The Economic Evaluation in Vaccines - A Systematic Review in Vietnam Situation

Nam Xuan Vo1,2,*, Trung Quang Vo2,3, Ha Thi Song Nguyen4, Thuy Van Ha5

1Department of Social, Economic and Administrative Pharmacy, Faculty of Pharmacy, Mahidol University, Bangkok 10400, THAILAND.
2Professional Healthcare Management, Education and Research center (ProHES), Ho Chi Minh City 700000, VIETNAM.
3Department of Pharmacy Administration, Faculty of Pharmacy, University of Medicine and Pharmacy, Ho Chi Minh City 700000, VIETNAM.
4Department of Postgraduate, Hanoi University of Pharmacy, Hanoi 100000, VIETNAM.
5Department of Health Insurance, Ministry of Health, Hanoi 100000, VIETNAM.

ABSTRACT

Background: Along with economic crisis, the budget for research is also affected. Systematic review of outcome measurement instrument is a method for choosing researches and articles for our research and practice. It provides evidences to make sure that our research will useful. Besides that, economic evaluation is a new approach to help policy maker giving affordable decision to invest in health sector. Our purpose was defined and summarize the status of economic evaluations of vaccines and to find out the new trend in economic evaluation of vaccines in the future in Vietnam.

Method: A systematic literature search was conducted in some database such as MEDLINE, SCOPUS, COCHRANCE and GOOGLE SCHOLAR between May 26th, 2016 and June 16th, 2016. The quality of reviews was assessed by using a specific checklist. Abstracts and titles are read firstly to eliminate articles are not related with our topic. Results: A total of six articles were included. These articles focus on three vaccines: rotavirus, typhoid VI and human papillomavirus vaccine. In there, only rotavirus vaccine is cost-effectiveness. The target population is children and women. These articles using mathematic model based on decision tree and Markov model are the method to approach. Conclusion: Economic evaluation is a new area in Vietnam, it need to pay attention to research and develop to control the investment effectively. It is important to be aware of methodology and interpretation of results because of affecting to decision of policy maker and also affecting in national expanded program in immunization on adding new good vaccines.

Key words: Cost-effectiveness, Economic evaluation, Immunization, Expanded Immunization Program (EPI), Systematic review, Vaccine(s), Vietnam.

Correspondence: Mr. Nam Xuan Vo
Department of Social, Economic and Administrative Pharmacy, Faculty of Pharmacy, Mahidol University, Bangkok 10400, THAILAND.
Phone no: +66(0)868490098
E-mail id: vonamlx@yahoo.com
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INTRODUCTION

A good deal of the substantial progress seen in global health over the past several decades can be ascribed to the beneficial impacts of various vaccines and immunization programs on the control of serious disease among both individuals and populations.1,2 In just the first decade of the 21st century, an estimated 2.5 million deaths of children younger than five were prevented worldwide by vaccines. The population coverage of many childhood vaccines has risen sharply in recent years, along with the number of countries using the more recently arrived vaccines.2,3 Based on the report of the World Bank, the vaccines covered by Expanded Program on Immunization (EPI) is one of the available measures most cost-effective interventions, with measles immunization estimated $10 per year of life with disabilities (DALY) prevented, and the Diphtheria-Pertussis-Tetanus (DPT) vaccinations $25 per DALY prevented.4 One recent analysis showed that the incremental cost per death averted of EPI is about $478 in East Asia and Pacific, $274 in South Asia, and $1754 in Central Asia and Europe in 2001.5,11,12 EPI was first mentioned in Vietnam in 1981, and became one of six health plans national target program in 1985. The initial immunization vaccinated against six diseases of children (tuberculosis, polio, diphtheria, pertussis, tetanus and measles). By 2005, 96% of children under 1 year of age was recorded as received three doses of DPT. The success of EPI include eliminating polio in 2000 and tetanus for mothers and newborns in 2005.14,15 Vietnam is the support of GAVI for the introduction of vaccines and strengthen health systems, but the conditions to support these funds may end when Vietnam is a middle-income country. Therefore, the current EPI program as well as introducing new vaccines will increasingly be funded by Vietnamese national budget. However, there are competing priorities for public investments in Vietnam both within and outside the health sector. As the government plans to invest in the future, it is difficult to assess the impact and value of Vietnam’s EPI.15,17,18,19

In the absence of a scientific basis for the cost effectiveness of vaccines, the policy makers in Vietnam may depend heavily on the research is published and available presentations unpublished real by industry or academic researchers.20,21 With unfiltered potential impact of literature on decision making, we set out to implement a system of economic assessment is published in the vaccine in Vietnam. Our objective is critically comprehensive review on vaccine research, funding, quality of research, changes over time, and a summary of their main findings.

