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Awareness of Infectious Diseases and their Effects on Pregnancy Outcome among Married Women in Riyadh, Saudi Arabia

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Abstract:
The aim was to assess the knowledge and awareness onInfectious diseasesduring pregnancy and their effect on pregnancy outcome among married or previously married women living in Riyadh, Saudi Arabia. ***Materials and Methods:****A questionnaire was prepared online by Google Forms containing three sections: demographic data, health disorders during pregnancy, and selected infectious diseasesand their complications on pregnancy outcome. A rating scale format was applied with agree, do not know, and do not agree options. A pilot study was performed and evaluated for validity. The questionnaire was distributed through social media networks targeting married women across Riyadh, Saudi Arabia.* ***Results:****A data of (491) respondents was analyzed,(40.4%) were among the 25-34 age group, and (60.3%)indicated a bachelor'sdegree.Of the sample a (45.2%)reported previous complications with pregnancy, mainly anemia in (33.9%), followed by gestational diabetes in almost (28%). More than two thirds (67.8%) were oblivious that Zika virus could result in microcephaly in infants(P= 0.012). Only (19.3%) of thesample knew that congenital heart diseases, deafness, autism, and cataractsmay occur in thedeveloping fetus when the mother is infected with the rubella virus(P= 0.038).While (62.7%)knew that toxoplasmosis in pregnant womanmay lead to miscarriage or preterm birth(P= 0.009).More than three quarters (75.4%)were unaware that hepatitis B and Cviral infections can increase the possibility of gestational diabetes, preterm birth and congenital defects(P= 0.037).Complication of herpes virus infection on the fetus was not recognized by almost three quarters of the subjects(P= 0.001).*
Conclusion: *The level of awareness among married and previously married women in Riyadh city regardinginfectious diseasesand their effects on pregnancy outcome was inadequate despite the reported education level.*

Keywords: *awareness, women,infectious diseases, pregnancy outcome, Saudi Arabia.*

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I. Introduction

Pregnancy, a state of carrying a developing embryo or fetus during aperiod of nine months within the female's womb, is considered a critical period for both the mother and her child.(1) During this period, the woman's body and its homeostasis are challenged by several physiological changes due to the hormonal alterations occurring concurrently with gestation.(2) These changes include hematological, cardiovascular, respiratory, and immunological shifts.(2) The exposure to such systemic alterations potentiate the susceptibility to various infectious diseases, which not only affects the pregnant woman but displays a direct risk on the developing fetus.The cardinal threats of serious infection during pregnancy are a group of infections compiled in the acronym TORCH.(3) TORCH includes Toxoplasmosis, Other (syphilis, varicella-zoster, Hepatitis B, Human Immunodeficiency Virus), Rubella, Cytomegalovirus, and Herpes infections as the most common infections associated with congenital anomalies.(3) Moreover, it is noted that Zika virus, which poses an exceptional health risk on pregnant women, has received an international concern as its rapid spread is associated with increasing dissemination of microcephaly.(4,5) It has been established that prenatal infections are responsible for 2% to 3% of all congenital anomalies.(6) Consequences of prenatal infections on the fetus include neurological and cardiovascular deficits, mental and psychomotor retardation, preterm delivery, miscarriage, and stillbirth.(7)

In order to reduce the incidence of prenatal infections and their threatening squeal, it is essential for women in the childbearing age to be aware of such infections, their route of transmission, most susceptible time for infection, and methods of prevention.[8] In the United States, a report from the University of Chicago measuring awareness regarding Zika virus found significant gaps in Americans' understanding of Zika, including its method of transmission and its health consequences. [9] Furthermore, a study by Chatterjee *et al.* (2006) has reported that human immunodeficiency virus (HIV) spread vastly among married women who were previously viewed as low risk individuals. With the increased tendency of married women to become pregnant, it would thereby become significant to educate pregnant women about the virus to prevent risks on the fetus as well. [10]In the current literature, it is evident that several studies have been conducted internationally to measure public awareness regarding infectious diseases and their effects on pregnancy outcome. However, a lack of these studies measuringthe knowledge and awareness among women nationally in Saudi Arabia was evident. Collection of such data will be a beneficial tool for policy makers in planning and implementing educational and preventive programs for women within the childbearing agegroup. Furthermore, it will aid clinicians with appropriate counseling of pregnant women on preventive measures. Therefore, the purpose of this study was to assess the level of knowledge and awareness regardinginfectious diseases during pregnancy and their effects on pregnancy outcome among married or previously married women living in Riyadh, Saudi Arabia.

