

Reversing the trend: a scoping review of health innovation transfer or exchange from low- and middle-income countries to high-income countries

Marie Consolatrice Sage Ishimwe ¹, Jepchirchir Kiplagat ²,
Arina Kadam Knowlton,³ Alicia A Livinski ⁴, Linda E Kupfer ³

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For numbered affiliations see end of article.

Correspondence to

Dr Marie Consolatrice Sage Ishimwe;
sageishimwe23@gmail.com

ABSTRACT

The transfer of innovations from low and middle-income countries (LMICs) to high-income countries (HICs) has received little attention, leaving gaps in the understanding of the process, its benefits and the factors influencing it. This scoping review, part of a National Institutes of Health (NIH) project and the focus for a 2022 NIH-sponsored workshop on Global Health Reciprocal Innovation, sought to identify publications describing health innovations that were researched, developed and implemented in LMICs and adapted to address similar health challenges in HICs. A protocol was written *a priori* and registered on Open Science Framework. Four databases were searched for articles published in English from 2000 to 2022 and described health innovations developed in LMICs and were transferred to HICs. Using Covidence, two reviewers initially screened the title and abstract and then the full text; discrepancies were resolved through discussion. Two reviewers collected the data from each article using Covidence and Microsoft Excel; discrepancies were resolved by a separate third reviewer. 7191 records were retrieved and screened of which 12 studies were included. Various frameworks and methodologies were employed in these studies, with a particular emphasis on adaptation and adoption of innovations. The review uncovered different paradigms of LMIC to HIC innovation transfer and exchange, including unidirectional transfers from LMICs to HICs as well as bidirectional or multidirectional mutually beneficial exchanges. The use of both qualitative and quantitative data collection methods was common across all the included articles. Facilitators for innovation transfers included stakeholder engagement, relevance of local context, simplicity, and sufficient funding, promotion and branding. Barriers to transfers were mostly the opposite of the facilitators. Our results highlighted the underexplored field of LMIC to HIC innovation transfer and exchange and lay the foundation for future research studies.

INTRODUCTION

This scoping review was undertaken as part of a global health reciprocal innovation (GHRI) project led by the Fogarty International Center at the National Institutes of

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The fact that health innovations from anywhere can help people everywhere highlight the interconnectivity of the world and of ideas, approaches and technologies all of which have potential for cross-pollination. The practice of transferring a successful innovation from one location to another, in any direction (e.g. from a HIC to a LMIC, from a LMIC to a HIC, from a HIC to another HIC and from a LMIC to another LMIC) has existed for decades in many fields including health. However, the flow of innovations from LMICs to HICs is rarely documented in the health literature, nor is it well studied and, therefore, very little is known about the methods used, frameworks followed and the barriers and facilitators to conducting it.

WHAT THIS STUDY ADDS

⇒ In this scoping review, we identified examples of innovation transfers or exchanges from LMICs to HICs, and the frameworks, methods and models used in the process of transfer. The review also highlights the barriers and facilitators that individuals who undertake innovation transfer or exchange programmes and projects must consider.

Health (NIH), and included 13 other NIH institutes, centres and offices, to examine case examples of health innovations (eg, technologies, methodologies and strategies) researched, developed and implemented in low and middle-income countries (LMICs) to address similar health and health-related challenges in different geographic locations and contexts, especially in high-income countries (HICs).¹ The flow of innovation from an LMIC to a HIC is rarely published and, therefore, very little is known about it. In carrying out the scoping review, we were interested in identifying any case examples of innovation transfers or exchanges from LMICs to HICs,

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ This review was conducted to scope the body of literature describing and investigating health innovations that had been developed in an LMIC and transferred or adapted to a HIC to address similar health issues. We found very few examples of scientific studies that reported on the entire process of the transfer of the innovation from the LMIC to the HIC making the process difficult to replicate. The articles that were identified through this review have already served as examples for discussion for both researchers and policymakers when they were presented at an National Institutes of Health (NIH) workshop on reciprocal innovation in 2022.
- ⇒ The need to understand the process of successful innovation transfer or exchange from LMIC to HIC became critical during COVID-19, where the experience and innovations developed by LMICs and used in prior epidemics were important for HICs to acknowledge, learn from and be able to transfer.
- ⇒ To further advance the exchange of innovation around the world, during pandemic and non-pandemic times, future studies on the transfer of innovations should aim to provide more robust evidence on the effectiveness and impact of transferred innovations as well as develop strategies to overcome the barriers identified to help guide other researchers interested in this field. Additionally, efforts should be made to enhance reporting standards, ensuring that detailed descriptions of the transfer and exchange processes are recorded and disseminated, the original innovation and innovator identified and stakeholder input into the transfer of the innovation is clearly indicated, thereby promoting transparency, and enabling recognition of prior work and replication of current work.

the scientific processes involved, and the frameworks, methods and models used in the process.

