



# Reverse innovation in global health

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**Abstract:** The term “reverse innovation”, also known as “trickle-up innovation” is being popularized since 2010 with an initial focus on corporate development and economics. In brief, reverse innovation refers to new ideas and solutions adopted and tested in low- and middle-income countries (LMICs), which subsequently spread to high-income countries (HICs). Reverse innovation very much applies to public health and wellbeing; indeed, a model for reverse innovation in global health has been proposed. Experience and lessons from reverse innovation in global health suggest system-wide benefits that arise from partnerships between LMICs and HICs. Further examples of reverse innovation in global health focus on integrated approaches to health and demonstrate potential for HICs. Intercultural and multilanguage competence are central elements for global partnerships to leverage reverse innovation as global innovation. Existing global product development partnerships have a high potential and should be expanded as platforms of global innovation hubs in health.

**Keywords:** Reverse innovation; public health; global health; transdisciplinarity; One Health

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## Reverse innovation

The term “reverse innovation”, also known as “trickle-up innovation” and originally coined “innovation blowback”, is being popularized since 2010 by Govindarajan & Trimble with an initial focus on corporate development and economics (1). In brief, reverse innovation refers to new ideas and solutions adopted and tested in low- and middle-income countries (LMICs), which subsequently spread to high-income countries (HICs). Financing, governance, health information systems, health service delivery, leadership, research and product development partnerships for new diagnostics, drugs and vaccines could be stated as examples for areas of successful reverse innovation here. Reverse innovation is primarily driven by the existing income gap between emerging markets and HICs and provides specific solutions to issues not previously addressed in an affordable or culturally sensitive manner. Key characteristics that govern reverse innovation include (i) performance of commodities that

must be adapted to an acceptable level at a fraction of the current costs (e.g., inexpensive, easy-to-use, point-of-care health care devices) (2); (ii) sustainability, thus favouring green solutions from the outset (e.g., environmental sanitation in densely populated settings where resources are being recovered and reused as fertilizer) (3); (iii) new technologies that leapfrog existing standards (e.g., fiber optics and mobile communication which were quickly adopted in LMICs) (4); (iv) removal of legal and regulatory barriers that impede implementation of new technologies and commodities and prevent rapid market access (5); (v) meeting local geographical and environmental needs (e.g., delivery of medicine to inaccessible populations during rainy seasons with the help of drones) (6); and (vi) meeting local preferences for adoption in prevailing social-ecological contexts (7), as Govindarajan and Trimble noted “a market wants to have its culture, values and taste” (1).

The examples provided above emphasise that reverse innovation very much applies to public health and

wellbeing; indeed, a model for reverse innovation in global health has been proposed (8). Distinctive for this kind of innovation is the bi-directional flow of knowledge between LMICs and HIC in terms of public health (9). Experience and lessons from reverse innovation in global health suggest system-wide benefits that arise from partnerships between LMICs and HICs in financing, governance, health information systems, health service delivery, leadership, research and product development partnerships (for new diagnostics, drugs and vaccines) (9). Reverse innovation in personalised, public and global health is relational, requiring iterative approaches and a spirit of mutual learning (10). HICs should be interested to support this reverse flow of innovation to capitalize on the enormous and rapidly emerging potential from more than half of the world (11). Further examples of reverse innovation in global health focus on integrated approaches to health and demonstrate potential for HICs.

### Integrated approaches to global health

For example in Tanzania and Ghana, innovation in decentralized health planning provides a tool for mapping population health needs versus health spending allocation priorities with a nationwide application. Further examples are provided in the areas of health information systems, vaccination effectiveness and integrated “One Health” approaches for zoonoses control.

Innovation in decentralized health planning—known as ‘district health accounts’—in Tanzania and Ghana provides a tool for mapping population health needs in terms of intervention to address the burden of disease versus health spending allocation priorities with a nationwide application (12). This approach could also be applied in European countries, for instance in Switzerland, where the annual health budget has grown, on average, more than 4% over the last decade, potentially leading to health reforms which identify how to curb and stabilize health expenditures. In Burkina Faso, the ‘district health information system’ is an advanced centralized digital patient information system, which has unified the health system across the country ([www.dhis2.org](http://www.dhis2.org); accessed on March 15, 2018). European patient information systems are often far from unified and electronically available; adoption of such systems would provide considerable savings and improve health care provision and health status. The above aspects will become increasingly relevant in the light of personalized health,

which, on the one hand, has the potential to increase health care expenditures and social gaps in access to care and, on the other hand, depends on access to electronically available medical information for research purposes, cost-benefit analysis, or pattern of care evaluation.

Poor dog rabies vaccination coverage in Bamako, Mali, spurred development of an ‘intervention effectiveness cycle’, which combines quantitative and qualitative tools to identify the most sensitive parameters for access to health care (13). This refers to the One Health approach—combining access to health care for humans and animals (14). Large areas in southern Germany, Switzerland and Italy could similarly benefit from such community-based methods and improve coverage of childhood vaccination programmes. Additionally, rabies surveillance in LMICs is hampered by expensive, complex standard diagnostic methods like immunofluorescence, limiting diagnostic capacity to capital cities. Novel low-cost diagnostic lateral flow devices developed in South Korea provide a 10 min, single step process enabling rural laboratories to diagnose rabies without fluorescence microscopes (15). Access to low cost diagnostic devices will not only benefit clinical medicine, but also research in the context of epidemiological studies with a large number of participants needing screening for biological markers.

