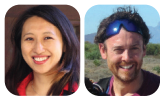


BUILDING AFFORDABLE CANCER CARE IN LOW- AND MIDDLE-INCOME COUNTRIES



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Investments in national health systems, infrastructure capacity and domestic allocations of health care support are crucial for developing quality cancer care in emerging economies. However, it is unlikely that low- and middle-income countries (LMIC) will be able to build the immediate resources required without international development assistance and partnerships. Biomedical innovations in improved diagnostics for screening, vaccines and drug therapies will help in decreasing mortality; however, effective delivery of new innovations must also be adequately managed to achieve impact. Delivery planning not only includes point-of-care procedures between medical personnel and the patient, but also includes predelivery training, mass education of cancer facts, prevention guidance and care options. However, as it stands the economics of affordable cancer technologies simply do not add up with most, if not all, therapeutic approaches used in high income countries well above the cost-effectiveness thresholds currently being set for emerging economies¹. There is an urgent need to innovate on the global financing model for cancer technologies in LMIC.

The 2010 *World Health Report*² focused on health systems financing and outlines international policy for raising sufficient resources: increasing revenue collection in all countries through taxes, reprioritizing government budgets on health, innovative financing and development assistance for health. The financing policies concentrate on raising resources for already proven and existing products, but what about financing to stimulate new innovations specific to developing country contexts? Including issues of affordability and availability?

The innovation value chain outlines the transformation of ideas into end products for the user. Biomedical innovation typically originates from scientific ideas that pass through discovery to clinical development and subsequently to delivery through national health systems^{3,4}. Figure 1 illustrates the innovation value chain applied to biomedical translation of ideas into use.

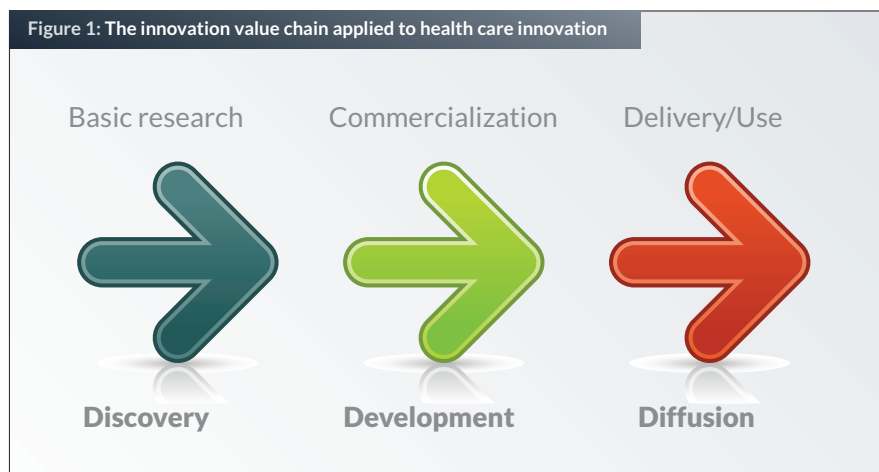
We propose that novel financing incentives need to be structured and available throughout the spectrum of the R&D cancer value chain for LMIC. Considerations of access need to be embedded throughout all development phases of

innovation. Unfortunately, in the past there has been a typical 15–20 year lag between introductions of new innovative vaccines in high-income countries before they are diffused and used in LMIC. This gap needs to be eliminated. We propose two new considerations of novel financing for emerging health systems:

1. Partnerships: with stakeholders along the innovation value chain (in discovery, development, delivery) with public and private innovators and across government initiatives.
2. Leveraging ecosystem resources: emerging health systems are part of a larger global health ecosystem and resources can be aggregated from internal national resources with ecosystem resources and capabilities.

A case study model: Rwanda and cervical cancer

Over 275,000 women die each year from cervical cancer in LMIC and virtually all victims were infected with the human papillomavirus. This is a major economic and social burden from cancer directly affecting LMIC. Two vaccines against the virus have been approved against HPV types 16 and 18 that cause about 70% of cervical cancer cases. Efficacy of the



vaccines have been tracked over longitudinal studies⁵, however there are still questions about its cost, at over US\$300 per the 3-dose combination in high-income countries⁶. Rwanda, a low-income country in sub-Saharan Africa became the first country on the African continent and the first low-income country in the world to roll-out the innovative HPV vaccine to its pre-adolescent girl population in April 2011⁷. Cervical cancer is the most common cancer among women in Rwanda⁸ and political will was mobilized to tackle the problem with a vaccine available. The following case study uses an innovation value chain perspective to illustrate how Rwanda achieved 93% coverage with its first HPV vaccination roll-out⁹. Impact was achieved through building effective partnerships and leveraging global health ecosystem resources.

