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TETANUS IMMUNIZATION STATUS AND KNOWLEDGE AMONG UNIVERSITY FEMALES AND DOCTORS AT WAD-MEDANI, SUDAN: A DESCRIPTIVE CROSS-SECTIONAL STUDY.

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Abstract

Background

Tetanus is a bacterial disease with the majority of reported cases being birth-associated due to unhygienic deliveries and lack of routine maternal vaccination, however, it can be prevented by routine vaccination. The current study aimed to determine tetanus vaccination status and knowledge among university females of childbearing age and the doctors who comprise an important category of maternal healthcare service delivery at Wad-Medani City, Sudan, based on the recommended WHO guidelines.

Methods

A descriptive cross-sectional survey was conducted using two types of researcher-administered questionnaires.

Results

The majority of the surveyed females were never (41.6%) or didn't know (22.4%) whether they were vaccinated or not, while some were incompletely vaccinated (26.4%), and few (9.6%) were completely vaccinated with the 5 doses of tetanus vaccine. The main reason for none or incomplete vaccination among the females was the lack of awareness (77.4%). On the other hand, 31% of the respondent doctors knew the correct target population to achieve maternal tetanus elimination as recommended by the documented guidelines with only 25% who knew the complete set of vaccine doses, while 63% were under the misconception that it should target only pregnant women or patients with wounds. Further analysis showed that females who have given birth to children or had a history of pregnancy were more likely to receive the complete 5 doses of the vaccine, while correct knowledge was found higher among doctors with advanced years of experience.

Conclusion

Tetanus vaccination coverage was relatively poor, and the main reason was the lack of knowledge about the vaccination program and its importance.

Recommendation

Improving public knowledge through media sources along with other guidance at healthcare facilities can play a vital role in imparting immunization. It is also necessary to ensure the availability of the vaccine and its accessibility for all females.

Keywords: *Childbearing age, Immunization, Tetanus, Vaccination.*
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Introduction

Tetanus disease could be considered as one of the most acute and fatal infections, it is caused by a gram-positive bacterium (*Clostridium tetani*) through its produced fatal exotoxins (1). As reported by Alex-Hart and Okoh, every year the disease kills a significant number of women and babies (2). Although the pathogen is widespread in the environment, the disease is not transmitted from one person to another, and it commonly occurs when bacterial spores are introduced into an injured or damaged tissue and start secreting their toxins (3). Most reported cases are birth-

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associated which occurred due to deliveries conducted in an unhygienic environment in addition to the lack of routine maternal vaccination with tetanus toxoid vaccine (2, 4). In sub-Saharan African countries, data showed that the mortality rate is more than 1000 fatalities among newborns due to tetanus per every 100000 (5). According to the findings of the Global Burden of Disease study (2015), there were 56743 cases of deaths due to tetanus, and among these deaths, 19937 occurred in neonates with 44% of these cases occurring in sub-Saharan Africa (6). It was also reported that there were approximately 30000 cases of maternal deaths due to tetanus every year which constitutes about 5% of maternal deaths, (7). Protection against tetanus can be achieved through routine immunization (no natural immunity) with tetanus toxoid-containing vaccine (TTCV) which could be available as a single one or in combination with other vaccines (8). Immunization against tetanus represents an effective tool with reports showing its efficacy in reducing maternal and neonatal tetanus mortality by 80-100% (9). The World Health Organization (WHO), in 1989, started the maternal and neonatal tetanus elimination program with an initial target of 1995 (10). For achieving maternal and neonatal tetanus elimination, the WHO stated a key strategy involving routine immunization to females of reproductive age (15-49 years) and children, with at least 90% vaccination coverage, especially in areas carrying a high risk of disease (7, 11). The stated WHO guidelines include a total of five tetanus vaccine doses for non-immunized or those with unknown immunization status (6). The United Nations International Children's Fund (UNICEF), the United Nations Population Fund (UNFPA), and the WHO, 1999, launched the Maternal and Neonatal Tetanus Elimination Initiative with a new target date of 2005, which was then extended to 2015 (10). In December 2020, the expected target again was not achieved and many countries were still yet to eliminate maternal and neonatal tetanus (5). Sudan is one of these countries, and although the expanded immunization program was first established in the country in 1976, information on the prevalence of maternal and neonatal tetanus vaccination is still scarce and rare (6).

