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Lifting all boats: strategies to promote equitable bidirectional research training opportunities to enhance global health reciprocal innovation

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ABSTRACT

Inequities in global health research are well documented. For example, training opportunities for US investigators to conduct research in low-income and middle-income countries (LMIC) have exceeded opportunities for LMIC investigators to train and conduct research in high-income countries. Reciprocal innovation addresses these inequities through collaborative research across diverse global settings.

The Fogarty International Center of the US National Institutes of Health (NIH) promotes research capacity building in LMICs. Fogarty K-grants for mentored career development in global health are available for both US and LMIC investigators, whereas the D43 is the standard grant to support institutional training programmes in LMIC. Other NIH institutes fund T32 training grants to support biomedical research training in the USA, but very few have any global health component. Most global health training partnerships have historically focused on research conducted solely in LMIC, with few examples of bidirectional training partnerships. Opportunities may exist to promote global health reciprocal innovation (GHRI) research by twinning K-awardees in the USA with those from LMIC or by intentionally creating partnerships between T32 and D43 training programmes.

To sustain independent careers in GHRI research, trainees must be supported through the path to independence known as the K (mentored grantee)-to-R (independent grantee) transition. Opportunities to support this transition include comentorship, research training at both LMIC and US institutions and protected time and resources for research. Other opportunities for sustainability include postdoctoral training before and after the K-award period, absorption of trained researchers into home institutions, South-South training initiatives and innovations to mitigate brain drain.

SUMMARY BOX

⇒ Reciprocal innovation aims to address inequities in global health research between high-income countries and low-income and middle-income countries through equitable cooperation and bidirectional flow of knowledge and innovation. However, opportunities to expand and sustain training in global health reciprocal innovation research are not well described.

⇒ This study offers an overview of traditional training programmes in global health research, opportunities for expanding bidirectional training partnerships and a long-term vision to sustain independent careers in global health reciprocal innovation research.

⇒ Reciprocal innovation, if incentivised by traditional funding agencies, will address the imbalance in global health research and training. Additionally, nascent reciprocal innovation initiatives should be scaled up to various settings and contexts while promoting sustainability and mitigating brain drain.

INTRODUCTION

Reciprocal Innovation and its distinction from other approaches in global health

Strong partnerships between high-income countries (HICs) and low-income and middle-income countries (LMICs) are essential to sustain effective global health research. Historically, these partnerships have been influenced by colonialism, which compromises equity and limits their full potential. Sors *et al* have proposed reciprocal innovation (RI) to address this issue and defines it as a 'bidirectional, coconstituted and iterative exchange of ideas, resources, and innovations to address shared health challenges across diverse global setting.'[1]

In contrast to RI, traditional global health efforts tend to consist of one-sided partnerships and methods, where innovations from HICs, primarily initiated and funded by HIC researchers and organisations, were introduced to LMICs to address specific health issues. This traditional approach resembles a kind of one-way street in terms of the flow of innovations. The success of these innovations in LMICs depended on how well they adapted to the local context, and sustainability was often compromised due to varying

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degrees of community involvement in innovation development and adaptation. Furthermore, most resources, including innovations, funding and administrative tasks, originated from HICs. Consequently, such projects tend to yield greater professional benefit to HIC researchers over LMIC researchers, since the former tended to hold roles as principal investigators (PIs), grant coordinators, lead authors and presenters of research findings.

Reverse innovation, introduced by Govindarajan, challenges the traditional directional flow of innovations from HICs to LMICs. He noted that innovations from LMICs can have tremendous value to HICs. Govindarajan and Ramamurti argued that innovations effective in resource-constrained areas are often affordable, user-friendly and scalable for HICs.[2 3] Like the traditional approach, this new form still comprises a one-way street innovation paradigm which limits utility. RI introduces a new two way-street paradigm, which aims to jointly benefit researchers and populations in both HICs and LMICs. Unlike forms of one-way street innovation, RI involves bidirectional partnerships with coproduced and coimplemented global health innovations to address shared problems. While traditional approaches have often used LMIC partners for cultural knowledge, RI calls for the sharing of technical knowledge, including hard skills, innovative practices and care techniques.[4] Bidirectional partnerships (ie, partnerships that emphasise equitable sharing of knowledge and tasks) can lead to iterative codesign (meaning multiple rounds of designing an innovation collaboratively until effectiveness is maximised) which can catalyse RIs that benefit both partners. Therefore, bidirectionality is necessary for RI. Global health reciprocal innovation (GHRI) research, then, is research that is done within a bidirectional partnership that is intentionally designed to catalyse RI.