Health innovation transfer can be unidirectional, for example, from LMICs to HICs²⁻⁴ and bidirectional or multidirectional, mutually beneficial exchanges recently coined ‘reciprocal innovation’⁵ and ‘reciprocal learning’.^{6,7} Reciprocal innovation ‘explicitly harnesses a bidirectional, coconstitutive and iterative exchange of resources, knowledge and innovation among global health partners’⁵ and can be between LMIC and HIC, HIC and LMIC, or LMIC and LMIC. Unidirectional innovation from LMIC to HIC, on which the concept of reciprocal innovation is built, is defined as the flow of ideas from lower to higher income settings.^{2,8} In this review, we will focus on innovations developed in LMICs and transferred/adapted to HICs. Following the COVID pandemic, HICs showed remarkable adaptability by drawing inspiration from experiences of LMICs. For example, countries like Rwanda and Vietnam swiftly embraced community engagement, using the community leaders and organisations to disseminate public health messages, facilitate contact tracing and following up with patients, a strategy that yielded impressive results.^{9,10} HICs, including the USA, soon recognised the success of these approaches and adopted similar community-driven strategies to curb the spread within its own population.¹¹

Thus far the idea that an innovation developed for and by LMICs can be used to address health needs in a HIC

is not yet a concept that everyone accepts, and it can be met with scepticism by some in HICs who believe, sometimes due to lack of information or bias, that only HICs can produce high-quality innovations.^{12,13} For instance, experiences and innovation from previous infectious respiratory epidemics such as Severe Acute Respiratory Syndrome (SARS) and Middle East respiratory syndrome (MERS) in LMICs, were not given due consideration in the COVID-19 pandemic, yet they could have helped in understanding and treating COVID-19.^{14,15} LMIC to HIC innovation transfer is also viewed with trepidation by some in LMICs, who fear, due to past experience, that they will be treated unfairly and unequally in the transfer of the technology due in part to the deep structural inequities and power imbalances that persist between HIC and LMIC institutional partnerships.^{16,17} Therefore, this scoping review seeks to identify cases of health innovation transfer from LMICs to HICs, shedding light on the frameworks and methods used in the transfer process while also identifying the obstacles, which have been recorded. It is hoped that this review will lay the foundation for more focused studies in this very under-recognised area.

METHODS

Protocol and registration

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist was used for the reporting of this scoping review.¹⁸ We wrote a protocol *a priori* following the PRISMA-ScR checklist as an outline and registered it on Open Science Framework.¹⁹ We chose to conduct a scoping review to address our study goal, which was to identify articles describing health innovations that were researched, developed and implemented in LMICs, and adapted and adopted to address similar health challenges in HICs. We wanted to identify the types of available evidence and examples, how and where the innovations were implemented and researched and identify gaps in the available evidence. We were not trying to determine if one innovation, implementation framework, or programme was more effective than another nor seeking to inform clinical practice; therefore, we did not conduct a systematic review nor critically appraise the included studies.²⁰

Eligibility criteria

We included articles where the health, public health or medical programme or innovation were developed in an LMIC and then transferred to an HIC. The programmes or innovations could involve any population or disease area. Articles also needed to be published from 2000 to 2022 in English and available in full text. Included article types were original research articles, commentaries/opinions, editorials, conference abstracts/proceedings, reviews (narrative, scoping, systematic) and grey literature (reports, white papers, technical reports, newsletters).

We used the World Bank categorisation of countries to determine those that are LMIC or HIC.²¹

We excluded any programme or innovation which was not developed in an LMIC and not transferred to an HIC. Programmes or innovations focused on business, agriculture, housing, general environment, general infrastructure, general information technology, general finance or general training were excluded. We excluded non-English articles as, while online translation tools are available, resources were not available for official translation of journal articles or other documents. We recognise that this is a limitation of our review and relevant examples may have been missed. Letters, errata, corrigenda and retractions were also excluded.

Information sources and search strategy

The following citation and abstract databases were searched by a biomedical librarian (AAL): Global Health (CABI), PubMed (US National Library of Medicine), Scopus (Elsevier) and the Web of Science: Core Collection (Clarivate Analytics). The searches were limited to those published in English from 2000 to 2022. The searches were completed in January 2022.

A combination of keywords and controlled vocabulary terms (eg, Medical Subject Headings (MeSH)) was used to describe each concept of interest: innovation transfer and LMIC. Two distinct and separate search strategies were used because a wide variety of terms are used to describe innovation transfer (eg, reverse innovation, frugal innovation) and the countries where these innovations originated from or were transferred to (eg, developing countries, developing nations). We used a second search with some additional terms added to the reverse innovation search strategy related to implementation, translation or adaptation. By using these two search strategies, we had broader coverage to identify potentially relevant literature. The search strategy was developed by the biomedical librarian with input and feedback by the review team members. See online supplemental file 1 for final search strategies used.

Additional records were identified by the reviewers (LEK, JK, MCSI) by searching the grey literature (eg, websites of known programmes working in reciprocal innovation) and from expert recommendations of articles or reports. The websites, bibliographies of the included articles and recommended articles were scanned for potentially relevant articles. Any articles or records identified through these supplemental methods were screened using the study selection process outlined below.

Selection of sources of evidence

A pilot of the screening process was conducted with all reviewers on a sample of 15 articles randomly selected by the biomedical librarian. After the pilot was conducted, the team met to discuss questions, changes to the eligibility criteria and overall process, which were documented in the protocol. Covidence (Veritas Health Innovations)

was used for the pilot and study selection (ie, screening) process.

