



A cost comparison of introducing and delivering pneumococcal, rotavirus and human papillomavirus vaccines in Rwanda



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ABSTRACT

Background: Detailed cost evaluations of delivery of new vaccines such as pneumococcal conjugate, human papillomavirus (HPV), and rotavirus vaccines in low and middle-income countries are scarce. This paper differs from others by comparing the costs of introducing multiple vaccines in a single country and then assessing the financial and economic impact at the time and implications for the future. The objective of the analysis was to understand the introduction and delivery cost per dose or per child of the three new vaccines in Rwanda to inform domestic and external financial resource mobilization.

Methods: Start-up, recurrent, and capital costs from a government perspective were collected in 2012. Since pneumococcal conjugate and HPV vaccines had already been introduced, cost data for those vaccines were collected retrospectively while prospective (projected) costing was done for rotavirus vaccine.

Results: The financial unit cost per fully immunized child (or girl for HPV vaccine) of delivering 3 doses of each vaccine (without costs related to vaccine procurement) was \$0.37 for rotavirus (RotaTeq[®]) vaccine, \$0.54 for pneumococcal (Prevnar[®]) vaccine in pre-filled syringes, and \$10.23 for HPV (Gardasil[®]) vaccine. The financial delivery costs of Prevnar[®] and RotaTeq[®] were similar since both were delivered using existing health system infrastructure to deliver infant vaccines at health centers. The total financial cost of delivering Gardasil[®] was higher than those of the two infant vaccines due to greater resource requirements associated with creating a new vaccine delivery system in for a new target population of 12-year-old girls who have not previously been served by the existing routine infant immunization program.

Conclusion: The analysis indicates that service delivery strategies have an important influence on costs of introducing new vaccines and costs per girl reached with HPV vaccine are higher than the other two vaccines because of its delivery strategy. Documented information on financial commitments for new vaccines, particularly from government sources, is a useful input into country policy dialogue on sustainable financing and co-financing of new vaccines, as well as for policy decisions by donors such as Gavi, the Vaccine Alliance.

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1. Introduction

Only a few detailed cost evaluations of the delivery of new vaccines such as pneumococcal, human papillomavirus (HPV), and rotavirus vaccines in low and middle-income countries exist [1–5]. This paper differs from other papers since it evaluates not only

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the costs of introducing individual vaccines, but also the costs of introducing multiple vaccines in a single country and then assesses the financial and economic impact at the time and implications for the future.

The policy implications of having accurate cost and financing information are several. These data can be used to improve planning of resource requirements and financing needs for multiple vaccine introductions at country level to evaluate their affordability. Understanding the delivery cost per dose or per child of new vaccines is important for informing domestic and external resource mobilization. Documented information on financial commitments for new vaccines, particularly from government sources, is a useful input into country policy dialogue on sustainable financing and co-financing of new vaccines, as well as for policy decisions by donors such as Gavi the Vaccine Alliance.

Rwanda is a small landlocked country with a population of 10.6 million located in East Africa. The Government of Rwanda (GOR) has had many achievements in health sector reform including the introduction of a system of performance-based financing and community-health insurance that covers more than 90 percent of the population with minimal co-payment. Rwanda has been very successful in achieving mortality reduction. Between 2005 and 2010, its child mortality decreased from 152 to 76 per 1000 live births and its infant mortality from 86 to 50 [6].

Rwanda was the first African country with national immunization programme introductions of pneumococcal conjugate vaccine (Pevnar[®]) in 2009, HPV vaccine (Gardasil[®]) in 2011 and rotavirus vaccine (RotaTeq[®]) in 2012. Pevnar[®] was initially provided in 2009 through Gavi via a donation from the manufacturer, Wyeth, and was then supported by Gavi with country co-financing beginning in 2010. ² Gardasil[®] was provided through a three-year donation from the manufacturer, Merck, during 2011–2013 [7], and was supported by GAVI with country co-financing starting in 2014. Rotateq[®] was introduced in 2012 through Gavi support with country co-financing.

