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# A Global Health Reciprocal Innovation grant programme: 5-year review with lessons learnt

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## ABSTRACT

Unilateral approaches to global health innovations can be transformed into cocreative, uniquely collaborative relationships between low-income and middle-income countries (LMICs) and high-income countries (HIC), constituted as 'reciprocal innovation' (RI). Since 2018, the Indiana Clinical and Translational Sciences Institute (CTSI) and Indiana University (IU) Center for Global Health Equity have led a grants programme sculpted from the core elements of RI, a concept informed by a 30-year partnership started between IU (Indiana) and Moi University (Kenya), which leverages knowledge sharing, transformational learning and translational innovations to address shared health challenges. In this paper, we describe the evolution and implementation of an RI grants programme, as well as the challenges faced. We aim to share the successes of our RI engagement and encourage further funding opportunities to promote innovations grounded in the RI core elements. From the complex series of challenges encountered, three major lessons have been learnt: dedicating extensive time and resources to bring different settings together; establishing local linkages across investigators; and addressing longstanding inequities in global health research. We describe our efforts to address these challenges through educational materials and an online library of resources for RI projects. Using perspectives from RI investigators funded by this programme, we offer future directions resulting from our 5-year experience in applying this RI-focused approach. As the understanding and implementation of RI grow, global health investigators can share resources, knowledge and innovations that have the potential to significantly change the face of collaborative international research and address long-standing health inequities across diverse settings.

## SUMMARY BOX

- ⇒ In the face of complex global health challenges and inequities, translational research requires cocreation and the bidirectional flow of knowledge, innovations and interventions across diverse settings, a process we define as reciprocal innovation (RI).
- ⇒ We review the development of the Global Health Reciprocal Innovation grants programme, established by the Indiana Clinical and Translational Sciences Institute in 2018, and the challenges and lessons learnt in its application.
- ⇒ To address the myriad of experiences learnt in the programme's 5-year experience, we identify three areas of future directions for RI research: (1) integration of key RI principles into research proposals and funding mechanisms; (2) creating connections across global partners and (3) funding inequities as a barrier to partnership equity.
- ⇒ We provide preliminary evidence through our grants programme that RI represents a new direction in global health research that can address shared health challenges across settings and strengthen global translational research.

## INTRODUCTION

There is an increasing recognition of the value and need for researchers across diverse settings to collaborate and cocreate testable, innovative solutions to address global health challenges.[1 2] Indiana University's Center for Global Health Equity (IUCGHE), rooted in its over 30-year Academic Model Providing Access to Healthcare (AMPATH) collaboration with Moi University and Moi Teaching and Referral Hospital in Kenya, has described key elements necessary for sustainable partnerships predicated on mutual respect and the bilateral exchange of knowledge.[3] Based on this history, the IUCGHE, working with the Indiana Clinical and Translational Sciences Institute (CTSI), coined the term Reciprocal Innovation (RI) to describe an equitable global research environment where innovations are codesigned and collaboratively adapted with the potential to accelerate the timeline from innovation to broad dissemination.[3] Evolved from the unidirectional concept of reverse innovation, RI is

defined as the bidirectional and iterative exchange of a technology, methodology or process between resource-rich and resource-limited settings to address a common health challenge and provide mutual benefit.[3] Lessons learnt are continuously shared throughout the process to suit the needs and infrastructure of each country.

More specifically, RI builds on traditional global health partnerships through the adaptation of three core elements: (1) knowledge sharing with bilateral exchange among academic partner institutions; (2) transformative learning across academic, community and health system partners; and (3) the identification of translational innovation through long-term engagement.[3] Programmes informed by the RI principles are uniquely situated to create a space for partnership across international institutions, and thereby meaningfully apply high-quality interventions across diverse settings. The focus on coconstituted, collaboratively adapted approaches to shared health challenges allows for critical health interventions to be translated, demonstrated, replicated and disseminated with momentum across multiple complex settings. As such, RI is more than sharing results from global health projects, but is the creation of equitable and mutually beneficial partnerships that engage stakeholders in a meaningful way, and contextualise research settings beyond the typical low-to-middle and HIC dichotomy.

