	5	0.1
Others	47	1.2
Any morbidity	756	18.7

E. Summary of morbidity during current pregnancy, labor, and post partum:

The occurrence of any sort of morbidity during the current pregnancy, labor, and post partum is summarized in Table 20. Overall, about 61% of the women have suffered from one or more morbidities. Morbidities occurring during labor have affected more than one third of the women; many of these are life threatening but usually of short duration. The general status after birth was rated as good in the vast majority of women in the study (97.6%), and bad only in 0.1% (Table 21).

Table 20: Summary of total morbidity of current pregnancy, labor, and post partum

Morbidity	N	Percent
Pregnancy	1861	41.3
Labor	1153	34.5
Post partum	756	18.7
Overall	2389	60.8

Table 21: General status of women after the current birth

General Health Status	N	Percent
Good	3950	97.6
Moderate	90	2.2
Bad	6	0.1
Total	4046	100

F. Reasons and complications of miscarriage:

The current pregnancy ended in miscarriage in 7.9% of the women, about 70% of whom were admitted to hospital because of spontaneous bleeding, and about 24% for induction of missed abortion (Table 22).

A few complications occurred as a result of miscarriage; the most common were impaired clotting in 5.2% and severe bleeding in 1.4% (Table 23).

Table 22: Reason for admission to hospital for women who had pregnancy termination

Reason for Admission	N	Percent
Spontaneous bleeding	245	70.2
Induction of missed abortion	83	23.8
Others	21	6
Total	349	100

Table 23: Complications of current miscarriage

Complication	N	Percent
Impaired clotting	18	5.2
Severe bleeding	5	1.4
Pelvic inflammatory disease	1	0.3
Cervical lacerations	1	0.3
Retained tissue that needed re-evacuation	1	0.3
None	323	92.6
Total	349	100

Note: A total of 349 (7.9%) of the women had their pregnancy terminated during current pregnancy

G. Bivariate Analyses:

Table 24 presents summary measures of morbidity by health sector, overall and separately for current pregnancy, labor, and post partum. Intrapartum morbidity was highest at MOH (38.7%), followed by the RMS, and lowest morbidity in the private sector (29.3%). The differences were statistically significant ($P=0.000$). On the other hand, no significant differences were observed in pregnancy and puerperal morbidities between the three health sectors. The observed difference in intrapartum morbidity could be a real difference among medical sectors in the quality of provided intrapartum services; but the variability of the characteristics of women attending the three different health sectors could also offer a legitimate explanation. It is clear from Table 25 that women attending the three health sectors differed significantly in parity, age, education, and anemia; any these differences could explain the observed difference in intrapartum morbidity. In other words, control for potential confounding is necessary before deriving final conclusions. This, in fact, was carried out using multivariate logistic regression, the results of which are presented later.

Table 24: Comparison between different health sectors in any morbidity during current pregnancy, labor, and post partum

Variable	MOH	RMS	Private Sector	P-Value
Pregnancy morbidity %	41.5	43.2	39.4	0.167
Intrapartum morbidity %	38.7	33	29.3	0.000
Post partum morbidity %	18.8	19	18.1	0.845
Overall morbidity	65.4	54.2	59.8	0.000

Table 25: Comparison between different health sectors in selected variables

Variable	MOH	RMS	Private Sector	P-Value
Total number of births >3	23.4	20.6	15	0.000
Age (mean and SD)	28.7 (6.4)	27.6 (5.5)	27.7 (5.9)	0.000
Education (secondary +)	56.8	66.4	75.5	0.000
Anemia <11gm/dl at enrollment	22.3	19.8	17.2	0.004
Anemia <11 gm/dl at delivery	29.2	25.1	23	0.002
Follow up visits >3	70.1	76.4	78.4	0.000
Gestational period >16 weeks	39.1	49.5	25.6	0.000
Cesarean Section	28.5	26.1	27.8	0.000
Genital infections	8.4	6.9	3.5	0.000

Regional overall morbidity rates differences were also examined and presented in Table 26. Pregnancy and puerperal morbidity were highest in the southern region, while intrapartum morbidity was highest in the northern region. Several characteristics differed by region (Table 27) and need to be controlled before deriving valid conclusions regarding the differences in morbidities. Such analyses are presented later.

