Determinants of Tetanus Toxoid Vaccination Use among Pregnant Women

Azza Fouad El-Adham[1], Anaam Ebrahim El-Nagar[2], Shimaa Mohamed Hashem[3].

[1]Assistant professor of Maternal and Neonatal Health Nursing, Faculty of Nursing, Tanta University, Tanta, Egypt

[2,3]Lecturer of Maternal and Neonatal Health Nursing, Faculty of Nursing, Tanta University, Tanta, Egypt

Abstract: Tetanus or trismus is an infection triggered by Clostridium tetani. Socio demographic characteristics, obstetric history, as well as knowledge and attitudes of pregnant women can be determinants of tetanus toxoid vaccination use among pregnant women. Despite widespread availability and safety of tetanus toxoid vaccine, little is known about determinants of its use among pregnant women. **Aim of the study**: was to identify determinants of tetanus toxoid vaccination use among pregnant women. **Subjects and Method: Design:** A cross sectional study design was used to implement this study. **Setting:** This study was conducted at out-patients' clinics of obstetrics departments of: Tanta University Hospitals, El-Menshawy General Hospital, El-Mogamaa El-Teby Hospital, Doctor Mohamed Mashally Medical Center at Said and Medical Center at Segar. **Subjects:** A purposive sample of 300 pregnant women was selected from the previously mentioned settings. **Tools of data collection:** Three tools were used for data collection: **Tool I:** Pregnant women's socio demographic characteristics and obstetrics' history questionnaire, **Tool II:** Pregnant women's knowledge regarding tetanus and tetanus toxoid vaccination questionnaire, and **Tool (III):** Pregnant women's attitudes regarding tetanus toxoid vaccination questionnaire. **Results:** The study proved that nearly two thirds of the studied pregnant women had low level of knowledge regarding tetanus and tetanus toxoid vaccination with negative attitudes among more than one half of them and three quarter had no information about benefits of tetanus toxoid vaccination. The studied pregnant women who were more careful to take the vaccine aged less than 25 years to less than 35 years old, and those who were still pregnant or primipara. **Conclusion:** Age, gravidity, parity, as well as knowledge, and attitudes were determinants of tetanus toxoid vaccination use among pregnant women. **Recommendations:** Knowledge, attitudes, age, gravidity, and parity should be carefully assessed especially by maternity nurses. Educational programs during pregnancy should focus on enhancing knowledge and attitude of pregnant women regarding tetanus toxoid vaccination use to reduce maternal and neonatal mortality and morbidity rates.

Keywords: Knowledge, Attitudes, Determinants, Tetanus Toxoid Vaccination.

Introduction

Tetanus is a bacterial non-communicable disease triggered by Clostridium tetanus in unvaccinated women who have low immunity. [1,2,3] It can occur due to unhygienic miscarriages, abortion, labor/delivery, and poor umbilical cord care practices. [4,5]

Although maternal and neonatal tetanus (MNT) can be prevented with vaccination, it continues to be a leading cause of morbidity and mortality in developing countries. [5,6]

Maternal tetanus is defined as tetanus acquired during pregnancy, after abortion, miscarriage, or within 6 weeks post-delivery. [2,7,8] It is characterized by generalized hypertonia (painful muscle spasms of the jaw and neck). [9]

Neonatal tetanus affects neonates born to pregnant women who did not receive the tetanus toxoid vaccine. They acquire the disease through the umbilical stump in the first 28 days of their life. [2,10] Symptoms of

neonatal tetanus in the majority of cases start within the first 3 to 14 days of their life with the inability to suckle, progresses to widespread stiffness or rigidity and excruciating muscle spasms. [6,11,12] Neonatal tetanus leads to death of about 30848 neonates in 2017 (the most recent year for which estimates are available). [13,14]

Tetanus is a vaccine preventable disease. [15] So, maternal and neonatal tetanus deaths could be prevented through vaccination of pregnant and childbearing women with at least two tetanus toxoid vaccine (TTV) doses, regardless of when they had their last dose. The ideal time for receiving the vaccine is between the 27^{th} and the 36^{th} weeks of pregnancy. [2, 15,16,17]

Receiving the (TTV) during pregnancy helps to protect the woman and her neonate against tetanus during childbirth. [12,18] and for three months after delivery or postpartum, [12] due to formation of the vaccine antibodies in the maternal body and their transfer to the fetus across the placenta. In this regard, some studies addressed that vaccination reduced neonatal tetanus mortality by 94%. [2,15,16]

Thus, the WHO and the Ministry of Health and Population in Egypt, recommended that all women should receive at least five doses of TTV during their reproductive age [19,20] to develop tetanus-protective antibodies that last for around 3, 5, 10, and 30 years. [7,21]

The World Health Organization (WHO) also proposed three major strategies to avoid maternal and neonatal tetanus infection. The first is high coverage of tetanus toxoid vaccination (TTV) among pregnant women. The second is clean delivery, and the third is availability of appropriate action for management of cases in high-risk locations. [15,22] Many determinants can affect and contribute to insufficient TTV uptake. [23]

Antenatal care visits and utilization of adequate antenatal care services are important and provide convenient times to assess pregnant women socio demographic characteristics, obstetrics' history, as well as their knowledge and attitude regarding tetanus toxoid vaccination and to provide them with the TTV. [22,24]

Tetanus toxoid vaccination use among pregnant women can be affected by determinants such as socio-demographic characteristics as (age, current marital status, residence, educational level, occupation, religion and family income, and place of delivery). [12,22,23] Furthermore, joint health decision of pregnant women with their husbands, the decision maker related to health issues, distance from health facilities, and fear of side effects are determinants impact vaccination utilization. [25]

Obstetrics' history of the pregnant women as (gravidity, age at childbearing, parity, mode of previous delivery, duration of current pregnancy, time of the initial antenatal visit, place of antenatal care, number of antenatal visits, reasons for antenatal visits and the decision maker related to health issues) can also be determinants for tetanus toxoid vaccination use. [26]

Knowledge about tetanus and tetanus toxoid vaccination is a crucial determinant of tetanus toxoid vaccination use among pregnant women. Misinformation about vaccination can affect, especially if the health care providers fail to provide adequate information and education regarding its benefits, importance, and effectiveness. [10,12,27,28,29,30,31]

Moreover, previous studies reported that beliefs or attitudes, such as tetanus vaccine could be harmful to the neonate are vital determinants that prohibit TTV, [4,27,32,33] as well as misconception thoughts that the primary healthcare organizations only have the responsibility for women's TTV. [27]

So, maternity nurses have a pivotal role in improving TTV use and prevention of future cases of maternal and neonatal tetanus through proper assessment of pregnant

women' socio demographic characteristics, obstetrics history, and knowledge and attitudes regarding tetanus toxoid vaccination. They can also enhance their knowledge about the TTV and consequently improving their attitudes regarding its use. [12, 23, 27,31]

Significance of the study

Maternal and neonatal tetanus is a worldwide life threatening disease. Its mortality approaches 100% without medical care. Tetanus toxoid vaccination of pregnant women is one of the most effective ways to protect against maternal and neonatal tetanus. Despite this fact, little is known about determinants that can prohibit tetanus vaccination use among pregnant women. [30,34,35,36] Therefore, it was crucial to conduct this study to identify the determinants of tetanus toxoid vaccination use among pregnant women.

