

# AWARENESS OF AND FACTORS INFLUENCING WILLINGNESS TO RECEIVE A TETANUS-DIPHTHERIA TOXOID BOOSTER VACCINE AMONG THAI ADULTS

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**Abstract.** Adults who complete the diphtheria tetanus pertussis (DTP) vaccine series during childhood should receive a tetanus-diphtheria toxoid (Td) booster vaccine every 10 years. We studied awareness of and willingness to receive the Td booster vaccine as well as factors influencing these attitudes. A total of 1,284 participants were interviewed using a questionnaire at the out-patient department (OPD) of Siriraj Hospital, Bangkok, Thailand from January 31 to February 28, 2011. The sample population included: OPD patients, family members accompanying patients and medical personnel other than doctors. Seven percent of the 961 general participants and 26.3% of the 320 medical personnel who completed the questionnaire were aware of the need to receive the Td booster vaccine. Eighty-six point five percent of participants stated they be willing to receive the vaccine if they were instructed by their doctors. Logistic regression analyses showed the following factors correlated with awareness of the need to receive the vaccine: born after 1978 (aOR = 2.17; 95% CI: 1.59-2.97), higher income (aOR = 1.93; 95% CI: 1.37-2.72), and higher general preventive awareness score (aOR = 1.08; 95% CI: 1.02-1.14). Factors that correlated with willingness to receive the vaccine were: higher education (aOR = 2.17; 95% CI: 1.54-3.05), a higher score on general knowledge of tetanus-diphtheria (aOR = 2.00; 95% CI: 1.15-3.51), a higher general preventive awareness score (aOR = 1.06; 95% CI: 1.007-1.115), and previous experience with the Td booster vaccine (aOR = 2.85; 95% CI: 1.71-4.76). Under-awareness of the adult vaccination program remains a problem in Thailand especially among older generations and low-socioeconomic groups. As passive immunity wanes with time, public health authorities need to take action to educate the general population and health care workers about the importance of the Td booster vaccine.

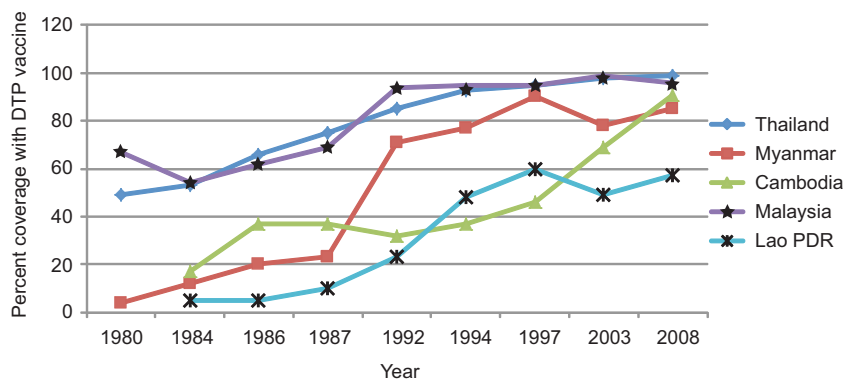
**Keywords:** tetanus-diphtheria toxoid, adult vaccination, awareness rate, booster vaccine, resurgence

## INTRODUCTION

The series of 4 doses of the diphtheria, tetanus and pertussis (DTP) vaccine has been used world-wide to control disease (Fig 1). The annual incidence of diphtheria in Thailand has been less than 0.1 case per 100,000 persons since the 1990's (Fig 2)

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DTP = diphtheria, tetanus and pertussis.

Fig 1–Diphtheria, tetanus and pertussis immunization coverage among 1-year-olds in Thailand and surrounding countries (Galazka, 2000).

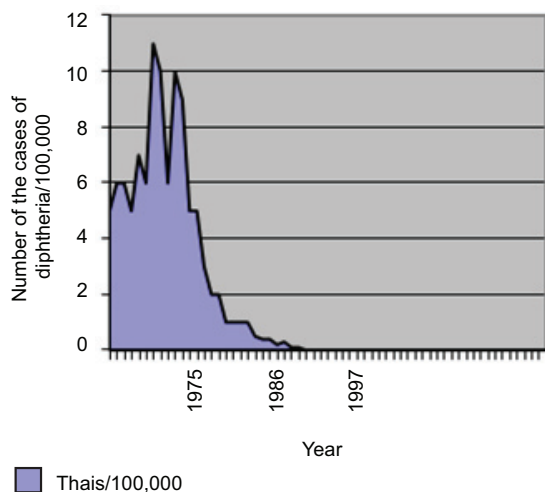


Fig 2–Number of reported diphtheria cases in Thailand (Bansiddhi *et al*, 2012).