Table 26: Comparison between different regions in any morbidity during current pregnancy, labor, and post partum

Variable	Middle	North	South	P-Value
Pregnancy morbidity %	41.2	31.5	53.2	0.000
Intrapartum morbidity %	32.6	40.5	34.1	0.001
Post partum morbidity %	16.8	15.1	29.3	0.000
Overall morbidity	61.7	55.1	64.2	0.000

Table 27: Comparison between regions in selected variables

Variable	Middle	North	South	P-Value
Total number of births >3	19.8	21.9	20.9	0.109
Age (mean and SD)	27.9 (6.1)	28.6 (6.1)	28.5 (5.8)	0.003
Education (secondary +)	65.5	66.5	58	0.000
Anemia <11 gm/dl at enrollment	18.1	28.8	24.6	0.000
Anemia <11 gm/dl at delivery	24.9	30.3	26.7	0.024
Follow up visits >3	77.1	70.4	67.2	0.000
Gestational period >16 weeks	34.4	36.3	51.6	0.000
Cesarean section delivery (current)	26.5	29.2	30.2	0.070
Genital infections	5.2	4.4	14.2	0.000

Table 28 presents the relationship of overall morbidity during pregnancy, labor, and post partum with a number of relevant variables. Morbidity was lowest among subjects, who were in the age group 20-39 years, educated, employed, not anemic, and who enrolled at a later stage in the study, had a parity of 1-3, and had spontaneous vaginal delivery. Women with educated husbands were also at lowest risk of morbidity.

Table 28: Overall morbidity of current pregnancy, labor, and post partum by selected variables

Variable	Morbidity	P-Value
Age		0.004
<20	61.5	
20-29	58.4	
30-39	63.3	
40-49	69.7	
Education of woman		0.000
Illiterate	68.3	
< Secondary	64.7	
Secondary +	58.6	
Employment		0.004
Employed	56.9	
Not employed	61.9	
Gestational period at enrollment		0.006
<8 weeks	61.6	
8-15	63.1	
16+	57.7	
Education of husband		0.000
<8	70.6	
8-15	64	
16+	58.3	
Anemia at current delivery <11gm/dl		0.000
Yes	75.6	
No	51.9	
Anemia at enrollment <11gm/dl		0.000
Yes	100	
No	47.3	
Parity		0.000
0	59.4	
1-3	59.2	
4+	67	
Mode of current delivery		0.000
Spontaneous	56.4	
Vacuum or Forceps	69.8	
Breech	87	
Cesarean Section	63.1	

H. Multivariate analyses using multivariate logistic regression:

Factors independently related to overall morbidity are shown in Table 29.

Multiparous women (≥ 4) were significantly at higher risk of overall morbidity compared with primipara after simultaneously controlling for region, mode of delivery, education, and number of follow up visits (adjusted odds ratio=1.34, $P=0.004$). The risk of overall morbidity by region was for subjects from the northern region (adjusted odds ratio=0.77, $P=0.002$). Breech delivery was associated with the highest overall morbidity compared to spontaneous vaginal delivery (adjusted odds ratio= 4.77, $P=0.012$). Other predictors of overall morbidity included education, and number of follow up visits as shown in Table 29.

Table 29: Factors independently related to overall morbidity of current pregnancy, labor, and post partum using multivariate logistic regression

Variable	Adjusted Odds Ratio	P-Value
Number of births		0.008
0	1	
1-3	1.03	0.719
4+	1.34	0.004
Region		0.003
Middle	1	
North	0.77	0.002
South	1.08	0.405
Mode of delivery		0.000
Spontaneous	1	
Vacuum or forceps	1.90	0.002
Breech	4.77	0.012
Cesarean section	1.29	0.001
Education		0.003
Illiterate	1	
Less than secondary education	1.01	0.965
Secondary +	0.79	0.308
Number of follow up visits		
< 4	1	
4+	1.25	0.011

Each variable is adjusted for all other variables in the table. Age, gestational age at enrollment, and employment were excluded from the model by the stepwise procedure.