A two-level screening process was conducted: first the titles and abstracts were screened, and then the full text of all records included after the title and abstract screening. Three reviewers (JK, MCSI, AK) independently screened each record in duplicate using the established eligibility criteria at both levels. At both levels, disagreements were resolved by consensus discussion during regular virtual meetings and were adjudicated by a third reviewer (LEK) if consensus was not met by discussion.

Data collection, data items and synthesis

Data collection was conducted in Covidence. Prior to commencing data collection, the reviewers conducted pilot test of three articles. After the pilot, additional clarifications and changes to the data collection form and process were made. Once commencing the data collection process, two reviewers (JK, MCSI, AK, LEK) independently collected the specified data from each article in duplicate (ie, two people collected data from same article). The collected data were compared using the consensus feature in Covidence, and any discrepancies resolved by discussion between the two reviewers who extracted the data. If necessary, a separate third reviewer was used to determine the correct data to collect. We collected the following data items from each article: citation details, article type, the intervention, countries involved in the transfer or exchange, health issue of focus, models, theories and frameworks (MTF) used in innovation transfer or exchange, study design and implementation outcomes.

Two reviewers (JK, LEK) used Microsoft Excel for data cleaning and analyses. Analyses of the data involved both deductive and inductive process. JK with input from LEK, developed initial themes following the overall objective of the scoping review—to identify the study designs and implementation outcomes and facilitators and barriers to transfer of innovations. Other priority areas for analysis included, the LMIC country where the original innovation was implemented and the HIC country where it was transferred to, description of the intervention and the health issue of focus. Where the article did not mention the specific LMIC country, we have indicated LMIC. Before completing the analysis, all the coauthors discussed and agreed on these themes.

In this scoping review, we present descriptive statistics and a narrative summary describing the interventions, methods, frameworks or methodologies used in the abstracted articles.

Patient and public involvement

The study did not involve patients or the general public. Their input was not sought in the design of the scoping review, interpretation of results or drafting or editing this document.

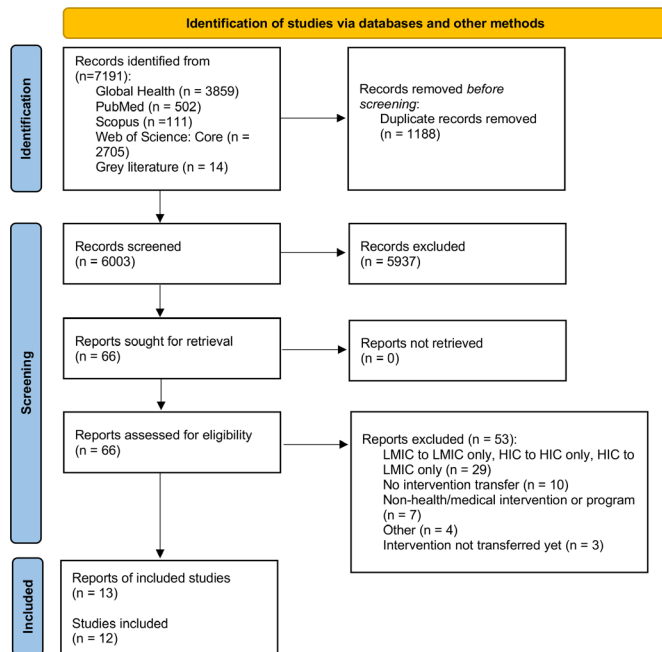


Figure 1 PRISMA flow diagram of the identification of studies via databases and other methods.

RESULTS

The database and grey literature searches yielded 7191 records of which 1188 were duplicates, resulting in 6003 unique records for screening (figure 1). Of the 6003 records screened at title and abstract, 5937 were excluded. Next, we conducted a full-text review of the remaining 66 articles and excluded 54 studies that did not meet our inclusion criteria (eg, transfer in wrong direction, no intervention transferred, non-health/medical intervention). We included 13 articles and 12 unique studies in our review; Absetz *et al*⁶ and van Olmen *et al*⁷ reported on the same study (SMART2D) and these articles were merged into a single study. Table 1 lists the included studies and some of their descriptive characteristics.

In Table 1, we report on some of the characteristics of the included articles. We identified eight articles that report on primary research of innovation transfer/exchange from LMIC to HIC^{6 22–28} and four articles report on secondary research on the same topic.^{2 3 5 29} Specific models, theories and frameworks (MTFs) and study designs identified in the articles are reported in table 1. A total of 13 different MTFs were reported. While none of the articles used the same MTFs, some articles reported using a combination of two or three MTFs to guide their study of the innovation transfer/exchange^{2 6 7 22} and only two articles did not report using any framework.^{23 28} New MTFs were proposed in three articles that were secondary reports.^{2 3 5–7 22 24 25 27 29} Two-thirds of the articles also used both qualitative and quantitative methods of data collection.^{3 5 22–24 26 28 29} In seven articles, a clear description of the process for innovation transfer included who was engaged for the transfer, how they were engaged and what strategies were used in the engagement process were provided.^{6 7 22–24 26–28} Three articles provided a summary

of articles and projects that had successfully transferred an innovation and/or guidance to transfer innovations, including an article on reciprocal innovation by Sors *et al*⁶ and two articles on LMIC to HIC innovation transfer by DePasse and Lee² and Sugarman and Reed.³ These three articles^{2 3 5} did not contain any details about the scientific process involved with the innovation transfer or innovation exchange. However, Sors *et al*⁶ highlighted the reciprocal innovation—a bidirectional process of cocreation and codevelopment of innovations. Of the articles that described a scientific process, adaptation and/or adoption was the main implementation/transfer outcome while others focused on feasibility, acceptability, efficacy, effectiveness, fidelity, sustainability/maintenance and spread of the innovation.^{6 7 22–29}