(Bansiddhi *et al*, 2012). The DTP vaccine has been included in the Expanded Program on Immunization (EPI) for Thai children since 1978 (Hayden *et al*, 1989).

The diphtheria surveillance system for Thailand began detecting greater diphtheria outbreaks in 2010 (Division of Epidemiology, 2011). The outbreaks are mostly seasonal with 52% of cases occurring in July–September and most of the cases occurring in rural areas near the Thai–Laos

and Thai–Malaysian borders (Division of Epidemiology, 2011). There were less children and more adults became susceptible to the disease comparing to the pre-vaccine era; the report from the Division of Epidemiology, Ministry of Public Health, Thailand (2011) showed that 60% of cases are under age 30 years and the mean age of cases is 12 years.

Post-vaccination outbreaks of diphtheria were seen in the Newly Independent States of the former Soviet Union during the 1990s where many of the cases were adolescents and adults rather than young children (Khuri-Bulos *et al*, 1988; Galazka, 2000). Outbreaks may occur due to declining herd immunity. Herd immunity is when a significant portion of the population has immunity, providing protection for others who do not have immunity (John and Samuel, 2000). A decline in herd immunity may be due to an increase in the number of unimmunized individuals who have migrated in or a decrease in passive immunity among those who did not receive adequate booster doses (Kim *et al*, 2011).

In 2005, the Advisory Committee on Immunization Practices (ACIP) recommended a Tetanus-diphtheria toxoid (Td) booster vaccine for adults every 10 years (Kretsinger *et al*, 2006; Lee *et al*, 2008). As passive immunity wanes with time, adults who complete the diphtheria tetanus pertussis (DTP) vaccine series during childhood supposed to receive a tetanus-

diphtheria toxoid (Td) booster vaccine every 10 years. However, Thailand EPI has not included the booster doses in its program. Moreover, the habit of prescribing booster vaccines for adults was not common for Thai clinical practice. This situation is similar in other developing countries. To date, there have been few studies addressing this issue and most of them were from developed countries (Hasselhorn *et al*, 1997; McQuillan *et al*, 2002; National Foundation for Infectious Diseases, 2009). This research project was conducted to determine the awareness of the need to receive the Td booster vaccine. We also attempted to determine factors relating to the willingness to receive the Td vaccine among the Thai population.

#### MATERIALS AND METHODS

We developed a questionnaire and conducted a cross sectional study among approximately 1,200 participants at the out-patient department (OPD) of Siriraj Hospital from January 31 to February 28, 2011. The resurgence of diphtheria in the former Soviet Union began in hospitals and nursing homes (Vitek *et al*, 2000); therefore, we chose Siriraj, a 2,500-bed hospital, as our single study site. The participants were determined to be a vulnerable population and have a high priority when providing information regarding adult vaccinations.

Siriraj Hospital has more than 2 million out-patient visits each year. Five thousand sixty-three nurses and 7,547 health care personnel work at the hospital. The hospital provides a broad range of care, including primary, secondary, and tertiary care for people in various socioeconomic levels. It is common for family members to accompany patients to the hospital in Thai culture; this allows us to obtain

data from a wide range of participants.

Inclusion criteria for our study participants were: age greater than 18 years and being an internal medicine patient at the OPD, being clinically stable, willing to be interviewed, being a family member accompanying a patient, or working at Siriraj in a non-physician medical position.

We developed a questionnaire and then validated it using a 200-participant pilot study. The questionnaire was then reviewed and adjusted to be appropriate for the study population. Six OPD nursing assistants were trained to use standardized random sampling how to conduct the interview. The questionnaire was then distributed at 6 locations in the Siriraj OPD. During the study period, 50 questionnaires were collected daily: 15 chronic internal medicine patients, 10 new walk-in patients, 10 family members, 5 nurses and 10 other medical personnel. All participants completed the questionnaire voluntarily after verbal consent was obtained.

Respondent baseline characteristics and possible correlating factors for outcomes of interest were obtained using a 16-item questionnaire about: age, sex, income, education level, participant status, the score for general knowledge of tetanus-diphtheria, perceptions about vaccine safety, healthy living habits and general preventive awareness score.

The questionnaire explored awareness of the need to receive the Td booster vaccine in 2 steps. The first question tested whether the participant was aware of the need to receive the Td booster vaccine with a yes or no response. If the participant responded yes, he or she was asked to specify the recommended interval between booster doses to verify their knowledge. The participants were

categorized as having correct knowledge if they answered both questions correctly. The participant's healthy living habits and general preventive awareness scores were obtained using selected General Self-Efficacy questions (Luszczynska *et al*, 2005). The study was approved by the Siriraj Hospital Institution Review Board, reference number Si055/2011- 774/2553 (EC3).

