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Prevalence of adverse birth outcomes and associated factors in Jazan, Saudi Arabia
A cross-sectional study

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Abstract

This study aimed to measure the prevalence of adverse birth outcomes and associated factors among mothers from the Jazan region in Saudi, Arabia. This was a cross-sectional investigation where data was collected via a semi-structured questionnaire. The questionnaire was completed during interviews to assess data regarding the participants' demographics, morbidity, the reported adverse birth outcomes, and maternal complications during pregnancy. Chi-squared and Fisher's Exact tests were both used to compare the distribution of demographic and obstetric risk factors according to the historical presence of adverse birth outcomes. A total of 1315 women with a combined history of 4950 pregnancies were involved in the current investigation. The mean age of the participants was 33.1 years. The total number of adverse birth outcomes was 1009. The most frequently reported adverse birth outcome was miscarriage (12.1%), followed by premature birth (2.3%) and underweight birth (1.9%). Reports of a minimum of 1 adverse birth outcome were higher among women who reported family incomes of more than 10,000 Saudi Arabian Riyal (SAR), women who were first-degree cousins of their husbands, and women with less than a secondary level education (*P* values <.05). This study found a relatively high prevalence of miscarriage. Further investigations are needed to assess factors associated with this high frequency level of miscarriage. Furthermore, these findings have preventive and clinical implications concerning pregnant women with a history of obesity, anemia, consanguinity, and hypertension. The goal is to target them with a better range of antenatal care services to reduce the incidence of potential adverse birth outcomes.

Abbreviations: BMI = body mass index, LBW = low birth weight, SAR = Saudi Arabian Riyal.

Keywords: adverse birth outcome, Jazan, miscarriage, pregnancy, primary health care, Saudi Arabia

1. Introduction

Pregnancy can be associated with several adverse events and birth outcomes. Adverse birth outcomes of pregnancy include stillbirth, preterm birth, low birth weight (LBW), macrosomia, neonatal death, congenital anomalies, and small for gestational age.[1–4] In developing countries, adverse birth outcomes have been reported to be more common than in developed countries. In newborn babies and infants, birth weight and gestational age are critical determinants of neonatal morbidity and mortality.[1,5] As a result, LBW and prematurity are associated with increased infant mortality and contribute to a range of health and developmental concerns while having crucial emotional and economic impacts on the family of the child.[6–10]

The World Health Organization defines LBW as a birth weight <2.5 kg. However, the birth weight is characterized by 2 processes: the gestation period and fetal growth rate.

Therefore, children may have a birth weight <2.5 kg either because they are born early (preterm birth) or because they are born small for gestational age, which is defined as having a birth weight below the 10th percentile, based on the sex-specific reference for gestational age.[1] A preterm birth is defined by the World Health Organization as a delivery before 37 weeks of gestation. Several factors affect the newborn's survival and long-term neurodevelopmental outcomes,[6,11] with a greater likelihood of unfavorable effects observed at lower gestational ages.[9,11] Prematurity following congenital defects is considered to be the second leading cause of neonatal mortality.

Some factors that correlate with preterm birth and LBW include congenital anomalies, chronic maternal health problems (e.g., high blood pressure), lifestyle factors (e.g., maternal use of tobacco, alcohol, and drugs), maternal and fetal infections, placental disorders, inadequate maternal weight gain, and socioeconomic factors (e.g., low income and poor education).