The importance of this study relies on the evaluation of tetanus vaccination status, knowledge, and attitudes among females of reproductive age in a nationally representative population sample, and among doctors who comprise an important category of maternal healthcare service in our local community by the documented guidelines; Understanding the factors that could potentially affect the vaccination process, and to address if there is a need to promote health in regards to tetanus disease.

The current study aimed to determine tetanus vaccination status and knowledge among university females of childbearing age and the doctors who comprise an important category of maternal healthcare service delivery at Wad-Medani City, Sudan, based on the recommended WHO guidelines.

Methods

Study design

This was a descriptive cross-sectional study and the data was collected using two types of researcher-administered questionnaires through face-to-face interviews.

Study setting

The current study was undertaken at Wad-Medani city, Sudan in Wad-Medani College of Medical Sciences and Technology (which is a private university that awards bachelor's degrees or equivalent in the fields of business administration, information technology, medical laboratory science, medicine, nursing, and pharmacy), Wad-Medani maternity hospital (which is the main public hospital at Gezira State, Sudan, and it is a stand-alone obstetric hospital that constitutes the first tier of maternal healthcare in the city), and at five public primary healthcare centers located in different cardinal directions that cover different locations in the city (selected based on the information obtained from the Ministry of Health - Gezira State, Sudan about maternal healthcare service provision and availability of vaccines through the immunization programs).

Participants

The subjects for this study were of two categories (the first one was females from Wad-Medani College of Medical Sciences and Technology, while the second one was doctors from Wad-Medani maternity hospital and the selected public primary healthcare centers).

For the first category, females of childbearing age (15-49 years) including the students of medical/non-medical programs, teaching staff, other employees, and workers were included, while females out of the age group or those who refused to participate were excluded.

For the second category, doctors working in the mentioned health facilities were included, while other health professionals in addition to doctors who refused to participate were excluded.

Sample size

The sample size for both categories (university females and doctors) was calculated using Epi Info 7 version 7.2.2.2 (CDC, Atlanta Georgia, USA) statistical software. The selected numbers were 250 participants

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from the first category (females), and 100 participants from the second category (doctors).

Data sources and tools

The data was collected using two types of researcher-administered questionnaires through face-to-face interviews.

The first instrument targeted the female subjects and consisted of their socio-demographic characteristics, knowledge, and sources of information regarding tetanus immunization. They were also asked about their status on each dose of TTCV and reasons for missed vaccination were noted. Records of immunization were collected through immunization cards but in the absence of cards, memory recall was used.

The second questionnaire targeted the doctors and consisted of the respondent's basic information, knowledge of tetanus toxoid, sources of information, target population, number of doses as per the national immunization schedule, and factors affecting the implementation of the vaccination process.

To maintain consistency, the first questionnaire was translated from English to Arabic (the native language of the study participants). To ensure reliability, and validity, avoid bias, and detect any modification needed, the two questionnaires were pre-tested on a sample of 20 participants (10 of each category) who were not included in the study.

Data management and analysis

The obtained data were processed and analyzed using IBM SPSS version 21. Simple descriptive tests were applied to observe frequencies and proportions, while t-paired tests were used to determine relationships between the different groups. The level of significance was set at *a P-value<0.05*.

Ethical considerations

As the current work was descriptive, non-interventional, and did not include work on human or animal subjects, the need for ethical approval was waived by the Ministry of Health - Gezira State Review Board, and Wad-Medani College of Medical Sciences and Technology Ethical Committee. Moreover, the researchers attained an agreement from the directors of the health facilities to perform the study. Also, verbal consents were obtained from the study participants, and only those who voluntarily agreed were included.

Results

Regarding the first category (university females) and based on the percentage of females in each college program (i.e. students of different programs, teaching staff, other employees/supporting staff and workers) out of the total number of females at the university, a specific number of females in each college program from the total number of participants (250) was selected by simple random technique.