Summary pregnancy morbidity in relation to a number of variables is shown in Table 30. The risk of any morbidity during the current pregnancy was highest in the southern region (adjusted odds ratio, 1.43, P=0.000) and lowest in the northern region (adjusted odds ratio= 0.67, P=0.000) after controlling for all variables in the table. Parity, education, and follow up visits were also significant predictors of pregnancy morbidity as shown in the table. Mode of delivery was also significantly associated with morbidity during pregnancy. Although statistically significant, this observation may be a chance finding, given the numerous tests performed in this study. On biological grounds, it is difficult to believe that women with ill health are more likely to have breech delivery than women with good health!

Table 30: Factors independently related to current pregnancy morbidity using multivariate logistic regression

Variable	Adjusted Odds Ratio	P-Value
Number of births		0.007
0	1	
1-3	1.11	0.176
4+	1.35	0.002
Region		0.000
Middle	1	
North	0.67	0.000
South	1.43	0.000
Mode of delivery		0.000
Spontaneous	1	
Vacuum or Forceps	1.81	0.002
Breech	2.96	0.014
Cesarean Section	1.34	0.000
Education		0.025
Illiterate	1	
Less than secondary education	1.08	0.731
Secondary +	0.89	0.606
Number of follow up visits		
< 4	1	
4+	1.45	0.000

Each variable is adjusted for all other variables in the table. Age, gestational age at enrollment, and employment were excluded from the model by the stepwise procedure.

The adjusted odds ratios and significance levels are shown for a number of variables in relation to intrapartum morbidity (Table 31). Consistent with the bivariate analysis presented earlier, the highest risk was observed in the North (adjusted odds ratio= 1.41, P=0.000) with no difference in Intrapartum morbidity between the South and the Middle regions. Cesarean delivery was associated with the highest morbidity (adjusted odds ratio=1.32, P=0.001). The other variables showed the same pattern observed with overall and pregnancy morbidities (Table 31).

Table 31: Factors independently related to intrapartum maternal morbidity of current pregnancy using multivariate logistic regression

Variable	Adjusted Odds Ratio	P-Value
Number of births		0.000
0	1	
1-3	1.14	0.129
4+	1.76	0.000
Region		0.001
Middle	1	
North	1.41	0.000
South	1.03	0.734
Mode of delivery		0.004
Spontaneous	1	
Vacuum or forceps	1.31	0.202
Breech	0.66	0.425
Cesarean section	1.32	0.001
Education		0.009
Illiterate	1	
Less than secondary education	0.89	0.620
Secondary +	0.71	0.140

Each variable is adjusted for all other variables in the table. Age, gestational age at enrollment, number of follow up visits, and employment were excluded from the model by the stepwise procedure.

The lowest puerperal morbidity was observed in the South (adjusted odds ratio=2.01, P=0.000). Vacuum or forceps delivery was associated with increased puerperal morbidity (adjusted odds ratio=1.86, P=0.003). The other adjusted risks are shown in Table 32.

Table 32: Factors independently related to puerperal maternal morbidity using multivariate logistic regression

Variable	Adjusted Odds Ratio	P-Value
Region		0.000
Middle	1	
North	0.91	0.401
South	2.01	0.000
Mode of delivery		0.032
Spontaneous	1	
Vacuum or Forceps	1.86	0.003
Breech	0.88	0.823
Cesarean Section	1.02	0.832
Education		0.000
Illiterate	1	
Less than secondary education	1.86	0.560
Secondary +	0.60	0.042
Number of follow up visits		
< 4	1	
4+	1.54	0.000

Each variable is adjusted for all other variables in the table. Age, gestational age at enrollment, parity, and employment were excluded from the model by the stepwise procedure.

