Thesis

Coping behaviour of low-income country researchers in global health collaborations with high-income country researchers

By

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NAME: TOM KAKAIRE

DATE: 30th September, 2023

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

Acronyms	Meaning
Africa CDC	Africa Centres for Disease Control and Prevention
AMA	African Medicines Agency
COVID 19	Coronavirus Disease 2019
CTSA	Clinical and Translational Science Awards Program
GDP	Gross Domestic Product
LMIC	Low- or middle-income country
NGOs	Non-governmental organisations
PI	Principal Investigator
R&D	Research and Development
SSA	Sub-Saharan Africa
UNCST	Uganda National Council for Science and Technology
WIS	Workplace Inequality Scale

Ethics Statement

I, Tom Kakaire consciously assure that for the manuscript “Coping behaviour of low-income country researchers in global health collaborations with high income country researchers’’ the following is fulfilled:

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3) The paper reflects the authors' own research and analysis in a truthful and complete manner.

4) The paper properly credits the meaningful contributions of co-authors and co-researchers.

5) The results are appropriately placed in the context of prior and existing research.

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Abstract

In this study, I investigated conditions of structural inequality that biomedical researchers based in low-income countries currently experience across key stages of collaboration with researchers based in high-income countries and the extent to which these conditions determine specific individual behavioural responses. Structural inequalities in research collaborations between researchers based in high-income countries and those based in low-income countries have historically been shown to disadvantage low-income country researchers. Little is known about the extent to which attempts made over the last 30 years to redress these inequalities have changed collaborative research conditions, and whether such changes are associated with specific individual behavioural responses that could improve collaboration outcomes for low-income country researchers. I used responses from a survey of 532 low-income country-based researchers to describe their current experiences of conditions of inequality in their collaborations with high-income country researchers. Through factor analysis and structural equation modelling I tested hypothesised relationships between these conditions and individual behavioural responses measured using a model from the acculturation literature. I utilised brief qualitative responses from the survey to inform policy recommendations. More nuanced structural inequalities still affect low-income country researchers, especially at the conclusion stage of collaboration with high-income country researchers. Addressing inequalities and securing research benefits at community level (named research citizenship outcomes) is a more significant predictor of low-income country researchers' likelihood of integration into these collaborations than individual, group and task-level outcomes, but maximising their final individual outcomes of research (publication and dissemination opportunities) leads to a stronger commitment to future collaboration. I recommend a focus on securing research citizenship outcomes in order to maximise their integration into collaborative research groups. I also recommend greater transparency and inclusivity particularly in assignment of collaboration roles; more institutionalisation of mentorship for junior researchers; and implementation of self-initiated policies to boost collective benefits from regional research resources. The study extends acculturation theory to a context where achieving community-level benefits predicts non-dominant individuals' integration into a dominant in-group. Future research could investigate parallel views of other stakeholders such as high-income country collaborators, funders and regulators and consider contextual differences across collaborations over a longer time frame.

Key words: global health, collaboration, high-income country researchers, low-income country researchers, structural inequality, coping behaviour

Chapter One

Background

Collaborations

Graham & Barter (1999) define collaboration as “a relational system in which two or more stakeholders pool together resources in order to meet objectives that neither could meet individually” (p. 7). This study particularly focused on individuals within scientific collaborations. Scientific collaborations are defined in many different ways (Shrum et al., 2007; Melin & Persson, 1996; Katz & Martin, 1997). This study adopted Ynalvez & Shrum’s (2011) definition as “the close interaction between two or more scientists in a research project with one or more specific goals—including the simple goal of resource acquisition” (p. 205). This study further adopted an additional criterion, following Ynalvez & Shrum, (2011) which excludes collaborations within the same work unit, such as the same department or organisation and focused specifically on inter-organisational and indeed transnational collaborations.

A rich body of literature demonstrates the need for organisations to look outside their boundaries in order to source out and integrate key knowledge from outside in order to improve their strategies, innovation and performance (Teece, 2009). Organisational sociologists contend that external factors such as unequal distribution of resources compel firms to establish partnerships with other organisations that have the resources that they need (Pfeffer & Salancik, 1978). Organisations enter into collaborations to benefit from social connections for inter-organisational transfer of knowledge (Reagans & McEvily, 2003), to explore new technological domains (Rosenkopf & Nerkar, 2001) and to increase organisations’ capacity to innovate (Ahuja, 2000). Organisations also form collaborations with more reputable partners in order to enhance their own status and image, and this is especially true for low income country organisations (Hitt, et al., 2000). Collaborative work is growing rapidly across fields and sectors and it is likely to grow further with rapid growth in knowledge and the need for integration of highly specialised expertise across multiple domains (Colbry, Hurwitz & Adair, 2014).

Collaborations in global health scientific research

Research and Development (R&D) consortia enable collaborating profit-making firms to share costs and risks, explore new concepts, pool scarce talent, share research or manufacturing facilities, set standards, share pre-competitive research results, accelerate technological development and/or facilitate technology transfer (Gibson et al., 1994). Collaborations are equally important in science because interaction among knowledge producers is critical to scientific practice (Melin & Persson, 1996). The complex nature of scientific work increasingly requires the collaborative work of large

numbers of individuals with distinctive expertise across nations and organisations (Beaver, 2001; Katz & Martin, 1997; Newman, 2001).

In the health sciences, research collaborations have led to ground breaking advances in areas as diverse as genomics (Collins, Morgan & Patrinos, 2003) and AIDS prevention (Stillwaggon, 2005). Early scholars pointed out that collaborative research groups' characteristics transcend formal organisation structures, enabling them to integrate ideas from multiple geographical locations or nations (Argote & McGrath, 1993). Thus, collaborators benefit from joint resources, access to diverse conditions and populations of mutual interest, less academic isolation, enhanced creativity and greater motivation due to shared responsibility for achieving major scientific goals. (Fox & Faver, 1984). Subsequent scholars pointed out that scientific collaboration also comes with complexities and costs at the level of collaborating organisations, workgroups and individuals (Lee & Bozeman, 2005; Paulus & Nijstad, 2003; Singh & Fleming, 2010). This calls for further exploration.

Collaborations have become particularly critical in global health research. Koplan et al. (2009) define global health as "an area for study, research, and practice that places a priority on improving health and achieving equity in health for all people worldwide" (p. 1995). In reality, it is often constructed, particularly by high-income country actors as "a growing academic field where high-income country faculty and students work in low-and-middle-income countries (and especially in Africa) to learn about cultures, settings and diseases and possibly to develop an expertise to address existing and emerging challenges in healthcare" (Chu et al., 2014, p. 1). Crane's (2010) ethnographic account contrasts this high-income country construction of "global health" as a range of diseases of academic and strategic interest arising out of resource-limited settings with a low-income country construction that arises out of a lived experience of social and economic disadvantages that are imposed by these diseases. This can be observed in the Ebola diseases outbreak in West Africa which illustrated the potential public health and security dangers posed when infectious diseases spread rapidly, often from low income countries, across borders (Spengler et al., 2016). The more recent COVID 19 outbreak amplified that perception of risk, triggering predictions of catastrophe for Africa and its neighbours (Wamai et al., 2021). These events not only exposed Africa's fragile health systems but also refocused attention on the need to conduct more global health research that is tailored to Africa's socio-economic and epidemiological setting (Wamai et al., 2021). High-income country/low-income country collaborations are the commonest vehicle for conducting such research. It is surprising therefore, as noted by some scholars (Tagoe et al., 2019) that empirical research has not adequately addressed the relational and managerial aspects of scientific collaboration within this context.