Table 1 shows the demographic characteristics of the studied females such as age, given birth to children or a history of pregnancy, educational level, and classification as health or non-health professionals (mean age was 23.8 ± 7.2 SD). The vaccination coverage for all doses of TTCV showed that the majority of the studied females were never or didn't know whether they were vaccinated or not, while some of them were incompletely vaccinated, and very few number were completely vaccinated. Data are represented in Figure 1.

The study also showed that vaccination records were presented by 37% of the vaccinated females (33 participants) while 63% of them had no record or used their memory recall (57 participants). The findings also indicated that the main reason among females who were not or incompletely vaccinated (226 participants) was the lack of knowledge about vaccination importance and/or the complete dose set (77.4%), while other reasons include, not knowing the time or place of vaccination (8.6%), wrong ideas or fears regarding immunization (6.6%), the vaccine was not available at the facility where they receive their health-care services (3%), have no time (2.6%), and 1.8% reported that the vaccination center is too far.

When asked for their knowledge about tetanus vaccination, 19.5% of the studied females replied that they knew about the vaccine from health practitioners, 14% showed that they gathered their information through media sources, 9% learned or read about the vaccination, 3.5% from relatives and/or friends, 0.5% from different sources, while 53.5% had no information regarding tetanus immunization. Furthermore, many of the studied females (48%) who were immunized with the tetanus vaccine got their vaccination doses from public health centers, while other health facilities where respondents received their immunization include private hospitals (39%), clinics (4%), and 9% received their vaccination from the mixed source.

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Table 1: Demographic characteristics of the female participants

Characters		Frequency	Percentage
Age	15 – 25	210	84
	26 – 35	28	11.2
	36 – 49	12	4.8
Given birth to children or had a history of pregnancy	Females with children or history of pregnancy	42	16.8
	Females with no children or history of pregnancy	208	83.2
Educational level	Secondary or less	35	14
	University student or higher	215	86
Occupation	Health professionals/students	138	55.2
	Non-health professionals/students	112	44.8

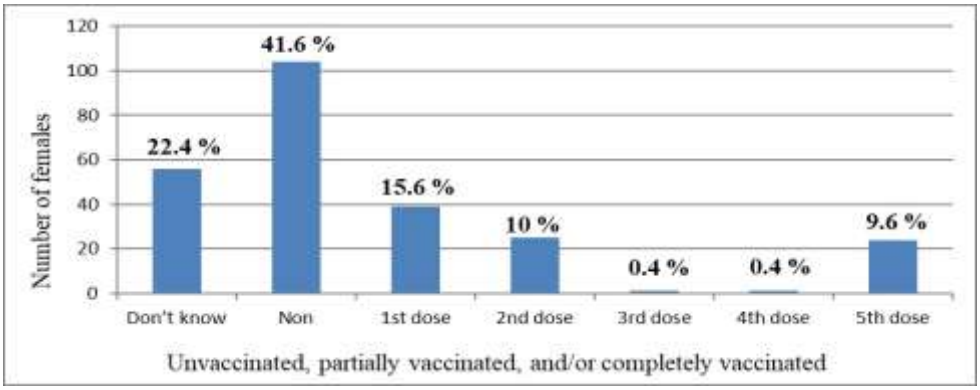

Figure 1: TTCV doses received by female participants

Among female participants, Table 2 represents the relationship between receiving any dose of TTCV and some variables (education level, given birth to children or a history of pregnancy, and occupation). The education level and occupation showed no significant differences between females of college and above or those related to health and medical sciences compared to those with lesser education or non-health and medical sciences professionals. Only the females who have given birth to children or had a history of pregnancy showed a significant increase in receiving TTCV than those with no children or a history of pregnancy (*P-value< 0.05*). On the other hand, Table 3 represents the relationship between receiving the complete 5 doses of TTCV and the previously mentioned variables. Data also showed no significant difference between respondent's educational levels or occupation and the immunization rate. Regarding the females who have given birth to children or had a history of pregnancy, again were found more likely to receive the complete TTCV doses compared to others (*P-value < 0.05*).