However, both maternal characteristics and obstetric practices play an important role. Other factors that may contribute to an increase in preterm and LBW rates include an advanced maternal age, multiple births (e.g., twins or triplets), the use of early cesarean sections and induction of labor, and the application of assisted reproductive technologies.[2,16–20]

There are a multiple number of studies that have described pregnancy outcomes in Saudi populations. A multicenter cohort study called "Riyadh Mother and Baby Cohort Study" by Wahabi et al - conducted in Riyadh - involved a total of 14,568 pregnant women who delivered between November 2013 and March 2015. This multicenter study reported that 68% of the mothers were either overweight or obese, 24% suffered from gestational diabetes, and 1.1% suffered from preeclampsia. Furthermore, the prevalence of preterm deliveries was 9%, with 1.5% as post-term deliveries.[21]

Related follow-up subgroup analysis reports published from the same cohort study (by Wahabi et al) revealed other findings relating the influence of obesity among pregnant women to an increased risk of gestational diabetes, hypertensive events in pregnancy, an induction of labor, failed labor induction, and delivery by cesarean section.[22] Similarly, another follow-up report identified an increased risk of hypertensive events among mothers who had experienced excessive gestational weight gain.[23] Furthermore, follow-up analysis identified that Saudi women had a high prevalence of gestational and pregestational diabetes. This increased the risk of macrosomia, preterm delivery, stillbirth, and neonatal intensive care unit admission.[24]

Other investigations conducted in Saudi Arabia assessed factors associated with adverse maternal and neonatal outcomes. A study was conducted within the city of Al-Kharj by Al-Saleh et al between 2005 and 2006 to measure exposure to heavy metals such as lead, cadmium and mercury during pregnancy and define its association with the birth outcomes of 1578 women. It illustrated that birth weight was influenced by cadmium levels.[25] Another cohort study conducted in Riyadh by Al-shaikh et al involved a sample of 3327 women. It reported that 27.2% of the women in the sample had a history of miscarriage and that this rate was significantly higher among women with grand multiparity.[26] A similar study conducted in Jeddah with 1586 women identified both a higher prevalence of gestational diabetes and higher rates of cesarean delivery among older women.[27]

Studies measuring the prevalence of adverse birth outcomes and their associated factors are currently limited in the southern regions of Saudi Arabia, including the Jazan region. This study aims to measure the prevalence of adverse birth outcomes and the associated factors among mothers from the Jazan region.

2. Methods

2.1. Context of the study

This was a cross-sectional investigation conducted between June and August of 2021. It targeted women who'd had a history of pregnancy and resided in Jazan, in southwestern Saudi Arabia. The Jazan Health Ethics Committee granted ethical approval for the study (approval number 2123—dated March 29, 2021). Identification of subjects was initiated in primary healthcare settings throughout the region.

2.2. Data collection tools

The data collection tool comprised a semi-structured questionnaire. It contained questions that were both open- and closed-ended and were included within the context of a face-to-face interview. The majority of the questions were closed-ended. The open-ended questions allowed the participating women to provide additional information related to pregnancy events and risk factors that were not conveyed in the closed-ended questions. The questionnaire was developed in the Arabic language to enable an easier process of data collection from the targeted population.

The questionnaire was designed to assess data about the demographics, morbidity, and reported adverse birth outcomes of participants, as well as maternal complications during pregnancy. The demographic data included the age, educational level, social status, and consanguinity of the patients, along with the number of children and any history of morbidity—in terms of chronic conditions. Also tracked were their areas of residence and any use of drugs (khat) or consumption of tobacco products. Finally, data pertaining to complications and adverse birth outcomes were collected via inquiries about each pregnancy, presence of complications during each pregnancy, and the number and presence of adverse birth outcomes during each pregnancy. In terms of case definitions of adverse birth outcomes, miscarriage was defined as the loss of pregnancy before 20 weeks gestation,[28] preterm birth as any birth before the completion of 37 weeks gestation, and early-term birth as any birth between 37 0/7 weeks through 38 6/7 weeks of gestation. Late birth was defined as a birth during 40 0/7 weeks through 41 6/7 weeks of gestation.[29] LBW was defined as a birth weight of <2500 g,[30] while high birth weight was defined as a birth weight of more than 4000 g.[31] Stillbirth was defined as fetal death during or after completion of 20 gestational weeks,[32] while neonatal death was defined as death during the first 28 days after birth.[33]