Chapter Two

Introduction

The research questions that guide this thesis are located in the literature on structural inequality and non-dominant individuals' coping behaviour as adopted from acculturation literature. Chapter 2 describes this literature in three sections. The first section defines structural inequality in collaborations and describes how it is manifested at the global and individual level of collaborations between high-income country and low-income country researchers. The second section describes the concept of acculturation and the individual behavioural coping strategies that have developed from this literature. The third section describes salient features of structural inequality at different stages of high-income country-low-income country collaborations. In this section, I adopt a model from the acculturation literature to conceptualise these inequalities and to explore specific behavioural strategies that individuals from minority/non-dominant societies adopt to cope with them. I end the chapter by stating the overall question that the thesis addresses in order to investigate behavioural outcomes for low-income country researchers in collaborations with high-income country researchers.

2.1 Structural inequality

Collaborations between low-income country and high-income country researchers exhibit features of structural inequality. Dani and Haan (2008) define structural inequality as "a condition that arises out of attributing an unequal status to a category of people in relation to one or more other categories of people, a relationship that is perpetuated and reinforced by a confluence of unequal relations in roles, functions, decision rights, and opportunities" (p. 13). These categories can be based on a fixed social attribute such as gender, race/ethnicity, nativity, religious affiliation, occupation or a relatively less rigid attribute such as social class, however it is determined (Liao, 2009). Interlocking unequal relations in roles, decision rights and opportunities can make structural inequality so pervasive that institutions that have the power to address it fail to acknowledge it and those who are disadvantaged by it accept it as a normal part of their lives (Dani & Haan, 2008).

Structural inequality is deeply embedded in the domain of science, technology and innovation. For example, the popular concept of the knowledge economy which relates to how knowledge can be turned into profit (or social benefit) demonstrates how the ability to create and benefit from new knowledge (particularly scientific knowledge) is skewed towards high-income countries) while restricting the policy options and strategies of low-income countries (Cozzens et al., 2007). Some scholars thus frame the inequalities in science at a global level specifically as inequalities of capacities, which translate into inequalities of representation (Cozzens et al., 2007). These in turn

lead to inequalities in the distribution of benefits and costs. Given the wide disparities between their respective national scientific capacities, it is likely that such inequalities will be a key feature of collaborations between high-income countries and low-income countries in global health research.

2.1.1 Structural inequality in health research at the global scale

The universal right to both health and knowledge is embodied in global discourse and in the socio-political fabric of high-income countries (Ooms et al., 2013). This serves as a legitimising force for high-income country/low-income country health research collaborations but also colours the institutional and individual relationships that develop within these collaborations (Aellah, Chantler & Geissler, 2016). Many of the infectious diseases that are the main focus of global health collaborations are largely prevalent in low-income countries (Crane, 2010). It is in the interests of high-income country researchers who specialise in infectious diseases to establish collaborations with low-income countries in order to conduct global health research, and to locate most of that research in the weak, underfunded health systems of that setting (Aellah, Chantler & Geissler, 2016). These systems tend to lack the means to sustain scientific research because they are often in a state of cumulative neglect primarily caused by underfunding at national and institutional levels. This translates into poor low-income country scientific capacity and output. Moreover, a variety of scholars and stakeholders have demonstrated that low-income country research output is often devalued, thus de-incentivising localised innovation and problem-solving in this setting (Ferretti et al., 2018; Hicks et al., 2015).

Scientists in a low-income country setting with all its capacity limitations, would not be expected to easily attract collaborators. Scientists collaborate in order to access resources such as expertise, data sets and apparatus (Beaver, 2001), to acquire new skills and knowledge that are complementary to theirs (Iglič et al., 2017) and thus to attain higher productivity, prestige and access to funding (Bukvova, 2010). In some cases, there is an explicit economic motive for collaboration. For example, pharmaceutical companies or their agents sometimes pay a fee to access the networks and local infrastructure of low-income countries in order to conduct drug trials in treatment-naïve populations (Petryna, 2005). By contrast, global health collaborations in Africa are typically funded by high-income country government agencies and private foundations, ostensibly to respond to the lack of low-income country funding to research locally relevant problems (Moyi Okwaro & Geissler, 2015) and to enhance local scientific capabilities through exchanging knowledge and experience (Wagner et al., 2001). Thus, they communicate an ethos of equal partnership. In reality, this is undermined by a post-colonial environment in which high-income countries, and their institutions historically have more symbolic and “active” power and prestige (Ogden & Porter, 2000) and are perceived to have a higher status (Earley & Mosakowski, 2000) relative to their low-income country

counterparts. High-income country ownership of the specific types of capital that are valued in science perpetuates a dominance (Walsh, Brugha & Byrne, 2016) which transcends institutional and individual levels of collaboration (Ogden & Porter, 2000). This gives rise to a tendency for high-income country partners to assume superiority, and for low-income country partners to accept an inferior position in negotiating rights and obligations (Crane, 2010; Ogden & Porter, 2000; Okeke, 2016). High-income country actors' dominance of funding in global health collaborations (Krull, 2005) not only introduces a donor-recipient tenor in the ensuing relationships but also leaves low-income country partners with little choice in accepting high-income country research investment priorities (Beyeler et al., 2019; Trostle & Simon, 1992) and in disregarding underfunding of their administrative costs (Crane et al., 2018). Amidst these multi-lever power imbalances, even the most well-intentioned collaborators often compromise on issues of equality in order to meet their primary objectives (Aellah, Chantler & Geissler, 2016).

2.1.2 Structural Inequality in global health at individual researcher level

Science is a domain in which there is intense competition for individuals to have important publications and discoveries credited to them as a way of enhancing their careers (Whitley, 2000). Collaboration in science thus occurs within a work, reward and career progression structure that is driven by individual credit for important new knowledge, usually in the form of high impact papers in prestigious journals (Kennedy, 2003; Whitley, 2000). These in turn largely determine individual recognition, tenure and promotion (Partha & David, 1994). This places African scientists, whose governments and institutions have limited capacity or willingness to fund public health services, let alone scientific research, at a great disadvantage (Pfeiffer & Chapman, 2015). Many African countries attribute as much as 90% of their scientific output (measured by authorship) to collaborations (Pouris & Ho, 2014). As a result, the majority of African research collaborations (79% for Uganda) were with countries outside Africa suggesting that Africans seek to collaborate with non-Africans because of their access to resources rather than the lack of suitable African collaborators (Pouris and Ho, 2014).

Despite the egalitarian rhetoric of such collaborations, glaring inequalities between high-income country and low-income country scientists in education, experience, academic accomplishments, pay, financial and technical resources, networks and prestige create inherent imbalances. Low-income country scientists are cast into the role of beneficiaries rather than equal members with potential to make solid, unique contributions to the collaboration (Moyi Okwaro & Geissler, 2015). Both high-income country and low-income country scientists generally acknowledge these dependencies and inequalities but justify them in the context of wider mutual benefits to low-income country health systems (such as better technology and access to expensive drugs) as well as

important benefits to individual researchers (such as publications, supplemental pay and access to global research networks) which are ingrained within these collaborations (Muldoon et al., 2012; Parker & Kingori, 2016).

