Vaccine 34 (2016) 4814–4819

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Vaccination program in a resource-limited setting: A case study in the Philippines

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ARTICLE INFO

Article history:
Received 30 January 2016
Received in revised form 23 June 2016
Accepted 2 August 2016
Available online 13 August 2016

Keywords:
Pneumococcal conjugate vaccine
Human resources for health
HRH
PCV
Philippines
Vaccination coverage

ABSTRACT

Objective: Implementing national-level vaccination programs involves long-term investment, which can be a significant financial burden, particularly in resource-limited settings. Although many studies have assessed the economic impacts of providing vaccinations, evidence on the positive and negative implications of human resources for health (HRH) is still lacking. Therefore, this study aims to estimate the HRH impact of introducing pneumococcal conjugate vaccine (PCV) using a model-based economic evaluation.
Methods: This study adapted a Markov model from a prior study that was conducted in the Philippines for assessing the cost-effectiveness of 10-valent and 13-valent PCV compared to no vaccination. The Markov model was used for estimating the number of cases of pneumococcal-related diseases, categorized by policy options. HRH-related parameters were obtained from document reviews and interviews using the quantity, task, and productivity model (QTP model).
Results: The number of full-time equivalent (FTE) of general practitioners, nurses, and midwives increases significantly if the universal vaccine coverage policy is implemented. A universal coverage of PCV13 - which is considered to be the best value for money compared to other vaccination strategies - requires an additional 380 FTEs for general practitioners, 602 FTEs for nurses, and 205 FTEs for midwives; it can reduce the number of FTEs for medical social workers, paediatricians, infectious disease specialists, neurologists, anaesthesiologists, radiologists, ultrasonologists, medical technologists, radiologic technologists, and pharmacists by 7, 17.9, 9.7, 0.4, 0.1, 0.7, 0.1, 12.3, 2, and 9.7, respectively, when compared to the no vaccination policy.
Conclusion: This is the first attempt to estimate the impact of HRH alongside a model-based economic evaluation study, which can be eventually applied to other vaccine studies, especially those which inform resource allocation in developing settings where not only financial resources but also HRH are constrained.

1. Introduction

Human resources are an integral part of every healthcare system [1]. However, in low- and middle-income countries (LMICs), human resources for health (HRH) are often limited, which impacts both the access to and quality of healthcare [1,2]. The shortage of healthcare workers can be due to different factors such as low production capacity for HRH, brain drain of healthcare workers, inefficient use of human resources or imbalance in the composition of demographics [3,4]. As the demand for healthcare services increases, this scarcity can result in instability of the healthcare system. In addition, introducing health interventions or technologies will always have an effect on the demand for human resources and this should be a serious concern for decision-makers, especially in LMICs, as training health workforce (i.e. general practitioners and medical specialists) requires a considerable amount of time [5–7].

Vaccination can be considered as a unique intervention in the context of human resources. Vaccination programs are a long-term investment for preventing specific diseases, and have a dynamic effect on the utilization of different types of HRH.

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http://dx.doi.org/10.1016/j.vaccine.2016.08.014
0264-410X/

Vaccination programs could increase the present need of particular types of human resources and reduce the future need of the health workforce in treating vaccine preventable diseases [8,9]. Although there are few papers addressing the success of vaccination in terms of HRH requirements [2,10], no study has been conducted that compares the impact of vaccinations in terms of both HRH needed and reduced within a study.

It would be appropriate for evidence-informed policy decisions to take into account both HRH required and saved due to vaccinations. Therefore, this study aims to take this challenge by estimating the HRH needed and reduced as a result of introducing the pneumococcal conjugate vaccine (PCV). This study is conducted as an additional analysis to the economic evaluation using the Philippines as a case study due to their existing economic model which compares various vaccination policy options [11].

2. Material and methods

This study examines the impact of HRH by using the quantity, task, and productivity (QTP) model. The QTP model is one of the approaches to determine HRH and was developed under the concept of functional job analysis whereby the skill requirements to complete a certain task are assessed [12]. There are four main key features of this model: (1) it includes a set of priority interventions, (2) it estimates HRH by calculating the number of cases needed for a service (service quantity), (3) it identifies the tasks and estimates the time needed to deliver a service, and (4) it includes the productivity by combining staff productivity and service productivity. This model has been developed for low-income countries that want to scale up their priority interventions. A study conducted by Kurowski et al. showed that the QTP method was robust in estimating the required human resources [13].