Beginning in 2018, the IUCGHE, together with the Indiana CTSI, established a Global Health Reciprocal Innovation (GHRI) grants programme to support the research of partnered Indiana CTSI and LMIC investigators. Over the past 5 years, the goal of this programme has been to engage global and local partners in collaborative projects informed by the core tenets of RI. Based on the identified characteristics and desired directions of the GHRI programme (figure 1), the Indiana CTSI developed two specific grants mechanisms to provide early support to develop and deepen equitable partnerships and to subsequently fund innovations and research grounded in RI principles, as well as create a virtual repository to support networking opportunities.[4] Demonstration Grants support high-impact solutions to health challenges affecting both Indiana and LMICs. The Planning Grants support partnership development activities, including the training and collection of pilot data needed to support an eventual Demonstration Grant application. The Indiana CTSI created an online repository of RI projects, the Global Health Innovation Exchange (GHIE),[4] to support the engagement process and share examples of funded RI grant projects. In this manuscript, our GHRI team (Indiana and LMIC partners collaborating as authors) build on our initial publication describing the development of the concept of RI to focus specifically on the operationalising of RI through our grants programme, and discuss opportunities, challenges and lessons learnt that can inform other programmes and funding agencies.

## GHRI GRANTS PROGRAMME DESCRIPTION

Prior to the launch of the RI grants programme, the Indiana CTSI housed a global health grants programme that provided US$10,000–US$20,000 awards, with funding through the Indiana CTSI and partner institutions (Indiana University, Purdue University and University of Notre Dame). These grants supported pilot studies conducted at international sites and spurred the creation of an infrastructure for collaborative review of applications between Indiana CTSI investigators and LMIC collaborators.

To encourage knowledge exchange and innovation between Indiana and LMIC investigators, the Global Health Pilot Grant Programme was restructured in 2018. The adapted programme supports both partnership development between Indiana CTSI and LMIC collaborators and the implementation of collaboratively developed demonstration projects. To support the transition from the initial Global Health Grants Programme to the RI Grants Programme, programme staff conducted

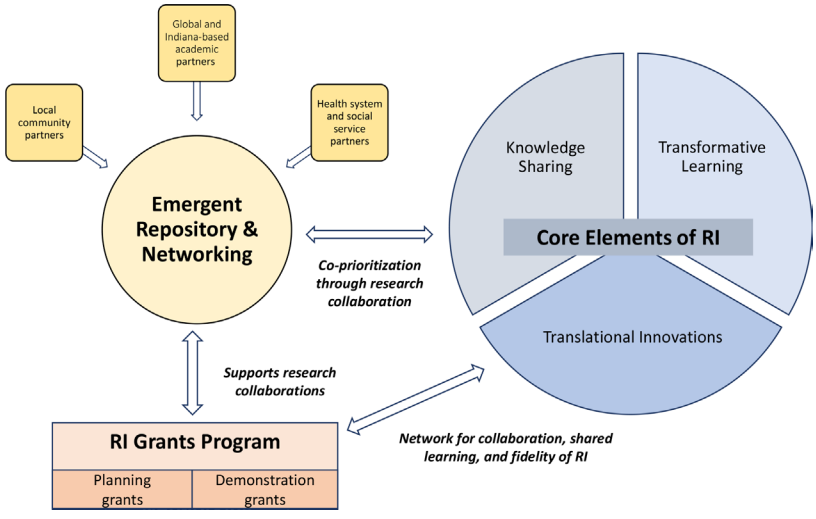


**Figure 1** Conceptual Framework of Indiana GHRI's Grants Program and Partnerships. RI, reciprocal innovation.

an environmental scan among global and local partners. The scan aimed to gauge available RI resources and interest among stakeholders, and later served as a roadmap for the RI Stakeholder Planning Meetings. Since 2018, together Indiana and LMIC partners have held annual stakeholder meetings to educate on RI and identify shared health priorities as the guiding principles for the upcoming round of request for applications (RFA).[5 6]

The first stakeholder meeting was focused on Indiana global health and Moi University investigators introducing the concept of RI to Indiana-based stakeholders, including the Indiana State Department of Health (ISDH) and Indiana CTSI institutions. Later stakeholder meetings have moved to a virtual platform to engage Indiana-based and LMIC stakeholders. The emphasis of each annual stakeholders meeting alternates between Indiana and LMIC priorities, followed by the RFA each winter. Recognising the challenges posed by the small US$10–US20,000 pilot award amounts and the 1-year grant timeline, the pilot awards transitioned to two funding mechanisms, including 1-year Planning Grants for US$10,000 and 2-year Demonstration Grants for US$50,000. Both awards allowed a no-cost extension to add further flexibility and support, as the planning and regulatory requirements between disparate countries lead to delays. RI Planning and Demonstration Grants are solicited once per year and reviewed by a selection committee, with hand-picked representation from the ISDH, Indiana CTSI institutions and LMIC stakeholders. The review process is structured according to the National Institute of Health (NIH) study section guidelines, with up to two awards for the Planning Grant and two awards for the Demonstration Grant each cycle. Per Indiana CTSI funding requirements, the lead principal investigator is required to be from an Indiana CTSI institution (IU, Purdue, Notre Dame). In future stages of the grant programme, our vision is to secure additional funding sources that allow LMIC and other investigators an opportunity to apply without the requirement of an Indiana-based primary lead.