The validity of the questionnaire was assessed through a series of multiple steps. The comprehensive scope of the questionnaire, in terms of its ability to measure demographics, obstetric risk factors, and adverse birth outcomes was assessed by a panel of experts involving a consultant in epidemiology, a specialist in family medicine, and a neonatologist who evaluated the questionnaire's content and its ability to measure the items needed to address the study's research questions. Additionally, a pilot study was conducted that comprised interviews of twenty women from the targeted population to test the clarity of the questions and determine the time needed to complete the interview. In order to reduce the occurrence of measurement bias, the interviews were conducted by trained medical students who had attended a workshop on how to perform the study.

2.3. Data collection process

This study targeted adult women with a history of pregnancy in the Jazan region. Women older than 60 years were excluded to reduce the probability of recall bias regarding events related to their pregnancies. Additionally, those who expressed interest in taking part but did not complete the interview were excluded.

Subjects were recruited through several steps. A poster was created to advertise the study and delivered to various primary care settings in the area. It provided information about the study and contact details for the research team. Patients who were interested in participating then met with the research team and scheduled a face-to-face interview. Verbal informed consent was obtained before the interviews were initiated. Data was collected from the participants under a guarantee of anonymity - no identification data was gathered. Interviews were conducted in private clinical settings to ensure the privacy of participating women.

Several studies were conducted in Saudi Arabia to measure the prevalence of adverse birth outcomes and their links to different demographic characteristics. A substantial variability of the prevalence of adverse outcomes and the types of measured adverse events was observed. For example, the prevalence of the observed adverse birth outcomes varied between 0% of the prevalence of stillbirth among mothers diagnosed with Aerobic vaginitis[34] 1, and 61.3% prevalence of LBW among mothers suffering from anemia.[35] A midpoint prevalence of 30.65% was used to calculate the required sample size using the StatCal

function of EpiInfo. Assuming a 5% margin of error and a 99% confidence level, the required sample size is 564 mothers with adverse birth outcomes.

Patients who completed the recruitment process were advised to recommend the study to their relatives, neighbors, and friends. They were, in turn, invited to participate in order to increase the response rate and demographic diversity of the study sample. The invitations given by the respondents to their acquaintances enabled the recruitment of many patients, including the illiterate. Given the impossibility of having a specific framework to allow random sampling, this investigation relied on purposeful, appropriate, nonrandom sampling to meet the required sample size.

2.4. Data analysis

Data was analyzed via the Statistical Package for Social Sciences software. For binary and categorical data, we utilized frequencies and proportions to generate a summary. For continuous data, the mean and standard deviations were used to summarize the normal data, while the median and interquartile range values were employed to summarize non-normal data. Moreover, several categorical and continuous variable types were grouped into binary variables to enable an easier comparison between the groups in the study, thereby reducing the number of empty cells. Selection of the cutoff points to proceed with binary classification was done via an estimation of the continuous variables' mean values. For categorical variables, including educational level, occupation, marital status, and follow-up location, women with lower than a secondary education were compared to those with a secondary (or higher) education; married women were compared to those unmarried at the time of recruitment; employed women were compared to those who were unemployed, students, or housewives; women who reported a family income of <10,000 Saudi Arabian Riyal (SAR) per month were compared to those who reported a monthly income of more than 10,000 SAR; and women who reported being married to their first-degree cousins were compared to those who were not. Chi-squared and Fisher's Exact tests were used to compare the distribution of demographic and obstetric risk factors according to the historical presence of adverse birth outcomes. A P value of .05 was presumed to be statistically significant for the applied statistical tests.