Table 2: Relationship between receiving any dose of TTCV and some variables among female participants

Variable		Receiving any dose of TTCV		
		Yes	**No/Don't know**	**Total**
Education level	Secondary or less	14	21	35
	University or higher	76	139	215
Given birth to children or had a history of pregnancy	Females with children or history of pregnancy	28*	14	42
	Females with no children or history of pregnancy	62	146	208
Occupation	Health professionals/students	49	89	138
	Non-health professionals/students	41	71	112

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**Significant (P-value < 0.05)*

Table 3: Relationship between receiving the complete 5 doses of TTCV and some variables among female participants

Variable		Complete 5 doses of TTCV		
		Yes	No	Total
Education level	Secondary or less	5	30	35
	University or higher	19	196	215
Given birth to children or had a history of pregnancy	Females with children or history of pregnancy	22*	20	42
	Females with no children or history of pregnancy	2	206	208
Occupation	Health professionals/students	16	122	138
	Non-health professionals/students	8	104	112

**Significant (P-value < 0.05)*

For the second category (doctors) and according to the percentage of doctors in each health facility out of the total number of doctors in all mentioned health facilities, a specific number at each health facility was selected from the total number of participants (100) by simple random technique.

The obtained data showed that 65% were females and 35% were males. 57% have less than five years of experience, 27% between five to ten years, and 16% have more than ten years of experience. Doctors' responses regarding how they get their information on tetanus vaccination include, policy or guidelines at the health facility (35%), studied at university (34%), media sources (29%), and 2% stated they joined vaccination programs. Regarding basic patient information, 38% of the studied doctors agreed that tetanus vaccination status should be considered in the history records of pregnant and patients with wounds, while 31% replied that it should be considered for all females, 23% reported that it should be considered for pregnant only, 5% for patients with wound only, and 3% replied that they didn't ask for immunization status when gathering patients' history. Studied doctors were also asked about the number of TTCV doses they prescribe for females at reproductive age if there was no history of immunization. The percentage of doctors who recommend a specific number of TTCV doses is shown in Table 4.

Table 4: Doses of TTCV recommended by doctors for females at childbearing age

	Non/ Don't know	1 dose	2 doses	3doses	4 doses	5 doses
Pregnant	26%	4%	9%	22%	0%	39%
All females	55%	4%	1%	15%	0%	25%

Among all doctors participating in the study, 64% reported that the tetanus vaccine was always available at the health facilities they work in when prescribed for patients, 29% replied some shortage, and 7% reported the availability of the vaccine when requested for their patient. Table 5 represents the relationship between the doctors' knowledge of the complete 5 TTCV doses compared to their genders and their years of experience. Correct information was found significant with advanced years of experience (*P value<0.05*).

Table 5: Relationship between doctor's knowledge of complete TTCV doses for females at childbearing age and some variables

Variable		Knowledge of complete TTCV doses		
		Yes	No	Total
Gender	Female	16	49	65
	Male	9	26	35
Years of experience	Less than 5 years	5	52	57
	5 – 10 years	7	20	27
	More than 10 years	13*	3	16

Significant (P-value < 0.05)

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Discussion

In the current study, the obtained results revealed that only 9.6% of the female respondents received the complete 5 doses of TTCV, and among all the reasons that may affected the vaccination status, the poor knowledge about the tetanus vaccination program and its importance represents the most common factor (77.4%). Many studies and surveys were conducted to assess the prevalence and adequacy of antenatal tetanus vaccination in low-income countries to address the status and its associated factors. The majority of findings were attributed to several maternal-related factors such as education, birth order, occupation, financial status, health care given, exposure to media sources, and accessibility to healthcare facilities (6). A similar study showed that only 8.88% of respondents had correct knowledge of tetanus disease and its vaccination (12). These findings also comply with a study that showed that vaccination coverage is directly related to awareness, and good knowledge among the community and people is associated with increased vaccination uptake (13). Furthermore, good knowledge of mothers toward immunization could also improve the application of neonatal tetanus vaccination.