Collaboration dynamics are also influenced by individual scientists' attempts to balance goals that preserve and enhance their professional goals against those that boost overall group goals (Bikard, Murray & Gans, 2015). For example, researchers with unique knowledge may not fully disclose it for group benefit in order to preserve their professional advantage (Gans, Murray & Stern, 2013). In high-income country/low-income country collaborations, high-income country researchers may take advantage of their control over key group resources to perpetuate a "service collaboration"; one in which they set the goals and perform the creative labour that is more professionally rewarding while leaving the more routine work to low-income country partners (Laudel, 2001). Low-income country researchers may thus be compelled to accept trade-offs that may be irrelevant, or even injurious, to their individual professional interests and to the needs of their context (Moyi Okwaro & Geissler, 2015).

This is often compounded by standard terms and conditions applied in contracts generated by high-income country organisations which primarily aim to protect high-income country interests regarding issues such as publishing rights, intellectual property, neutrality/fairness of dispute resolution mechanisms, jurisdictions, and indemnification. (Sack et al., 2009). Moreover, contractual terms and conditions tend to vary across multiple funders, further complicating objective reviews of their contents. Both high-income country and low-income country organisations tend to overlook these anomalies in the interests of securing the collaboration and thus wittingly or unwittingly abet power imbalances.

The feelings and attitudes of individual low-income country researchers in such unequal collaborations are rarely discussed openly for fear of complicating these relationships (Parker & Kingori, 2016). This is an oversight and as observed by Geissler & Okwaro (2014), global collaborations will be well served by empirical examination of experiences of inequality in this setting and how it shapes individual behaviour.

2.2 Key stages of global health research collaboration

Following my own anecdotal observations and existing literature, I adopted the key stages of research collaboration as a framework for investigating variations in individual experiences of inequality across the collaboration cycle. An extensive body of global health research collaboration literature has developed for over 30 years describing a variety of complex conditions that shape

individual low-income country collaborators' experiences of inequality in collaborative groups and challenge their efforts to balance individual professional and societal benefits against the costs of membership in these groups (Aellah, Chantler & Geissler, 2016; Binka, 2005; Bradley, 2007; Costello& Zumla, 2000; Crane, 2010; Edejer, 1999; Jentsch & Pilley, 2003; Matenga et al., 2019; Moyi Okwaro & Geissler, 2015; Munung, Mayosi & De Vries, 2017; Trostle & Simon, 1992). To address these complexities, I sought to adopt a guiding conceptual framework based on distinct stages of the collaboration cycle as derived from the collaboration literature. While these stages may vary across collaborations and/or may overlap, they represent a useful broad structure for identifying key features in each stage of global health collaboration work and how they might perpetuate (or accentuate) specific elements of structural inequality. This facilitates identification of, and theoretical inquiry into the extent to which individual experience of inequality and the resultant behaviours exhibit patterns that inform management of collaboration in similar contexts.

I conducted a literature search on stages of collaboration, identifying four alternative frameworks that address specific stage-related variables. A framework developed by Kraut, Galegher & Egidio (1987) identifies personal and task-related factors affecting collaboration in a large sample of researchers from a broad disciplinary base. However, it offers little relevant context because it is primarily aimed at supporting development of computer and telecommunications-based tools to aid collaborative work. Tellioglu's (2008) Collaboration Lifecycle (CLC) framework describes an initiation, formation, operation and decomposition phase in a distributed team collaboration. This builds on a methodology called "Formation and Operation of Sustainable Collaboration" from the Computer-Supported Cooperative Work (CSCW) literature, which also limits its applicability to the current study's setting. Maglaughlin's (2003) framework explores information and communication factors that are most salient in enhancing the success of various stages of scientific interdisciplinary collaboration. This framework identifies key facets of collaboration that influence collaboration outcomes in this setting being the personality, matter, energy, space and time facets, which make it better suited to the study context. However, Sonnewald's (2007) framework is much more comprehensive and multi-dimensional, exploring social settings (geographical, political, socio-economic and resource factors), organisational and community factors (such as information and communications technology, intellectual property and legal issues) ,group and task-specific issues (vision, goals and tasks, communications and professional networks) as well as individual level factors (such as human behaviour, social networks and perceptions of success) specifically in scientific collaboration. While the stages in Sonnenwald's (2007) framework mirror those of other scholars therefore, it allows for much richer exploration of inequality in scientific collaboration at all these levels in order to illuminate their impact on individual behavioural outcomes. It is also the most cited. I therefore adopted Sonnenwald's (2007) framework not only to identify key stages of research collaboration but also to describe some aspects of structural asymmetries therein. Sonnenwald (2007) describes a

foundation phase in which the collaboration is conceived; a formulation phase in which collaborators convene to plan the research work; the sustainment phase in which the collaborators work together to implement the objectives of the collaboration; and the conclusion phase in which the results of the collaboration are realised and disseminated. Conclusion of a specific research project may then trigger the dissolution of the collaborative group or its extension in some formal or informal fashion.

2.2.1 The foundation phase of collaboration: the roots of structural inequalities in global health research collaborations between high-income country researchers and low-income country researchers

The foundation stage is the formative stage of the collaboration in which the collaborators determine reasons and criteria for collaborating, mutually assess compatibility, develop common goals and objectives and identify sources for the necessary financial and human resources (Czajkowski, 2007). Sonnenwald (2007) suggests that collaboration is often triggered by a scientific need such as the emergence of a specific global health threat or a specific funder's call for applications targeting an area of their interest. Sonnenwald (2007) suggests that this stage can be influenced by political, socio-economic, resource and personal factors

In the high-income country/low-income country research collaboration setting, political factors may include solving a problem that transcends borders (such as cross-border health epidemics). In this setting, collaborations may be coloured by perceptions of scientific or economic imperialism (Velho & Velho, 1996) especially when there are huge economic disparities between the countries where collaborators are based. Low-income country collaborators may be compelled to take the role of mediators when there is local suspicion about high-income country motives for collaboration which could place them at odds with their communities.

Socio-economic factors may include the need to have access to unique and complementary resources such as data, specialised instruments, samples and funding (Birnholtz & Bietz, 2003; Wray, 2006). Individual researchers today are much more specialised, so they often need to collaborate with others who have complementary skills, knowledge and resources to execute research work (Beaver, 2001; Iglic et al., 2017). They are particularly attracted to others whom they perceive as being potentially able to increase the material resources (such as funds, equipment and data), social resources (such as networks), perspectives (such as different research methodologies and philosophies), and identities (such as different experiences, memories and characteristics) available for achieving individual goals (Aron et al., 2013). Similarly, scientists seek to find collaborators who have a demonstrable record of accomplishment in their field of interest because those perceived to have high scientific productivity have greater potential to attract scarce resources

(Iglic et al., 2017). Valued attributes for collaboration might include prior experience, unique skills, influence, special data or equipment and institutional arrangements that match the needs of the proposed collaborative work (Beaver, 2001; Bozeman & Corley, 2004; Melin, 2000).