3. Results

In this study, a total of 1344 participants were identified, of which 29 women were excluded for not meeting the inclusion criteria. A total of 1315 women with a cumulative history of 4950 pregnancies were involved in the current investigation. Demographic characteristics of the recruited women are displayed in Table 1. The mean age of the participants is 33.1 years, and the median body mass index (BMI) is 25.3. The majority of the participants were Saudis (94.6%), married (92.8%), housewives (50.5%), and possessed a bachelor's degree (59.9%). Thirty-two percent of the women were married to their first-degree cousins. One-quarter of the sample reported having a monthly family income of <5000 SAR, 74% reported owning their residence and a majority reported that they can reach their nearest primary healthcare center in less than half an hour (94.8%).

Table 2 illustrates obstetrics history, history of morbidity, and history of khat and tobacco usage. The median number of pregnancies among the recruited women is 3. Ninety-eight women (7.5%) reported using pregnancy aids, and 53 women (4%) reported having twins. Among the reported history of chronic morbidities, obesity was the most frequently described (8.9%), followed by hypertension (6.8%), and polycystic ovarian syndrome (6.3%). However, it must be noted that upon

calculating the BMIs of participants - based on their reported height and body weight - the number of mothers who had a BMI of 30 or more was 280 (21.5%). This variation suggests that some of the participating women were not aware of the fact that, according to their estimated BMIs, they could be seen as obese individuals. Finally, the most common means of exposure to tobacco products was via passive smoke inhalation, by 420 women (31.9%). This was followed by hookah smoking (7.4%). Only 29 women (2.2%) reported any history of using khat.

Table 3 illustrates the reported history of pregnancy-related complications and adverse birth outcome events across the 4950 pregnancies. The most frequently reported pregnancy-related complications were vaginal inflammation (4.5%), followed by urinary tract infection (4.9%) and hard physical exertion (3.7%). Among the recruited sample of women, the total number of adverse birth outcome events were 1009. The most frequently reported adverse birth outcomes were miscarriages - with a total of 597 (12.1%) - followed by premature birth (2.3%), and underweight birth (1.9%). Among the identified 613 women who reported a minimum of 1 adverse birth outcome, the number of adverse birth outcome for each woman varied from 1 to 8 events.

The distribution of reports encompassing at least 1 adverse birth outcome among the recruited women - according to

Table 1

Demographic characteristics of 1315 women with a history of pregnancy from Jazan, Saudi Arabia.

Variables:	
Age: mean [SD]	33.1 [9.4]
BMI: median [IQR]	25.3 [22.2–29.2]
Nationality: frequency [%]	
Saudi	1244 [94.6%]
None Saudi	71 [5.4%]
Marital status	
Married	1220 [92.8%]
Divorced	53 [4.0%]
Widowed	42 [3.2%]
Relationship	
No relation	670 [51.0%]
Cousins	421 [32.0%]
Related to some tribe	224 [17.0%]
Employment	
Student	203 [15.4%]
Governmental employee	335 [25.5%]
Private employee	52 [4.0%]
Private business	14 [1.1%]
Housewife	664 [50.5%]
Other	47 [3.6%]
Educational status	
Illiterate	70 [5.3%]
Elementary	91 [6.9%]
Intermediate	84 [6.4%]
Secondary	253 [19.2%]
Bachelor	788 [59.9%]
Postgraduate	29 [2.2%]
Family income	
<5000 SAR	329 [25.0%]
Between 5000 and 10000 SAR	501 [38.1%]
Between 10000 and 150000 SAR	301 [22.9%]
More than 15000 SAR	184 [14.0%]
Residence type	
Owned	977 [74.3%]
Rented	338 [25.7%]
Time to nearest PHC	
<30 min	1247 [94.8%]
Thirty min or more	68 [5.2%]

IQR = inter quartile range, PHC = primary health care, SAR = Saudi Arabian Riyal, SD = standard deviation.

Table 2

Reported obstetric history, history of morbidity and khat chewing, and tobacco products consumption among 1315 women with a history of pregnancy from Jazan, Saudi Arabia.