Through a series of new partnerships, Rwanda reduced the historical two-decade gap in vaccine roll-out between high- and low-income countries to just five years. First, Rwanda built a partnership between the Ministry of Health and a supplier of HPV vaccines, Merck, where a memorandum of understanding was signed guaranteeing Rwanda three years of vaccinations at no cost and lower pricing for future doses. Second, the Ministry of Health built internal partnerships with other ministries including the Ministry of Education, the Ministry of Gender and Family Promotion, the Centre for Treatment and Research on AIDS, TB and Malaria and other epidemics and built an education strategy to mobilize 60,000 community health workers. The Ministry of Health did not undertake the national vaccine implementation role alone and brokered multidisciplinary subcommittees to plan delivery logistics well in advance. Technical committees identified use of cold chains and planned a nationwide education campaign regarding the new vaccine. Health care professionals, government and clergy gave speeches and announcements were made through media channels such as newspapers, radio and magazines. The vaccination was a voluntary opt-out

intervention and teachers, parents and guardians were instructed to discuss HPV, cervical cancer and the vaccine with the targeted age groups of girls. Third, the Ministry of Health established partnerships with technical assistance providers using in-depth interviews and focus groups to engage technical experts as well as local leaders, community health workers and teachers. Fourth, the Ministry of Health also maintained a good working relationship with the Ministry of Finance to sustainably

deliver innovations in Rwanda's health system¹⁰.

In April 2011, a HPV mass vaccination campaign was launched targeted at Rwandan girls in primary grade six with over 92,000+ girls completing all three rounds of HPV vaccination. The campaign reached coverage of 95.04% in round one, 93.90% in round two and 93.23% in round three as reported by government data¹¹. Each round took place over six days with students in schools tracked in the first two days, out-of-school girls tracked on day three and the remaining three days used for surveillance of potential adverse events.

Rwanda's pioneering roll-out of HPV implementation in resource-poor settings is an example of an emerging health system leveraging global health ecosystem resources to help achieve its objectives. Although the first three years of the HPV vaccines were provided at no cost to Rwanda, other delivery logistics and expenditures needed to be secured. Rwanda acknowledges support from the government, the GAVI Alliance (Global Alliance for Vaccines and Immunizations), the President's Emergency Plan on AIDS Relief and the Global Fund to Fight AIDS, TB and Malaria as key partnerships in implementing the vaccine delivery. The roll-out was made possible by Rwanda's prior commitments to strengthen its health systems and built upon an existing national infrastructure where 90% Rwandan infants receive all basic immunizations. The mass vaccination campaign required concentrated efforts of manpower and existing national resources were leveraged including the 60,000 community healthworkers already working for the Ministry of Health and technical assistance partners in civil society. Not everyone agrees with the use of scarce resources for a cancer vaccine versus other prevalent epidemics¹², but it is now a frequent decision ministries of health need to make in tackling the onset of noncommunicable diseases in developing countries.

Rwanda's actions in choosing to combat cervical cancer and

its broad-ranging partnerships have helped shaped the vaccine markets for HPV. Merck announced lowered tiered pricing for its HPV vaccine for GAVI-eligible countries in August 2011 to US\$5 per dose. By engaging in a memorandum of understanding with Rwanda, Merck, as a biomedical innovator in the discovery and development vaccines, also found an excellent delivery partner (Rwandan Ministry of Health) to diffuse its biomedical innovation to patients in need. In the global health ecosystem, Merck requires strong delivery partners with political will and commitment. Rwanda's Ministry of Health's partnerships and combination of existing national infrastructure and external ecosystem resources resulted in shared value being built for global health ecosystem participants.

Policy perspective

The economics of cancer in emerging economies has traditionally focused in two areas; the first is to understand the macro-economics of the cancer burden: trends, drivers, direct health care/out-of-pocket expenses, informal care costs and productivity costs, and the second around the finance models for cancer care systems. Few policy perspectives have, to our knowledge, attempted to link the value chain of cancer technologies in any meaningful way between high-income and LMI countries. Indeed the prevailing mantra is that there is little connection between the techno-economic developments of cancer in high and LMI countries. However, innovation in cancer research and technologies for care are very much needed in LMIC and novel models of financing this are essential if tangible technology transfer is going to diffuse quickly. There is clearly a need for bodies such as the International Monetary Fund and the World Bank to develop novel regional and high-LMI country institutional models of technology transfer to address some of the key areas of cancer control (including women's cancers) in emerging economies.

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