Such attributes are harder to find in Africa, which has a huge health research funding gap. A widely cited report of the Commission on Health Research for Development (COHRED) found that less than 10% of the world's expenditure on health research was spent on health conditions that cause 90% of the global health burden (COHRED, 1990). This situation has historically been particularly dire in sub-Saharan Africa (SSA) where health research funding is often allocated less than 0.5% of national health budgets and national health budgets themselves are funded with less than 1% of GDP (Ramsay, 2002). The African Capacity Report 2017 highlights Africa's abysmal share of global expenditure on R&D which stands at 1.3% compared with its 5% share of global gross domestic product resulting into heavy dependence on high-income country sources to conduct research (ACBF, 2017; UNESCO 2015). Sub-Saharan Africa (SSA) in particular has 12% of the world's population and the highest per capita burden of diseases but accounts for about 0.72 % of global research (Blom, Lan & Adil, 2015) This creates a cyclical pattern in which glaring resource limitations create systemic barriers such as lack of credibility and eligibility for funding and disproportionately isolates African researchers from global scientific communities (Glew, 2008). Not surprisingly, high-income country actors with research resources seek out collaborators in low income-countries who are under-resourced but provide access to populations and global health conditions that are of mutual interest (Crane, 2010). A substantial number of high-income country biomedical scientists and graduate students are attracted to the instrumental attributes of their low-income country collaborators such as access to certain subjects of interest (such as treatment-naïve populations) in settings with high disease burdens, along with networks and knowledge of the local context. (Crane, 2010; Laabes et al., 2011). This forms the backdrop to an extensive body of literature that describes inherent historical, social and economic inequalities that influence the way these collaborative groups are founded (Boum II, et al., 2018; Chu et al., 2014; Franzen, Chandler & Lang, 2017; Munung, Mayosi & de Vries, 2017; Parker & Kingori, 2016). Inequalities are compounded by status-defining attributes that are associated with different nationalities (Earley & Mosakowski, 2000) which can have dire consequences. For example, accusations of inequity in this type of collaboration have led at least once to a discrimination lawsuit (Nordling, 2012). More commonly, the situation is accepted by both high-income country and low-income country partners as a necessary condition for common objectives to be met, even if they may inwardly question its moral and ethical implications (Moyi Okwaro & Geissler, 2015).

Social factors including common membership of networks, compatibility of scientific approaches, characters, work ethics, trust and collegiality have a bearing on the decision to collaborate and on

the generation of suitable collaborative research ideas (Beaver,2001; Bozeman & Boardman, 2003; Sonnenwald & Maglaughlin, 2005). Social ties and networks are often cultivated through scientific meetings and events, (Lambert, 2003) which are less accessible to low-income country-based researchers and thus denies them an opportunity to identify suitable collaboration opportunities. Social factors in turn, are influenced by cultural factors. For example, historical or colonial ties between countries increase the chances of collaborative work (Wagner & Leydesdorff, 2005). Research ties between African low-income countries and their colonial high-income country masters (typically described as Anglophone vs. Francophone vs. Lusophone) for example may be stronger than those with neighbouring low-income countries with similar socio-economic and cultural profiles thus colouring the power dynamics between collaborators while limiting opportunities for South-South cooperation (Ager & Zarowsky, 2015),

Given the above conditions, many scholars have highlighted the need for high-income country and low-income country collaborators to jointly determine research priorities and questions in order to derive the maximum mutual benefit from collaborative research (Bradley, 2007; Costello & Zumla, 2000; Munung, Mayosi & De Vries, 2017; Parker & Kingori, 2016). Many high-income country institutions are broadly in favour of addressing the post-colonial paternalistic tone of past collaborations (Hedt-Gauthier et al., 2018) and often incentivise meaningful engagement of low-income country partners in setting collaborative research priorities (Hedt-Gauthier et al., 2018). Nonetheless, resource imbalances still tend to perpetuate the dominant high-income country worldview in global health and to legitimatise it by a claim to superior knowledge (Shiffman, 2014). This subtle structural power coupled with inconsistent low-income country attempts to articulate national scientific research strategic priorities (Franzen, Chadler & Lang,2017) and to develop national research leadership structures (Lansang & Dennis, 2004) continues to skew priorities to those of high-income country actors (Ager & Zarowksy, 2015). There has been some debate, for example as to whether more areas with a significant social dimension such as overpopulation and malnutrition should be prioritised for funding (Garner et al., 1996). Similarly, there is a debate as to whether applied research which meets the practical needs of communities with less dependence on sophisticated high-income country research infrastructure and skill sets should be prioritised and evaluated more favourably (Tijssen & Kraemer-Mbula, 2018) than novel science that has less immediate impact (Acharya & Pathak, 2019) and whose recommendations often have less population-specificity for low income country settings (Adhikari, 2021). In these circumstances, collaborations tend to focus on a high-income country-defined research agenda and disciplinary focus and to engage only a limited range of low-income country individuals and disciplines (Bradley, 2007). Low-income country collaborators, in turn may be compelled to focus on these areas sometimes to the exclusion of other important areas which might benefit their organisational and community context, serve their individual professional interests, experience and aspirations

(Munung, Mayosi & de Vries, 2017) or generate solutions that are specific to their populations (Adhikari, 2021). The diversion to research areas that attract the funding and prestige associated with collaborations (Ager & Zarowksy, 2015) has long been observed and likened to an “internal brain drain” (Edejer, 1999 p. 440) and to prostitution (Wolffers, Adjei & Drift, 1998). This is a manifestation of the conditions of inequality experienced within collaborative groups even before any specific task-driven relationships emerge.

2.2.2 Structural inequalities at the formulation stage of high-income country/low-income country collaborations

Inequalities continue to persist at the formulation stage of collaboration in which scientists start to conceptualise and plan the actual research (Sonnenwald, 2007). At this stage, collaborators attempt to generate and articulate a shared vision and research goals within their collaborative group and its stakeholders such as their home institutions, funding agencies and community groups (Sonnenwald, 2007) which motivates their efforts (Schiff, 2002). Collaborators at this stage attempt to resolve differences in language, research philosophies and individual understanding of task responsibilities particularly when collaboration is across separate geographical locations (Sonnenwald & Maglaughlin, 2005). Such resolution is enhanced by mutual acknowledgement of gaps in individual understanding and capabilities (Sonnenwald, 2007) as well as differences in the availability of resources such as funds, management infrastructure, equipment, research time and human resources (Adessa & Sonnenwald, 2003). Factoring such gaps and differences into the research planning and design and the assignment of roles is particularly important when geographical, cultural and economic differences between collaborators are significant.