Another example of reverse innovation is ‘One Health’ that is, the added value of improved health and wellbeing of humans and animals and/or financial savings from closer cooperation of human and animal health—in general, not limited to LMICs (16). In a world of ever growing specialization, however, human and veterinary medicine have diverged, too often failing to communicate even with shared interest in the same disease. This point is exemplified by an outbreak of Q-fever in the Netherlands; public health authorities were not notified by veterinary authorities about a wave of abortions in goats (14).

Many zoonoses were eliminated through state interventions with massive budgetary support for operations and farmer compensation for culled livestock. Such funding is not available in LMICs. Hence, zoonoses control/elimination in LMICs requires different models, which are effective at low cost, and hence, the need for reverse innovation (17). Cross-sector economic analyses demonstrate that interventions in the disease animal reservoir cost less than those focused solely on human health (18). There is a vast untapped potential for closer cooperation of human and animal health in the realms of integrated surveillance of infectious disease,

**Box 1** Steps towards reverse innovation in global health

- ❖ Recognize the phenomenon
- ❖ Reduce barriers through social, intercultural and multi-language competence
- ❖ Be aware and reflect on own background (self-reflexivity)
- ❖ Engage with stakeholders in participatory, intercultural and transdisciplinary processes
- ❖ Adopt a mutual learning and partnership attitude
- ❖ Share understanding and benefits of partnership
- ❖ Learn and share practical examples
- ❖ Build capacity and professional education
- ❖ Apply and share benefits



**Figure 1** Intercultural, multilingual, participatory stakeholder process between mobile pastoralist communities, Chadian health and veterinary authorities and scientists to identify priorities for locally adapted, acceptable health care delivery (photo by Jakob Zinsstag).

joint cancer registration of humans and companion pets, and integrated monitoring of biomarkers and microbiomes in relation to environmental pollution (19).

### Towards global innovation partnership

South-North and South-South partnerships (20) are a key element within a global innovation flow—exchanging knowledge and ideas between Northern and Southern partners in different settings (9). Suggested steps towards reverse innovation in global health are proposed in *Box 1*. Following the recognition of emerging phenomena, in our experience, ‘intercultural transdisciplinary’ approaches

contribute to reduce barriers through intercultural and multilingual competence (7). In this way, a trustful relationship can be established that elicits participation by local communities resulting in a better understanding of local conditions and pathways to culturally adapted and locally acceptable health interventions. Intercultural transdisciplinarity can be considered as the inclusion of different cultures (national, disciplinary, etc.) involved in a transdisciplinary research process by emphasizing and making use of the benefits of their interaction with each other. Research partnerships between academic and non-academic actors incorporating different cultures and academic disciplines, may lead to mindful co-production and efficient sharing of knowledge (*Figure 1*).

For example, developing health care for mobile pastoralist communities in intercultural and multilingual contexts requires a self-reflexive awareness on the own cultural background, i.e., as health scientist (21) to avoid the loss of meaning in conversations for the development of linguistically sensitive health programmes (22).

### Conclusions and outlook

Reverse innovation is an increasingly important part of global innovation that is driven by resource constraints and infrastructure gaps between emerging markets and HICs; yet it holds promise to revolutionize health systems in rich countries and improve their cost-effectiveness and social justice. Reverse innovation may have system-wide effects on health if attention is given to unexpected innovation from far away. Global research and product development partnership across continents is a core approach to capitalize on global innovation and to assure its benefit for populations across the world. Becoming mindful of the wealth due to multicultural, multilingual, transnational research partners is essential for cooperating in these research collaborations. Only with understanding the individual concepts included in national and disciplinary cultures and transferred in various languages, collaboration becomes feasible. Engaging with academic and non-academic stakeholders in participatory transdisciplinary processes might lead to unexpected epistemic enrichment of understanding and new systemic and transformational knowledge. By their participatory inclusion, non-academic stakeholders often contribute insights and perspectives from longstanding observations and experiences that are overlooked in cross-sectional studies. Such insights may lead, for example, to a

better understanding of barriers to effective interventions and novel locally adapted solutions for better health services. Existing infrastructure, institutional and regulatory settings should be scrutinized as they may hinder innovation in health systems. For example, laboratory infrastructure could be used for animal and human infectious diseases and ministries could create permanent cross-sector working groups on the surveillance and response to zoonotic disease. Normative guidelines of global research partnership are universally valid as a foundation for global innovation (23). They need to be completed by adding guidelines on language and communication, making efficient communication among all involved partners a basis for successful collaboration and therewith also as essential for reverse innovation. We conjecture that global product development partnerships such as the Geneva-based Drugs for Neglected Diseases *initiative* (DNDi), Medicine for Malaria Venture (MMV) and the Foundation for Innovative New Diagnostics (FIND) should be enhanced and expanded as platforms of global innovation hubs in health.

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