II. Materials And Methods

The present study was conducted as a cross sectional questionnaire-based survey targeting married or previously married women living in Riyadh, Saudi Arabia. The approval to conduct the study was obtained from the College of Dentistry Research Center (CDRC) at King Saud University. The consent of the respondents was based on their approval to initiate and complete the online questionnaire. The questionnaire was prepared online through Google Forms containing the following three sections: 1. Demographic data (includingage group educational level, social status, and number of children,). 2. Health complications during pregnancy and related information.3.Knowledge regarding selectedsystemic infectious diseasesand their complications on pregnancy outcome. A rating scale format was applied with agree, do not agree, and do not know options. The questions were formulated to state wrong and correct facts to adequately analyze the knowledge level. The inclusion criteria involved married or previously married women to be Saudi nationals or residents living in Riyadh city.
The questionnaire was distributed in Arabic language through social media networks targeting married or previously married women across Riyadh from January 2017 to April 2017. A pilot studyon20 participants was performed and evaluated for validity.

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 21 software (SPSS Inc., Chicago, IL, USA). The frequencies and percentages for all nominal variables was performed. Chi-square test was used. The Pearson's Correlation Coefficient was calculated to find the relationship between the dependent variables (knowledge) and independent variables (levels of education, age groups, marital status, complications developed during pregnancy, and to those who have children and those who do not have children). All statistical analyses were set at a significance level of $P<0.05$.

III. Results

A total of (525) females responded to the questionnaire, within a given age range. Thirty-four respondents did not meet the inclusion criteria and were excluded. The dataof (491)replies was analyzed. Most of the sample (95.7%) were married. A considerable percentage (40.4%) were among the age range of 25 to 34 year, followed by (35.4%) among 35 years and above. A bachelor's degree of education was reported by (60.3%) of the sample, a low education level had the least response rate of (4.1%) as illustrated in Table 1. The majority (83.6%) had children with 13.4% of who reported two children. More than forty percent (45.2%) reported health complications during their pregnancy. Interestingly, the highest percent of these complications was reported during the first pregnancy (41.6%), reduced to (30%)in the second pregnancy, and increased again during the third and fourth pregnancy to (32%) and (35.6%), respectively. Acommon reported complicationwas anemia among (33.9%), followed by gestational diabetes and preterm delivery among (27.9%)and(24.3%), respectively. As illustrated in Table 2.

Almost one third of the sample (32.2%) knew that Zika virus can be transmitted through a mosquito bite. However,more than two-third of the respondents(61.9%) did not know the route of transmission. More than two thirds of the sample (67.8 %) were unaware that Zika virus could result in microcephaly in infants, and only (17.1%) were aware about the signs and symptoms of Zika virus infection such as rash, arthritis and conjunctivitis. Around two thirds of the respondents(65.6%)were unaware that the infant can acquire rubella if the mother is infected during the last three months of pregnancy. Furthermore, only (19.3%) knew that congenital heart diseases, deafness, autism, and cataracts may occur in the developing fetus when the mother is infected with the rubella virus. More than half of respondents did not know that toxoplasmosis can be transmitted to pregnant woman through direct contact with the soil or cats' feces with (58.7%) and(52.5%),

respectively. On the other hand, (62.7%) were aware of the complication that toxoplasmosis in pregnant woman can lead to miscarriage or preterm birth. Furthermore,(47.9%)of the respondents,were aware of the timing of such critical complications to appear,the first trimester rather than the last trimester, as shown in Table 3.

