

Short Report

Cost effectiveness analysis of meningococcal vaccine: A report from a tropical country

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Introduction

Meningococcal disease, sporadically seen worldwide, is an important bacterial infection with a high mortality rate among infected cases. It is an acute disease caused by *Neisseria meningitidis*^{1,2}. Clinically, man is the only natural host. As a vaccine preventable disease, the vaccine is the best primary preventive measure for any person at risk¹⁻³. According to a report from the United Kingdom, the introduction of vaccination among the paediatric population has proven cost effective³.

Thailand, a tropical country in Indochina, still has meningococcal disease. There is also a chance for increasing number of cases due to importation of the disease by local Thais who visit highly endemic areas⁴. Phrom-in S⁵ suggested that “*it is worth having a good surveillance system for meningococcal meningitis in order to prevent epidemics*”. Management of this disease using meningococcal vaccine is a new idea that is under consideration. To assess the idea of using meningococcal vaccination as a part of national immunization requires a systematic medical economic analysis. Here, the authors perform a standard cost-effectiveness analysis of vaccination versus no vaccination scenario.

Method

This is a standard medical economic analysis. The target population is the paediatric population. The authors use cost-effectiveness analysis model to

compare the cost per effectiveness value in two alternative options, a) “with meningococcal vaccination” and b) “without meningococcal vaccination”. First, the authors defined the cost of vaccination, which was referred to the standard vaccination cost provided by referencing the tropical medicine centre in Bangkok, Thailand (<https://www.thaitravelclinic.com/th/cost-th.html>). The cost is presented in US dollars (USD). Regarding effectiveness, the authors referred to the standard publication on the efficacy of meningococcal vaccine, which indicated vaccine efficacy equal to 85%⁶. The incidence of meningococcal disease, which was referred to the official data of Thai Centre of Disease Control (CDC), Ministry of Public Health (www.boe.moph.go.th), was used in simulating the corresponding situation in each studied alternative option, with and without meningococcal vaccination. As a primary assumption, loss means the amount of money to pay which might be vaccination cost and medical care for infected case cost in both alternative options.

Results

The cost of meningococcal vaccination in the present study is equal to local 2,435 THB, which is equal to 79.1 USD (1 USD = 31 THB) per case, referring to the standard vaccination cost. Regarding the cost effectiveness simulation model, the results on effectiveness analysis are shown in Table 1.

Table 1: Results on effectiveness analysis using cost effectiveness simulation model

Option	Rate of patient with meningococcal disease (/100,000 population)	Expected clinical loss (USD) (/100,000 population)
Without vaccination	0.07	132,440,000
With vaccination	0.0105	98,966,000

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For option “without vaccination”, the medical care for infected case cost is defined as the loss. This loss is calculated based on the referencing data⁷ that the loss is equal to 18,920 per disease case. The total medical care for infected case cost will be equal to “loss per disease case x rate of patient meningococcal disease”. Here, the rate of patients with meningococcal disease equal to 0.07/ 100,000 population, based on the local data from Thai CDC. Therefore, the final expected clinical loss will be equal to 132,440,000 USD (=18,920 x 0.07 x 100,000)/100,000 population. For option “with vaccination”, the cost for vaccination plus medical care for infected case cost is defined as the loss. The total cost of vaccination per 100,000 population will be equal to 79,100,000 USD (= 79.1 x 100,000).

The total medical care is also calculated in the same way as that earlier mentioned in the option “without vaccination”. Here, the total medical care for infected case cost will be equal to “loss per disease case x rate of patient meningococcal disease x rate of unpreventable disease.” Here the rate of unpreventable disease in percentage is equal to “100 – vaccine efficacy”. Based on the referencing data, the rate unpreventable disease will be equal to 15% (100 – 85). The final total medical care for infected case cost will be equal to 19,866,000 USD (= 18,920 x 0.07 x 0.15 x 100,000)/100,000 population. Therefore, the final expected clinical loss will be equal to 98,966,000 USD (=79,100,000 + 19,866,000 USD) USD / 100,000 population. Based on the derived calculated result, the final expected clinical loss for the option “without vaccination” is higher. This means the option “with vaccination” is more cost effective.

Discussion

Meningococcal disease is a bacterial infection that can be seen in several developing countries worldwide. Naturally, meningococcus can be detected as a commensal inhabitant in the nasopharynx^{8,9}. The detection rate of this organism is about 10% of adults^{8,9}. Nevertheless, the organism can cause invasive disease. Common clinical manifestations of invasive meningococcal disease include meningitis and septicaemia⁹. In the paediatric patient, the clinical manifestations may be more serious and the diagnosis is usually difficult⁸. This neurological infectious disease can result in a high morbidity and mortality^{1,2,8,9}. Up to one-tenth of the patients might die^{1,2,8,9}. Survivors of the disease usually have clinical sequelae and a poor quality of life^{8,9}. Common sequelae are neuropsychiatric problems such as neurological hearing loss, anxiety, learning difficulties, emotional and behavioural difficulties^{8,9}.

Using vaccination against meningococcal disease is widely discussed in preventive medicine. Chinese

Preventive Medicine Association noted that “*Immunization with meningococcal vaccine is the most effective measure to control and prevent transmission of meningococcal meningitis*”⁴. Several countries consider including this vaccine in their national immunization programmes. There is a need to carefully assess the effectiveness and safety of the vaccination prior to actual implementation.

There are some reports on cost effectiveness analysis of meningococcal vaccination from several settings. In a recent report from Hong Kong, Xing N, *et al*¹⁰ found that the vaccination “*appeared to reduce quality-adjusted life year losses at a higher cost*”. In the present study, the authors firstly assess the cost effectiveness of meningococcal vaccination in Thailand. Thailand is a country where meningococcal disease is observable. The meningococcal vaccine is available in Thailand but it is still not included in the national immunization programme. In the present study, the authors found that the expected benefits of the vaccine use are shown compared to no vaccination. The loss in cases without vaccine use is about 1.3 times higher. Of interest, although a low incidence of meningococcal disease is observed in Thailand, meningococcal vaccination is cost effective.

Conclusion

Based on the present evaluation, it can be said that the meningococcal vaccination is cost effective.

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