Tables 33-36, respectively, present the findings of multivariate logistic regression analyses for summary morbidities, overall, and separately for pregnancy, labor, and post partum in relation to health sector after controlling for potential confounders. Overall morbidity was significantly lower in the RMS (adjusted odds ratio=0.69, P=0.000) and private sector (adjusted odds ratio=0.85, P=0.046) compared to the MOH (Table 33). Intrapartum morbidity was also lower in the private sector (adjusted odds ratio=0.70, P=0.000) and RMS (adjusted odds ratio=0.81, P=0.020) as compared to the MOH (Table 35). However, there was no significant relationship between health sector and morbidity during pregnancy (Table 34) or morbidity during post partum (Table 36).

Table 33: Overall morbidity of current pregnancy, labor, and post partum in relation to health sector using multivariate logistic regression analysis

Health Sector	Adjusted Odds Ratio	P-Value
MOH	1	
RMS	0.69	0.000
Private sector	0.85	0.046

Adjusted for parity, education, and mode of delivery because most of women using the private sector came from the middle of the country, with a few from the North and fewer yet from the South. The variables “health sector” and “region” were not included together in this model or any other model throughout these analyses.

Table 34: Morbidity of current pregnancy in relation to health sector using multivariate logistic regression analysis

Health Sector	Adjusted Odds Ratio	P-Value
MOH	1	
RMS	1.05	0.554
Private sector	0.99	0.886

Adjusted for parity, education, and mode of delivery because most of women using the private sector came from the middle of the country, with a few from the North and fewer yet from the South, the variables “health sector” and “region” were not included together in this model or any other model throughout these analyses.

Table 35: Morbidity of current labor in relation to health sector using multivariate logistic regression analysis

Health Sector	Adjusted Odds Ratio	P-Value
MOH	1	
RMS	0.81	0.020
Private sector	0.70	0.000

Adjusted for parity, education, mode of delivery, and number of follow up visits because most of women using the private sector came from the middle of the country with a few from the North and very few from the South. The variables “health sector” and “region” were not included together in this model or any other model throughout these analyses.

Table 36: Morbidity of current post partum in relation to health sector using multivariate logistic regression analysis.

Health Sector	Adjusted Odds Ratio	P-Value
MOH	1	
RMS	1.05	0.611
Private sector	1.00	0.972

Adjusted for parity, education, mode of delivery, and number of follow up visits because most of women using the private sector came from the middle of the country with a few from the North and very few from the South. The variables “health sector” and “region” were not included together in this model or any other model throughout these analyses.

Overall morbidity was independently related to anemia <11gm/l at delivery (adjusted odds ratio=3, P=0.000), hypertension at enrollment (adjusted odds ratio=3.63, p=0.000), and diabetes mellitus at enrollment (adjusted odds ratio=5, P=0.000). These illnesses seem to be the strongest predictors of overall morbidity (Table 37).

Table 37: Overall morbidity during current pregnancy, labor, and post partum in relation to selected morbidities using multivariate logistic regression analysis

Variable	Adjusted Odds Ratio	P-Value
Anemia as measured at delivery < 11gm		
Yes	3.03	0.000
No	1	
Hypertension at enrollment		
Yes	3.63	0.000
No	1	
Diabetes at enrollment		
Yes	5.00	0.000
No	1	

Adjusted to region, education, mode of delivery, and number of follow up visits; parity was excluded from the model by the stepwise procedure.

Table 38 presents the factors significantly and independently related to genital infections following delivery. Genital infections were among the most common maternal morbidities (6.6% during post partum). Genital infections were commonest in the southern women, illiterate women, and women who suffered from severe genital lacerations during delivery or had retained placenta. Women who had severe genital lacerations during delivery were about 22 times more likely to have genital infections during post partum. The adjusted odds ratios and their significance level are shown in table 38. In comparison with the private sector, both the MOH and RMS were about two times more likely to have genital infections during post partum (Table 39).

Table 38: Genital infections in relation to selected variables using multivariate logistic regression analysis

Variable	Adjusted Odds Ratio	P-Value
Region		0.000
Middle	1	
North	0.81	0.275
South	2.87	0.000
Education		0.001
Illiterate	1	
Less than secondary	0.68	0.216
Secondary +	0.44	0.009
Severe genital lacerations		
Yes	21.79	0.000
No	1	
Retained Placenta		
Yes	3.84	0.000
No	1	

Parity was excluded from the model by the stepwise procedure.