Initially, a significant amount of effort was required to educate and disseminate information about the GHRI Grant Programme and support investigators' engagement with partners. To educate investigators about RI, programme staff created webinars, informational videos,[6] and online materials with tips for successful grant applications. Key components of successful applications are a strong commitment to collaborative learning, well-articulated plans and goals for identification of future funding sources to support further adaptation and implementation. Demonstration Grants have required a letter of intent (LOI) since 2022. The LOI's purpose is to determine if the proposal falls within the RFA guidelines and successfully demonstrates the concept of RI. Applicants have the opportunity for a 30-minute 1:1 mentorship session, tailored feedback and additional resources from Indiana CTSI programme staff. These efforts to refine the principles of RI within each project are intended to ensure the strength of all Demonstration and Planning Grants and the success of their interventions. Every partnership has its challenges, and programme staff respond by dedicating time and resources to provide continued support throughout the grant for each Indiana and LMIC partnership.

**Table 1** Descriptive review of grant applications

| | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| No of applications | | | | | |
| US$10 000 planning | 0 | 0 | 4 | 5 | 7 |
| US$50 000 demonstration | 15 | 6 | 4 | 11 | 13 |
| No of grants awarded (percentage awarded) | | | | | |
| US$10 000 planning | 0 | 0 | 2 (50) | 2 (40) | 2 (43) |
| US$50 000 demonstration | 1 (7) | 1 (17) | 2 (50) | 2 (18) | 2 (15) |
| Demonstration grants reviewed in committee* (percentage reviewed) | 9 (60) | 6 (100) | 4 (100) | 5 (45) | 7 (53) |
| No referred for mentorship | 0 | 2 | 2 | 0 | 3 |
| Total funding distributed (US$) | 110 | 60 | 120 | 120 | 120 |

*Includes only demonstration grants. All planning grants are reviewed.

## GHRI PROGRAMME EVALUATION

The history of the grants programme was assessed by reviewing all past applications, funding history and annual reports. Table 1 and figure 2 display these data as a descriptive review. Since the inception of the GHRI grant programme, a total of 16 planning grants and 49 demonstration grants have been submitted with 6 (37.5%) and 8 (16.3%) awarded, respectively. Total applications decreased in 2020 and 2021 due to the overall shift in research priorities amidst the COVID-19 pandemic, but the number of grants submitted has increased over the past 2 years. The GHRI grants programme has distributed US$530,000. Successfully funded projects, consisting of both planning and demonstration awards, include the following topics: maternal and infant health (7), mental health (3), infectious diseases (3) and health promotion and prevention, including chronic and acute health problems (1).

Investigators were contacted by email and given the option to follow a link to a REDCap survey or have a 1:1 personal interview to complete the survey by phone. No investigators opted for the phone survey, but we received surveys from nine I-CTSI grantees and four LMIC cograntees, a response rate of 100% and 66%, respectively. As shown in table 2, 69% of survey participants stated the funding led to publications including abstracts, posters and manuscripts, with a total of 18 manuscripts published or submitted at the time of the survey.[7–21] In addition, 69% of the respondents stated the funding led to further grant applications, with 38% of those applications resulting in successful funding. Most notably, 92% of all participants felt the funding mechanism helped