The WHO, UNICEF, and UNFPA recommended that in high-risk countries, 90% of women of childbearing age should receive TTCV to achieve and maintain the elimination of maternal and neonatal tetanus (2). However, the published data reported that worldwide maternal and neonatal tetanus immunization coverage is 75% (95% in Southeast Asia, 53% in the East Mediterranean, and 63% in Africa) which fails to meet the WHO global immunization target of at least 90% national coverage and at least 80% coverage in each district indicating that tetanus is still a substantial but preventable cause of mortality (14, 15). In the current study, and in line with other studies (16), only 36% of the respondents had received at least one dose of TTCV, showing that we are still far away from total elimination of maternal and neonatal tetanus, and suggesting that increasing the level of knowledge could increase the uptake of tetanus immunization.

In addition, the data also showed that vaccination records were presented with 37% of the vaccinated females, while 63% have no record or used their memory recall. It is known that tetanus immunization is only acquired through vaccination, and vaccination history is a good indicator of immunity against tetanus (8). Furthermore, the estimation of serological tetanus antibodies could also be a reliable indicator of tetanus immunization (17). Therefore, the application of a vaccination record system could be an effective tool because vaccination received during childhood or adolescent period may not be easily remembered in adulthood, however, in the absence of vaccination records the use of tetanus antibody test should be applied in the health-care facilities, especially hospitals.

The main sources of information that surveyed females obtained their knowledge about tetanus vaccination are from health professionals at health-care facilities (19.5%) and through media tools (14%). These findings demonstrated the important role of health facilities and media sources in the dissemination of health information to the general population.

Further analysis also showed that giving birth to children or having a history of pregnancy significantly influenced receiving the complete 5 doses of TTCV. The factor that could enhance the knowledge among these specific populations could be that females with a history of pregnancy might have been exposed to information, education, and/or counseling on tetanus immunization by healthcare providers during antenatal care, and in addition, in almost all low and middle-income countries, pregnant women could receive a dose as part of the Maternal and Neonatal Tetanus Elimination Initiative, which could account for the uptake during this period. Thus, this finding could also highlight the important role of healthcare professionals in boosting tetanus vaccination coverage.

Regarding surveyed doctors, the study revealed that only 31 % of the respondents knew that tetanus vaccination should target all women of childbearing age with only 25% who knew the complete set of vaccine doses, while 63% were under the misconception that it should target the pregnant women only or patients with wounds. The study also showed that the correct knowledge of the target population and the number of doses were mainly associated with advanced years of experience. Several findings were also reported on the knowledge regarding tetanus immunization schedules among health care providers indicating that the knowledge needs to be improved (18, 19, 20). In agreement with that reported by Ghori et al. (21), the misconception about the target population, poor knowledge of the vaccination program along lack of record-keeping at the healthcare facilities may have contributed to the poor uptake of the vaccine.

Conclusion

Tetanus vaccination coverage was relatively poor, and the main reason was the lack of knowledge about the vaccination program and its importance. However, the antenatal care given at the healthcare facilities is expected to play a critical role in achieving higher rates of tetanus vaccination in the community and also could provide a great chance to identify incompletely or unvaccinated women to enforce complete

immunization, because healthcare professionals were considered the role models in vaccination, their knowledge and attitudes about vaccination are very important to implement the elimination of maternal and neonatal tetanus.

Recommendation

Women's education and improving public knowledge along with healthcare providers of full immunization using media sources and/or any other tools that could guide the use and doses of tetanus vaccine at the healthcare facilities can play a vital role in imparting immunization. It is also necessary to ensure the availability of the vaccine and accessibility to healthcare delivery systems for all females. However, further studies are recommended to cover a larger population.

Limitations of study

The small-scale features of the current work cannot be generalized to the whole situation in the country; due to the absence of some doctors, the researchers had to visit some health facilities several times and wait for a long time to complete data; work overload in some health facilities lead to postpone interviewing questioner.

List of abbreviations

TTCV: Tetanus Toxoid Containing Vaccine
WHO: World Health Organization
UNFPA: United Nations Population Fund
UNICEF: United Nations International Children's Fund

Author contribution

All authors contributed equally in concept, design, resources, data interpretation, and critical review of the study. Draft writing was done by the corresponding author. We all gave the final approval of the version to be published and agreed to be accountable for all aspects of the work.

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The author(s) declared that no grants were involved in supporting this work.

Conflict of interest

The author(s) declare that there are no conflicts of interest regarding the current study or between the authors and anyone.

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