Table 39: Genital infections during post partum in relation to health sector using multivariate logistic regression analysis

Health Sector	Adjusted Odds Ratio	P-Value
MOH	2.03	0.001
RMS	2.11	0.000
Private sector	1	

Adjusted for mode of delivery, education, severe genital lacerations, and retained placenta. Parity was excluded from the model by the stepwise procedure

Discussion and conclusions:

In this chapter, we focus on the main findings of the study and how they relate to available literature, provide possible explanations for observed discrepancies, and derive relevant conclusions. We also discuss the strengths and limitations of the study and provide suggestions for future research on maternal morbidity.

Strengths of the present study:

At the outset, we would like to point out that, on careful review of available literature, we could not identify any similar studies using the same design on approximately one tenth of the target population and collecting prospectively data on all morbidities during pregnancy, labor, and post partum. In this sense, the present study may be considered unique. The literature is full of studies dealing with one or another aspect of maternal morbidity. Certain studies focused on key or severe morbidities during pregnancy or delivery (Minkauskiene M, Nadisauskiene R, Padaiga Z, Makari S. Systematic review on the incidence and prevalence of severe maternal morbidity, *Medicina (Kaunas)* 2004, 40(4):299-309; Gulmezoglu AM, Say L, Betran AP, Villar J, Piaggio G. WHO systematic review of maternal mortality and morbidity: methodological issues and challenges. *BMC Med Res Methodol* 2004, 5(4): 16; Say L, Souza JP, Pattinson RC, for the WHO working group on maternal mortality and morbidity classifications, *Best Pract Res Clin Obstet Gynsecol* 2009 (Epub ahead of print)). Others dealt with single complications after delivery such as vesico-vaginal fistulae. Some studies targeted "maternal near miss" situations (Penney G, Brace V. Near miss audit in obstetrics, *Curr Opin Obstet Gynecol* 2007, 19 (2): 145-50).

The relatively huge sample size of the study (about 10% of all eligible pregnant women at enrollment), representation of all governorates and health sectors of the country, the comprehensiveness of the morbidity data obtained, and the fact that the data collection teams were women's attending physicians, all add to the usefulness and validity of the study results. However, these same strengths may be easily criticized on cost-benefit basis. In other countries, particularly with larger populations, it may be difficult to justify the present study approach and methodology. A less comprehensive approach and the use of existing data sources (for example, data from the regular Hospital Discharge Survey of the United States) may provide sufficient information for planning, policy making, and resource allocation. Such arguments may be valid, but also highlight the importance of the data at hand and give credit to the findings of the present study.

Main findings:

Our discussion will focus on the following points:

- 1- The magnitude and pattern of maternal morbidity
- 2- The regional differences in maternal morbidity
- 3- The health sector related differences in maternal morbidity
- 4- Predictors of maternal morbidity
- 5- Maternal health care indicators indirectly observed in this study

Discussion of the above points depends largely on the findings related to the current pregnancy, labor and delivery, and post partum. Much of the findings that pertain to previous pregnancies are based on self-reports and prone to recall bias.

1- The magnitude and pattern of maternal morbidity:

Overall, about 61% of the women in this study suffered from one or more health problems during pregnancy, labor, and post partum. The highest rate of morbidity was during pregnancy (41.3%), followed by labor and delivery (34.5%), and least during post partum (18.7%). Comparison of these figures with other studies is difficult because of variability in the definitions used from one study to another and the different approaches to obtain the data, raising the need for the development of standard protocols and definitions of morbidities. A higher figure of morbidity during labor and delivery was reported from the United States (43%) based on analysis of data from the Hospital Discharge Survey between 1993 and 1997 (Danel I, Berg C, Johnson H, Atrash H, 2003). The figure became closer to ours on ignoring cesarean section morbidity (31%).

Near miss morbidity refers to women who survived a fatal complication of pregnancy, child birth, or post partum. Studying near miss morbidity is increasingly recognized as a useful means to assess quality of obstetric care and prevent maternal mortality. For this purpose, the WHO has embarked on a process to develop a consensus on uniform definitions and identification criteria for near miss cases (Say L, Souza JP, Pattinson RC, 2009).

