Baseline immunity to diphtheria and immunologic response after booster vaccination with reduced diphtheria and tetanus toxoid vaccine in Thai health care workers

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A prospective study to evaluate immune status against diphtheria and immunologic response after tetanus-diphtheria (Td) booster vaccination was conducted in 250 Thai health care workers (HCWs). A protective antibody was found in 89.2% of the HCWs (95% confidence interval [CI], 83.3%-91.5%) before receipt of the Td booster vaccination, compared with 97.2% (95% CI, 95.1%-99.3%) after receipt of the first dose of booster (P < .001). The mean antibody level against diphtheria increased from 0.39 IU/mL (95% CI, 0.35-0.44 IU/mL) before the Td booster vaccination to 1.20 IU/mL (95% CI, 1.12-1.29 IU/mL) after the vaccination (P < .001). Td booster vaccination should be considered for Thai HCWs to maintain immunity against diphtheria, which still circulates in Thailand.

METHODS

Study design

This prospective study was conducted between March and September 2013 at Bamrasnaradura Infectious Diseases Institute in Nonthaburi, Thailand. Participants were HCWs aged 18-60 years who were willing to participate and provided written informed consent. HCWs who were allergic to Td or tetanus toxoid (TT) or who had received Td within 3 years before enrollment were excluded. Demographic data were collected using a questionnaire. Blood samples were collected before and after Td booster vaccination. The level of antibody against diphtheria toxoid was measured by indirect enzyme-linked immunosorbent assay using a commercial kit (Euroimmun Medinische Labordiagnostika, Lubeck, Germany). A diphtheria antibody level ≥0.1 IU/mL was considered sufficient to provide seroprotection. A 0.5-mL dose of Td vaccine (Serum Institute of India, Pune, India) containing 5 Lf units of diphtheria toxoid and 5 Lf units of TT with 1.25 mg of aluminium phosphate was injected intramuscularly after baseline blood collection and again 6 weeks later to those who demonstrated no seroprotection. Participants who had received the Td booster within 3-5 years before enrollment were assigned to wait for their immunity results, and were not vaccinated if immunity was established. Participants were observed directly for immediate adverse events, and were contacted by telephone at 14 days after vaccination to check for any later adverse events.

This study was approved by the Ethics Committee for Research in Human Subjects of the Department of Disease Control, Thailand Ministry of Public Health.

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DISCUSSION

Our results demonstrate that Thai HCWs may be at risk of acquiring diphtheria infection. Compared with other studies of
HCWs, in this study, the prevalence of HCWs with immunity against diphtheria was higher than that reported in Spain, but comparable to that in a study from Brazil. Using a diphtheria antibody titer ≥0.1 IU/mL as a seroprotective level and studying the same age group, we found a higher seroprotection rate at baseline compared with a previous study in Thailand (89.0% vs 53.9%). Our higher rate could have resulted from implementation of the national Extended Program on Immunization (EPI) for infants and children in 1977. Nonetheless, most participants born before institution of EPI who were not receiving routine Td booster vaccinations also had immune protection. Considering the high prevalence of diphtheria infection in the past 20-30 years in Thailand, repeated natural boosters from the environment could have affected long-term immunity. The combination of immunity from vaccination and natural contact with circulating diphtheria in the past might have contributed to our findings in our study. It also may explain why we found a poor correlation between age and diphtheria immunity level. This latter result conflicts with numerous previous studies performed in countries with a low prevalence of diphtheria, which have shown declining immunity level with increasing age. With the current reduction of diphtheria incidence, it should be emphasized that 90.1% of our immune participants had an antibody level between 0.1 and 1.0 IU/mL at enrollment, which may provide protection against diphtheria for a few years if immunity was acquired by childhood immunization. Our results clearly suggest that the recommended immunization schedule for Thai HCWs should be changed from a booster with TT or Td to Td only, given every 10 years.

This study has some limitations, including the small sample size, use of local data only, and single-center nature, which may limit the generalizability of our findings. A number of the participants reported frequent changes in workplace, preventing categorization of some key epidemiologic data, wards worked in and duration of work, for analysis.

In summary, Thai HCWs may be at risk of acquiring diphtheria infection. The Td vaccine is safe, and the booster vaccination should be recommended for Thai HCWs. A routine Td booster vaccination program in Thai HCWs should be considered by local and public health administrators.

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References