Aim of the study

The aim of this study was to identify determinants of tetanus toxoid vaccination use among pregnant women**.**

Research Question

What are the determinants of tetanus toxoid vaccination use among pregnant women?

Subjects and Method

Research Design

A cross sectional study design was used to conduct this study.

Setting

This study was carried out at out-patients clinics of obstetrics departments of: Tanta University Hospital (Ministry of High Education), El-Menshawy General Hospital (Ministry of Health and population), El-Mogamaa El-Teby Hospital (Health Insurance), Doctor Mohamed Mashally Medical Center at Said, and Medical Center at Segar.

Subjects

- A purposive sample of 300 pregnant women was selected from the previously mentioned settings according to women's attendance flow rate at each setting:

Table (1): S**ample size** determination **of pregnant women according to their attendance flow rates** at the previously mentioned settings.

Name of hospital	Average number of women's attendance flow rate within 6 months	Number of selected cases
Tanta University Hospitals	100	(10 pregnan women)
El-Menshawy General Hospital	850	(90 pregnan women)
El-Mogamaa El-Teby Hospital	900	(90 pregnan women)
Doctor Mohamed Mashally Medica Center at Said	430	(40 pregnan women)
Medical Center a Segar	720	(70 pregnan women)
Total	**3000**	**300**

-The sample size and power analysis were calculated using Epi-Info software statistical package created by World Health Organization and center for Disease Control and Prevention, Atlanta, Georgia, USA version 2002.

- The calculation of sample size was estimated at 95% confidence limit.

-So, the sample size is determined to be (n >231).

-This number was increased to 300 to compensate for missing and improving quality of data of the study.

-The study subjects were selected according to the following **inclusion criteria**

- Primigravida or multigravida
- At any trimester of pregnancy
- And agreed to participate in the study.

While the exclusion criteria were

- Women not in their reproductive age
- Non pregnant women.

Tools of data collection

To achieve the aim of this study, three tools were developed and used for data collection:

Tool I: Pregnant Women's Socio Demographic Characteristics and Obstetrics' History Questionnaire

It was developed by the researchers after reviewing the recent related literatures to collect the basic data regarding the study subjects. It comprised two parts as follows:

-Part (1): Socio demographic characteristics of the pregnant women: It included seven close ended questions relate to age, current marital status, residence, educational level, occupation, religion, family income, and the decision maker related to health issues.

-Part (2): Obstetric history: This part included seven close ended questions related to gravidity, parity, mode of previous delivery, duration of current pregnancy, time of the initial antenatal visit, place of antenatal care, and number of antenatal visits. It also included two open ended questions related to age at childbearing, and reasons for antenatal visits.

Tool II: Pregnant Women's Knowledge regarding Tetanus and Tetanus Toxoid Vaccination Questionnaire

It was developed by the researchers after reviewing the recent related literatures. It comprised two parts as follows:

- **Part (1): Pregnant Women's Knowledge about Tetanus:** This part included two close question answered with yes=1 and no=0 (hear about tetanus disease, and know types of tetanus). It also included nine open-ended questions related to definition of tetanus, the causative organism, types of tetanus, definitions of maternal and neonatal tetanus, predisposing factors for maternal tetanus, causes of neonatal tetanus, signs and symptoms of maternal and neonatal tetanus, and prevention of tetanus.
- **Part (2): Pregnant Women's Knowledge about Tetanus Toxoid Vaccination:** This part included three close ended questions answered with yes=1 and no=0 (previous vaccination against tetanus, knowing about the tetanus toxoid vaccination schedule during pregnancy, and the importance of receiving tetanus toxoid vaccination dose in the second or third pregnancy). It also included seven open ended questions related to the importance of receiving tetanus toxoid vaccination during pregnancy, number of tetanus toxoid vaccination doses that should be received during first pregnancy, the appropriate time for receiving tetanus toxoid vaccination during pregnancy, maternal and neonatal consequences of not receiving tetanus toxoid vaccination during pregnancy, number of tetanus toxoid vaccination protection doses throughout the lifespan, available places for tetanus toxoid vaccination, reasons for not receiving the vaccine, and their sources of knowledge.

The scoring system of pregnant women's knowledge about tetanus and tetanus toxoid vaccination was as follows:

- Correct and complete answer was given a score of (2).
- Correct and incomplete answer was given a score of (1).
- Incorrect or don't know was given a score of (0).

The total score level of pregnant women's knowledge was calculated as follows:

– High level of knowledge >75% of the total score. Moderate level of knowledge 50%-<75% of the total score. Low level of knowledge < 50% of the total score.

Tool (III): Pregnant women's attitudes regarding taking Tetanus Toxoid Vaccination.

This tool was adapted from **Mehanna et al (2019) [4].** A three point Likert scale was used to assess pregnant women's attitudes regarding taking tetanus toxoid vaccination. It consisted of thirty one statements (17 positive

and 14 negative statements). The pregnant women responses to these statements were from agree, neutral, and disagree.

The scoring system of pregnant women's attitudes regarding taking Tetanus Toxoid Vaccination was as follows:

- The positive statement was scored as (2) if women's response was agree, (1) if it was neutral and (zero) if it was disagree.
- The negative statement was scored as (2) if women's response was disagree, (1) if it was neutral and zero if it was agree.

The total score level of pregnant women's attitudes was calculated as follows:

- Positive attitudes towards tetanus toxoid vaccination ≥ 60% of the total score.
- Negative attitudes towards tetanus toxoid vaccination < 60% of the total score.

Method

The study was implemented using the following steps.

1. **Administrative design:** - An official letter clarifying the purpose of the study was obtained from the Faculty of Nursing and submitted to the responsible authorities of the previously selected settings.
2. **Ethical considerations:** Approval of the ethical committee of Faculty of Nursing Tanta University was obtained. The studied pregnant women' informed consent was obtained to participate in the study after explanation of the study' purpose. The nature of the study did not cause any harm and/or pain for the entire sample. Also, confidentiality of information and privacy were ascertained and each subject had the right to withdraw from the study at any time if desired.
3. **Tools development**

- **Tool I and Tool II** were developed by the researchers after reviewing the relevant recent related literatures. **Tool III** was adapted from Mehanna et al (2019). The study tools were translated into Arabic language and tested for construct and content validity by a jury of 5 experts in the field of maternal and neonatal health nursing. The tools were tested for their validity which indicates 0.95 and 0.97 respectively. The reliability of the translated Arabic tools was tested by the pilot subjects at first interview and retested after two weeks as test-retest reliability for calculating Cornbrash's Alpha which was 0.875 and 0.880 respectively.