Facilitators and barriers for innovation transfer

We categorised facilitators for transfer of innovations into four thematic areas (stakeholder engagement, relevance to local context, simplicity of the innovation, funding, branding or promoting), which are listed below. We found that much of the time the barriers that were mentioned in the articles were the reverse of the facilitators so, as appropriate, we mention them together below.

Stakeholder engagement—community members, policymakers, users, original innovators

Examples of the facilitation of transfer by stakeholder engagement were part of many of the articles in the scoping review.^{5–7 23–29} Some highlights include the Ciclovía project originating in Bogota, Columbia involved closing of streets to promote exercising through cycling and walking among the community members.²⁸ In transferring Ciclovía innovation to cities in the USA, specifically San Francisco, California and St. Louis, Missouri, the project team engaged stakeholders in the planning, including identification of the routes, volunteers and advertising of the events, which promoted sustainability while also increasing spread of Ciclovía to a dozen other cities in the USA. Original innovators of Ciclovía in Bogota were engaged in the ‘Sunday Streets’ and ‘Open Streets’ implementation. Identifying these key stakeholders, communicating the benefits of the innovations, actively listening to their concerns and addressing them, while engaging them in the decision-making process helped build support and momentum for the uptake of Ciclovía in the USA.

Another intervention described by Wright and team²⁷ engaged healthcare professionals responsible for delivering the trachoma control programme in identifying barriers and facilitators to implementing the WHO’s Surgery, Antibiotics, Facial cleanliness, Environmental Improvement (SAFE) programme. Engagement of healthcare professionals resulted in recommendations that would promote success of the adoption of the SAFE innovation. The ‘Secret History’ project used the long-term collaboration among the investigators in South Africa, USA and Germany that brought in extensive

Table 1 Key characteristics of included articles (n=12)

Citation and type of research (primary or secondary)	Intervention	Countries involved in transfer or exchange	Models, theories and frameworks used in innovation transfer or exchange	Study design	Implementation outcomes for innovation transfer
Absetz <i>et al</i> ⁶ and van Olmen <i>et al</i> ⁷ Primary report	SMART2D—Community strategies to support self-management in prevention and control of type 2 diabetes project used reciprocal learning process to identify, adopt and adapt a type 2 diabetes self-management support intervention in a multisite implementation trial conducted in a rural setting in a low-income country (Uganda), a peri-urban township in a middle-income country (South Africa) and socioeconomically disadvantaged suburbs in a high-income country (Sweden). The teams co-created, and contextualised model of T2D management for each site.	South Africa and Uganda to Sweden	Framework for knowledge translation Evidence integration triangle framework Theory of change	Implementation research using learning cycles	Adaptation Fidelity Scale-up Sustainability
Adams <i>et al</i> ²⁹ Primary report	Financial incentives and quasi-mandatory interventions for preschool vaccinations have been used to promote uptake of childhood vaccination with school children in developing countries. This innovative method was assessed for acceptability in UK among parents, professionals and other stakeholders to inform implementation. This paper uses Triangulation Protocol to synthesise findings from three previous studies on acceptability of the intervention.	LMIC* to UK		Triangulation Protocol	Acceptability
Batey <i>et al</i> ²² Primary report	A stigma-reduction intervention—Finding Respect and Ending Stigma around HIV (FRESH) initially developed and used in Africa was implemented in Alabama, USA to assess feasibility and acceptability among healthcare workers.	Lesotho, Malawi, South Africa, Swaziland and Tanzania to USA	Social cognitive theory Intergroup contact theory	Mixed methods: online survey, focus groups, pre-post workshop questionnaires	Adaptation Feasibility Acceptability Efficacy