Variables	
Obstetric history:	
Number of pregnancies: median [IQR]	3 [2-5]
History of using pregnancy aids: frequency [%]	98 [7.5%]
History of twinning: frequency [%]	53 [4.0%]
History of morbidity: frequency [%]	
Diabetes	69 [5.2%]
Hypertension	90 [6.8%]
Asthma	71 [5.4%]
Immune diseases	10 [0.8%]
Epilepsy	3 [0.2%]
Thyroid disorder	71 [5.4%]
PCOS	83 [6.3%]
Depression	35 [2.7%]
Kidney disease	20 [1.5%]
Cardiac disease	11 [0.8%]
Obesity	117 [8.9%]
Anemia	81 [6.2%]
History of smoking and khat chewing: frequency [%]	
Cigarettes smoking	14 [1.1%]
Hooka smoker	97 [7.4%]
Khat chewing	29 [2.2%]
passive smoking	420 [31.9%]

IQR = inter quartile range, PCOS = polycystic ovarian syndrome.

Table 3

Reported history of pregnancy related complications events and adverse birth outcomes of 4950 pregnancies among 1315 women from Jazan, Saudi Arabia.

Variables:	Events frequency [%]
Pregnancy related complications events	
Gestation diabetes	43 [0.9%]
Gestational hypertension	87 [1.8%]
Hard physical exertion	183 [3.7%]
Rh incompatibility	12 [0.2%]
Vaginal inflammation	225 [4.5%]
UTI	240 [4.9%]
Gestational infection	6 [0.1%]
Placental disorders	51 [1.0%]
Blood transfusion	77 [1.5%]
Adverse birth outcomes events	
Preterm birth	116 [2.3%]
Late birth	48 [1.0%]
Underweight	92 [1.9%]
Overweight	17 [0.3%]
Miscarriage	597 [12.1%]
Stillbirth	63 [1.3%]
Neonatal death	39 [0.7%]
Born with defects and deformities	31 [0.6%]
Intrauterine growth restriction (IUGR)	6 [0.1%]

UTI = urinary tract infection.

measured demographic variables, histories of morbidity, and pregnancy-related events are displayed in Table 4. Reports of a minimum of 1 adverse birth outcome were higher among women who stated a family income of more than 10,000 SAR, women who were first-degree cousins of their husbands, and women with less than a secondary level education (P values of <.05). Assessing the distribution of adverse birth outcome histories according to BMI levels shows a higher frequency of adverse birth outcomes among women with BMIs higher than 18, in comparison with those having BMI levels below 18 (P value of .009). Within the measured

history of comorbidities, the proportion of women who reported adverse birth outcomes was higher among women with histories of hypertension and anemia (P values of <.05). Similarly, women who reported the use of pregnancy aids had a higher frequency of adverse birth outcomes (P value of .02). Finally, women with histories of having twins, of more than 3 pregnancies, or of complications during pregnancy or delivery reported a higher incidence of adverse birth outcomes (P values <.001).

4. Discussion

This was a cross-sectional study that included 1315 mothers with a total history of 4950 pregnancies. They attended different primary healthcare centers throughout the Jazan region of Saudi Arabia. The aims of this study were to assess the prevalence of adverse birth outcomes and the related prevalence of risk factors involving the mothers. The total number of adverse birth outcome events was 1009 - with miscarriage the most frequently reported, followed by premature birth. A total of 613 women reported a minimum of 1 adverse birth outcome during their pregnancies. The prevalence of women with a history of at least 1 adverse birth outcome was greater among women with a higher monthly income, women married to their first-degree cousins, women with lower levels of education, women with higher BMI levels, women with histories of hypertension and anemia, women with histories of twins and the use of pregnancy aids, and women with a greater number of pregnancies.