GHRI research can be a powerful tool in mitigating inequity and promoting mutual benefit. However, it remains a novel concept largely absent from existing research training programmes. While established GHRI research training programmes are scarce, valuable lessons can be drawn from select research partnerships that have embraced bidirectionality. In this practice paper, we will explore pathways to enhance and optimise RI through deliberate funding initiatives and training programmes. We will review some barriers to and facilitators of GHRI research training. We will evaluate conventional global health research funding and training programmes, propose avenues for expanding bidirectional training collaborations, and outline a vision for independent careers in GHRI research (figure 1).

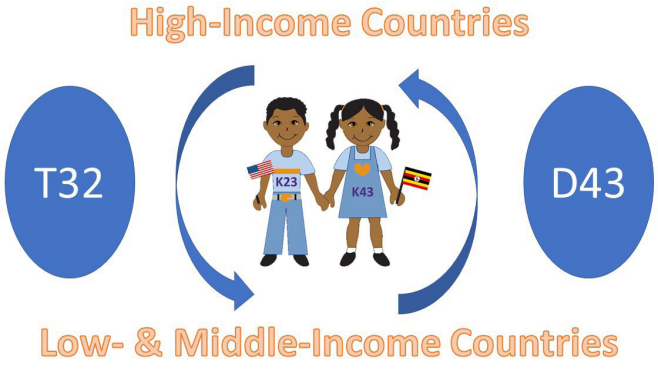

Figure 1 Training in reciprocal innovation requires equitable partnerships. By pairing trainees (eg, K23 and K43 awardees) or training centres (eg, T32 and D43 grants), intentional efforts are required to maximise reciprocal innovation.

GHRI IN PRACTICE

Examples of GHRI in practice and potential barriers and facilitators

Most global health training partnerships have historically focused on research conducted solely in LMICs.[5 6] GHRI focused training is an emerging alternative to this paradigm. There are many excellent examples of successful GHRI research projects, some of which are discussed in other articles of this BMJ Global Health Supplement.[1 7–11] These examples offer insight into potential models, barriers and core components of GHRI, which may be incorporated into traditional research training programmes.

A model for codeveloping GHRI research and training is the 30-year partnership between Indiana University in the US and Moi University in Kenya (2022).[1] This model used separate initial local environmental scans to assess available infrastructure and stakeholder engagement events to clarify targets for GHRI. This was followed by a joint local to global meeting to facilitate GHRI research. These meetings illuminated the barriers to GHRI, which included lack of funding, limited community education and lack of protected time for potential researchers and limited number of qualified individuals to conduct GHRI research. These findings led to the development of GHRI research grants that require an international co-PI or collaborator, educational and training resources, and initiation of a repository of GHRI projects to help connect researchers and promote partnerships.

Researchers from Uganda and the USA have employed bidirectional partnerships for over two decades. Here, we can find two examples of GHRI.[7 12] First, an important diagnostic procedure in HIC (cardiac ultrasound) was made more accessible in Uganda through the development of a programme which trained non-physicians to use this diagnostic tool. Training modules and protocols are now being adapted for use among Indigenous communities in the USA.[13] Second, models of differentiated service delivery have been implemented in the context of HIV treatment in Uganda, and, in turn, have later been used to improve cardiovascular care for people with HIV in the USA.[14 15] In either case, ideas from HICs were adapted and refined to suit LMIC needs and in turn were brought back again to be adapted and refined to better address issues in an HIC. In this particular case, unlike traditional approaches, US trainees

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worked in Uganda and Uganda trainees worked in the USA, creating mutual professional benefits, and lifting all boats in the process.