4. **Pilot Study**: After the development of the tools, a pilot study was be conducted on 10% of the total sample (30 pregnant women). The purpose of the pilot study is to test the clarity and applicability of the developed tools from the previously mentioned settings. The pilot study was conducted before the actual data collection. Accordingly the necessary modifications, and/or rephrasing, were done according to the results of this pilot study, then the tools made ready for use. Data obtained from the pilot study were excluded from the current study sample.
5. **Field work**

– Data collection were accomplished through face to face individual interview with each pregnant woman attending the outpatient clinics for antenatal follow up in the previously mentioned settings in the morning from 9:00 a.m. to 1:00 p.m. three times per week according to the identified days of the week for antenatal care over a period of six months from the first of September 2021 to the first of March 2022. The pre designed data collection questionnaire tools were used.

– The researchers introduced themselves to the pregnant women, got their informed consent, and then they distributed the questionnaire for each educated participant or the researchers fulfilled the questionnaire after asking the questions for each illiterate participant. .

– Filling the individual interview questionnaire needed from 20-30 minutes.

6. **Statistical analysis of the data:** Data were fed to the computer and analyzed using IBM

SPSS software package version 20.0**.** **(**Armonk, NY: IBM Corp**)** Qualitative data were described using number and percent. Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. Significance of the obtained results was judged at the 5% level.

The used tests were

1 - Chi-square test

For categorical variables, to compare between different groups

2 - Monte Carlo correction

Correction for chi-square when more than 20% of the cells have expected count less than 5

3 - Pearson coefficient

To correlate between two normally distributed quantitative variables

4 – Regression

To detect the most independent/ affecting factor for affecting vaccination against tetanus

Results

Table (2): Shows percent distribution of the studied pregnant women according to their **socio-demographic characteristics** (n = 300). It was observed that the age of more than one half of the studied pregnant women (53.0%) ranged from 25 to <35 years, with a mean age of 27.63 ± 6.0. As regards to their marital status, the majority (97.7%) of them were married. Concerning to their residence, nearly three quarters (72.3%) were from rural areas.

This table also reveals that slightly more than one third of them (34.0% and 34.7% respectively) had secondary school education / Diplome and university or postgraduate education. In relation to their occupation and family income, slightly more than four fifth (80.3% and 83.3% respectively) were house wives and had enough income.

Table (3): Illustrates percent distribution of the studied pregnant women according to their **obstetric history** (n = 300). It indicates that (66.7%) of the studied pregnant women were multigravida with a mean age at childbearing of 22.67 ± 3.28, almost one half (51.0% and 46.3% respectively) were multipara with a previous cesarean section, and slightly more than thre-e fifths of them (62.3%) were in the third trimester of their current pregnancy.

Table (3) also presents that slightly more than four fifths of the studied pregnant women (82.7%) had their initial antenatal visit during their first trimester. additionally, slightly more than three fifths (65.3%) had their antenatal care at private hospital or private doctor's clinic followed and nearly one half (45.7%) had their antenatal care at Maternal and Child Health Centers. It also displays that nearly three fifths of the studied pregnant women (56.7%) had five or more antenatal care visits. The main reasons for these were follow up, and receiving tetanus vaccination among (71.0% and 43.3% respectively).

Table (4): Demonstrates percent distribution of the studied pregnant women according to their **knowledge about Tetanus** (n = 300). It verifies that slightly more than one half (50.3%) of the studied pregnant women didn't hear about tetanus. Moreover, (89.3%, 57.0%, 90.0%, 63.7%, 84.4%, 50.7% and 58.3% respectively) of them didn't know any information about definition of tetanus, causative organism, types, definition of maternal and neonatal tetanus, causes of neonatal tetanus, as well as signs and symptoms of maternal and neonatal tetanus.

On the other hand, nearly one half (46.0% and 44.7% respectively) of the studied pregnant women knew that birth at unhygienic places, as well as wounds resulting from punctures, lacerations, minor scratch on the skin or burns are predisposing factors for maternal tetanus. Additionally, slightly more than one half (50.7%) didn’t know causes of neonatal tetanus, and nearly three fifths (58.0%) reported that tetanus can be prevented by vaccination.

Table (5): Exhibits percent distribution of the studied pregnant women according to their

knowledge about Tetanus Toxoid Vaccination (n = 300). It is eminent that nearly three fifths (56.7%) of the studied pregnant women didn't have previous vaccination against tetanus. Regarding importance of receiving the tetanus toxoid vaccine during pregnancy (55.7% and 49.0% respectively) knew that tetanus toxoid vaccination is important for preventing the mother from contracting the tetanus disease and that the vaccine protects the fetus the disease.

On the other hand, (61%, 42.3% and 43% respectively) of the studied pregnant women didn't know about schedule, doses during first pregnancy, and appropriate time for receiving the tetanus toxoid vaccination during pregnancy. Conversely, slightly more than three fifths (61.3%) of them Knew the importance of receiving tetanus toxoid vaccination doses during second and third or more pregnancies. Additionally, approximately three fifths (58.3%) reported that acquiring tetanus infection is a maternal consequence if pregnant woman didn't not receive tetanus toxoid vaccination.

However, (60.3% and 48.3% respectively) of the studied pregnant women didn't knew the neonatal consequences if pregnant woman didn't not receive tetanus toxoid vaccination, and didn't knew the number of tetanus toxoid vaccination protection doses throughout lifespan. Finally, slightly more than two fifths (42.7 % and 42.3% respectively) of them mentioned that governmental hospitals, as well as Maternal and Child Health Centers (MCH) /Health centers are the available places for tetanus toxoid vaccination.

Figure (1): Percent distribution of the **actual tetanus toxoid vaccination doses** among the studied pregnant women (n = 130). It illustrates that more than one third (36.9%) the studied pregnant women actually had one tetanus toxoid vaccination dose followed by more than quarter (28.5%) of them toke two doses.

Figure (2): Percent distribution of the studied pregnant women according to **reasons for not receiving the tetanus toxoid vaccination during pregnancy (n =170 who didn't receive the vaccine out of 300**). It displays that three quarter (74.7%) of the studied pregnant women didn't have any information about the benefits of tetanus toxoid vaccination during pregnancy.