The primary outcomes in the study were awareness of the need to receive the Td booster vaccine every 10 years and willingness to receive the vaccine. Secondary outcomes were potential factors correlated with awareness of the need to receive the vaccine and willingness to receive the vaccine categorized by sex, age, education level, income, general knowledge of tetanus-diphtheria score, risk for occupational exposure, perceptions about vaccine safety, general preventive awareness score and healthy living habits score.

We used univariate analyses to determine normal distribution. For continuous data, a *t*-test and Wilcoxon rank-sum test were used for normal and non-normal distributions, respectively. We compared categorical data with either the Fisher's exact test or the chi-square test, where appropriate. All tests were 2-tailed using an alpha of 0.05 and a power of 80%.

The relationship between the agreement to receive the Td booster vaccine and possible influencing factors was investigated with a logistic regression model. The variables were sequentially added in blocks to determine the extent of their effects.

## RESULTS

One thousand three hundred twenty-six questionnaires were obtained and of these, 1,284 were completely filled out and used for analysis. Characteristics of

respondents and their awareness of the need for the tetanus-diphtheria vaccine are presented in Table 1. Eight hundred seventy-four of the participants were women and 393 were men. Fifty-eight point five percent had an education higher than high-school level and 22.5% earned less than USD2,800 per year (USD1= 32 Baht). Seven hundred twenty respondents were OPD patients, 241 were family members accompanying a patient and 320 were Siriraj medical personnel. Of the 320 medical personnel, 60 were nurses, and 260 were other ancillary support staff.

The majority of respondents (68.9%) did not know what a tetanus infection was and 88.2% were not aware of the need to receive a Td booster vaccine. Twenty-two point one percent and 12.1% of respondents had previously seen someone infected with tetanus or diphtheria, respectively. Forty-five percent of nurses were not aware of adult booster vaccine recommendations. Logistic regression analyses showed the following factors correlated with awareness of the need to have the Td vaccine: being born after 1978 [adjusted Odds Ratio (aOR) = 2.17; 95% Confidence Interval (CI): 1.59-2.97], higher income (aOR = 1.93; 95% CI: 1.37-2.72) and higher general preventive awareness score (aOR = 1.08; 95% CI: 1.02-1.14).

After being informed about the recommended vaccine guidelines and the self-pay price of USD2.50 for the vaccine, 86.5% of the 1,274 respondents agreed to receive the booster vaccine. The characteristics of the respondents who were willing and unwilling to receive the vaccine on bivariate analyses are shown in Table 2. On multivariate analysis, factors associated with willingness to receive the vaccine were: higher education (aOR = 2.17; 95% CI: 1.54-3.05), a higher score on general knowledge of tetanus-diphtheria

Table 1  
 Characteristics of respondents and their awareness of the need for the tetanus-diphtheria vaccine.

Baseline characteristic	Number	Aware of need for vaccine (%)	Not aware of need for vaccine (%)	p-value
Total	1,284	151 (11.8)	1,133 (88.2)	
Male	393	40 (10.2)	353 (89.8)	0.28
Female	874	109 (12.5)	765 (87.5)	
Age				<0.01
Mean age		42.44	46.13	
Born during or after 1978	399	74 (18.5)	325 (81.5)	
Born prior to 1978	885	77 (8.7)	808 (91.3)	
Education level				<0.01
Primary school or lower	204	7 (3.4)	197 (96.6)	
Secondary school	119	7 (5.9)	112 (94.1)	
High school or technical certificate	207	16 (7.7)	191 (92.3)	
Advanced technical certificate	118	11 (9.3)	107 (90.7)	
Bachelor's degree	540	95 (17.6)	445 (82.4)	
Higher than bachelor's degree	89	14 (15.7)	75 (84.3)	
Income level (Baht/month)				0.01
Mean income		18,344.9	16,008.0	
<7,500	289	18 (6.2)	271 (93.8)	
7,501-13,000	293	35 (11.9)	258 (88.1)	
13,001-20,000	276	40 (14.5)	236 (85.5)	
>20,000	426	58 (13.6)	368 (86.4)	
Respondent type				<0.01
Nurse	60	33 (55.0)	27 (45.0)	
Other medical personnel	260	51 (19.6)	209 (80.4)	
OPD patient	720	57 (7.9)	663 (92.1)	
Accompanying family member	241	10 (4.1)	231 (95.9)	

(aOR = 2.00; 95%CI: 1.15-3.51), a higher general preventive awareness score (aOR = 1.06; 95%CI: 1.007-1.115) and previous experience with the vaccine (aOR = 2.85; 95%CI: 1.71-4.76).

Seventy point five percent of respondents felt the vaccine was safe. Eight percent of respondents were uncertain about the safety of the vaccine. Thirteen point five percent of respondents chose not to receive the vaccine. The most common reasons for hesitation in receiving the vac-

cine were: low preventive value (41.8%), fear of an anaphylactic reaction (29.7%), financial difficulties (15.4%), and fear of needle or pain (13.2%) (Fig 3).