In addition, only (15.5%) of respondents, were aware of hepatitis B virus vaccine efficiency in preventing the transmission of the virus to the fetus during pregnancy. Moreover, almost one quarter of the respondents (24.6%) falsely believed, that infants infected with hepatitis C can be treated immediately after birth and were unaware of the fact that it was considerably easier to treat hepatitis B than hepatitis C infection, their lack of awareness was;(69.5%) and (66.6%), respectively. Similarly, around three quarters of the sample (75.4%)did not know that infection with hepatitis B and C viruses can increase the possibility of gestational diabetes, preterm birth and congenital defects. As shown in Table 4. Additionally, the study revealed that(60.7%)were unawarethat Herpes virus infection in the last trimester increases the likelihood of infecting the fetus. Whereas, only(20.6%) were aware ofits symptoms in affected infant such as fever, epileptic seizures, skin ulcers and infant mortality. More than one third(36.3%)of the respondents knew that complications of syphilis during pregnancy could lead to preterm birth and miscarriage. Moreover, (77.2 %)were unaware that infants infected by syphilis during pregnancy can be treated.Among the studied sample, (38.7%) perceived that pregnant women with HIVinfection have a higher rate of mortality than uninfected women. Furthermore, (20.8%) recognized that infant of an HIV infected mother's might not be infected. Additionally, (62.5%)of the respondents lacked the knowledge that natural childbirth increases thelikelihood of HIV transmission to infants. As shown in Table 4.

IV. Discussion

The present study investigated the level of knowledge and awareness concerning systemic infectious diseases during pregnancy and their effects on pregnancy outcome among married or previously married women living in Riyadh, Saudi Arabia. Viral infections including Zika virus, toxoplasmosis, rubella, herpes simplex virus, and hepatitis C virus among others have been reported in numerous occasions worldwide presenting with serious complications to both the pregnant mother and the fetus.[11-16]Zika virusinfection, for example, has been declared as a "public health emergency of international concern" by the World Health Organization (WHO) on February 2016 due to its neurological complications as well as it results in neonatal deformities including microcephaly and central nervous system (CNS) malformations.[17,18] Nevertheless, (67.8 %) of the studied sample lacked awareness of the fact that Zika virus could result in microcephaly in infants, and while Zika virus could also result in a rash, arthritis and conjunctivitis, merely (17.1%) of the sample were aware of such complications.[19] Additionally, only (32.2 %) were aware of the fact that Zika virusinfection is transmitted to humans by a mosquito bite. The lack of awareness demonstrated in all three questions further revealed a statistically significant association with the sample's lowerlevelsof education P value at 0.031, 0.012, and 0.009, respectively, as evident in Table 3. Moreover, older age groups lacked knowledge of the fact that Zika virus is transmitted to humans by a mosquito bite (P=0.02).Furthermore, rubella has been described to infect the vascular system of the developing fetus via transmission through the placenta causing cytopathic destruction of the blood vessels resulting in ischemia.[13] This, in turn, may result in the development of congenital heart disease, deafness, autism, and cataracts in the developing fetus when the mother is infected with rubella virus.

Nevertheless, only (19.3%)were aware of such effects,this lack of awareness was correlated with those who reported no complications during pregnancy (P=0.038) and those with low levels of education (P=0.029).Additionally, responses on toxoplasmosis, which is an infection developed from the intracellular protozoan parasite *Toxoplasma gondii*. [12] A lack of knowledge on toxoplasmosis's means of transmission through direct contact with a cats' feces displayed a statistically significant difference with the sample's older age groups (P=0.044). Nevertheless, an increased number of respondents (62.7%)answered correctly when suggesting that the complications of toxoplasmosis in pregnant woman may lead to miscarriage or preterm birth demonstrating a statistically significant difference with womenwho have children (P=0.044),also with older age groups (P=0.004), and who reported the presence of complications during pregnancy (P=0.009).