Table (6): Explains percent distribution of the studied pregnant women according to their **total score level of knowledge, total score level of attitudes, and correlation between knowledge and attitude regarding tetanus and tetanus toxoid vaccination** (n = 300). It confirms that more than three fifths (68.7%) of the studied pregnant women had low total score level of knowledge about tetanus and tetanus toxoid vaccination with a mean total score of 12.94 ± 9.05. It also indicates that slightly more than one half (53.7%) of the studied pregnant women had negative attitudes regarding tetanus and tetanus toxoid vaccination with a mean total score of 38.93 ± 8.22. The table also shows a positive correlation between knowledge and attitude about tetanus and tetanus toxoid vaccination where r= 0.481 and p<0.001*.

Figure (3): Demonstrates percent distribution of the studied pregnant women according to their **sources of knowledge about Tetanus and Tetanus Toxoid Vaccination** (n = 300). It shows that pregnant woman's mothers, health care providers (doctors and nurses), and their mothers in law were the main sources of knowledge about tetanus and tetanus toxoid vaccination among (32%, 29.3%, and 21.7% respectively).

Figure (4): Shows percent distribution of the **decision maker related to health issues among the studied pregnant women** (n = 300). It illustrates that both the women and their husbands were the main decision maker

(45.7%), followed by their mothers in law and husband among (27.3%), and husband alone (20%), while only (7%) of the pregnant women can decide issues related to their health.

Table (7): Regression analysis of **determinants of tetanus toxoid vaccination use among pregnant women** (n= 300). All socio-demographic and obstetrics history variables, as well as knowledge and attitude variables were analyzed and studied to identify the determinants of tetanus toxoid vaccination use among pregnant women. The non-statistically significant variables that are not confirmed as determinants of tetanus toxoid vaccination use among pregnant women are not displayed in table (7). Only the statistically significant variables that are identified as determinants of tetanus toxoid vaccination use among pregnant women are presented in this table.

So, table (7) shows that maternal age, gravidity, parity, knowledge, and attitudes were significant predictive determinants of tetanus toxoid vaccination use among the studied pregnant women. Women whose their age from 25 to less than 35 (p= 0.043), COR 0.471(0.227-0.976) were more careful to have the tetanus toxoid vaccination. In addition to primigravida women (p= 0.001), COR 0.0.288 (0.140-0.594) respectively, those who were primiparas (p= 0.003), COR 0.434 (0.252-0.748) respectively, and women who had two children (p= 0.048), COR 0.532 (0.285-0.994) respectively.

On the other hand, the studied pregnant women who had low level of knowledge regarding tetanus toxoid vaccination (p= 0.003) COR 6.833 (1.033-45.186), as well as those who had negative (p= < 0.001), COR 7.930 (4.645-13.538) respectively were less careful to have the vaccine.

Table (2): Percent distribution of the studied pregnant women according to their socio-demographic characteristics (n = 300).

Socio-demographic characteristics of women	No.	%
Age (years):		
<25	103	34.3
25 – <35	159	53.0
≥35	38	12.7
Mean ± SD.	**27.63 ± 6.0**	
Marital status	293	97.7
Married	6	2.0
Divorced		
Widow	1	0.3
Residence:		
Rural	217	72.3
Urban	83	27.7
Educational level:		
Illiterate	21	7.0
Primary / preparatory	73	24.3
Secondary / Diplome	104	34.7
University / postgraduate	102	34.0
Occupation:	241	80.3
House wife	59	19.7
Employee		
Religion		
Muslim	293	97.7
Christian	7	2.3

Family income**		
Enough	250	83.3
Not enough	50	16.7

SD: Standard deviation ****According to woman's view**

Table (3): Percent distribution of the studied pregnant women according to their obstetric history (n = 300).

Obstetric history	No.	%
Gravidity:		
Primigravida	100	33.3
Multigravida	200	66.7
Age at childbearing:		
Mean ± SD.	22.67 ± 3.28	
Median	22.0	
Parity:		
Nullipara	90	30.0
Primipara	57	19.0
Multipara	153	51.0
Mode of previous delivery: (n = 210)		
Vaginal delivery	71	23.7
Caesarean section	139	46.3
Duration of current pregnancy:		
First Trimester (8- 12 weeks)	41	13.7
Second trimester (13-27 weeks)	72	24.0
Third trimester (28- 40 weeks)	187	62.3
Time of the initial antenatal visit:		
First Trimester	248	82.7
Second trimester	36	12.0
Third trimester	16	5.3
Place of antenatal care: **		
Governmental Hospital	67	22.3
Maternal and Child Health Centers	137	45.7
Private hospital/private doctor's clinic	196	65.3
Number of antenatal visits:		
Once	17	5.7
Twice	36	12.0
Three visits	36	12.0
Four visits	41	13.7
Five or more visits	170	56.7
Reasons of antenatal visit:**		
Follow up	213	71.0
Receive tetanus vaccination	130	43.3
Registration for delivery	35	11.7
Have complains	31	10.3

**** More than one answer**

Table (4): Percent distribution of the studied pregnant women according to their knowledge about tetanus (n = 300).

Pregnant women's knowledge about Tetanus (**More than one answer)	No.	%
Did you hear about Tetanus?		
Yes	149	49.7
No	151	50.3
Definition of Tetanus:		
Correct	32	10.7
Incorrect	268	89.3
Identify the causative organism of tetanus?		
Bacteria	102	34.0
Viruses	27	9.0
Don't know	171	57.0
Do you know types of tetanus?		
Yes	30	10.0
No or don't know	270	90.0
If you answer is yes; what are the types of tetanus? **	(n = 30)	
Neonatal tetanus	29	96.7
Maternal tetanus	26	86.7
Definition of maternal tetanus:		
- Maternal tetanus occurs during pregnancy or within 6 weeks of th end of pregnancy (Correct answer)	93	31.0
- Maternal tetanus happens to women of childbearing age	16	5.3
- Don't know	191	63.7
Definition of neonatal tetanus:		
Neonatal tetanus happens to children during the first year of life	25	8.3
Neonatal tetanus occurs within the first twenty-eight days of a child's life (Correct answer)	22	7.3
Don't know	253	84.4
What are the predisposing factors for maternal tetanus? **		
Birth in places that lack hygiene	138	46.0
Multipara	28	9.3
Caesarean section	41	13.7
Wounds resulting from punctures, lacerations, minor scratch on the skin or burns	134	44.7
Contamination of wounds by feces or saliva	65	21.7
Bite of animals or insects	63	21.0
Don't know	115	38.3
What are the causes of neonatal tetanus? **		
Preterm labour	25	8.3
Using non-sterile instruments to cut the umbilical cord	104	34.7
Transmission from mother to fetus	54	18.0
Don't know	152	50.7

What are the signs and symptoms of maternal and neonatal tetanus? **		
Cramps and stiffness in the jaw muscles	83	27.7
Difficult swallowing	56	18.7
Dry cough	21	7.0
Muscle spasms, especially in the neck, back, chest and limbs	97	32.3
Diarrhea	21	7.0
Headache, fever and sweat	49	16.3
Changes in blood pressure or increased heart rate	44	14.7
Muscle spasms that are usually preceded by the infant's inability to suck or breastfeed and excessive crying	56	18.7
Don't know	175	58.3
What are the measures of prevention of tetanus? **		
Vaccination	174	58.0
Birth in well-equipped and sterile places	100	33.3
Well Balanced diet	33	11.0
Don't know	100	33.3

Table (5): Percent distribution of the studied pregnant women according to their knowledge about tetanus toxoid vaccination (n = 300).