## DISCUSSION

A resurgence of diphtheria infections among adults has become a concern in several countries that have previously been successful in implementing children's vaccination programs (Khan *et al*, 2007; Rohani and Drake, 2011). These outbreaks

Table 2  
 Characteristics of respondents who were willing and unwilling to have the Td booster vaccine.

	Number	Agree (%)	Disagree (%)	p-value
Total	1,274	1,102 (86.5)	172 (13.5)	
Age				0.01
Born during or after 1978	397	359 (90.4)	38 (9.6)	
Born before 1978	877	743 (84.7)	134 (15.3)	
Education level				<0.01
Primary school or lower	199	156 (78.4)	43 (21.6)	
Secondary school	119	93 (78.2)	26 (21.8)	
High school or technical certificate	205	176 (85.9)	29 (14.1)	
Advanced technical certificate	116	100 (86.2)	16 (13.8)	
Bachelor's degree	540	487 (90.2)	53 (9.8)	
Higher than bachelor's degree	89	84 (94.4)	5 (5.6)	
Income level (Baht/month)				0.13
<7,500	285	238 (83.5)	47 (16.5)	
7,501-13,000	291	262 (90.0)	29 (10.0)	
13,001-20,000	275	235 (85.5)	40 (14.5)	
>20,000	423	367 (86.8)	56 (13.2)	
Respondents type				0.41
Nurse	60	53 (88.3)	7 (11.7)	
Other medical personnel	258	225 (87.2)	33 (12.8)	
OPD patient	712	607 (85.3)	105 (14.7)	
Accompanying family member	231	208 (90.0)	23 (10.0)	
Healthy living habits score (mean/SD)		7.0/2.5	7.3/2.5	0.23
General preventive awareness score (mean/SD)		16.9/3.0	16.1/3.5	0.01

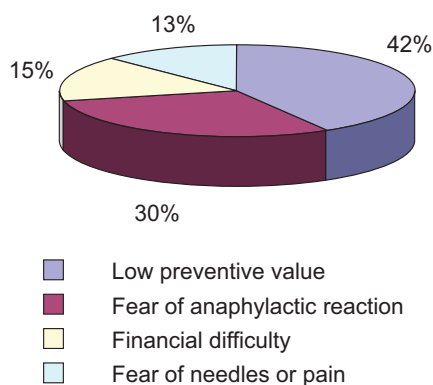


Fig 3—Reasons for being unwilling to have the Td booster vaccine.

may be explained by the loss of herd immunity within society as a result of migrating populations and waning passive immunity. In Thailand, the DTP vaccine has been included in the EPI for children ages 0-12 years since 1978 (Tharmaphornpilas *et al*, 2001). The country has achieved >90% coverage continuously from 1994 until now (Bansiddhi *et al*, 2012). However, during 2010-2012, a resurgence of diphtheria in Thailand has been observed (Division of Epidemiology, 2011).

Vaccine antibody responses can wane over time to below protective thresholds. All adults should receive vaccinations

periodically to boost immune memory (Poovorawan *et al*, 2008). However, adult vaccination has been underutilized (Janes *et al*, 1999; Schaffner, 2008). In this study, we found the majority of participants were not aware of the recommended booster vaccine schedule despite the fact this population might be a target audience for education about this need.

People born after 1978 were more aware of the need for the Td booster vaccine but the awareness was still low (18.5%) among those born after 1978 *vs* 8.7% among those born before 1978. Nearly half of the health care personnel in our study were unaware of the need to receive a Td booster vaccine.

Population migration has a strong impact on the issue of disease resurgence and emerging infections (Kim *et al*, 2011). The ASEAN Economic Community changes that will take place in 2015 may increase the number of migrant populations in Thailand with a resultant decline in herd immunity.

We strongly recommend public health authorities establish a national policy to educate the general population regarding the need for a Td booster vaccine. Increasing adult Td booster vaccine coverage should not be difficult because when respondents were informed about the recommended vaccine guidelines and the cost of USD2.50/dose once every 10 years (Thai daily minimum wage is USD10/day) 86.5% agreed to receive the booster vaccine.

Missing data may be a cause of error in this study as might be a questionnaire-based study design which could over-represent the number of people willing to have the vaccine.

Under-recognition of the adult vaccination program is a problem in several

countries (Gabutti, 2008), including Thailand. Since the population's immunity has changed significantly over the past few decades (Bansiddhi *et al*, 2012), there is an urgent need to educate the general population and health care personnel about the need for a Td booster vaccine to maintain the herd immunity and to prevent resurgence of previously controlled diseases.

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