Formulation also benefits from orchestrated efforts to integrate disparate knowledge claims, strategies of enquiry and methodologies that the research will employ to achieve a common research goal. When collaborators and their stakeholders, including participating organisations and communities are involved in formulating the research, even with very basic review, their various interests and perspectives are better incorporated into the design (Fisher & Ball, 2003; Secrest et al., 2004) and this can generate useful feedback (Secrest et al., 2004) and advocacy in support of the research (Sonnenwald, 2007). Such inclusiveness is rarely achieved in the current study context because high-income country scientists tend to lead the conceptualisation, leaving low-income country scientists with little opportunity to provide input that could improve the local relevance, acceptability and potential application of the research (Jentsch & Pilley, 2003). Low-income country researchers are often excluded from the more technical aspects of research conceptualisation (Van der Veken et al., 2017). Sometimes, this is because of high-income country collaborators’ scepticism about their technical abilities (Okwaro & Geissler, 2015) or because they are alienated by the choice

of topic (Van der Veken et al., 2017). Lack of engagement may also be coloured by historical injustices or prejudices which may not be freely disclosed (Fisher & Ball, 2003; Secrest et al., 2004). This mistrust can extend to the contractual aspects underlying the collaboration (Sack et al., 2009) which tend to take advantage of low-income country lack of power, capacity and resources for negotiating fair terms regarding mutual priorities, benefits, obligations, resource allocations and alignments, ethical practises and mechanisms for accountability to stakeholders (Cohen, 2000). Despite some efforts to level the ground therefore, high-income country partners may find it more convenient to play the more sophisticated creative research design, analytical, interpretive and presentational roles in order to achieve group objectives more efficiently, even when they have relatively limited understanding of contextual factors underlying the research (Walsh, Brugha & Byrne, 2016).).

Collaborators also carve out individual roles for group members at this stage (Tellioglu, 2008) including the overall leadership position, usually in the form of a Principal Investigator (PI). In assigning these roles, it is often implied that low-income country researchers' skills and experience are inferior their high-income country counterparts (Okwaro & Geissler, 2015). Low-income country researchers are often assigned roles within their collaborative groups that do not match their seniority, experience and creative abilities (Parker & Kingori, 2016). In some collaborations, low-income country researchers may find that they are relegated to roles that essentially support data collection (Walsh, Brugha & Byrne, 2016) and/or those with less visibility and recognition such as supervising and providing administrative support to students (Provenzano et al., 2010). This contrasts with the high esteem with which low-income country researchers with the capacity to be involved in global collaborations are likely to be held within their local communities and organisations and thus aggravates their experiences of inequality. For example, low-income country researchers are less likely to take the key role of Principal Investigator (PI) in which much of the capacity to realise individual and collective value from research resides (Cunningham, Menter & O'Kane, 2018). In some cases, they may be designated "Local PI" which itself implies that their legitimacy/credibility is confined to their local low-income country setting (Okwaro & Geissler, 2015). As a result, low-income country researchers often choose to defer to their high-income country collaborators' views and to high-income country authorship in collaborative projects in order to boost the credibility of the research (Parker & Kingori, 2016). These roles are embedded in research management structures and practises which may also lack sensitivity to the research context (for example when poor infrastructure in low-income countries impedes satisfactory task execution and/or delays key project milestones (Jones et al., 2004) and further highlight inequalities.

The assignment of roles in turn has a significant effect on the pay rates for individual collaborative group members. Low-income country collaborators' rates may be significantly lower than their high-

income country counterparts' even when the time commitment and technical proficiency demanded of them is comparable (Moyi Okwaro & Geissler, 2015). Disparities are particularly glaring when relatively junior high-income country staff are remunerated at relatively higher rates than senior low-income country scientists. At the same time, low-income country researchers' pay rates within collaborative groups is typically higher than pay rates for their parallel employment in local institutions (Costello & Zumla, 2000; Fourie, 2018) which may cause resentment or ill will from local peers. The dissonance caused as collaborators attempt to strike a balance between fair compensation and temporary or permanent distortion of local salary scales makes it difficult for low-income country collaborators to experience a sense of equality in pay (Crane, 2010; Moyi Okwaro & Geissler, 2015).

2.2.3 Structural inequalities at the sustainment stage

The sustainment stage involves the execution of the collaborative research work, after formulation is largely concluded (Sonnenwald, 2007). This stage addresses issues around collaborative decision-making on shared working arrangements, organisational structure and management and implementation practices including, structures, norms and standards which are crucial for actual project execution. As the group members adapt to each other's characteristics, low-income country group members may feel psychologically safe enough (Raes et al., 2015) to voice the needs of their local stakeholders (primarily their organisations and communities) along with the cultures, practices, and standards that they represent. The extent to which these needs are then met is likely to affect experiences of inequality.

Low-income country individual and organisational capacity building has recently become a common requirement for awarding global health research funds and has been integrated into the design and implementation of many high-income country/low-income country collaborative research projects (Bradley, 2007; Hedt-Gauthier et al., 2018; Parker & Kingori, 2016). Franzen, Chandler & Lang (2017) in their meta-analysis note that many research funding opportunities now require applicants to show more involvement of low-income country staff, more exchange visits and more small grants for early stage low-income country researchers. Through these efforts, low-income country researchers and their organisations may benefit from a wide range of capacity building opportunities ranging from acquiring technical skills and technology to mentorship and peer review, grant writing, presentation and scientific writing skills (Parker & Kingori, 2016) which in turn may provide access to world-class networking and publication opportunities. Multi-level, multi-directional capacity building can be truly transformative (Lansang & Dennis, 2004), particularly when it allows low-income country researchers to tap into important repositories of organisational, technical and social perspectives from their environment to generate unique knowledge (Phillips, 2003).

However, the capacity gap narrative is often a double-edged sword that is used to justify excessive sourcing of high-level services back to high-income countries (Jentsch & Pilley, 2003). This exacerbates inequality, especially when it necessitates the irretrievable loss of low-income country research assets such as blood samples or unique data (Muldoon et al., 2012). At the same time, reciprocal low-income country research assets and capacities that collaborations benefit from such as data sets and analytical capabilities as well as mentoring of relatively inexperienced high-income country researchers (such as doctoral students) may not be accorded as much credit as those of high-income country counterparts (Jentsch & Pilley, 2003). A condescending attitude may also develop within the collaborative group that justifies lower standards from low-income country researchers than that expected of their high-income country counterparts (Parker & Kingori, 2016). These conditions could disincentivise quality work, create a vicious cycle of incompetence, and ultimately perpetuate the very inequalities that disadvantage low-income country researchers.

Moreover, capacity building tends to be more sustainable when it is localised. Low-income country researchers are better equipped to provide targeted mentorship that bridges the gaps between their collaborative groups and their local research community (Bennett et al., 2010) to produce relatively quick, quantifiable research outputs (Lansang & Dennis, 2004). Bennet et.al (2013) found that while high-income country collaborators and their resources often provided formal training and basic skills needed for research, local mentors were critical in helping young researchers to navigate the local institutional environment and to view research as an attractive long-term career option. Credible local mentors embedded in collaborative research are critical in helping young low-income country researchers to find a research focus (Shah et al., 2011) and in exposing them to grant writing (Manabe et al., 2011). They can provide access to funded field sites for experiential learning and collaborative study resources such as research staff, equipment, laboratories, samples (Tweheyo, et al., 2011) and professional networks (Bennett et al., 2013). This benefits low-income country organisations' researcher "pipelines" but also provides professional growth opportunities for the local mentors (Bennett et al., 2013). Such learning in collaborations is more effective when it is consciously allocated adequate time and when collaborators are trustful, transparent and willing to tailor it to emerging needs (Solomon et al., 2001). Low-income country collaborators sometimes have heavy parallel clinical and teaching duties and may struggle to devote enough time to mentoring, especially since it is rarely institutionalised (Lescano et al., 2019) or adequately rewarded (Nundulall & Dorasamy, 2012). Additionally, collaborative research groups often delegate considerable managerial responsibility to the local Principal Investigator (PI). This is not a core scientific role but it forms an important part of the overall "ability to deliver" by which low-income country researchers' performance is judged (Parker & Kingori, 2016). The pressure to meet all these demands alongside service delivery to their communities with inadequate overhead costs (Crane et al., 2018) sometimes compels low-income country collaborators to change local clinical practises

and protocols, to take on extra, unpaid work (Fourie, 2018) and/or to establish parallel administrative systems (Crane et al., 2018). These conditions undermine broader capacity building opportunities and exacerbate inequalities.