Pregnant women's knowledge about Tetanus Toxoid Vaccination	No.	%
Did you have previous vaccination against tetanus?		
Yes	130	43.3
No	170	56.7
**Identify the importance of receiving tetanus toxoid vaccination during pregnancy? ** **		
Treatment	40	13.3
Preventing the mother from contracting the disease	167	55.7
Protection of the fetus from disease	147	49.0
Do not know	93	31
Do you know the tetanus toxoid vaccination schedule during pregnancy?		
Yes	117	39.0
No	183	61.0
What are the doses of tetanus toxoid vaccination should be received during first pregnancy?		
Single dose	34	11.3
Two doses	87	29.0
Three dose	23	7.7
Four dose	6	2.0
Five dose	23	7.7
Don't know	127	42.3
What is the appropriate time for receiving the tetanus toxoid vaccination during pregnancy?		
Within the first 12 weeks of pregnancy	50	16.7
The period between 26 week to 36 week of pregnancy	121	40.3
Don't know	129	43.0
Do you know the importance of receiving tetanus toxoid vaccinatic dose in the second or third pregnancy?		
Yes	184	61.3

No	116	38.7
What are the maternal consequences of not receiving tetanus toxoid vaccination during pregnancy? More than one answer **		
Had tetanus	175	58.3
Muscle paralysis occurs	30	10.0
Muscle contraction	39	13.0
Die	50	16.7
Premature birth	45	15.0
What are the neonatal consequences of not receiving tetanus toxoid vaccination during pregnancy? More than one answer **		
The newborn has birth defect	54	18.0
Neonatal death	80	26.7
Had neonatal tetanus	7	2.3
Nothing happen	11	3.6
Don't know	181	60.3
What is the number of tetanus toxoid vaccination doses throughout life?		
Single dose	9	3.0
Two doses	11	3.7
Three dose	22	7.3
Four dose	14	4.7
Five dose	99	33.0
Don't know	145	48.3
What are the available places for tetanus toxoid vaccination? More than one answer **		
Governmental hospitals	128	42.7
Maternal & Child Health Centers (MCH) /Health centers	127	42.3
Pharmacies	17	5.7
Private doctors' clinics	11	3.7
Don't know	89	29.7

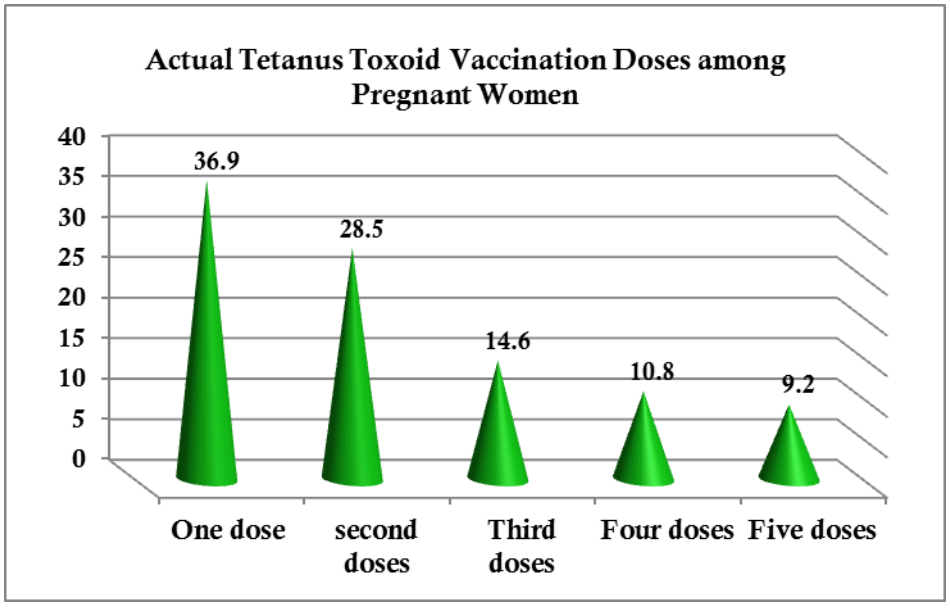

Figure (1): Percent distribution of the actual tetanus toxoid vaccination doses among the studied pregnant women (n = 130).

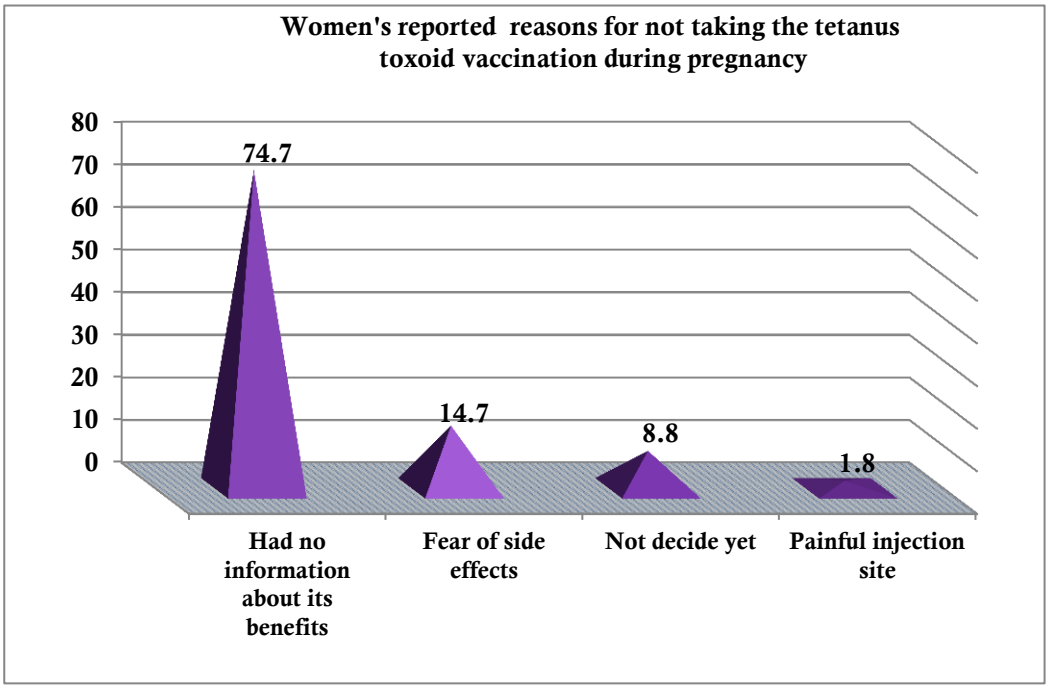

Figure (2): Percent distribution of the studied pregnant women according to their reported reasons for not receiving the tetanus toxoid vaccination during pregnancy (n =170 who didn't receive the vaccine out of 300).