Another case that ties GHRI training with research comes from a three-phase Evidence Integration Triangle to facilitate reciprocal learning through diabetes prevention and care between Uganda, South Africa and Sweden.[8] This collaboration included a formative phase to identify opportunities and threats for interventions, an intervention phase to contextualise interventions, and an adaptive trial phase that included implementation and evaluation. Contextualisation and stakeholder engagements were included throughout the cycle. Mindfulness of power dynamics within partnerships was key to promoting GHRI. Similar barriers and facilitators of GHRI were highlighted in the adaptation of the directly observed therapy with highly active antiretroviral therapy model from rural Haiti to inner-city Boston for high-risk HIV patients, where they noted marked improvements in adherence, quality of life and decreased hospitalisations.[9]

Other cases of bidirectional partnerships and GHRI include those between researchers from Kenya, South Africa, Mozambique and the USA.[10] These included qualitative formative work, building partnerships, evidence-based interventions, feasible delivery, task sharing and mixed, hybrid design evaluation. Authors highlighted strategies to encourage bidirectional learning including consultations with LMIC researchers, joint research meetings, collaborative intervention evaluations, coauthorship and ongoing adaptation for progressive improvements. Barriers included limited funding opportunities for LMIC PIs to pursue research in HICs, differing priorities of communities in LMIC versus HIC, racism, language barriers and differences in training in LMIC versus HIC. Authors recommended addressing imbalance in power, privilege and positionality in partnerships to better facilitate GHRI research and training.

Though the above examples do not all fully embody the core essentials of codesign and coimplementation of GHRI, they still highlight the potential of bidirectionality and mutual benefit. These cases also offer examples of barriers and facilitators to consider, many of which are reiterated elsewhere in this supplement.[16] These barriers include limited familiarity with GHRI, challenge of contextualising interventions to complex diverse settings including differing expectations and beliefs, lack of time and training to build qualifications in GHRI research including challenge of knowledge deliberation and knowledge combination, legal/policy/geographical barriers, and general constraints of attention and learning. These barriers may differ depending on the direction of GHRI flow (ie, LMIC-to-HIC vs HIC-to-LMIC). Addressing these barriers through intentional GHRI research training programmes is severely restricted by inadequate funding. Prior to discussing some potential solutions to these issues, we will review current research training programmes.

MAJOR GLOBAL HEALTH RESEARCH TRAINING GRANTS AND PROGRAMMES

The US National Institutes of Health (NIH) is the largest funder of global health research and training (US$26.1 billion annually), followed by the European Commission (US$3.7 billion) and the UK Medical Research Council (US$1.3 billion).[17] Given this, we will mainly review major NIH funding opportunities and programmes, and in the next section of the paper, offer considerations for how these opportunities can be adjusted to account for bidirectionality and promote GHRI. We will separate these categories based on the recipient (institutions vs individual researchers) and further classify them by their domestic or international focus.

Institutional NIH training grants include the D43, D71, T37 and U2R (as described in more detail on NIH websites).[18] The D43 is the standard international NIH training grant to develop mentored research training in global health but is limited to research in LMICs. A D43 may be awarded to a US institution working with partners in an LMIC or may be awarded directly to an LMIC institution. The D71 is a planning grant for LMICs to prepare for a D43. The U2R acts as the cooperative agreement mechanism for D43, while the G11 provides funding to bolster research-related institutional infrastructure in LMICs. Domestic institutions dedicated to aiding minority students and faculty at international sites can seek the T37 grant. These institutional training initiatives mirror their US-based counterparts, with the T32 programme being the most prevalent for domestic research. The potential to leverage these training programmes will be explored in the subsequent section.