The main conditions included in studies of near miss morbidity are hemorrhage, sepsis, hypertensive disorders of pregnancy, thrombo-embolic complications, and ruptured uterus. In a systematic review of near miss morbidity, Souza JP et al, 2004 reported an incidence of 8.2/1000 live births and a case fatality ratio of 6.3%.

As regards puerperal morbidity, Hadidi R 2007 reported a rate of 54% among women from the Balqa governorate, Jordan. However, minor conditions were considered in that study such as headache, blues, dyspareunia, etc. Such conditions were not considered in the current study which explains the observed discrepancy.

Among the morbidities that deserve special attention in the current study are urinary and genital infections, which affected about one fifth of the study population each during the current pregnancy. Unfortunately, we have no further information on the types of these infections or the methods of diagnosis. While pregnancy is well-known to predispose women to these infections, such high rates urge thorough investigation, and if confirmed, response must be initiated. All pregnant women should be routinely screened for bacteriuria using urine culture and treated by appropriate antibiotics when found positive (Ovalle A, Levancini M, 2001).

The observed relatively low rates of diabetes mellitus (3%) and hypertension (5.9%) during the current pregnancy reflect the young age of women in this study.

Rupture of the uterus occurred only in one case out of the 4,501 women enrolled in this study. While we believe that such a complication should be totally eliminated through good obstetric care, it seems that a lot of progress has been achieved toward this goal. The low rate of severe genital lacerations (0.8%) and the fact that no maternal deaths occurred in the study population are in support of this conclusion. However, the high rate of cesarean delivery observed in this study is a great concern (27.7%). In fact, an increasing trend in cesarean deliveries has been observed almost everywhere during the past few decades. In the United States, cesarean delivery increased from 20.7% in 1996 to 31.1% in 2006 (MacDorman MF, Menacker F, Declercq E, 2008). In 1970, the rate of cesarean was 5.5% as reported by the National Center for Health Statistics and the Center for Disease Control and Prevention. In Egypt, cesarean rate increased from 4.6% to 10% between 1992 and 2000 (Khawaja M, Jurdi R, Kabakian-Khasholian T, 2004). The Jordan Population and Family Health Survey, 2007 showed a cesarean section rate of 18.5%.

It is difficult to offer explanations for the exceptionally high rate of cesarean deliveries in this study. The rate of cesarean delivery ranged from 28.5% in the MOH to 26.1% in the RMS. The rate was 27.8% in the private sector. However, the differences between sectors in cesarean rate are too small to be meaningful. So, it is not possible to explain the high rate in relation to the interests and preferences of certain health care providers.

Hussein Q. et al 2002 reported a rate of cesarean deliveries of 9.5% in two military hospitals in Jordan. A cross-sectional study conducted in Al-Eman Hospital, Ajlun in 2006 reported a lower rate of cesarean deliveries (5.6%) (Jabali A. 2007). However, in another cross-sectional study conducted in Balqa, the rate of cesarean delivery was 21.4% (Hadidi R. 2007). Results of the study were based on interviewing women bringing their babies to health centers for the first immunizations. The variability in these rates suggests that the indications for cesarean are not the same everywhere in the country, or they are easily manipulated by obstetricians according to their preferences. Referral practices may also contribute to such variability in cesarean rates, but offer no explanation for the very high rates observed in the public, military, and private sectors in this study. It seems that the study obstetricians were willing to take a high risk by delivering women with previous cesarean vaginally; but at the same time it may appear as if they were denying others with no previous history of cesarean section a fair opportunity for vaginal delivery. The rate of vacuum or forceps delivery in the study cohort was only 3%. The American College of Obstetrics and Gynecology has recommended training in instrumental delivery to control and reduce the rates of cesarean section (American College of Obstetricians and Gynecologists, 2000). First cesarean almost means that subsequent deliveries will be cesarean (repeat cesarean rate in the United States is almost 91%) (Menacker F, Declercq E, MacDorman MF, 2006).