Scientific collaborations also require low-income country researchers to work with staff at local health facilities and with various social structures to negotiate access to research subjects and to ensure community acceptability of the research in target populations (Crane, 2010). This role places them in a position of power because they are perceived to control access to study resources such as drugs, jobs, medical services and participant incentives or supplemental income for community members (Parker & Kingori, 2016). In the under-resourced setting in which many collaborative studies are located, these resources are highly valued and may raise community expectations, sometimes beyond what is achievable. Low-income country researchers therefore strive to ensure that collaboration partners appreciate the need to integrate wider community/institutional needs into the research planning and operationalisation (Muldoon et al., 2012). This is not always possible. For example, ethical guidelines or research policies may limit basic incentives (such as food or allowances for undernourished patients providing blood samples) that are well within the study's means to provide (Parker & Kingori, 2016). Low-income country researchers who are cast in the role of restricting the use of these resources to study purposes may face more pressure such as community misunderstandings and "rumours," related to perceived exploitation (Geissler & Pool, 2006) than their high-income country counterparts.

Resource gaps further complicate the resolution of cultural, professional and ethical differences between the high-income country and low-income country settings of the collaborators. Research projects are conducted in a context where Africa, which makes up 16% of the world population and carries 23% of the global diseases burden, contributes only about 1% of global scientific research output (Blom, Lan & Adil, 2015). Many complexities arise for researchers in this setting. For example, the volume of HIV research in LMICs has grown dramatically in a context where external funding for HIV/AIDS constitutes as much as 85% of all LMIC HIV/AIDS spending. (Dieleman et al., 2018). This has been the backdrop to the emergence of resource-driven cultural and ethical dilemmas affecting aspects of research conduct such as access to treatment, identity protection and autonomy of vulnerable populations (Coovadia & Rollins, 1999) as well as post-trial sustainability (Zumla & Costello, 2002). Some high-income country collaborators have recently made low-income country organisations' ability to review ethics and to monitor studies for quality, integral components of their capacity building efforts (Chu et al., 2014). However, amidst pressure to meet their research objectives their focus tends to be on practical, procedural ethical issues rather than the wider "ethics-in-practise" issues that are underpinned by structural inequity and injustice in their relationships with low-income country peers, research populations, field staff and local organisational systems (Hunt

& Godard, 2012; Molyneux & Giessler, 2008). The same is true for methodological standards that predominantly comply with high-income country research traditions, cultures, experiences, and views that are transposed to the low- income country setting (Jenstch & Pilley, 2003). Thus, differences in cultural, ethical and professional standards may be experienced by low-income country researchers as unreasonable or as dismissive of local practise and standards and thus, as unequal.

2.2.4 Structural inequalities at the Conclusion stage

At the conclusion stage, collaborators finalise the research, and they document, evaluate and disseminate the results. Collaborators take stock of the results of collaboration (Sonnenwald, 2007) which may range from joint publications, greater embeddedness in the global knowledge network of a specific field (Graf & Kalthaus, 2018), identification of peers and mentors (Parker & Kingori, 2016) and greater visibility, to acquisition of new scientific technologies (such as equipment), knowledge and skills (such as research methods), as well as broader educational and career advancement (Sonnenwald, 2007). Collaborators may also seek evidence of wider long-term benefits to their local organisations and communities such as improved practices and more robust administrative and management systems (Sonnenwald & Maglaughlin, 2005).

The primary evaluative criterion for the success of scientific projects tends to be the extent to which they are considered to have created new knowledge measured through publications and citations (Stokols, et al., 2008). Authorship is the most commonly used yardstick for the results of scientific collaboration partly because it is easy to verify and measure (Katz and Martin, 1997; Bozeman & Corley, 2004). Scientists who collaborate more frequently have been shown to publish in higher impact journals and to be cited more frequently and for a longer time (Frenken, Holzl & de Vor, 2005; Leimu & Koricheva, 2005; Persson et al., 2004). However, low-income country researchers do not benefit as much from authorship of collaborative work as their high-income country counterparts (Duque et al., 2005). This is due to a number of reasons. Firstly, as demonstrated by Crane (2010) and Block (2006), high-income country collaborators tend to be first authors on publications, with low-income country collaborators generally taking relatively minor roles. Fundamentally, co-authorship is inadequate as a measure of the quality, depth and performance of contributors to collaborative research because it does not allow for the influence of social, political or other non-research related factors (Katz and Martin, 1997). In the study setting, this inadequacy mainly disadvantages low-income country collaborators and has triggered calls by the global health scientific community for collaborators to use alternative inclusive measures of impact such as local embeddedness (Hedt-Gauthier et al., 2018) but these have not been consistently adopted. Secondly, token authorship may give a superficial appearance of equity by exaggerating low-income country

collaborator contributions (Rohwer et al., 2017) without addressing the underlying inequalities that would make more substantial low-income country contributions possible (Walsh, Brugha & Byrne ,2016). Thirdly, low-income country collaborator's post-project follow on publications are likely to be disadvantaged by editorial policies and processes of major journals, which are often skewed to the advantage of high-income country scientists (Mbaye et al., 2019) and tend to exacerbate inequalities. For example, current research evaluation practices often devalue aspects of research quality such as relevance and socio-economic impact that tend to be more important to low-income country researchers (Tijssen & Kraemer-Mbula, 2017).

Outside submission to professional journals, collaborators may disseminate results at different fora in order to fulfil obligations to funders and/or to share findings with the wider scientific community. Low-income country researchers may find that they have less influence on the selection of knowledge translation and dissemination objectives, audiences and channels (Lombe, et al., 2013; Murunga et al., 2020). This is particularly true when low-income country-based researchers aim to engage local audiences that may benefit from applying the findings (Jentsch & Pilley, 2003) because their high-income country counterparts often prefer international audiences that value novel contributions in their specialised research domains (Ager & Zarowksy, 2015; Costello & Zumla, 2000; Paina et al., 2013). Thus, there may be limited opportunities for low-income country researchers who seek to deliver additional policy or practise benefits for their setting (for example, a more efficacious or cheaper clinical intervention) to fulfil that aspiration through formal collaboration research channels (Ager & Zarowsky, 2015; Costello & Zumla, 2000), adding to their dissatisfaction with research outcomes.