Fogarty grants for mentored career development in global health include the K43 for international trainees and the K01 and Fulbright-Fogarty for domestic trainees.[18] The Emerging Global Leader grant, or K43, is for LMIC scientists committed to research at an LMIC institution. The International Research Scientist Development Award, or K01, is for US citizens in any health discipline with a project related to LMIC health priorities. The Fulbright-Fogarty Fellowships in Public Health are offered to US medical and graduate students interested in public health research in LMICs. Other K-series grants are available to US citizens (eg, K23, K08) or citizens and non-citizens (eg, K99/R00) to conduct global health research, but these awards are issued by the other institutes of the NIH rather than FIC.

Outside the NIH, other fellowships, rotational experiences, resource funding and project-based grants are available.[19] Project-based grants may facilitate intervention development, collaboration between HIC and LMIC, graduate student funding supplementation, incorporation of international or language aspects into graduate work, or enhancing teaching skills. A select number of organisations offer long-term mentorship and mutual learning opportunities, including Fulbright scholars and foreign student programmes, Global Health Corp,

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World Academy of Sciences, the Harvard T.H. Chan public health programme, the US CDC programme in applied epidemiology, the US Agency for International Development and the Global & Rural Health Fellowship at the University of Washington (Seattle, Washington, USA).[20 21] Despite these opportunities, structured longer-term programmes offering bidirectional GHRI research opportunities for trainees to conduct research across HIC and LMIC contexts, coupled with robust and enduring mentorship, remain limited in availability.

A NEW PARADIGM: RI IN RESEARCH TRAINING

Core components of GHRI research training

Developing the infrastructure for GHRI research training programmes requires consideration of core components to ensure its success.[16] Besides fundamental research methods, trainees need skills to acknowledge and address power imbalances among partners to foster inclusive problem-solving. Codesign and collaboration are integral, including opportunities for jointly developed grants, shared meetings, coauthorship, and ongoing collaboration for adaptive interventions. Contextualisation is crucial, and we propose exposing trainees to both HICs and LMICs to correct historical training imbalances.[11]

Potential opportunities for GHRI research training

To overcome funding constraints for GHRI training, we suggest strategically pairing funding sources. For instance, coupling a T32 training programme at a US institution with an LMIC D43 grant could intentionally foster bidirectional training. Coupling these programmes might include joint seminars, joint short courses and even shared research projects for trainees. Similarly, matching US K23 awardees or other K recipients with LMIC K43 trainees would provide cross-context exposure. This programme could enable US-based trainees to host LMIC K43 counterparts for research/clinical experiences in the USA. Furthermore, offering funding incentives for joint research in both US and LMIC settings would encourage cocreation of adaptable solutions. The effectiveness of such twinning programmes has been demonstrated in GHRI.[22] We recommend that the NIH and FIC explore issuing specific funding calls and notices of special interest to encourage these collaborations.

PATHWAY TO INDEPENDENCE: SOLUTIONS TO FUNDING GHRI RESEARCH TRAINING

To promote the longevity of LMIC-HIC relationships, supporting trainees through their journey to independence is crucial. This prepares them to later offer GHRI mentorship to upcoming generations. Career development awards, such as the NIH K programmes, furnish initial grants to clinicians and research scientists aiming for research autonomy. These awards cover mentored research, training and career development, usually with a stipulation of at least 75% full-time commitment to research.[23] Independence is typically defined as successful competition for an NIH R01 or equivalent award,[24 25] sometimes by means of a smaller pilot award (eg, R21) along the way. The K99/R00 is a unique phased award that supports a shorter period of mentored career development (K99; up to 2 years) before transitioning to an independent phase (R00; up to 3 years).[26] The K-to-R transition is a vulnerable time due to career uncertainty, competition for research opportunities, time conflict between clinical work and research and uncertainty of future research funding.[27 28] Opportunities to support the K-to-R transition include mentorship,[23] research training at both the LMIC and US institutions and protected time including providing resources for research.

Mentorship focuses on research methods, clinical research or practice, ethics, scientific writing, grant writing, leadership and management. To optimise mentorship, the mentee needs to show utmost interest and initiative.[23] K43 awardees, who are based in the LMICs, receive mentorship from both LMIC and US-based mentors. Similarly, K23 (or other K-series) awardees from US institutions who are conducting global health research should always have mentors from both the USA and the LMIC where they work, as exemplified by FIC's International Research Scientist Development Award (K01) programme.