Continued

Table 1 Continued

Citation and type of research (primary or secondary)	Intervention	Countries involved in transfer or exchange	Models, theories and frameworks used in innovation transfer or exchange	Study design	Implementation outcomes for innovation transfer
Behforouz <i>et al</i> ²³ Primary report	Directly observed therapy for people with HIV using <i>accompagneurs</i> (community health workers (CHWs)) is an innovation by Partners In Health that used CHWs who visited people with HIV at their homes and helped overcome barriers to care by addressing some of the social determinants of health such as food, transport and psychosocial support. This was adapted to poor urban US populations in Boston, as the Prevention and Access to Care and Treatment (PACT) Program.	Haiti to USA	Directly observed therapy with highly active antiretroviral therapy (DOT-HAART) model	Mixed methods Descriptive case studies Comparison of clinical measures	Adaptation Feasibility Acceptability Efficacy/effectiveness
Depasse and Lee ² Secondary report	Medical product: General Electric's low-cost MACi EKG machine was developed in partnership with Indian leaders at GE for rural health clinics in India. The MACi EKG machine was 10 times less than the standard EKG machines. Additionally, it was lightweight, durable, and had minimalist easy-to-use interface. Success in India prompted GE to develop MAC 600 and MAC 800, adaptations of the simple EKG machine for value-oriented US consumers.	India to USA	Diffusion of innovation framework Model for reverse innovation	N/A	Adaptation Adoption Spread
	Health information: Ushahidi, a crowdsourcing programme used to map violence reports, disaster impact and response in Kenya in the aftermath of the presidential elections in 2007 was used in New Orleans, USA during hurricanes to report chemical spillages and health hazards for quick response.	Kenya and Haiti to USA	Diffusion of innovation framework Model for reverse innovation		
	Partners Health used CHWs to deliver services to patients at home in order to help overcome barriers to care, and provide psychosocial support. CHWs were able to directly address root causes of disease by providing support for items such as food, transport, and housing (reported separately in Behforouz <i>et al</i> ²³).	Haiti to USA	Diffusion of innovation framework Model for reverse innovation	Descriptive case studies	

Continued

Table 1 Continued

Citation and type of research (primary or secondary)	Intervention	Countries involved in transfer or exchange	Models, theories and frameworks used in innovation transfer or exchange	Study design	Implementation outcomes for innovation transfer
Hanselmann <i>et al</i> ²⁴ Primary report	‘Secret History’ training: 2–4 h interactive training of health workers that uses didactic, and role plays to depict scenarios for healthcare workers and patients with debriefing after role play. In the training, healthcare workers learn empathic engagement and self-care skills to promote optimal health outcomes for patients.	South Africa to Germany	Barrera’s steps of adaptation	Mixed methods: focus group discussions, surveys, pilot testing of the intervention	Adaptation Fidelity Sustainability Feasibility
Ibe <i>et al</i> ²⁵ Primary report	The Baltimore Community-based Organizations Neighborhood Network: Enhancing Capacity Together (CONNECT) Project is a randomised controlled trial that evaluated whether or not a community engagement strategy, developed to address patient safety in low and middle-income countries throughout sub-Saharan Africa, could be successfully applied to create and implement strategies that would link community-based organisations to a local healthcare system in Baltimore, Maryland in the USA.	Uganda to USA	APPS Community Engagement (ACE) Framework (rooted in Community Based Participatory Research (CBPR) and Participatory Action Research (PAR))	Randomised controlled trial	Adaptation Quality Sustainability
Sors <i>et al</i> ⁵ Secondary report	Use of ‘one-stop-shop’ HIV clinic with standardised antiretroviral treatment (ART) standardised visit documentation and middle-level providers incorporated into care. ³⁰ This HIV clinics was originally started in the Academic Model Providing Access to Healthcare (AMPATH) in western Kenya and co-created standardised ART Guidelines, parts of which informed the Kenya Ministry of Health (MOH) HIV Care and Treatment Guidelines, providing significant assistance to the Kenyan MOH as Kenya initiated roll out of countrywide ART.	Kenya to USA	Reciprocal innovation model	Mixed methods: descriptive case study, environmental scan (interviews, online questionnaire), stakeholder meetings, process and platform for Identifying Priority Areas for RI with stakeholders from HICs and LMICs	Adaptation Adoption

Continued

Table 1 Continued

Citation and type of research (primary or secondary)	Intervention	Countries involved in transfer or exchange	Models, theories and frameworks used in innovation transfer or exchange	Study design	Implementation outcomes for innovation transfer
	Using paper test card, the idPAD, to screen and detect falsified antibiotics ^{36–38} pervasive problems with dispensing practices such as repackaging and selling antibiotics to patients without a prescription. Using lessons learnt from the Malawian implementation, the card was redesigned to detect a wide range of controlled substances and cutting agents found in street drugs in the USA.	Malawi to USA	Reciprocal innovation model	Chemical analysis	Adaptation Adoption
	Deploying CHWs as ‘coaches’ to provide care and education in their own communities for pregnant women and new mothers. ³⁹ Originally initiated in Kenya CHWs were trained to provide care and education throughout their own communities in western Kenya. CHWs guided and supported mothers, fathers and caregivers toward behaviour changes that decrease risk factors for infant mortality. Utilising this CHW model, in Indiana infant mortality rates in Marion County, Indianapolis were targeted by training CHW in techniques to guide and support mothers, fathers and caregivers toward behaviour changes that decrease risk factors for infant mortality.	Kenya to USA	Reciprocal innovation model	Randomised controlled trial	Adaptation Feasibility
Stephenson <i>et al</i> ²⁶ Primary report	Couples HIV Testing and Counseling (CHTC), an intervention that was originally used in various countries in Africa as a strategy for HIV prevention among heterosexual couples. CHCT has successfully been used in the USA among male couples. This project tested adaptation, feasibility and acceptability of using CHCT among heterosexual couples in the USA.	Sub-Saharan African countries† to USA	ADAPT-ITT framework	Mixed methods: qualitative study, focus groups	Adaptation Feasibility Acceptability
Sugarman <i>et al</i> ³ Secondary research review/report	This grey literature review provides a framework for incorporating global learning, specifically on community engagement into the ongoing efforts of healthcare delivery organisations and CBOs to improve health outcomes and advance health equity.	LMICs to USA	The Global Learning for US Primary Healthcare Framework	Grey literature, review of community engagement from LMICs to HICs	N/A