However, this was not true in the present study where 72% of cesarean deliveries were new and only about 28% were repeat cesarean. Among the proposed factors contributing to the increase in cesarean is patient desire; however, less than 1% of cesarean deliveries in the present study were upon request of women. The World Health Organization proposed 15% as the highest acceptable cesarean section rate (WHO 1985). Culturally, in this study, subjects are likely to have more children compared to developed countries.

Without jumping to explanations not based on solid evidence (many such explanations are possible), there seems to be a real need to investigate the underlying causes of the observed high rate of cesarean section delivery. First, the study in this respect has to be independently confirmed. If so, research is needed to explore the attitudes, behaviors, preferences, and skills of obstetricians as well as the social, economic, and legal environment in this country. We need also to understand the preferences of women in this regard. As much of the offered causes for cesarean delivery in this study are to an extent subjective and dependent on the judgment of the physician, research may be directed to uncover the true causes for this alarming health problem.

2- Regional differences in morbidity:

Significant differences existed among regions in overall morbidity, morbidity during pregnancy, morbidity during labor, and morbidity during post partum. These differences persisted after simultaneously controlling for potential confounding through multivariate stepwise logistic regression. Potential confounders that were considered included: age, parity, gestational age at enrollment, number of follow up visits, education, and mode of delivery. Southern women had the highest rates of morbidity during pregnancy and post partum while northern women had the highest rates of intrapartum morbidity, after controlling for potential confounders. While it may be possible to interpret the higher morbidity during pregnancy and post partum in the South as related to the lower status of general socioeconomic development, interpretation of the high intrapartum morbidity in the North deserves special attention because intrapartum morbidity is closely linked to obstetric practices. The data at hand offer no satisfactory explanation for this observation as it persisted after controlling for potential confounders. Therefore, the question of poor obstetric practices may be raised waiting for further research.

Differences in morbidity among health care providers (health sectors):

Significant differences between health sectors were observed in overall morbidity and morbidity during labor with no differences in morbidity during pregnancy or post partum. Observed differences in bivariate analyses with regards to pregnancy and puerperal morbidity disappeared after controlling for potential confounders using multivariate logistic regression.

Intrapartum morbidity was lowest in the private sector (adjusted OR=0.70), followed by the RMS (adjusted OR=0.81) in comparison with the MOH. Although it is noted that the public sector (MOH and RMS) receives the referred complicated cases from all over Jordan, findings suggest that there is a room for improvement of obstetric services at the MOH and RMS compared to the obstetric services provided by the private sector.

3- Predictors of morbidity observed in the study:

Under this heading, we will discuss only factors that were independently related to morbidity after controlling for potential confounding using multivariate stepwise logistic regression.

a. Parity:

Multiparity has been widely reported as a risk factor of maternal morbidity and mortality (Evjen-Olsen B et al 2008, Ciemiski A, Dlugolecki E 2005). Consistent with available literature, in this study, parity >3 was significantly and independently related to overall morbidity as well as to pregnancy and labor morbidity. No significant relationship, however, was observed between parity and puerperal morbidity.

b. Education:

As expected, women's education was significantly and independently related to overall morbidity and to morbidity during pregnancy and post partum. Women with secondary education or higher had lower morbidities than illiterate and less educated women. Better health awareness and better socioeconomic status may provide the explanation of the observed differences in morbidity. Although the differences in intrapartum morbidity were not significant, a gradient of morbidity existed with the more educated having the lowest morbidity.

c. Mode of delivery:

Compared to spontaneous vaginal delivery, breech delivery was associated with the lowest intrapartum and puerperal morbidities while forceps delivery was associated with the highest. Strangely enough, morbidity during pregnancy was highest in women having breech delivery. Of course, it is not easy to offer an explanation for this finding. The most likely explanation is that this observation, although statistically significant, is due to chance, given the numerous comparisons performed in this study. Otherwise, we may speculate that breech presentation is associated with more morbidities during pregnancy.

d. In general, cesarean delivery was associated with about a 30% increase in overall morbidity and morbidity during labor and pregnancy in comparison with spontaneous vaginal delivery. This is in line with published literature (and calls again for action to curb the escalating rate of cesarean delivery).

e. Number of follow up visits:

The number of follow up visits was consistently related to higher overall morbidity and morbidity during pregnancy and post partum. This is understandable, since sick women during pregnancy are more likely to seek health care than healthier women, and thereafter, they may be more likely to be sick during post partum.