Approximately six percent (5.9%)had awareness concerning the treatment of hepatitis C, as evident in Table 4. This lack of awareness was shown to be statistically significant with older age groups(P=0.003) in addition to lowerlevelsof education (P=0.031).A lack of awareness was also detected with lower levels of education demonstrating a statistically significant difference with hepatitis B and C potential complications (P=0.037) in addition to complications of herpes virus infection in infants (P=0.001).Older age groups' lack of knowledgehasbeen further associated with the complications of syphilis during pregnancy (P=0.018) with only (36.3%) of the respondents answering correctly. Moreover, the absence ofcomplications developing during pregnancy has shown to have a statistically significant difference with the sample's lack of knowledge concerning the possible risk of transmission of HIV to infants (P=0.021).

A potential limitation of the present study is due to its distribution through the social media platform. Nevertheless, the social media was aimed to be used to attain an adequate number of respondents while clearly

stating our target sample: married or previously married women living in Riyadh, Saudi Arabia. Furthermore, it should be noted that the lack of knowledge and awareness displayed by the sample is likely to be due to the potential lack of interest to gain knowledge about the subject at hand in addition to the lack of education material presented by the physician and the health educational programs.

V. Conclusion

The present study concluded that there is a lack of knowledge and awareness in regard toinfectious diseases during pregnancy and their effects on pregnancy outcome among women living in Riyadh, Saudi Arabia. Educational and preventive programs should be implemented to improve the knowledge and prevent infectious diseasesdeveloping to both the mother and fetus.

Physicians are also advisedto present their patients with knowledge regarding infectious diseases and their adverse effects during pregnancy to raise further awareness on such matter.

DECLARATION

Acknowledgment
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Conflict of Interest
The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Table (1): Description of the sample by age, marital status, and level of education.

Age		
Characteristic	Frequency	Percentage
19 and below	56	11.4
20-24	63	12.8
25-29	102	20.8
30-34	96	19.6
35-39	68	13.8
40 and above	106	21.6
Total	491	100.0
Marital Status		
Characteristic	Frequency	Percentage
Married	470	95.7
Divorcee	14	2.9
Widow	7	1.4
Total	491	100.0
Education Level		
Characteristic	Frequency	Percentage
Intermediate School	20	4.1
High school	109	22.2
Bachelor's degree	296	60.3
Master's degree	40	8.1
PhD	26	5.3
Total	491	100.0

Table (2):Description of the sample by pregnancy related complications.

Characteristic	**Yes**		**No**	
Had pregnancy complications	237	45.2%	210	54.8%
Type of pregnancy complications				
Gestational diabetes	70	27.9%		
Hypertension	36	14.3%		
Anemia	85	33.9%		
Preterm delivery	61	24.3%		
Depression	46	18.3%		
Others	42	16.8%		
Occurrence of pregnancy complications				
First	104	41.6%		
Second	75	30%		
Third	80	32%		
Fourth or more	89	35.6%		

Table (3):Description of the responses of the sample to questions about knowledge on infectious diseases and their complications on pregnancy outcome.

	Question	**Correct**		**Wrong**		**Do not know**		**P-value**
1	Zika virus is transmitted bymosquito bite.	158	32.2%	29	5.9%	304	61.9%	0.02*[2] 0.009*[3]
2	Infants infected with Zika virus have microcephaly.	125	25.5%	33	6.7%	333	67.8%	0.031*[3]
3	Zika virus causes rash, arthritis and conjunctivitis.	84	17.1%	26	5.3%	381	77.6%	0.012*[3]
4	Infants gets rubella virus if mother is infected during last three months of pregnancy.	54	11%	115	23.4%	322	65.6%	0.641
5	Congenital heart diseases, deafness, autism, and cataracts occur in the developing fetus when mother is infected withrubella virus.	95	19.3%	44	9%	352	71.7%	0.029*[3] 0.038*[4]
6	Toxoplasmosis can be transmitted to a pregnant woman by direct contact with soil.	119	24.2%	84	17.1%	288	58.7%	0.629
7	Toxoplasmosis can be transmitted to pregnant woman by direct contact with a cats' feces.	210	42.8%	23	4.7%	258	52.5%	0.044*[2]
8	Complications of toxoplasmosis can	308	62.7%	8	1.6%	175	35.6%	0.044*[1]

	result in miscarriage or preterm birth.							0.004*[2] 0.009*[4]
9	Toxoplasmosis has more dangerous complications in the first trimester compared to the last trimester.	235	47.9%	9	1.8%	247	50.3%	0.570