Continued

Table 1 Continued

Citation and type of research (primary or secondary)	Intervention	Countries involved in transfer or exchange	Models, theories and frameworks used in innovation transfer or exchange	Study design	Implementation outcomes for innovation transfer
Wright <i>et al</i> ²⁷ Primary report	Implementation of Surgery, Antibiotics, Facial cleanliness, Environmental Improvement (SAFE) strategy to combat trachoma. Australia is the only developed country with endemic trachoma in some of its remote indigenous communities. The SAFE strategy, an innovative approach developed in poor countries in the world and recommended by WHO for endemic trachoma has not been successfully launched in Australia. This study, a series of interviews with key stakeholders including government, community and workforce, was undertaken to understand the barriers to implementing a trachoma strategy SAFE in Australia.	LMICs* to Australia	Strategic management framework	Qualitative study using semi-structured interviews	Adaptation
Zieff <i>et al</i> ²⁸ Primary report	Ciclovia (scheduled events in which streets are closed to motorised vehicles and opened for recreational activities) originally started in Bogota, Colombia has been transferred to other US cities. Ciclovia, a family-friendly event encourages residents and visitors to get out, get active and explore their city through car-free streets. The organisation accomplishes this by activating parks, bringing exposures to local businesses and inviting community organisations. Participants can enjoy walking, biking, exercise classes, activities for youth, treats for their pets, food trucks and more.	Colombia to USA	N/A	Mixed methods: process review, structural review using mixed methods, systematic investigation, comparisons and analyses	Adoption Quality Sustainability Cost

*Specific country not specified in article; author just used 'LMIC' or 'poorest countries in the world'.

†Specific country/countries in Sub-Saharan Africa not specified.
LMICs, low and middle-income countries.

knowledge of the intervention, implementation, evaluation, clinical expertise, access to the relevant participants and international project management that promoted the success of the intervention development and transfer of learning.²⁴ Leveraging the expertise among the study's community-based organisation partners and advancing their role as community knowledge brokers, the Baltimore, Maryland project 'Community-based Organizations Neighborhood Network: Enhancing Capacity Together' was able to promote engagement by the locals on global innovations.²⁵

Relevance to local context

A facilitator to successful transfer of an innovation was initially identifying common problems and settings between the LMIC and HICs. The DOT-HAART project²³ originally developed in Haiti to address social determinants of health (providing services closer to the clients) in a poor population living with tuberculosis, identified a similarly poor population of people living with HIV in Boston, Massachusetts and showed positive impact of the innovation.⁵ Similarly, the Indiana-based project identified key health priorities both in Indiana and in Kenya related to HIV taking into account the similarities in the populations it affected, promoted the successful implementation of a one-stop-shop HIV clinic that resulted in scaling up of HIV services in Indiana.³⁰ Shared challenges and tailoring the innovations to address the local context promoted adaptation of promoted adaptation of Ciclovía,²⁸ and implementation of the Finding Respect and Ending Stigma around HIV workshops to end HIV stigma,²² provision of couple HIV testing and counselling services in Boston²⁶ and in implementation of SMART2D project in three different contexts.^{6 7} Tailoring the innovation to local context was also identified as a facilitator in the exploratory interviews assessing acceptability of using incentives and quasi-mandatory interventions for preschool vaccinations.²⁹

Differences in context can challenge adaptation or adoption of innovations from LMICs to HICs. Adopters of the 'Secret History' training in Germany struggled with adaptation of scientific instruments due to differences across cultural settings and language barriers.²⁴ Gaining acceptance by the communities in which the innovation was implemented or was planned for implementation required teams to engage varied strategies.^{28 29}

Simplification of the innovation—ease of testing, availing standardised resources

Simple innovations that were easier to understand and use, and those that provided standardised tools to guide implementation were cited as facilitators to transfer innovations.^{6 7 24} Standardisation ensured that innovations are implemented in a uniform and a systematic manner. The Prevention and Access to Care and Treatment project was cited as a simple innovation that was easily tested, received less resistance making it more attractive to adopters, which in turn accelerated its

adoption.²³ By reducing complexity in the SMART2D innovation, it made it easier to implement the innovation across different settings.^{6 7} Besides assuring quality, engaging a developer in facilitating the training ensured fidelity to the original 'Secret History' innovation.²⁴ The SMART2D project that was implemented simultaneously in three countries (Uganda, South Africa and Sweden) was complex in nature and required several iterative processes of the innovation.^{6 7} The learning cycles that formed the backbone of the project demanded continuous communication and monthly meeting among the implementing teams to keep each other informed of different setting's activities. Learning cycle output management was complex and unpredictable necessitating reliance on personal commitments, relationships, and performance of team members.