Table (6): Percent distribution of the studied pregnant women according to their total score level of knowledge, total score level of attitudes, and correlation between knowledge and attitude regarding tetanus and tetanus toxoid vaccination (n = 300).

Total score level of knowledge about Tetanus and Tetanus Toxoid Vaccination	**No.**	**%**
Low level of knowledge < 50%	206	68.7
Moderate level of knowledge 50% - <75%	86	28.7
High level of knowledge ≥75%	8	2.7
Total score	**(0 - 40)**	
Min. – Max.	0.0 – 36.0	
Mean ± SD.	12.94 ± 9.05	
Median	13.0	
Total score level of attitudes regarding Tetanus an Tetanus Toxoid Vaccination	**No.**	**%**
Negative attitudes < 60%	161	53.7
Positive attitudes ≥ 60%	139	46.3
Total score	**(0-62)**	
Min. – Max.	15.0 – 56.0	
Mean ± SD.	38.93 ± 8.22	
Median	38.50	

Correlation between Knowledge and Attitude (n = 300)		
	Knowledge	
	R	**P**
Attitude	0.481*	<0.001*

r: Pearson coefficient

***: Statistically significant at p ≤ 0.05**

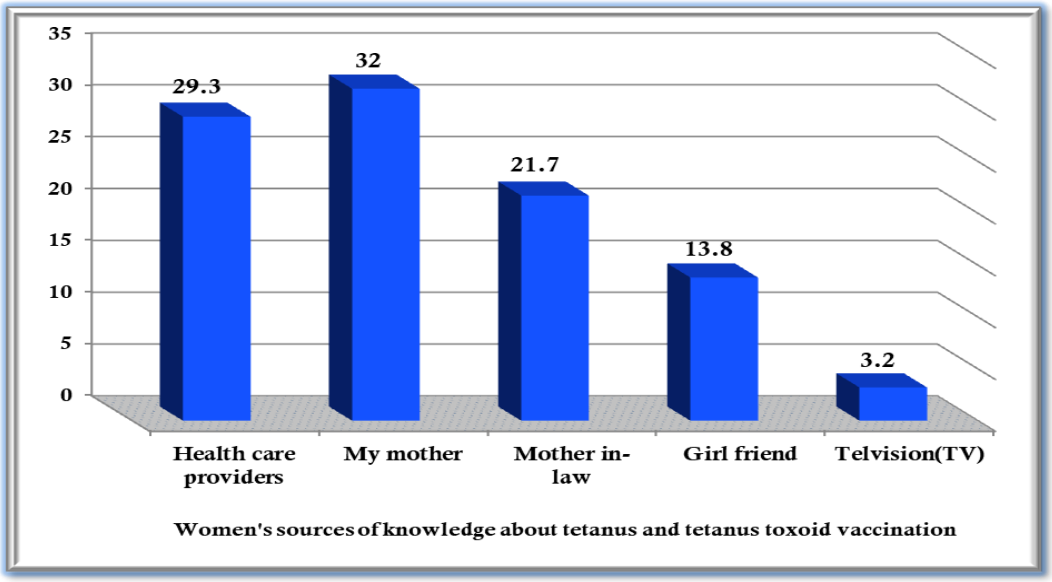

Figure (3): Percent distribution of the studied pregnant women according to their sources of knowledge about tetanus and tetanus toxoid vaccination (n = 300).

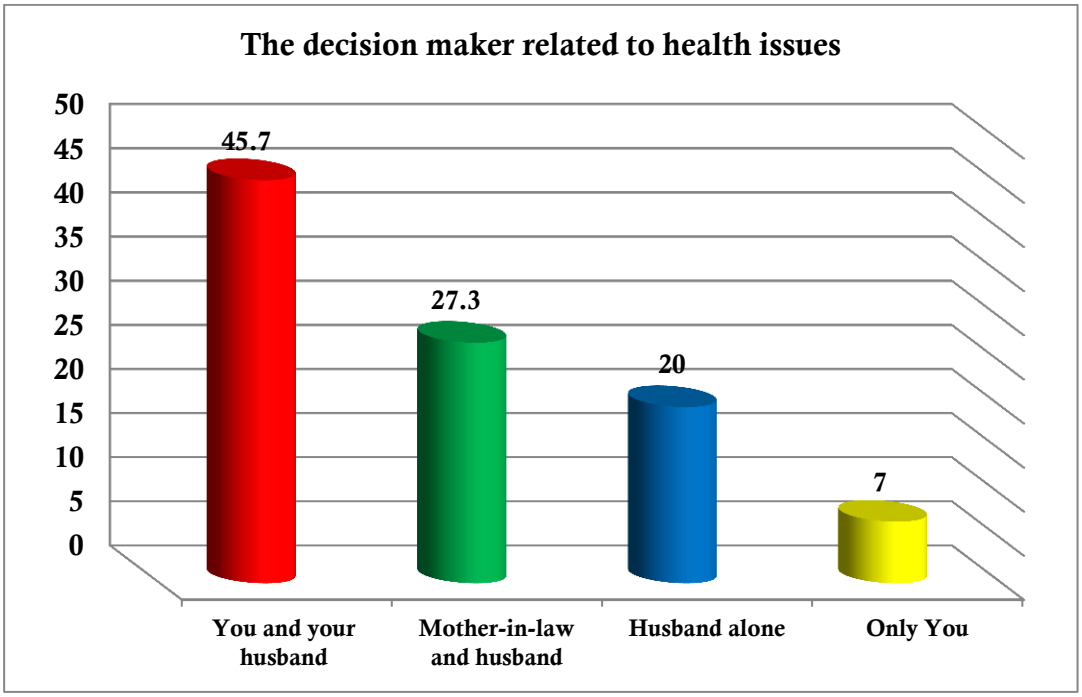

Figure (4): Percent distribution of the decision maker related to health issues among the studied pregnant women (n = 300).

Table (7): Regression analysis of determinants of tetanus toxoid vaccination use among pregnant women (n= 300).