Finally, low-income country researchers may benefit less from post-project retention of research capacity than their high-income country counterparts. This is especially true when they encounter the prevalent research culture which focuses more on making them leaders in their fields without ensuring that their environment has the necessary elements for them to flourish for the longer term (Davies & Mullan, 2016). This may have the effect of overcommitting them as lone researchers (Ager & Zarowsky, 2015) while isolating them to varying degrees from their local research communities and research problems (Moyi Okwaro & Geissler, 2015; Wolffers, Adjei & Drift, 1998). It may also mask both high-income country and low-income country actor's lack of commitment to a holistic research environment that provides adequate research governance and administration, protected research time and access to role models and peers (Franzen, Chandler & Lang, 2017; IJsselmuiden et al., 2012). This, coupled with the lack of post-project resources to invest in equipment, supportive infrastructure, leadership and career structures, among others may limit positive self-appraisal of individual low-income country researchers' potential (Hyder, Akter & Qayyum, 2003; Lansang & Dennis, 2004). It makes it more likely that they will look to their external networks rather than their

low-income country organisations to sustain their careers (Ghaffar, IJsselmuiden & Zicker, 2008) and to introduce new knowledge into their low-income country research communities (Barnard, Cowen & Muller, 2012). Indeed, when low-income country researchers remain active in the networks that develop from collaborations with high-income countries, they tend to publish more with high-income country publications than with their local publications (Ynalvez & Shrum, 2011). In some cases, they may totally disengage from their low-income country organisations permanently or for extended periods and relocate to high-income country organisations in order to benefit from greater stability, better technologies and career rewards (Costello & Zumla, 2000; Kupfer et al., 2004). In other cases, low-income country researchers may remain involved in creation of knowledge that benefits their local context but through independent work whose outputs are claimed by external parties (usually from high-income countries) who can pay for their services (Jeffery, 2014; Wight, 2008).

2.3 Individual coping behaviour of minority individuals in conditions of inequality as per the acculturation literature

Low-income country researchers who collaborate with high-income country researchers typically join collaborative work groups. These groups are likely to have conditions that introduce changes in the work environment of low-income country researchers that reflect and perhaps perpetuate dominance by their high-income country counterparts, despite the local/native setting of the research. This in turn is likely to trigger specific patterns of coping behaviours as they attempt to integrate the needs of their local setting with those of their collaborative groups in order to preserve their professional and social objectives. These coping behaviours are likely to be influenced by their pre-collaboration experiences and by support mechanisms and relationships within and outside the collaboration. These experiences mirror those of similarly disadvantaged individuals and communities in the acculturation setting.

The current study setting has striking conceptual parallels with the setting of acculturation (Berry, 1997). The acculturation literature describes individuals' separate and simultaneous affiliation with two communities, one of which is socially dominant (Berry, 1997). The study therefore adapts acculturation literature to explore patterns in low-income country researchers' coping behaviour in conditions of inequality within high-income country/low-income country collaboration groups. This is likely to provide a useful complementary framework for investigating behavioural responses of non-dominant individuals in unequal workgroups.

Specifically, this study draws from Berry 's (1997) seminal work which demonstrates the influence of cultural context on individual behavioural development. Berry (2001) defines acculturation as "a process that entails contact between two cultural groups, which results in numerous cultural changes

in both parties" (p. 616). Acculturation is used to refer to the complex psychological, sociocultural and economic changes that occur when people who have developed in one cultural context attempt to live in a new cultural context (Berry, 1997). This might, for example include mutual adaptation of languages, diets, dressing and social interactions between two cultures (Berry, 2005). The current study adopts this phenomenon and applies it to low-income country researchers whose primary work context is that of low-income country organisations and communities but who have parallel membership of a collaborative work group whose high-income country members have a dominant effect on the low-income country researchers' professional environment and outcomes. Membership of a such a work group may require low-income country researchers to adapt to professional and social dynamics (such as a new status, new tasks and new work outcomes) which have a bearing on their ability to function optimally in their work environment.

Acculturation was originally conceptualised as a group level phenomenon involving cultural and psychological changes that result from contact between cultural groups. Berry (2005) however argued that there is significant variability within groups, families and individuals in the way in which psychological acculturation occurs and in the outcomes of their unique acculturation experience. Berry (2005) specifically described changes occurring in the "behavioural repertoire" (p. 699) of individuals because of acculturation. This study therefore draws from the literature on individual level behavioural changes triggered by the acculturation process. It hypothesises that comparable changes may occur in individuals whose primary organisational work group (such as a low-income country organisation) collaborates with a dominant external group (such as a collaborative group).

Berry (1997) expounded that many modern societies comprise of people from multiple cultural backgrounds. When they come to live together, they form cultural groups, which are not equal in power (numerically, socially and politically) giving rise to such terms as "mainstream" or "minorities". To convey their relative power, he adopted the terms "dominant" to describe the group of settlement and "non-dominant" to describe the individual's group of origin. He noted that while acculturation occurs in both groups, the members of the non-dominant culture are usually more affected than the dominant ("receiving" or "settlement") culture (Berry, 2001).

Changes in individuals may be far-reaching. They may include physical changes (including new location, housing, urbanisation, and environment), biological changes (such as new diets and new diseases), economic changes (such as new forms of employment), cultural changes (new religion, language/s and education) or social changes (new intergroup and inter-personal relationships). Changes in behaviour ("behaviour shifts") occasioned by new attitudes, values, abilities and motives depending on the individual's views on how to participate in the acculturation process, were well documented in Sam & Berry's (2006) review. The extent to which an individual appraises changes negatively (as problems) or positively (as opportunities) is influenced by the extent to which he/she

has the necessary pre-acculturation experiences (such as knowledge of the host country language and a suitable education). It may also be influenced by the extent to which one has an established support mechanism that eases his/her engagement with the dominant group (Berry, 2005).

2.4 Acculturation

Berry (2005) suggests that individuals' choices regarding how to acculturate are driven by two related components, namely the individual's attitude (which is reflective of their preferences on how to acculturate) and their actual behaviours. When analysed across individuals, these choices exhibit distinct patterns that suggest the use of consistent strategies. Scholars have developed two major types of models to describe the resulting acculturation process. These models are differentiated on the basis of the way they describe acculturating individuals' behaviour as it relates to cultural maintenance (the extent which cultural identity and characteristics are important) and contact and participation (the degree to which they become involved with the other groups or alternatively keep to their own culture). Unidimensional models assume that maintenance of the culture of origin and adaptation to the culture of settlement are bipolar opposites so that an individual adopts one or the other along a single continuum. This view has been largely overtaken by various scholars' conceptualisation of acculturation as a complex-, bi-directional, multi-domain process (see reviews by Sam & Berry, 2006 and Schwartz et al., 2010)

Bidimensional models, as exemplified by Berry (1997), treat cultural maintenance and adoption as distinct dimensions with weak, negative correlations. Moreover, non-dominant (minority) individuals have been found to have a more distinctly bidimensional acculturation orientation than would be favoured by the dominant mainstreamer (majority) members of the society (Verkuyten & Thijs, 2002). Berry (1997) in his bidimensional conceptualisation of acculturation suggests that individuals have varying levels of success in balancing between cultural maintenance on one hand and contact and participation in other groups and cultures on the other. Individuals who succeed in achieving their desired contact level are said to have low "contact discrepancy" because there is a relatively small difference between their actual and desired contact levels with other groups. Those with high contact discrepancy experience greater stress from the acculturation experience. For non-dominant groups and individuals Berry (1997) suggests that when these two factors are considered simultaneously this translates into a four-strategy model of behaviour.

Berry (1997) further makes a conceptual distinction between psychological outcomes and socio-cultural outcomes of acculturation. The current study focuses on behavioural responses and thus aligns itself with the latter. Consistent with that focus, it investigates personal outcomes following adaptation of individuals to align their behaviour to a new social reality so that they are better able to deal with daily problems (Ward & Kennedy, 1993). As applied to acculturation, this relates to settings such as work, family and school in which individuals find their acculturation experiences. In

the study's collaborative research setting, this applies to work groups, organisations, and communities in which individual researchers are embedded.

