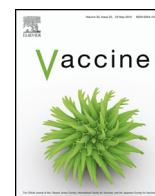




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Successive introduction of four new vaccines in Rwanda: High coverage and rapid scale up of Rwanda's expanded immunization program from 2009 to 2013

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ABSTRACT

As the pace of vaccine uptake accelerates globally, there is a need to document low-income country experiences with vaccine introductions. Over the course of five years, the government of Rwanda rolled out vaccines against pneumococcus, human papillomavirus, rotavirus, and measles & rubella, achieving over 90% coverage for each. To carry out these rollouts, Rwanda's Ministry of Health engaged in careful review of disease burden information and extensive, cross-sectoral planning at least one year before introducing each vaccine. Rwanda's local leaders, development partners, civil society organizations and widespread community health worker network were mobilized to support communication efforts. Community health workers were also used to confirm target population size. Support from Gavi, UNICEF and WHO was used in combination with government funds to promote country ownership and collaboration. Vaccination was also combined with additional community-based health interventions. Other countries considering rapid consecutive or simultaneous rollouts of new vaccines may consider lessons from Rwanda's experience while tailoring the strategies used to local context.

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1. Introduction

Access to vaccines in many of the poorest countries has risen dramatically in recent years with improvements in health care delivery systems, the advent of new funding, monitoring and evaluation mechanisms, and increased global connectivity. Partnerships with multilateral organizations including the World

Health Organization (WHO) and UNICEF to launch and bolster nationally-owned and managed immunization programs significantly accelerated progress toward meeting the international targets for child survival, including the 2015 Millennium Development Goals.

Twenty years ago in Rwanda, child survival plummeted as a result of the 1994 genocide during which one million people were killed. Often overlooked in this period of history were the major short- and long-term health impacts of the violence on newborns and young children. In the years that followed the genocide, more than one in four children would die of preventable causes before their fifth birthday [1]. With a national health system that was all but destroyed, coverage of most WHO-recommended immunizations plummeted below 25% in 1994 (Fig. 1) [2].

Yet, over the past two decades, Rwanda has been able to not only rebuild its Expanded Program on Immunization but also to increase its scope to include vaccination against 12 pathogens with coverage rates above 90% [3].

Abbreviations: PCV, pneumococcal conjugate vaccine; HPV, human papillomavirus; MR, measles–rubella; MDG's, United Nations Millennium Development Goals; CHWs, community health workers; EPI, Expanded Program on Immunization; BCG, Bacillus Calmette–Guerin; DTP, diphtheria, tetanus and pertussis; TT, tetanus toxoid vaccine; Gavi, Gavi, the vaccine alliance; ICC, inter-agency coordinating committee; MOH, Ministry of Health of Rwanda; HMIS, Health Management Information System; CRS, congenital rubella syndrome.

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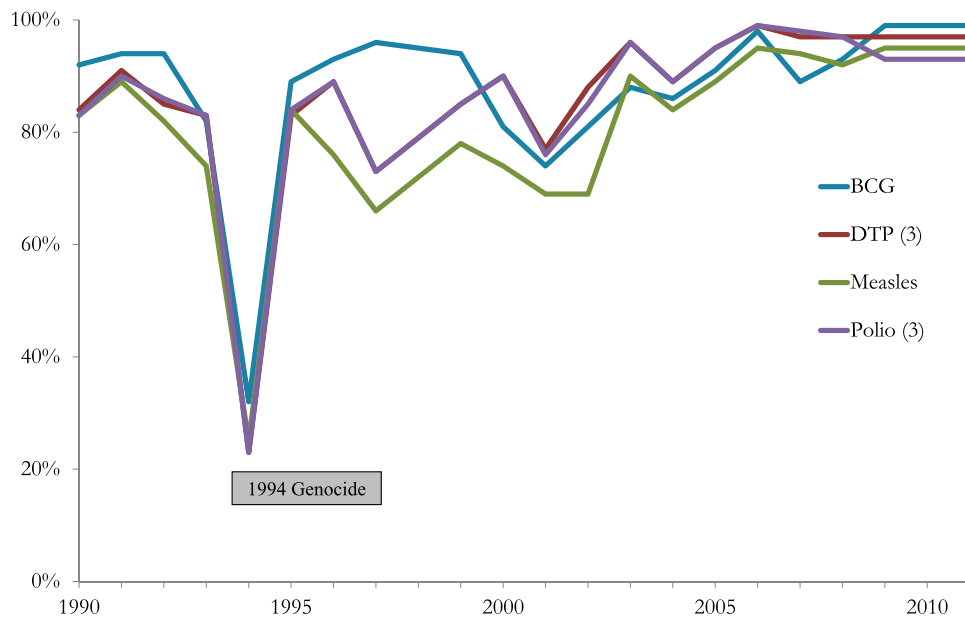


Fig. 1. WHO-recommended vaccination coverage in Rwanda.