The findings of our investigation may be compared with similar local and international research. A cohort study was conducted by Wahabi et al in Riyadh, with a sample of 14,586 women. In this study, 24% of the recruited women were married to first-degree cousins and 22% were exposed to secondhand smoke.[21] The proportion of women married to their first-degree cousins and of those exposed to secondhand smoke were relatively higher in our sample, at 32% and 31.9%, respectively. Among the reported adverse birth outcomes described by Wahabi et al, premature birth was most frequently recorded (9%), which is higher in comparison with the proportion of women reporting preterm birth (2.3%). Nonetheless, methodological variation between our current investigation and the study by Wahabi et al must be considered when comparing adverse birth outcome assessments. For example, the study by Wahabi et al did not assess the incidence of miscarriage - the most frequently reported adverse birth outcome in our study.

In another investigation conducted in Riyadh by Al-Shaikh et al - which recruited a sample of 3327 women in a tertiary healthcare facility[26] - the proportion of women reporting a history of miscarriage was 27.2%; this is similar to our finding, where miscarriage was the most frequently reported adverse birth outcome. Nonetheless, the study by Al-Shaikh et al identified gestational diabetes as the most frequent pregnancy-associated complication (12.6%). This result diverged from our findings, in that urinary tract infections were more often reported.

Comparing our investigation to studies conducted in international settings served to identify several areas of both similarity and variation. In an Ethiopian cross-sectional study involving a sample of 580 pregnant women, the proportion of women who reported having a child with an adverse birth outcome was 18.3%.[36] In a similar Ethiopian study involving a sample of 576 births, the prevalence of an adverse birth outcome was 21%.[37] The prevalence in both Ethiopian studies was smaller than the identified prevalence in our sample (46.6%). The high prevalence of adverse birth outcomes is chiefly explained by the frequency of reported miscarriages.

A larger scale Chinese study by Lin et al included a total of 43,403 women. Lin et al compared the prevalence of adverse birth outcomes according to the presence of anemia. LBW, preterm labor, neonatal complications, and neonatal intensive

Table 4

Distribution of reporting a minimum of 1 adverse birth outcome according to demographic variables, history of morbidity, and pregnancy related events among 1315 women from Jazan, Saudi Arabia.

Variables	History of a minimum of 1 adverse birth outcome			P value*
	Yes	No	Total	
Demographic variables				
Nationality				.111
Saudi	573[46.1%]	671[53.9%]	1244[100%]	
None Saudi	40[56.3%]	31[43.7%]	71[100%]	
Evolvement				.727
Non-employed	401[46.3%]	466[53.7%]	867[100%]	
Employed	212[47.3%]	236[52.7%]	448[100%]	
Education				**.046**
Less than secondary education	128[52.2%]	117[47.8%]	245[100%]	
Secondary education and above	469[45.1%]	572[54.9%]	1041[100%]	
Family income				**.005**
<10000 SAR	362[43.6%]	468[56.4%]	830[100%]	
10000 SAR or more	251[51.8%]	234[48.2%]	485[100%]	
Relationship to husband				**.021**
None 1st degree cousins	397[44.4%]	497[55.6%]	894[100%]	
1st degree cousins	216[51.3%]	205[48.7%]	421[100%]	
Ever Khat chewing	19[65.5%]	10[34.5%]	29[100%]	.058
Ever cigarettes smoking	11[78.6%]	3[21.4%]	14[100%]	**.027**
Ever hooka smoking	43 [44.3%]	54[55.7%]	97[100%]	.673
History of morbidity				
Diabetes	40[58.0%]	29[42.0%]	69[100%]	.062
Hypertension	55[61.1%]	35[38.9%]	90[100%]	**.004**
Asthma	34[47.9%]	37[52.1%]	71[100%]	.903
Immune disease	8[80.0%]	2[20.0%]	10[100%]	.052
Epilepsy	2[66.7%]	1[33.3%]	3[100%]	.601
Thyroid disorders	34[47.9%]	37[52.1%]	71[100%]	.903
PCOS	46[55.4%]	37[44.6%]	83[100%]	.111
Depression	19[54.3%]	16[45.7%]	35[100%]	.393
Kidney disease	11[55.0%]	9[45.0%]	20[100%]	.503
Cardiac disease	7[63.6%]	4[36.4%]	11[100%]	.364
Anemia	49[60.5%]	32[39.5%]	81[100%]	**.011**
BMI				**.009**
Underweight	19 [37.3%]	32 [62.7%]	51[100%]	
Normal BMI	242 [43.1%]	320 [56.9%]	562[100%]	
Overweight or obese	347 [50.8%]	336 [49.2%]	683[100%]	
Pregnancy related events				
Number of pregnancies				
Three or less	247[33.2%]	497[66.8%]	744[100%]	<.001
More than 3	366 [64.1%]	205[35.9%]	571[100%]	
History of use of pregnancy aids	57[58.2%]	41[41.8%]	98[100%]	**.020**
Twinning	39[73.6%]	14[26.4%]	53[100%]	**<.001**
Complications during pregnancy or delivery	191[65.6%]	100[34.4%]	291[100%]	**<.001**