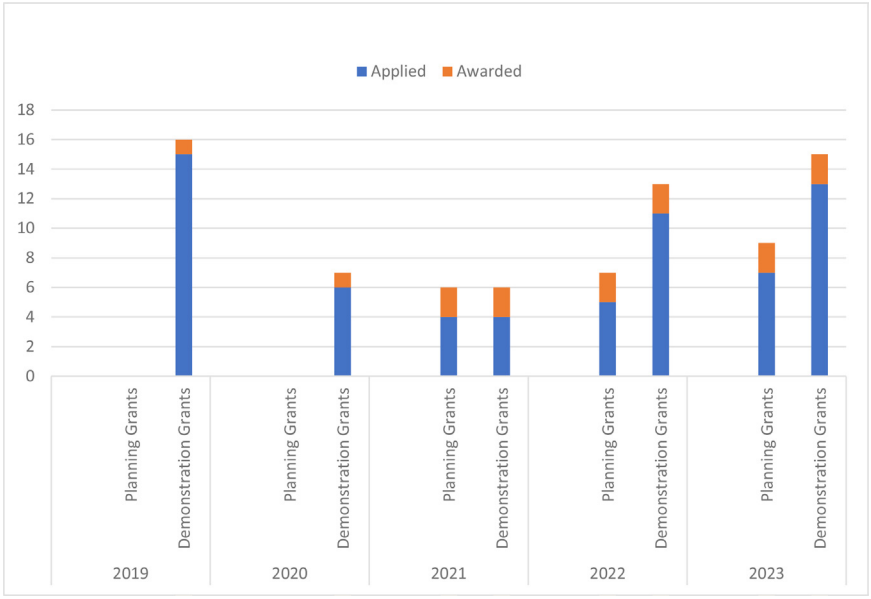


**Figure 2** Summary of grant submissions and awards 2019–2023.

create new or deepened partnerships; 75% of respondents from an LMIC said the grants programme led to deepened partnerships. One LMIC-based respondent stated:

> *As a result of the project, our partnership with the [local] Health Directorates have deepened and led to a heightened interest in our projects.*

All the respondents provided positive statements regarding RI potential to highlight mutual learning, building partnerships and collaborations, and shared innovation between contexts. One Indiana-based respondent stated:

> This program has been integral to building a successful research and education portfolio, both as an independent and team scientist. I am extremely grateful not only for the funding opportunities, but for the coordinated and comprehensive support provided by program staff. This was especially critical during the COVID-19 pandemic, when research efforts were significantly and deleteriously impacted by lockdowns, moratoriums on research, and travel restrictions. Without the steadfast, unwavering support of the reciprocal innovation program staff, success would have been impossible. I simply cannot express enough gratitude for this program's investment in faculty and students to build international capacity for reciprocal innovation to address urgent global public health challenges.

**Table 2** Results of GHRI demonstration grantee survey (beginning with grants in 2018)

| | N (%) |
|---|---|
| New/deepened partnerships | |
| Yes | 12 (92) |
| Peer-reviewed publications | |
| Yes | 9 (69) |
| Other intellectual products* | |
| Yes | 3 (23) |
| Subsequent grant applications | |
| Yes | 9 (69) |
| Successful grant applications | |
| Yes | 5 (38) |

*Inventions, intellectual property, etc.
GHRI, global health reciprocal innovation.

Overall, participants focused on the strengths of RI in their responses, though there are some stated challenges. Respondents stated the largest challenge is securing future funding to continue the work, especially since working in more than one location requires larger funding sources. In addition, participants stated that time is a major barrier, since working across global locations requires increased communication and ensuring compliance with multiple countries' research regulations. Many applicants are early-stage investigators, which may amplify these barriers due to insufficient protected time and grant writing experience. When asked about challenges, one respondent stated:

> *Time- reciprocal innovation takes sustained effort.*

Investigators identified the need for higher funding thresholds within grants to provide sufficient salary support and protect the time necessary to conduct RI-focused research.

We present three cases of RI-funded research grants in table 3. Due to the requirements of the CTSI grant mechanism, the contact principal investigator was required to represent a CTSI institution, however, to promote equity, the RI funding mechanisms required a co-lead from an LMIC institution. These examples include