All three vaccines had the similar requirement of having 3-dose schedules for administration but the vaccine products differed in other aspects. The vaccine product presentations were different and this had consequences on the cold chain volume and waste management: Pevnar[®] was in a prefilled syringe for intramuscular injection (cold chain volume: 55.9 cm³); RotaTeq[®] was in a single dose tube for oral administration (cold chain volume: 46.3 cm³); and Gardasil[®] was in a single dose vial (cold chain volume: 15 cm³) with separate syringe for intramuscular injection. Furthermore, target populations and delivery strategies for the three vaccines differed. Pneumococcal and rotavirus vaccines are recommended for infants and are commonly given through immunization sessions using the existing health system and existing health service delivery structure. The recommended target population for HPV vaccine is 9–13 year old girls [8], a population that has not been routinely served by immunization programs in most low or low middle income countries. Thus, the decision to introduce HPV vaccine in such countries requires creation of new vaccine delivery services in order to deliver multiple doses to each girl. In Rwanda, all three doses of HPV vaccine were delivered at schools to girls in primary grade 6 and were delivered at health facilities to a smaller proportion of girls (3%) who were not attending school.

The objective of the analysis was to estimate the cost of introducing and delivering each of the three vaccines nationwide in Rwanda, a low-income country, and to compare and understand

Table 1
Description of vaccination activities in cost analysis.

	Description
Micro-planning	Meetings at national and district level for planning vaccine introduction activities
Training	Development of training curricula and materials, Training of trainers, training of supervisors, training of vaccinators at district/provincial level, training of monitors
Social Mobilization and Information, Education, and Communication (IEC)	Meetings with community leaders, IEC material development, production of leaflets, posters, TV spots, and radio, media/journalist workshop
Vaccine/injection supply procurement	Procurement of vaccines and injection supplies, clearance from customs, receiving, storage, and co-financing fees for Gavi supported vaccines
Service delivery	Personnel time spent on vaccination and traveling, per diem and transport costs associated with health worker vaccination of infants or adolescent girls.
Supervision, monitoring & evaluation	Supervisory trips by national and district-level program managers, production of registers and tally sheets, disease surveillance, and post-introduction evaluation
Waste management	Incineration and burial of syringes, safety boxes and vaccine containers
Cold chain	Purchase of additional cold chain equipment to store and transport vaccines

the differences in cost components among the different vaccines to identify the main cost drivers.

2. Methods

The analysis focused on estimating the incremental direct costs to the government health system of vaccinating children with the new vaccines and did not include existing costs of buildings or cold chain infrastructure. No indirect costs such as cost to the user (children, parents or caregivers) due to productivity losses were included.

The cost components for service delivery included startup costs (micro-planning, training, social mobilization and Information, Education, and Communication (IEC)), recurrent (vaccine and injection supply procurement, service delivery, supervision and monitoring and evaluation, and waste management) and capital costs (purchase of cold chain equipment). See Table 1 for a description of vaccination activities.

Both financial (or costs to the MoH) and economic costs were estimated so that opportunity costs could be compared. Financial costs included the value of resources purchased (or real expenditures) for the vaccine introduction. For example, these included resources used for vaccination (vaccines and injection supplies), training, social mobilization, transport and outreach allowances. Financial costs differ from economic costs since financial costs do not include resources that are already paid for or owned by the MoH such as the salaries of health personnel or resources paid for by external partners such as vaccines.

Table 2 provides an overview of the different cost components for calculating financial and economic costs. Service delivery is comprised of personnel, per diem and travel. However, salaries for personnel are already paid for by the Rwanda government, therefore, financial costs consist of per diem and travel allowances for personnel. These costs were only incurred for Gardasil since 97% of vaccines were delivered at schools, where health workers, community health workers and supervisors received per diem and travel allowance for the school based vaccination program. Rotateq and Pevnar were provided at health facilities.

² Rwanda switched its presentation of Pevnar[®] from prefilled syringe to vials (PCV13) when it switched to GAVI financing.

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