Funding, promotion and branding of the innovation

Funding played a crucial role in facilitating adoption and adaptation of innovations from LMIC to HIC. The availability of funding to support the research involved with transferring innovations helps to ensure that such solutions are feasible, acceptable and appropriate for use in the context into which they are being transferred.^{2 27 28} Besides incentives given to stakeholders, promotion and branding of the initiative during implementation of 'Sunday Streets' and 'Open Streets' played a critical role in increasing adoption of the Ciclovía initiative.²⁸ Highlighting the benefits, features and successes, promotion, visibility and branding of the innovations ensured that the potential adopters were convinced that the innovation is worth adopting and using.^{23 25 27} In addition to influencing the decision-making of the adopters, promotions make innovations more appealing to potential adapters.²⁸

Lack of or limited funding support to research and implement innovations developed in an LMIC into an HIC can hinder implementation. In the 'Open Streets' and 'Sunday Streets' initiatives, inconsistent and limited funding and staffing support was a concern that was noted to lessen the certainty of the quality and sustainability of the initiative.²⁸ Sors *et al*⁵ identified the lack of funding support for innovation transfer as a barrier. Lack of teaching, educational and promotional resources was cited as a barrier by Wright *et al*²⁷ in the transfer of initiatives for trachoma control programmes in Australia.

DISCUSSION

This scoping review was undertaken to identify literature available about specific examples of health innovations that were researched, developed and implemented in a low-income country and that were simultaneously or asynchronously adapted and adopted to address similar challenges in HIC. Through our scoping review, we identified 12 articles that described this type of transfer or exchange of innovation and learning and have included them in our analysis. Our results covered a broad range

of interventions that have been transferred that included clinical and community interventions, mHealth and medical devices, covering a range of diseases (chronic and infectious diseases vaccinations) and cross-cutting areas such as empathy and stigma.

As is the case with much research, especially implementation research, models, theories, and frameworks (MTFs) were commonly employed when studying the transfer of innovations from LMICs to HICs. This highlights the importance of systematic approaches to guide adoption and adaptation of innovations. These FTM provide a structured process for planning, implementing and evaluating the transfer of innovations and we assume that is why many of the researchers cite at least one that they used while conducting their study. We note that both the small sample of articles in this review and that each study used different MTFs makes it impossible for us to conclude anything about which FTM is the most popular or best to use for LMIC to HIC innovation transfer and exchange. MTFs for conducting implementation and dissemination science can be explored at the website <https://dissemination-implementation.org/tool/explore-di-models/>. The searchable database on this website lists 19 out of 114 implementation science MTFs that have constructs for adaptation and adoption and five that have constructs for acceptability/feasibility. In addition to looking at dissemination and implementation MTFs for this research, it might also be useful to explore frameworks such as the Non-adoption, Abandonment, and Challenges to the Scale-Up, Spread and Sustainability of Health and Care Technologies framework and other MTFs from the technology field for conducting innovation transfer/exchange from LMICs to HICs.³¹

As expected, and as mentioned above, constructs such as adaptation and adoption and fidelity were outcomes of interest in the innovation transfer described in the included articles. This highlights the importance of tailoring innovations to the specific needs and contexts of the receiving countries while ensuring fidelity to the core components of the innovation. Feasibility, acceptability, efficacy effectiveness, sustainability and spread were also considered in assessing the best way to modify the innovation for the new context.

Several facilitators and barriers to innovation transfer were identified across the included articles. Facilitators included the recognition of the potential effectiveness and impact of innovations from LMICs, utilisation of community strengths and resources, establishment of trust and partnerships and identification of high-priority problems common to both LMICs and HICs. These facilitators emphasise the importance of collaboration, community engagement and a shared understanding of the priority of the problem being addressed to the country/context in which it will be used.

However, barriers to innovation transfer included differing perspectives and beliefs, institutional and systemic factors, resource allocation and the need for rigorous evidence to convince early adopters. These

barriers highlight the challenges and complexities involved in the transfer and exchange of health innovations, particularly in navigating cultural, social and structural differences between countries. It is worth noting that while some studies provided a clear description of the process of innovation transfer, including the stakeholders involved, engagement strategies and transfer strategies, others lacked such details. This indicates a need for more comprehensive reporting of the transfer process to facilitate replication and learning from successful innovation transfers.

Because the literature studying LMIC to HIC transfer of innovation is so small, yet the need is so great for global learning, it is important that certain research questions are asked and answered. For example, these questions are—*Are there specific MTFs to use when studying innovation exchange between LMICs and HICs? and Do these MTFs need to be modified to accommodate some of the barriers and facilitators to innovation transfer identified in this review?* For the first question, in our small set of 12 included articles, we found all used different MTFs, and for the second question that the barriers and facilitators appeared to be typical of innovation transfer and implementation research. However, we did identify some important factors within those categories that are worth mentioning. Under the category of ‘engaging stakeholders’, the importance of engaging the original innovator and of giving credit to the original innovator and country of the innovation is of paramount importance to the success of innovation exchange or transfer from LMIC to HIC in the short and long term. In the long term, one of the barriers to innovation transfer that is unique to LMIC to HIC innovation transfer is the unconscious bias that some in HICs have against using innovations from LMICs.¹³ With more attribution in the literature regarding innovations from LMICs helping to address similar health issues in HICs, some of this bias may be countered with knowledge. In the short term, engaging the innovator in the research project as a consultant or as a coprincipal investigator will improve the chances that the innovation transfer will succeed because the team has the expert with experience about the innovation on it. It is also more likely the research will be an exchange of knowledge and the innovation will improve in the LMIC and the HIC.