**Table 3** Three case examples of funded GHRI grants

| Investigators | Country | Type of grant | Intervention | Brief description | Implications |
|---|---|---|---|---|---|
| Case 1:<br>McHenry (USA)<br>Oyungu (Kenya)<br>Kigen (Kenya) | Kenya | Planning Grant | NA | To develop a caregiver curriculum for children with autism, two members of each international team visited the other respective study site (Eldoret or Indiana) to codesign the implementation guide, identify shared needs and ensure two-way translation. | After the behavioural training manual is developed, there are plans to secure funding for demonstration projects and conduct studies across MTRH and low-resourced clinical settings in rural Indiana. |
| Oyungu (Kenya)<br>Chelagat (Kenya)<br>McHenry (USA) | Kenya | Demonstration Grant | Care for Child Development (CCD) Programme | Investigators implemented a pilot study of a group-based, culturally adapted CCD programme of thirty-one children in Kenya and their caregivers. | The CCD programme has potential to be adapted within low-resourced clinical settings in Indiana given its positive preliminary data on maternal depressive symptoms, home environment and caregiver perspectives. |
| **Summary:** The GHRI-funded programme has followed two caregiver-focused interventions in Kenya that target young children with neurodevelopmental delays, specifically autism spectrum disorder, who are often stigmatised across sub-Saharan Africa. Through the AMPATH collaboration, Kenyan and US-based investigators from Moi Teaching and Referral Hospital (MTRH) and IU collaborated on two culturally adapted, group-based pilot studies for caregivers of children with neurodevelopmental disabilities or autism. The initial group-based pilot at MTRH was funded through the demonstration grant. After demonstrating success, the Indiana CTSI awarded the investigators a planning grant to build partnerships between the Kenyan Ministry of Health, MTRH and Indiana-based collaborators. | | | | | |
| **Case 2:**<br>Bucher (USA)<br>Esamai (Kenya)<br>Linnes (USA) | Kenya and Nigeria | Demonstration Grant | Swaddling with automated Monitoring Reporting and Tracking (NeoSMART) | This device warms the baby, while using sensor technology to simultaneously capture vital signs, such as body temperature and heart rate, and track infant health data on a corresponding mobile app. | Following expanded studies, NeoSMART may potentially be applied across low-resourced clinical settings for critical populations, such as opioid-exposed newborns in the USA, babies with hypothermia in Kenya and Nigeria, and preterm births across multiple settings. |
| **Summary:** Opioid use is a public health crisis in Indiana. The biomedical device, Neonatal Swaddling, Monitoring, Automated Reporting and Tracking (NeoSMART), was initially developed for preterm infants in Kenya. With support from a GHRI Demonstration Grant and the collaboration of faculty from IU School of Medicine, Purdue University and Moi University, the device was further adapted, developed and tested for feasibility with infants exposed to opioids in-utero. This device comforts and warms the baby with a kangaroo mother care swaddling carrier, while using sensor technology to simultaneously capture vital signs and track infant health data on a corresponding mobile app. Preliminary data suggests that this 'middle tech' device accurately monitors infant vital signs, such as body temperature and heart rate.[26–28] | | | | | |
| **Case 3:**<br>Lieberman (USA)<br>Chikowe (Malawi) | Malawi and Kenya | Demonstration Grant | Paper analytical device (PAD) | PAD was re-engineered to detect a wide range of risk elements commonly found among street drugs in the US and poor-quality pharmaceuticals in Malawi. | PAD has expanded to address safer behaviour among people who use drugs and become a tool for harm reduction counsellors in Chicago. |
| **Summary:** The PAD was originally developed to test faulty antibiotics inexpensively and rapidly in Kenya and Malawi by investigators from University of Notre Dame, AMPATH-Kenya, and the University of Malawi. They re-engineered an illicit drug PAD to then meet the needs of opioid harm reduction organisations in Chicago and detect a wide range of risk elements commonly found among street drugs in the USA through the support of GHRI funding. Since this funding, the use of PADs has been expanded and used to detect inferior quality chemotherapy products in Ethiopia, Malawi, Cameroon and Kenya, with US$2.5 million in funding received from the NIH. | | | | | |

NIH, National Institute of Health.

social-behavioural science, technology development and testing, and applied basic science research projects.

## CHALLENGES, LESSONS LEARNT AND NEW DIRECTIONS

Based on the first 5 years developing and implementing the GHRI grants programme, we identified three unique challenges to the field: (1) operationalising a new concept like RI in a grants programme; (2) connecting global and local partners and (3) funding inequities as a barrier to partnership equity. Each challenge has informed lessons learnt and suggestions for future directions.

The concept and core principles of RI informed by the 30-year AMPATH partnership in Kenya have begun to change the focus, quality and outputs of partnerships between institutions affiliated with Indiana CTSI and LMIC partners.[22 23] The concept of RI has the potential to create more equitable and impactful partnerships between high-resource and low-resource settings, helping to broaden the global health research ecosystem.[24] However, these gains require a commitment to long-term engagement, trust and relationship building, and significant investments in resources and infrastructure for collaborative work. Implementation of this approach is challenging as we translate lessons learnt to new settings and partnerships and cannot be achieved with the one-off funding opportunities that have been a hallmark of previous, traditional global health research. In addition, RI as a new concept is often challenging for investigators to fully comprehend and effectively operationalise. To address this knowledge and skills gap, this programme has invested significant resources in educating investigators and other partners about the concept of RI and its core principles. This has included developing educational videos and webinars; implementing 1–1 meetings

with investigators; and convening annual stakeholder meetings. The time and resources dedicated to operationalising RI through a grants programme requires extensive funding and personnel commitment from the parent institutions and leadership team, which creates challenges for sustainability. Expansion of RI across institutions and partnerships will require that donors understand the opportunity cost of supporting RI and commit to the necessary financial support.