Variables	Previous vaccination against tetanus							
	No (n = 170)		Yes (n=130)		p	COR (95%C.I)	p	AO (95%C.I)
	No.	%	No.	%				
Age (years)								
<25	68	40.0	39	30.0	0.286	0.684(0.340-1.375)	0.418	1.818 (0.427–7.737)
25 – <35	88	51.8	71	54.6	0.043*	0.471(0.227-0.976)	0.207	0.478 (0.152–1.503)
≥35®	14	8.2	20	15.4	-	-		
Gravidity:								
First pregnancy ®	72	42.4	28	21.5	-	-		
Two	52	30.6	48	36.9	0.001*	0.288(0.140-0.594)	0.194	2.141(0.679–6.751)
Three	26	15.3	27	20.8	0.286	0.684(0.340-1.375)	0.418	1.818 (0.427–7.737)
Four or more	20	11.8	27	20.8	0.515	0.769(0.349-1.695)	0.613	1.512 (0.305–7.502)
Parity:								
None	61	35.9	29	22.3	0.003*	0.434(0.252-0.748)	0.713	0.792(0.229–2.739)
The first birth	36	21.2	21	16.2	0.048*	0.532(0.285-0.994)	0.405	0.636(0.219–1.848)
More than once®	73	42.9	80	61.5	-	-		
Total score level of knowledge about Tetanus and Tetanus Toxoid Vaccination								
Low level of knowledge	164	96.5	42	32.3	0.003*	6.833 (1.033–45.186)	0.015*	12.96(1.64–102.484)
Moderate level of knowledge	4	2.4	82	63.1	0.046*	0.085(0.017–0.438)	0.054	0.173 (0.029–1.032)
High level of knowledge ®	2	1.2	6	4.6				
Total score level of attitudes regarding Tetanus and Tetanus Toxoid Vaccination								
Negative attitudes towards TTV	113	66.5	26	20.0	<0.001*	7.930(4.645–13.538)	<0.001*	5.613(2.710–11.624)
Positive attitudes towards TTV ®	57	33.5	104	80.0				

COR, crude odds ratio. AOR, adjusted odds ratio

C.I: Confidence interval LL: Lower limit UL: Upper Limit

#: All variables with p<0.05 was included in the multivariate *: Statistically significant at p ≤ 0.05

Discussion

Tetanus is one of the life-threatening diseases, which cannot be eradicated (spores of tetanus bacteria are everywhere in the environment).

However, maternal and neonatal tetanus (MNT) can be prevented. The easiest, fastest and most cost-effective preventive measure against MNT is vaccination of the pregnant women with the tetanus toxoid (TT) vaccine. Unfortunately many determinants can interfere with tetanus toxoid vaccination use among pregnant women. [37, 38]

The aim of this study was to identify determinants of tetanus toxoid vaccination use among pregnant women. A cross sectional study design was used to implement this study. The study was conducted at out-patients clinics of obstetrics departments of: Tanta University Hospitals, El-Menshawy General Hospital, El-Mogamaa El-Teby Hospital, Doctor Mohamed Mashally Medical Center at Said and Medical Center at Segar.

A purposive sample of 300 pregnant women was selected from the previously mentioned settings. Three tools were used for data collection: Tool I: Pregnant women's socio demographic characteristics and obstetrics' history questionnaire, Tool II: Pregnant women's knowledge regarding tetanus and tetanus toxoid vaccination questionnaire, and Tool (III): Pregnant women's attitudes regarding tetanus toxoid vaccination questionnaire.

The results of the present study revealed that as regard to socio-demographic; the age of more than one half of the studied pregnant women ranged from 25 to <35 years, with a mean age of 27.63 ± 6.0, the majority of them were married, nearly three quarters were from rural areas, slightly more than one third had secondary school education / Diplome and university or postgraduate education, slightly more than four fifth were house wives and had enough income.

In this regard, **Mamoro et al (2018)** [39] identified that based on residence, (84.8%) rural and (60.1%) of the mothers age falls in the range of 21–30 years with the mean age of 28 (±5.362) years, (98.2%) were married, (45.9%) mothers have no formal education, (94%), and mothers were housewife.

Moreover, **Orimadegun et al (2017),** [40] indicated that the mean age of the women was 27.9±3.4 years (range: 20-33), (93.0%) were married and living with their spouses, and the most frequent socioeconomic group was the middle class in rural (79.8%) and urban (80.0%) and none of the women fell into the high class in the urban. On the other hand, **Anatea et al (2018),** [23] demonstrated that the mean age was 29.25 years and the standard deviation + 5.11. The majority, 414 (99.5%), of the respondents were in the age group of 19–43 years.

Regarding obstetric history of the studied pregnant women, this study outlined that slightly more than two thirds of the studied pregnant women were multigravida with a mean age of 22.67 ± 3.28 at childbearing, almost one half were multipara with a previous cesarean section, and slightly more than three fifths were in the third trimester of their current pregnancy, slightly more than four fifths and slightly more than three fifths respectively had their initial antenatal visit during their first trimester, at private hospital or private doctor's clinic, and nearly one half had their antenatal care at Maternal and Child Health Centers, nearly three fifths had five or more antenatal care visits, and nearly three quarters and slightly more than two fifths respectively their main reasons for the

antenatal visits were follow up and receiving tetanus vaccination.

In this regard, **Faria et al (2021),** [41] revealed most women in their study were not primiparous, and presented median number of 8 prenatal consultations, which were mostly performed by doctors in the public network. Finally, the mean prevalence of women who did not take the tetanus vaccine has decreased by 0.65 times after each prenatal consultation ($p = 0.044$).

Concerning knowledge of the studied pregnant women about tetanus, the present study verified that slightly more than one half of them didn't hear about tetanus, the majority didn't know its definition, causative organism, and types of tetanus, around one half didn't know definition of maternal and neonatal tetanus, their causes, as well as signs and symptoms On the other hand, slightly more than two fifths reported that birth at unhygienic places, wounds resulting from punctures, lacerations, and minor scratch on the skin or burns are predisposing factors for maternal tetanus, and nearly three fifths stated that tetanus can be prevented by vaccination.

Although around one half of the studied pregnant women in the present study had information about the importance of receiving the tetanus toxoid vaccine during pregnancy; nearly three fifths of them didn't have previous vaccination against tetanus, around one half didn't know tetanus vaccination schedule, doses during first pregnancy, and appropriate time for receiving the tetanus toxoid vaccination during pregnancy.

Additionally, approximately three fifths reported that acquiring tetanus infection is a maternal consequence for not receiving tetanus toxoid vaccination, but they didn't knew its consequences on the neonates and the number of tetanus toxoid vaccination doses throughout lifespan. Finally, slightly more than two fifths mentioned that governmental hospitals, and Maternal and Child Health Centers (MCH) are the available places for tetanus toxoid vaccination.

In this concern, **Mehanna et al (2021),** [42] stated that the vast majority of women did not know or had incorrect information regarding the total number of TTV doses that should be taken during the reproductive age, more than one-third mentioned that the vaccine protected both the mother and her child, about half mentioned that TTV can protect from infections during delivery whatever the cause and only 8.9% recognized that the vaccine can protect from tetanus, less than one-fourth reported delivery or abortion in non-equipped places as the main cause of MNT, around two-thirds did not know the exact causes, symptoms, complications, and methods of protection against MNT.