*[1] Statistically significant with those who have children
*[2] Statistically significant with age groups
*[3] Statistically significant with education level
*[4] Statistically significant withcomplicationsduring pregnancy group

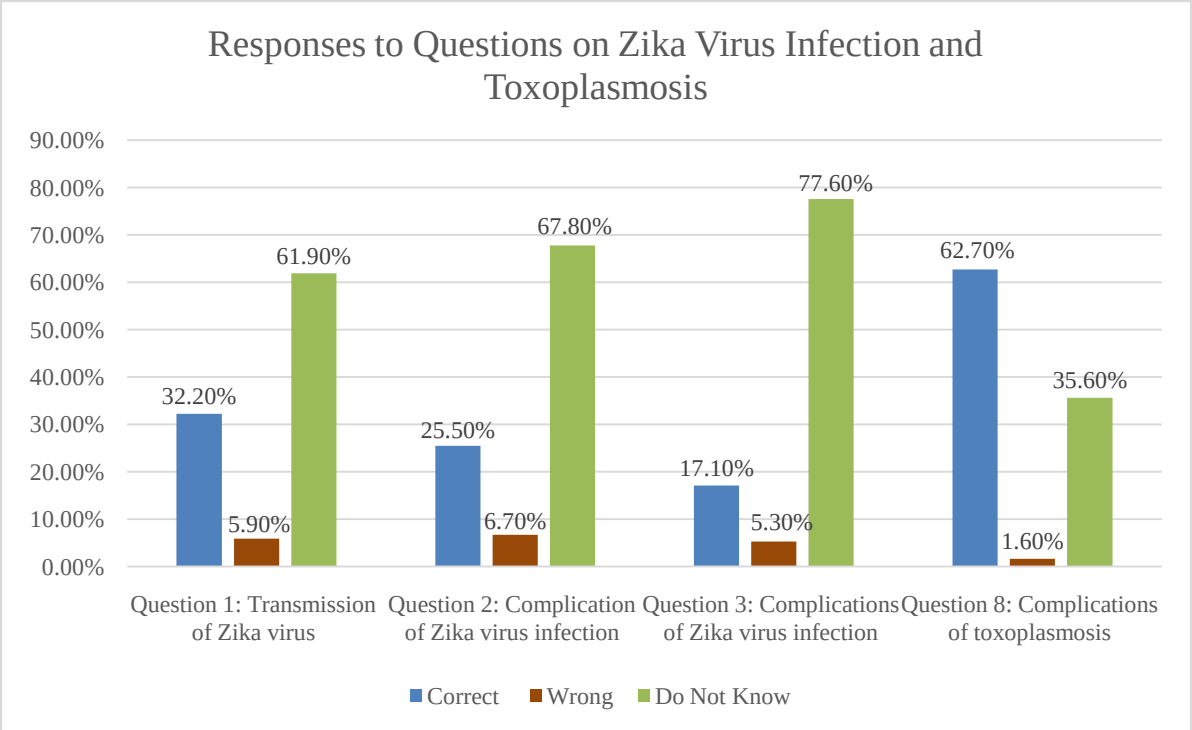

Figure (1): Bar Chart representing the Responses to Specific Questions with Statistically Significant results.

Table (4):Description of the responses of the sample to questions on Sexually Transmitted diseases and their complications on pregnancy outcome.