Training at both the LMIC and US institution is critical to enhance knowledge, skills, experience and to share innovations across LMIC and HIC settings. For example, a mentored researcher from an LMIC university may receive training in her home institution but take in-person courses at a HIC university. Less commonly, LMIC medical graduates may be able to pursue clinical training at an academic hospital in the USA[29] or experiential learning in public health. More traditional global health training programmes for HIC trainees in LMIC settings can also foster GHRI if they are part of a sustained bidirectional relationship between institutions.[30]

Emerging global health researchers need flexibility of time and resources to innovate. Both LMIC and US institutions should find ways to give protected time to people who have a track record of creativity, and to network them with successful leaders in research and other relevant fields. Opportunities may arise from traditional academia or the private sector. For example, Google offers 15%–20% time to employees to pursue new ideas.

Additional postdoctoral training before or after the K-award period also provides opportunities for innovation. Some postdoctoral awards support researchers from LMICs to receive training at HIC institutions and learn innovations that may be adopted to LMIC settings.[31] To reciprocate learning, more opportunities must also be made available for HIC post-docs to learn and adopt LMIC innovations.

Other opportunities to foster GHRI include allowing post-docs from LMIC settings to collaboratively participate in US-based research with US researchers. Such opportunities should not detract or siphon resources from US-based trainees who wish to participate in LMIC

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research alongside LMIC researchers. Finally, we recommend continued efforts to promote South-South collaborative learning in research, training, clinical and public health practice, such as the Consortium for Advanced Research Training in Africa.[32] For example, many innovations in the PEPFAR programme were disseminated from country to country in LMIC settings.[33]

The pipeline for GHRI will dry up without job or career opportunities for trainees. Jobs are rarer and more poorly paid in LMICs compared with high income settings. For research continuity, LMIC universities need to partner with their governments and Ministries of Health to absorb the trained researchers into jobs. However, this will require additional funding to health sectors. To this effect, global health researchers need to build an investment case for their governments and show the benefits of investing in health and science to society. Additionally, trainees should be given opportunities to conduct research together with government institutions such as hospitals, ministries of health and universities in their LMIC settings, which may then lead to job offers after training. LMIC government agencies should also consider sponsoring current employees to pursue research training. Finally, industry may also offer job opportunities for researchers trained in RI, and this could be fostered by university–industry partnerships.

Although governments and universities may have structures in place to retain their trained researchers and healthcare workforce, brain drain remains a threat to this investment. To prevent brain drain, researchers in the LMIC setting need to be supported to continue conducting research in the LMIC setting beyond the K-award period. This would be possible if emerging researchers win an R01 or equivalent grant before expiry of their K-award. Potential R01 recipients would require mentoring and training in grant writing early in the first half of their K-award period since obtaining independent funding often requires multiple submissions. Mentors should also help early career investigators to grow their social networks, since transition to independence often requires multiple grants with coinvestigator support to maintain sufficient funding and increase scientific productivity. GHRI research is particularly well suited to team science done across larger networks of investigators.

Hiring trained researchers into Ministries of Health, academic institutions and research non-governmental organisations at competitive salaries with protected time for research, teaching and mentoring is critical to preventing brain drain. Additionally, pairing researchers in LMIC and HIC to conduct research in LMIC as co-PIs promotes bidirectional trust and mutual respect, which in turn prevents brain drain.

CONCLUSION

GHRI research has the potential to catalyse RI and mitigate inequities in global health research and training. To sustain GHRI research, however, training opportunities should be intentionally designed to promote sustainable bidirectional training between HIC and LMIC to foster RI. We suggest several opportunities including pairing of individual and institutional training grants, more postdoctoral training for emerging GHRI researchers, resources to support the pathway to independence and careers in GHRI, and promotion of South-South initiatives. The NIH should additionally consider specific funding opportunities to promote GHRI research training.

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