Connecting local and global investigators and supporting these engagements has been another major challenge for RI within the Indiana CTSI. Global health investigators from the USA often primarily conduct research in non-US settings and are challenged with understanding how to identify and link with local investigators and communities in the USA engaged in addressing similar problems. This challenge is magnified for non-US investigators, who may have innovative approaches to addressing health challenges that impact their country, as well as the USA. As such, research collaborations that bring together domestically focused and globally focused USA and LMIC investigators to address common health challenges are rare. To help investigators identify promising partners and promote the characteristics of successful partnerships, we created the GHIE.[4] We are planning to build on the GHIE to create a more dynamic web presence that will serve as a living dashboard for RI initiatives and provide a virtual gateway for investigators to seamlessly network and collaborate across settings. However, even if fully optimised, the GHIE will initially only be able to support the collaboration of Indiana-CTSI institutions and LMIC partners. A large-scale comprehensive platform that has the capacity to engage a broader spectrum of investigators from across the globe and facilitate networking and collaboration would be ideal in supporting wide adoption of RI.

Finally, long-standing funding and other inequities in global health research represent a significant barrier to fully implementing RI principles. For example, while Indiana CTSI global health investigators are heavily involved in work in global settings, the capacity for LMIC investigators to engage in RI work in the USA is limited by time and funding constraints. In our experience with the AMPATH programme, Kenyan investigators are often overburdened with teaching and clinical responsibilities within their home institution. This is the result of institutional funding constraints that lead to limitations on faculty size, as well as the absence of mechanisms to create protected time for research, even for extramurally funded faculty. Such drains on time and energy leave insufficient capacity to engage in RI in the USA. In addition, beyond funding opportunities for LMIC investigators in training (eg, Fogarty D43 programmes that support US-based training and research opportunities), there are limited funding opportunities and visa pathways that support LMIC investigator engagement in US-based research.

While activities undertaken within the scope of these RI grants programme are unable to address broader structure challenges, the Demonstration Grant mechanism is positioned to support time for international faculty engagement in US-based projects. This has allowed us to leverage Kenyan investigators' growing expertise in community-based care, peer support and integrated care to inform innovations in Indiana.[23] It is clear that LMICs are the source of significant innovations that have the potential to improve health both within the country of origin and in the USA. As such innovations are adopted and adapted, it is necessary to establish an equitable feedback cycle that recognises the expertise of LMIC investigators, and to ensure that they are part of the adaptation process. As our programme matures, we are working to create opportunities for LMIC investigators to become the contact PIs for future RI cycles,[24] to require that all future Demonstration Grant applicants include a 'reflexivity statement' in their grant application, and to continue to ensure that grants are reviewed by a diverse and inclusive panel of investigators representing HIC and LMIC countries. We strongly advocate for the development of funding opportunities that increase the capacity for LMIC investigators to engage in US-based research and diversify the perspectives addressing health challenges in the USA. Further, more diverse funding opportunities are needed to encourage LMIC-to-LMIC partnerships and lengthen grant funding to facilitate sustainable research. The NIH supports future directions to advocate for more equitable and impactful global health partnerships,[25] yet there is still a need for additional funding opportunities that are explicitly based in the principles of RI partnerships and collaboration.

## CONCLUSION

While the limitations in this article include a small number of grantee respondents and emphasis on a US-based grant mechanisms with its own barriers for LMICs, the Indiana-CTSI GHRI programme takes the first steps toward supporting the development of meaningful and impactful partnerships and research based on RI principles, using an innovative grants programme and a GHIE platform. However, the full potential of RI will not be realised without broader support by academic institutions and donors for this potentially transformative approach to global health. Through their inclusive approach, RI programmes foster greater equity in global health by actively engaging stakeholders from diverse backgrounds and learning from one another through long-standing relationships beyond the project period. By embracing this collaborative model, RI programmes can generate higher-quality knowledge, drive innovation and improve overall well-being, surpassing the outcomes achieved with more conventional and parochial approaches. Consequently, these programmes not only mitigate existing inequities, but also produce more relevant and effective

outcomes, redefining the landscape of global health collaborations in a truly collaborative way.

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