Furthermore, this model is practical and feasible for application in the Philippines where data resources are restricted. The adapted version of the QTP model for estimating the HRH impact of introducing the PCV vaccination in the Philippines is shown in Supplement A. Using this model, the HRH-related parameters were obtained from existing clinical practice guidelines [14–17] wherein the applicability of each procedure in the local setting was verified by conducting interviews with healthcare providers. The adapted QTP model includes four major steps (Fig. 1) and is described in the following paragraphs.

In the first step, several health services for the treatment of pneumococcal-related diseases were identified, including the number of cases that occurred in each scenario, i.e. with and without the vaccination program. The number of cases for each disease was estimated using the Markov model from a prior economic evaluation study that was conducted in the Philippines [11]. One-year time horizon was employed in this study, while the prior economic evaluation used a Markov model with a lifetime horizon. The target population for universal coverage of the PCV vaccination was set at 2,200,000 eligible infants below the age of one year based on 2013 data obtained from the Philippine Statistics Authority [18].

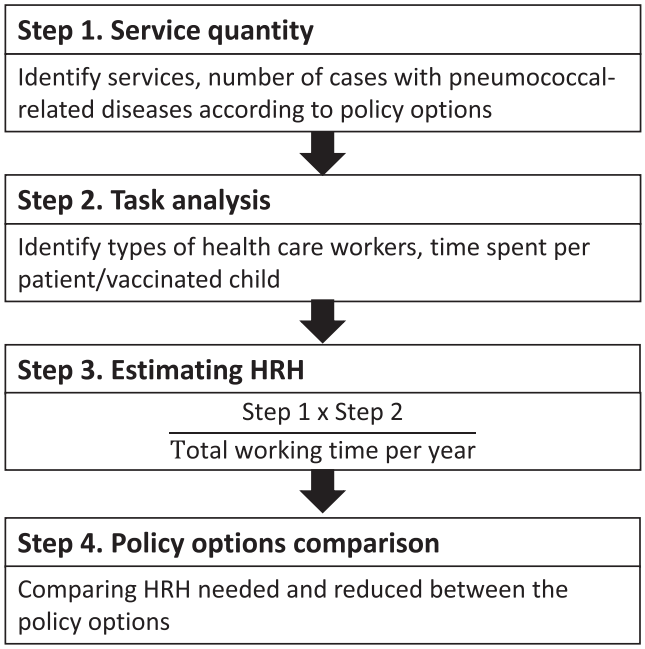

Fig. 1. Summary of the four steps in HRH estimation.

In the second step, the types of health workforces needed for each type of health service relating to vaccination, treatments of non-hospitalized pneumonia, and acute otitis media were obtained based on consensus among municipal health officers in the seminar for the primary care benefit package of the state insurance scheme; meanwhile, data on treatment of meningitis, sepsis/bacteraemia and hospitalized pneumonia in intensive care units (ICU) and non-ICUs were derived from four medical specialists. In the data collection process, participants were given information on healthcare services as stated by the clinical practice guidelines from the Philippine Health Insurance Corporation [14]; Philippine Clinical Practice Guidelines on the Diagnosis, Empiric Management, and Prevention of Community-acquired Pneumonia (CAP) in Immunocompetent Adults [15]; and Integrated Management of Childhood Illness (IMCI) [16,17]. After that, they were asked to indicate the set of healthcare services they provide in their practice, followed by identifying the types of health workforce needed as well as the average amount of time (minutes) for each health professional spent per treated patient or vaccinated child.

In the third step, the magnitude of HRH needed for each policy option was estimated. Staff productivity was assumed to be 6 h or 360 min per day, with 220 working days in a year. The number of healthcare workers needed for the implementation of the PCV vaccination and for the treatment of pneumococcal-related diseases was calculated in full-time equivalent (FTE) using the formula below. One FTE equals one employee that works on a full-time basis. In the last step, HRH needed and reduced were compared with each other for each policy option.

$$\text{Number of healthcare workers (in FTEs)} = \frac{\text{Total time spent of healthcare provider per case (minutes)} \times \text{Number of cases or target population}}{\text{Total working time per year } (= 360 * 220 \text{ min/person/year})}$$