METHODS

The systematic searching was conducted on June 16th, 2016, in MEDLINE (using PubMed), Scopus (using www.scopus.com), Google Scholar (using www.scholar.google.com) and Cochrance (using www.cochrane.org) to identify all articles of health-related quality of life outcome published from previous to June 16th, 2016. We aimed to identify all articles having economic evaluation in vaccines in their researches to make a comparison these studies together.

The search method consisted of search terms for systematic reviews, search terms for measurement instrument, and a validated methodological search filter for measurement properties.22 References of included articles were checked again for additional relevant studies in case they are necessary. The Boolean word (AND, OR), field specification (Title, Abstract, All fields), checking duplication, comparison between articles and criteria also were used as technique in searching process. The full syntax was used in this study is: ((Economic Evaluation [MeSH Terms])
AND (Vaccine* [MeSH Terms]) AND (Viet* [Title/Abstract])).

The following inclusion criteria were used in studies on economic evaluation area were conducted in vaccine in Vietnam population. These studies were health technology assessment as a method in their researches. On the other hand, the exclusion criteria were used: (1) the studies were conducted in Vietnamese population but they are costing studies; (2) the economic evaluation of vaccines was conducted on Vietnamese population living overseas were not excepted; (3) the publications were published on non-English journals also were not included. The quality of articles were evaluated based on the same method of Quang et al. article and Nam et al. research.

The results of the study were compared together, which used the health technology assessment as the same method. We concern about the incremental cost-effectiveness ratio; what instrument is used; when the study was conducted; and what function the authors were mentioned. The searching progress based on the abstracts and article selection is provided in Figure 1.

RESULTS

The review was conducted on 16th June 2016. Through the searching syntax as above, we apply it into searching progress in the databases. 13 articles were identified from PubMed database and 9 articles were identified from Scopus by search terms. Besides that, 11 articles in Cochrance and 32 articles in Google Scholar also were found.

When we combine these studies together, 16 articles were duplicated. In there, 15 articles were excluded because of criteria selection. They are not related in vaccine area (three articles); six studies are not in economic evaluation area. Besides that, they did not conduct in Vietnam (two articles) and four articles only have abstract. In conclusion, six articles were reviewed. The procedure of review is summary as Figure 1 as above.

In these articles, three of them using Markov model are the approach in their studies, the others used mathematic model to simulate expected costs and benefits through decision tree as the model in these articles. Almost articles had used incremental cost-effectiveness ratio (ICER) per DALY as a standard of effective, one of them used ICER per QALY. As the summary in Table 1 and Figure 1, it is very less of economic evaluation in vaccine was conducted (three articles in 2008, and one article in 2005, 2009 and 2012) in Vietnam and the most of articles was taken based on supporting by GAVI projects.

Among these economic evaluation articles in vaccine in Vietnam, they only focus on three type of vaccine, such as rotavirus vaccine, typhoid Vi and human papillomavirus (HPV) as summary on Table 2. These vaccines are very important for children and women to avert diseases. They had calculated to define they should be available in list of EPI or not. That is why the main target population in these studies are children (four articles) and women (2 articles).

DISCUSSIONS

Vietnam just join in middle-income countries, the social – economic conditions still lack of more necessary resources, especially in health sector. It leads to Vietnam does not have strength and resources to col-
Table 2: Summary the results of articles.