While not our main goal in conducting this scoping review, we were very interested to try to find an equitable, mutually beneficial and systematic approach to this type of work, which resulted in the identification of an article by Sors *et al*⁵ on GHRI. As mentioned in the introduction, GHRI is an approach to bringing a health innovation that is developed and implemented in one context and then used for a similar purpose in another context that involves an exchange rather than a transfer of the innovation, learning and research. A GHRI approach demands equitable, mutually beneficial partnerships be formed between the researchers involved and uses iterative learning and research cycles to guide the innovation adaptation. Many times, GHRI involves attention to

local laws and regulations.³² The GHRI approach should support the researchers to co-identify priority research and innovations to address mutual health challenges. Innovation transfer is often led by individuals and institutions from HICs, which can lead to a lack of diversity in perspectives and solutions and innovations.³³ Utilising a GHRI approach should will help create a respectful partnership, where mutually beneficial learning takes place and both sides benefit from the exchange.^{5 34} We hope that this scoping review, which formed the basis for the 2022 NIH sponsored workshop on GHRI,³⁵ will promote global health funders and researchers to incorporate equitable, innovation exchange through mutually beneficial learning and research based on respectful partnerships between HIC and LMIC researchers to address health challenges worldwide.

Limitations

It is important to acknowledge limitations. First, the limited number of articles available may restrict the generalisability of the findings and the depth of analysis. The lack of detailed information in some articles regarding the innovation transfer process, engagement strategies and stakeholders involved hampers comprehensive insight into innovation transfer. The strength of evidence and the ability to draw robust conclusions were impacted as many of the included articles were descriptive case studies or used mixed methods, with a scarcity of randomised controlled trials or other rigorous study designs identified. Searching for literature on the concept of 'innovation transfer from LMIC to HIC' is very difficult due to the wide variation in terminology used to describe innovation transfer across different fields and disciplines. Therefore, although we used a wide variety of search terms to locate as many potentially relevant studies as possible, we likely still missed some relevant studies due to other terminology used, the authors not recognising the study was an example of innovation transfer and did not use relevant terms, or the ongoing reciprocal innovation is not yet published. We also found that it was very difficult to identify studies that originated in one region or country and were implemented elsewhere—especially if the authors did not use any terms describing innovation transfer or the authors did not consider it an innovation transfer. While we did search the scholarly literature, we also searched for grey literature and employed supplemental methods to try and identify as many additional studies as possible. However, some articles may still have been missed, especially if published in another language, used different terminology to describe reciprocal innovation or was not published in a journal. We also recognise that by limiting to the English-language literature only that we possibly missed relevant articles published in other languages in journals not indexed in the databases we searched.

CONCLUSIONS

While LMIC to HIC innovation transfer has the potential to promote and use LMIC innovations to address health challenges globally, there are barriers to equity in the field

that include the presence of unequal power dynamics in LMIC–HIC partnerships, lack of attribution for the original discovery of the innovation and a lack of trust on both sides.¹⁶

To further advance the exchange of innovation around the world, future research should focus on addressing the challenges identified in this review. Researchers should provide more robust evidence on the effectiveness and impact of transferred innovations as well as develop strategies to overcome the barriers identified such as addressing differing contexts, cultures and languages as well as a lack of investment in this area. Additionally, efforts should be made to enhance reporting standards, ensuring that detailed descriptions of the transfer process are provided and stakeholder input into the transfer of the innovation is clearly indicated, thereby promoting transparency, and enabling replication. Finally, the country of origin of the original innovation and the developer/researcher needs to be correctly identified and given credit and, if possible, brought into the process. There is a significant need to expand the scope of research in innovation transfer. This would entail delving into areas that have received limited attention in the existing literature, including but not limited to an assessment of the effectiveness of the MTF employed in the study of global health innovation exchange, an examination of new MTF to guide this research and a critical analysis of deficiencies and benefits in current approaches, to innovation transfer as well as the use of novel approaches such as reciprocal innovation and learning.

Author affiliations

¹Institute of Global Health Equity Research, University of Global Health Equity, Kigali, Rwanda

²College of Health Sciences, Academic Model Providing Access to Healthcare, Eldoret, Kenya

³Center for Global Health Studies, Fogarty International Center, National Institutes of Health, Bethesda, Maryland, USA

⁴Division of Library Services, Office of Research Services, National Institutes of Health, Bethesda, Maryland, USA

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ORCID iDs

Marie Consolatrice Sage Ishimwe <http://orcid.org/0000-0001-9928-5891>

Jepchirchir Kiplagat <http://orcid.org/0000-0002-7836-2138>

Alicia A Livinski <http://orcid.org/0000-0002-7201-3500>

Linda E Kupfer <http://orcid.org/0000-0002-6886-6818>

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