The present study also illustrated that only fourty three percent of the studied pregnant women are previously vaccinated against tetanus, only slightly one quarter of them achieved the recommended WHO TT2+ vaccination doses, and nearly fifty seven percent did not have any tetanus toxoid vaccination dose during pregnancy. This is a major health challenge in eliminating the tetanus disease.

These results are consistent with **Mehanna et al (2020),** [4] who conducted a study regarding knowledge and health beliefs of reproductive-age women in Alexandria about tetanus toxoid immunization and clarified that (41%) of the sample size were vaccinated and only 27.7% achieved the TT2+ injections recommended by the WHO.

Oppositely, **Ahmed et al (2019),** [30] on their study about factors affecting maternal tetanus vaccination in Dakahlia Governorate, Egypt,

reported that about two thirds (63.2%) of the surveyed women received the full recommended doses of TT. Another study by **Hassan et al (2016)**, [35] about tetanus vaccination status and its associated factors among women attending a primary healthcare center in Cairo governorate, Egypt, showed that 60.6% had taken all required doses of TT vaccine and 42.6% of the mothers studied were fully protected against MNT in their last birth. In their study, the rate of vaccination was affected by mothers' socioeconomic level, education level, place of receiving antenatal care, health education about importance of TT vaccine, knowledge of mothers about NT disease and TT vaccine and the source of this knowledge.

This study reported that the main reason for not receiving the tetanus toxoid vaccination during pregnancy was that pregnant women didn't have any information about the benefits of tetanus toxoid vaccination during. This result is consistent with S. **Hasnain et al (2007),** [43] who presented that the most common reason (32%) was that the women did not know the importance of the TT vaccination, followed by 18% who did not know the correct place or time to get the vaccination. Other reported reasons included fear of injection and side effects of the vaccine, lack of awareness, misconceptions, lack of documentation, shortage of staff, religious and traditional factors and poor socio-economic status.

Furthermore, the decision maker related to their health issues were both the studied pregnant women themselves and their husbands, followed by their mothers in law and husbands or their husbands only. They can decide to take the vaccine because didn't have any information about the benefits of tetanus toxoid vaccination during pregnancy as stated by three quarters of them. **Otieno et al (2021)** [44]**,** disagreed with the present study. They illustrated that

Additionally, the present study confirmed that more than two thirds of the studied pregnant women had low total score level of knowledge about tetanus and tetanus toxoid vaccination with a mean total score of 12.94 ± 9.05, slightly more than one half of them had negative attitudes with a mean total score of 38.93 ± 8.22, and there is a positive correlation between knowledge and attitude about tetanus and tetanus toxoid vaccination ($r= 0.481$ and $p<0.001$*).

These results are in line with **Mehanna et al (2020),** [4] who displayed that more than three quarters of their studied women had poor knowledge about maternal neonatal tetanus and tetanus toxoid vaccination, as well as low perception of being susceptible to maternal neonatal tetanus and the majority of them were not aware about tetanus disease and TT vaccine.

In addition, **Ahmed et al (2019),** [30] supported the results of the present study. They indicated that nearly one half of unvaccinated women reported that their doctor did not motivate them to receive the TT vaccine. Likewise, **Tuan et al (2019),** [27] concluded that the greatest obstacle caused by the healthcare professionals is the lack of providing sufficient information about vaccine, not explaining the necessities of vaccine to patients and the perception of obstetricians in particular that only the primary healthcare organizations are responsible for TTV.

The current study determined that the studied pregnant women sources of knowledge about tetanus and tetanus toxoid vaccination were there mothers, health care providers (doctors and nurses), and their mothers in law. In this regard, **Jasim et al (2021),** [45] presented that

the majority of sources of knowledge in their study were from primary health center approximately (31%) of study sample were received their information about tetanus toxoid vaccine from television, (11.4%) from radio, (10.9%) from other sources (relatives or friends), (6.2%) from newspaper, (12.9%) from health center and (27.6%) more than one source.

Furthermore, the decision maker related to their health issues in this study were both the studied pregnant women themselves and their husbands, followed by their mothers in law and husbands or their husbands only. They cannot decide to take the vaccine because didn't have any information about the benefits of tetanus toxoid vaccination during pregnancy as stated by three quarters of them. Otieno eth al (2021) stated disagreed with the current study. They highlighted the important of stakeholders and lobby groups for acceptance of vaccine at the community level.

Additionally, the present results showed that primigravida and primipara women were more commitment to receive TTV compared to multigravida or multiparas. These results are supported by **Ahmed et al (2019), [30]** who proved that the highest percentage of fully vaccinated women was observed among women who experienced one pregnancy, while the lowest percentage of fully vaccinated women was among multigravida. From the researchers' point of view, primigravida women are keener to have antenatal care for keeping healthy growth and development of their neonates.

Several factors as socio-demographic and obstetric characteristics, level of knowledge and attitudes regarding tetanus and tetanus toxoid vaccination could affect the receiving of TTV among pregnant women. Moreover, **Tuan et al (2019), [27]** in their study about factors affecting tetanus vaccination and vaccination rate in pregnant women concluded that the greatest obstacles to receive the TT vaccination were the lack of knowledge about vaccination and the negative belief that vaccine may harm the baby.

Moreover, **Shafiq et al (2017), [46]** mentioned that the attitude of women and support from family towards the importance of TT vaccine were key findings. Participants were unvaccinated if the family was against vaccination (adjusted OR, 5.7; 95% CI, 2.33–13.93). Having another family member as a decision-maker about vaccination and healthcare seeking was associated with unvaccinated status (adjusted OR, 2.9; 95% CI, 1.31–6.58). Poor care seeking for antenatal care during pregnancy largely impacted on TT vaccination status (adusted OR, 2.2; 95% CI, 1.03–4.83) in all married women (pregnant and non-pregnant) (n = 272).

Conclusion

Age, gravidity, parity, as well as knowledge, and attitudes were determinants of tetanus toxoid vaccination use among pregnant women. Thus, the research question is answered and the aim of the study is met.

Recommendations

Knowledge, attitudes, age, gravidity, and parity should be carefully assessed especially by maternity nurses during antenatal care visits of the pregnant women.Educational programs implemented during pregnancy should focus on enhancing knowledge and attitude of pregnant women, as well as of maternity nurses regarding tetanus toxoid vaccination use, and access to booster doses, in order to reduce maternal and neonatal mortality and morbidity rates. Additionally, tetanus toxoid vaccination services should be made available for all pregnant women at all locations, and vaccination doses should be recorded in a

special certificate to be presented during antenatal follow up visits.

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