4- Maternal health care indicators indirectly observed in this study:

Several indirect indicators of maternal health services were discussed earlier in this chapter. These included the complete absence of deaths among the cohort of 4,501 women, the low rate of severe genital lacerations, and the occurrence of only a single case of uterine rupture. This generally suggests an acceptable level of the obstetric health services in the country. On the other hand, a number of unfavorable findings were observed, for example, renal failure and liver failure occurring in one woman each. Moreover, the incidence time for these conditions, whether they existed as a medical condition prior to conception or were associated with delivery, is not evidenced.

The occurrence of urinary injury in nine cases lack information related to the circumstances related to its incidence. We do not have enough information to establish whether these complications were directly related to delivery or just existing medical conditions before conception. Also, we do not know the circumstances related to the occurrence of urinary injury in nine cases.

The high rate of cesarean delivery observed in this study has been discussed earlier in this chapter and represents the most alarming finding in this study.

Although the rate of anemia is still high (about 26% as measured at delivery), the figure suggests that much progress has been made in this regard. Ensuring the availability of iron and folic acid in all health facilities, the universal prescribing of these medications to pregnant women, and improving the compliance of women in taking these medications are needed strategies to maintain progress toward further reduction of the rate of anemia.

Southern women were at a disadvantage in morbidity during pregnancy and post partum. This may largely reflect the poor socioeconomic development in the South as compared to other regions of Jordan. Efforts are needed to increase the awareness of women as regards the importance of antenatal and postnatal care and improving access of women to these health services. Among the worrying indicators observed in this study is the higher rate of intrapartum complications in the North; these are closely linked to the quality of obstetric care provided. There is a need to investigate this finding to uncover its underlying causes.

Limitations of the study:

Despite the merits of the study mentioned earlier in this chapter, the study has a number of limitations:

- The main limitation is the lack of strict definitions for the morbidities considered in the study. Given the large number of obstetricians involved in this study and the lack of formal training, a significant degree of interobserver bias is likely. Misclassification of women with respect to certain morbidities is also likely. However, the use of standard clinical criteria for diagnosis of morbidities may have reduced, to some extent, the above biases.
- The range of morbidities included in this study was very wide. However, the study did not differentiate clearly enough between maternal morbidities and unrelated preexisting medical conditions. It may have been better if the study had focused on morbidities that are clearly linked to childbearing and childbirth, and narrowed its scope to morbidities with a certain degree of severity.

Recommendations

Based on the results of the study, the following recommendations may be offered:

The single most important finding of this study is the sharp rise of cesarean section. There is a need to conduct a thorough investigation of the underlying causes of this finding. The rise in cesarean delivery has accompanied the recent introduction of new technologies for fetal monitoring. Are there any deficiencies related to these technologies? Are they properly implemented? Are there clear unified criteria or guidelines to use? Are they known to all users? Was there any formal training for users? These are examples of possible questions related to this issue. The attitudes of obstetricians and their competence particularly in instrumental delivery are likely areas for inquiry. Are there any clinical audits as regards to cesarean delivery?

Based on the observed lower intrapartum morbidity in the private sector and to an extent at the Royal Medical Services (RMS) in comparison with the MOH, it is recommended to study the circumstances and potential causes of this finding.

- There is also a need to study factors responsible for the observed higher intrapartum morbidity in the Northern region compared to other regions.
- As parity >3 was a significant predictor of pregnancy and intrapartum morbidity, efforts for making family planning services and information available and more accessible should be promoted.
- An in-depth study of urinary and genital infections during pregnancy is needed to elucidate the underlying causes, types, risk factors, and prevailing microorganisms and their sensitivities. A protocol for detection and management of these infections may be developed and implemented.
- Future studies should focus on well-defined maternal morbidities and differentiate these from preexisting medical conditions and conditions with a weak link to childbearing and childbirth. Severity of morbidities should be considered in such studies.

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