The significance of bold values is <0.05.

BMI = body mass index, PCOS = polycystic ovarian syndrome, SAR = Saudi Arabian Riyal.

* All applied statistical tests were Chi-squared test except for the distribution according to presence of history of immune disease or epilepsy, ever cigarettes smoking where Fisher's Exact test were applied.

care unit admissions were higher among anemic pregnant women in comparison with those who were not anemic.[38] Considering the methodological variation between the study by Lin et al and the current investigation, it is possible to argue that similar results could be presented if a higher overall prevalence of adverse birth outcomes were detected in our investigation due to the presence of anemia among the women.

In addition to the identified higher prevalence of reported adverse birth outcomes among women with anemia, a higher prevalence of reported adverse birth outcomes was detected among women with histories of other chronic conditions such as obesity and hypertension. These findings are consistent with the results of other investigations. A study by Yang et al indicated that maternal overweight and obesity are associated with an increased risk of such adverse birth outcomes as preterm birth and macrosomia.[39] Similarly, a higher risk of adverse birth outcomes was reported among pregnant women with elevated blood pressure.[40] The identified similarity of findings in the current investigation to other national or international efforts suggests a possible generalization of the findings to similar community-based settings.

4.1. Strengths and limitations

This study has certain strengths and weaknesses. One strength is that the data was collected via a personal, face-to-face participant interview, including those with lesser levels of education. A limitation is that some mothers did not remember the entire history of their earlier births, thereby increasing the risk of recall bias. Despite limiting the study sample to women younger than 60 at the time of recruitment, we cannot neglect the probability of the occurrence of recall bias. However, it must be noted that this study was able to collect variables related to pregnancy and its associated adverse events that are not routinely collected in the medical files of healthcare facilities in the Jazan region. Finally, another limitation of the study has to do with the reliance on nonrandom sampling to reach the study participants.

Nonetheless, it can be argued that the recruited sample was representative of women with a wide range of variable demographic characteristics, including some who are illiterate and others with limited levels of education.

5. Conclusion

In conclusion, this study found a relatively high prevalence of adverse birth outcomes, with the most frequently reported being miscarriage. Comparing the frequency of women with a history of adverse birth outcomes to those with no such history indicated that women with lower educational levels and higher monthly incomes - who are married to their first-degree cousins, have a history of chronic disease such as obesity, hypertension, or anemia, and have experienced complications during pregnancy or delivery - were higher among the group of women with a minimum of 1 adverse birth outcome. Further investigations are needed to assess factors associated with the high frequency of miscarriage. Furthermore, these findings have preventive and clinical implications concerning the targeting of pregnant women with histories of obesity, anemia, consanguinity, and hypertension with better antenatal care services in order to reduce the potential incidence of adverse birth outcomes. This targeted intervention can include efforts to raise the awareness about adverse birth outcomes among women throughout the region, enhancing pregnancy planning among at-risk women, and encouraging antenatal follow-up protocols.

Author contributions

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