	Question	Correct		Wrong		Do not know		P-value
1	Hepatitis B vaccination is efficient in preventing transmission of virus to the fetus	76	15.5%	51	10.4%	364	74.1%	0.853
2	Hepatitis C virus infection can be treated directly after birth.	29	5.9%	121	24.6%	341	69.5%	0.003*[2] 0.031*[3]
3	Hepatitis B infection is easier to treat compared to hepatitis C.	60	12.2%	104	21.2%	327	66.6%	0.910
4	Hepatitis B and C viral infections increase risk of gestational diabetes, preterm birth and congenital defects.	89	18.1%	32	6.5%	370	75.4%	0.037*[3]
5	Herpes virus infectioninlast trimester may infectthe fetus.	129	26.3%	64	13%	298	60.7%	0.608
6	Herpes virus infection can cause fever, epileptic seizures, skin ulcers and mortality to the infant.	101	20.6%	24	4.9%	366	74.5%	0.001*[3]
7	Complications of syphilis may lead to preterm birth and miscarriage.	178	36.3%	14	2.9%	299	60.9%	0.018*[2]
8	Infants infected by syphilis during pregnancy can be treated.	61	12.4%	51	10.4%	379	77.2%	0.250
9	HIV infected mother have a higherrate of mortality than uninfected one.	190	38.7%	27	5.5%	274	55.8%	0.281
10	HIV infected mother's infant will not be infected.	102	20.8%	140	28.5%	249	50.7%	0.990
11	Natural childbirth increases the risk of HIV	89	18.1%	95	19.3%	307	62.5%	0.021*[4]

	transmission to infants.							

*[1] Statistically significant with those who have children
*[2] Statistically significant with age groups
*[3] Statistically significant with education level
*[4] Statistically significant withcomplicationsduring pregnancy group

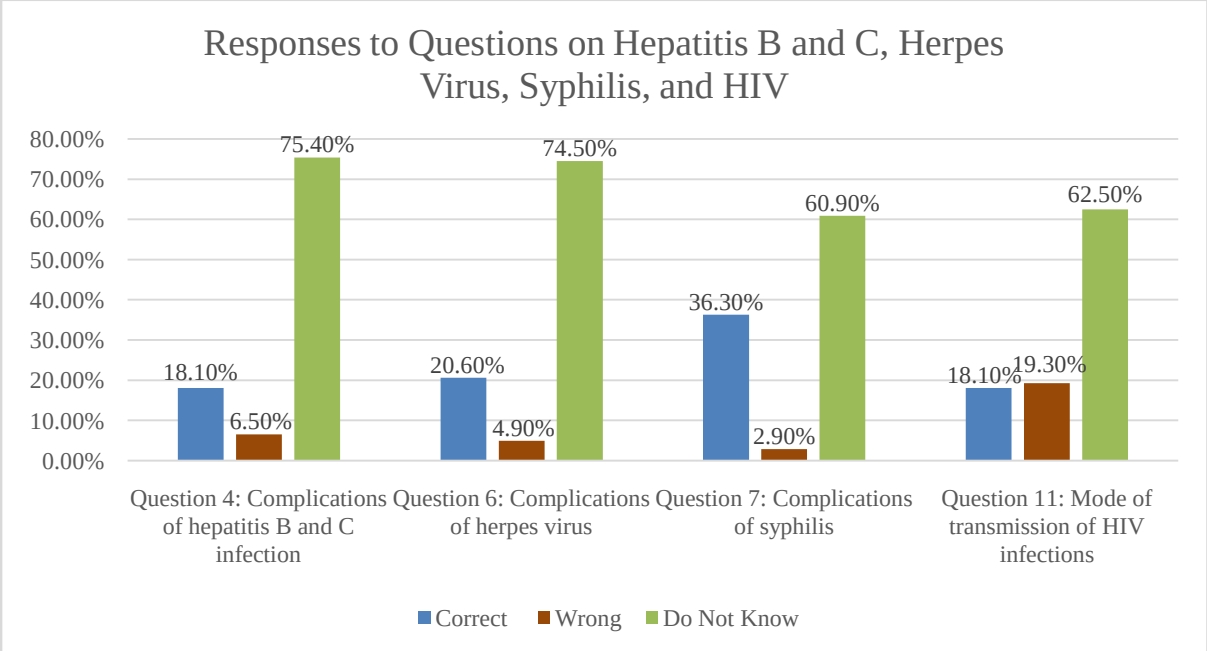

Figure (2): Bar Chart representing the Responses to Specific Questions on Sexually Transmitted Diseases with Statistically Significant results.

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