After the genocide, few predicted seeing a rebound in Rwanda's health sector for decades to come. Indeed, there were only a handful of health workers in the whole of Rwanda at the time of the genocide [4,5]. The turnaround achieved over the course of the following decades has been a product of strong national ownership, a commitment to equity and evidence-based policy making, collaboration and participation at all levels, and community access to and involvement in health care [6]. Life expectancy more than doubled between 1995 and 2011, while deaths attributable to HIV, tuberculosis, and malaria fell by more than 75% from peak levels [7]. Between 2000 and 2011, Rwanda's child mortality rate dropped 70.4%—more than any other country in the world above 500,000 population [7].

As the pace of vaccine uptake accelerates across Africa and around the world with the support of Gavi, the Vaccine Alliance, and other organizations, there is a need to document low-income countries' experiences in planning and implementation of new vaccine introductions [8]. In the present article, authors describe Rwanda's successive roll-out of four new vaccines between 2009 and 2013: pneumococcal conjugate (PCV) in 2009, human papillomavirus (HPV) in 2011, rotavirus in 2012, and measles–rubella (MR) in 2013. Rwanda was the first country in sub-Saharan Africa to roll out the PCV, HPV, and MR vaccines, and the third Gavi-eligible country in Africa to roll out the rotavirus vaccine [9–12]. Authors describe the national immunization program and share lessons that may be useful to other countries.

2. Immunization program context

In 2011, 625 physicians, 8273 nurses, and 240 midwives served in Rwanda's 5 referral hospitals, 42 district hospitals, and 469 health centers [13]. Of particular relevance to the immunization program, there are approximately 45,000 elected, trained, and equipped community health workers (CHWs) who provide basic health services related to malaria, respiratory infections, diarrhea, and other major childhood killers. Each community elects 3 health workers, two assigned to community health, nutrition, and HIV/AIDS and one assigned to maternal health. Local cooperatives (such as small stores) help to finance the program. All CHWs must have 6 years of education and payment is based upon performance [15]. CHWs are supervised by a coordinator at their local health

post who provides information on immunization campaigns [15,16]. CHWs are additionally responsible for referring patients to health centers and hospitals.

Rwanda's Health Management Information System (HMIS) is a central repository for health data from public and private health facilities used to monitor the burden of disease and intervention coverage, as well as to support decisions regarding vaccine rollout

Rwanda's Expanded Program on Immunization (EPI) was founded in 1978, one year after the World Health Organization's EPI global policies and targets were established. By 1980, Rwanda had introduced three childhood vaccines nationwide: Bacillus Calmette–Guerin (BCG), diphtheria, tetanus and pertussis combination (DTP), and measles, as well as maternal tetanus toxoid (TT) [17]. The rebirth of the national vaccination program after the genocide came in 1996 when an inter-agency coordinating committee (ICC) was formed with development partners; the ICC still manages all national immunizations. The years of introduction and

Table 1
New vaccine introductions in Rwanda.

| Vaccine | Date introduced | 2013 coverage (%) |
|------------------|-----------------|-------------------|
| BCG | 1980 | 99 |
| DTP3 | 1980 | 98 |
| MCV | 1980 | 97 |
| Pol3 | 1980 | 98 |
| PAB | 1980 | 85 |
| HepB3 | 2002 | 98 |
| Hib3 | 2002 | 98 |
| PCV3 | 2009 | 98 |
| HPV ^a | 2011 | 97 |
| Rota | 2012 | 99 |
| MR ^b | 2013 | 98 |

^{a,b} WHO does not currently provide data on HPV and MR, so EPI estimates were used. Adapted from: World Health Organization (2013). WHO-UNICEF vaccination coverage estimates time series for Rwanda. **BCG**: Bacillus Calmette–Guérin vaccine, **DTP3**: diphtheria, tetanus and pertussis vaccine 3rd dose, **MCV**: meningococcal vaccine, **Pol3**: oral polio vaccine 3rd dose, **PAB**: 2 doses of tetanus toxoid given to mothers to protect infants at birth, **HepB3**: hepatitis B vaccine 3rd dose, **Hib3**: *Haemophilus Influenzae* type B vaccine 3rd dose, **PCV3**: pneumococcal conjugate vaccine 3rd dose, **HPV**: human papillomavirus vaccine, **Rota**: rotavirus vaccine last dose, **MR**: measles–rubella vaccine http://apps.who.int/immunization_monitoring/globalsummary/estimates?c=RWA and Rwanda Biomedical Center–Vaccine Preventable Diseases Division. Routine Immunization Coverage Evaluation Survey, 2013

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