<table>
<thead>
<tr>
<th>No</th>
<th>Authors</th>
<th>Year</th>
<th>Target populations</th>
<th>Intervention vs comparator</th>
<th>Perspective</th>
<th>Method</th>
<th>Cost</th>
<th>Outcome</th>
<th>Types of model</th>
<th>Time horizon</th>
<th>Discount</th>
<th>Sensitivity analysis</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fischer, Dang Duc Anh, Lynn Antil, N. D. L. Cat, Paul E. Kilgore, Vu D. Thiem, Rick Rheingans, Le H. Tho, Roger I. Glass, and Joseph S. Bresee</td>
<td>2005</td>
<td>Young children less than 5 years old</td>
<td>Rotavirus vaccination compared to no intervention</td>
<td>Societal perspectives</td>
<td>-</td>
<td>-$3.1 million (Medical direct cost $685,000) $1.5 million (non-medical direct cost)</td>
<td>Incremental cost-effectiveness ratio (ICER) per DALY</td>
<td>Mathematical model - Decision tree</td>
<td>5 yrs</td>
<td>3%</td>
<td>Monte Carlo simulations</td>
<td>It is cost-effectiveness intervention. $40/ DALY</td>
</tr>
<tr>
<td>2</td>
<td>Sun-Young Kim, Sue J Goldie and Joshua A Salomon</td>
<td>2009</td>
<td>Young children less than 5 years old</td>
<td>Rotavirus vaccination compared to no intervention</td>
<td>Societal perspectives and health care system perspectives</td>
<td>CEA</td>
<td>Social perspective: $19.0 million; Healthcare perspective: $18.6 million</td>
<td>Social perspective: $2.6 million; Healthcare perspective: $1.2 million</td>
<td>Incremental cost-effectiveness ratio (ICER) per DALY</td>
<td>Markov</td>
<td>5 yrs</td>
<td>3%</td>
<td>Univariate sensitivity analyses and Monte Carlo simulations</td>
</tr>
<tr>
<td>3</td>
<td>Hong-Anh T. Tu, Mark H. Rozenbaum, Peter C. Coyte, Shu Chuen Li, Herman J. Woordenbag, Maarten J Postma</td>
<td>2012</td>
<td>Young children less than 1 year old</td>
<td>Rotavirus vaccination compared to no intervention</td>
<td>Societal perspectives and health care system perspectives</td>
<td>CEA</td>
<td>Mild: $4.64; Moderate: $5.07; Severe: $35.28</td>
<td>Mild: $4.01; Moderate: $5.61; Severe: $8.76</td>
<td>Incremental cost-effectiveness ratio (ICER) per QALY</td>
<td>CoRoVa model (the Consensus Model on Rotavirus Vaccination)</td>
<td>5 yrs</td>
<td>3%</td>
<td>Monte Carlo simulations</td>
</tr>
</tbody>
</table>
lecting data. Many parameters do not have real data, so that, they almost use mathematic model to estimate, to predict expected costs and benefits through decision tree analysis or they assume that parameters in the Markov model as summarize in Table 2. Despite facing to many difficulties, Vietnam Government try to take these vaccines into National expanded program on Immunization, and all of studies had researched in social perspective. Besides that, half of articles also had done in health care provider perspective. With Rotavirus vaccine, three researches were conducted in 2005, 2009 and 2012. The article published later improved the previous research. In 2005, Fischer et al. had published original articles to make background not only the findings but also the risk of the economic evaluations and interpretation of results. Vietnam need more research, review, and assess not only the findings but also the risk of the economic evaluations.

**CONCLUSIONS**

We observed diverse approached to evaluate vaccine economics in Vietnam. Because economic evaluation analysis may influence policy maker decision about national EPI, it is important to be aware of methodology and interpretation of results. Vietnam need more research, review, and assess not only the findings but also the risk of the economic evaluations.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Study Authors</th>
<th>Year</th>
<th>Population</th>
<th>Vaccine</th>
<th>Model</th>
<th>Perspective</th>
<th>Method</th>
<th>ICER</th>
<th>Perspective</th>
<th>Cost per DALY</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Joseph Cook, Marc Ijzert, Dale Whittington, Christine Poulos, John Clemens, Dipika Sur, Dang Duc Anh, Magdarina Agtini, Zulfiqar Bhutta, DOMI</td>
<td>2008</td>
<td>Children (2-14.9 aged)</td>
<td>Typhoid vaccine compared to no intervention</td>
<td>CEA</td>
<td>Societal perspectives and health care system perspectives</td>
<td>Markov</td>
<td>3 yrs</td>
<td>3 yrs</td>
<td>$540</td>
</tr>
<tr>
<td>5</td>
<td>Sue J. Goldie, Mireia Diaz, Sun-Young Kim, Carol E. Levin, Hoang Van Minh, Jane J. Kim</td>
<td>2008</td>
<td>Women (9-12 aged) and Women (30-35)</td>
<td>HPV vaccination compared to no intervention</td>
<td>Societal perspectives</td>
<td>Markov</td>
<td>Decision tree</td>
<td>5 yrs</td>
<td>3 yrs</td>
<td>Individual-based Monte Carlo simulation</td>
</tr>
<tr>
<td>6</td>
<td>Jane J. Kim, Katie E. Kobus, Mireia Diaz, Meredith O’Shea, Hoang Van Minh, Sue J. Goldie</td>
<td>2008</td>
<td>Women (9-12 aged) and Women (30-35)</td>
<td>HPV vaccination compared to no intervention</td>
<td>Societal perspectives</td>
<td>Markov</td>
<td>Decision tree</td>
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<td>3 yrs</td>
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</tr>
</tbody>
</table>
of vaccines before applying new vaccine into national expanded program in immunization.

**ABBREVIATION**

DALY: Disability-Adjusted Life Year; DPT: Diphtheria-Pertussis-Tetanus; EPI: Expanded Program on Immunization; ICER: Incremental cost-effectiveness ratio; GAVI: Global Alliance for Vaccines and Immunization; QALY: Quality-Adjusted Life Year.

**COMPLIANCE WITH ETHICAL STANDARDS**

**CONFLICT OF INTEREST**

All authors of this study participated in this study had done searching filter separately with high agreement. None of author and co-authors on any of the included articles in this systematic review.

**ETHICAL APPROVAL**

This research does not contain any studies with human participants conducted by any of the authors.

**REFERENCES**