2.4.1 Acculturation strategies and their adaptation to a high-income country/low-income country collaboration context

Using Berry's bi-dimensional approach leads to a conceptual framework that describes four distinct acculturation strategies adopted by individuals from non-dominant/migrant societies to acculturate to dominant/settlement societies. I describe each of these strategies and my adaptation of their features to the high-income country/low-income country research collaboration context below.

A strategy which individuals adopt when they place a value on holding onto their cultures and avoid interaction with the dominant host/settlement group is defined as a separation strategy. Separation is a "collective" strategy because it can only be pursued when one's group of origin shares in the wish to maintain its cultural heritage (Lalonde & Cameron, 1993). Separation may impede successful integration into the host society and perpetuate social isolation thus increasing adaptive stress (Berry et al., 1987). However, it may also be a mechanism for individuals to access social support and may in fact be the only viable option in the face of exclusion (Berry, 1997). In the current study context, a separation strategy implies that low income country researchers choose to collaborate only with their fellow low-income country peers. In this setting, given the scarcity of low-income country research investment, it implies that such individuals will have limited opportunity to do any research at all, but nonetheless deliberately choose that path, probably because of an enhanced sense of injustice within collaborations with high-income country researchers.

In an assimilation strategy, individuals do not wish to maintain their original cultural identity and they prefer to seek daily interactions with other cultures. Assimilation, is a more individualistic strategy because it is driven mainly by the wishes of the individual with little regard to his group of origin (Lalonde & Cameron, 1993). However, it cannot occur without willingness on the part of the dominant group to accept it (Berry, 1997). It may be considered less adaptive because minorities who primarily acculturate to the host culture may feel betrayed if discrimination and structural inequalities signal rejection (Chae et al., 2012; Park et al., 2013). Individuals opting to use this strategy may face constraints such as different physical features which increase the chances of prejudice or discrimination (Berry et.al. 1989) and they may be confronted with racism, which discourages a sense of belonging to the receiving culture (Paradies, 2006; Reitz & Banarjee, 2007). This study conceptualises individuals who assimilate in collaborative groups to be those who seek to associate mostly with the collaborative group, and to progress their research careers primarily within it and its global networks, rather than in their low-income country institution. They may face constraints such as different languages, cultures, work ethics and professional objectives so that their success in

adopting this strategy depends on the willingness of high-income country collaborators to accept them and to render their support.

When there is little interest both in maintaining the original culture (often because of cultural loss) and in having relations with others (often for reasons of exclusion or discrimination) then marginalisation occurs. In the acculturation literature, marginalisation is generally considered undesirable as it indicates unsuccessful integration with any group in the society (Matsunaga et al., 2010; a phenomenon whose existence some scholars have questioned (Schwartz et al., 2010). However, Berry (2001) suggested a distinction between a non-dominant individual who willingly loses both cultures, undergoing what he labelled marginalisation and an imposed loss of both cultures by the individual which, following Bourhis et.al (1997), he termed as “exclusion”. This study’s conceptualisation of marginalisation in a high-income country-low-income country collaboration setting builds on this distinction and suggests that it does not necessarily translate into undesirable consequences for the non-dominant individual if it is a deliberate choice. For example, some low-income country researchers choose to use their understanding of their local context to act as independent consultants for both local and collaborative groups with no formal direct ties to either group (Wight, 2008).

An integration strategy on the other hand involves maintaining the original culture while at the same time interacting daily with other groups. For integration to be achieved, both the non-dominant and dominant groups (and the individuals therein) often have to compromise; the former by adopting key values of the larger society and the latter by adapting national institutions, such as social services to the needs of the settling group (Berry, 2009). Thus, integration is also a collective strategy because it requires the support of one’s group of origin (Lalonde & Cameron, 1993) as well as the dominant group’s willingness to accept diversity and to foster a mutually positive attitude (Berry & Kalin, 1995).

The resulting four strategy model for non-dominant individual coping behaviour as adapted to a high-income country/low-income country research collaboration setting is illustrated in Figure 1 below.

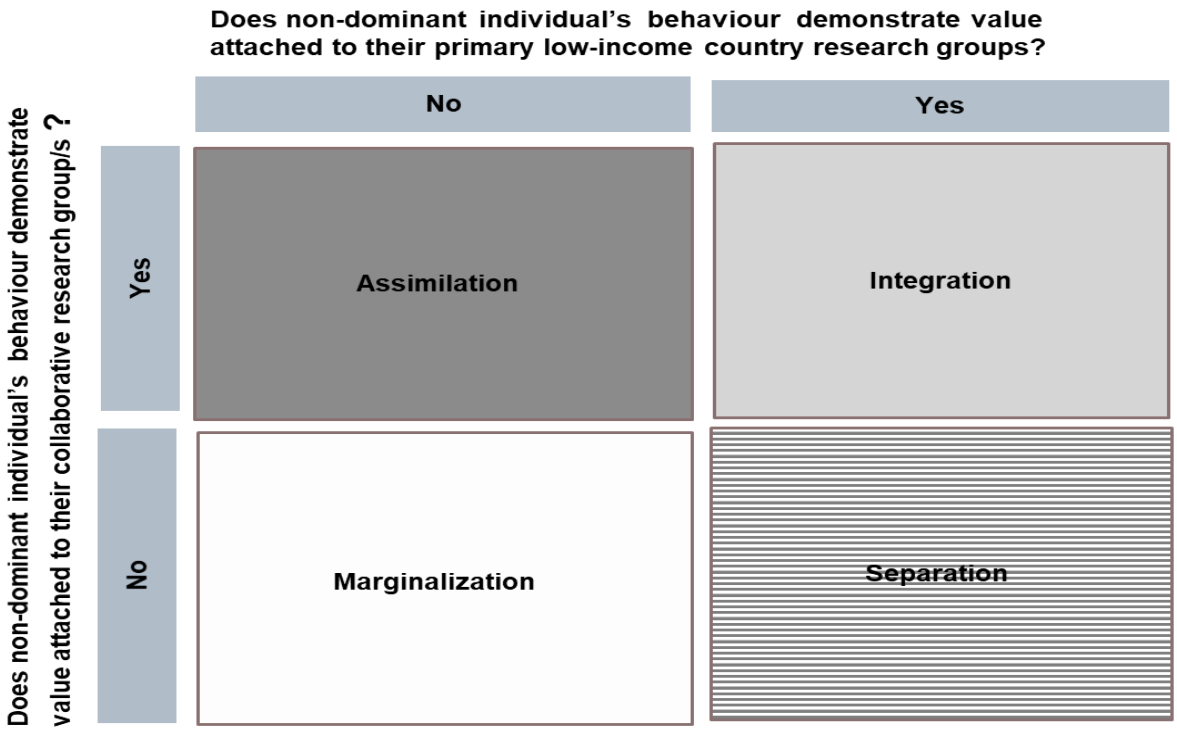

Figure 1: Coping strategies of non-dominant individuals in unequal collaborations

Source: Author's illustration adapted from Berry, J. W., Kim, U., Minde, T., & Mok, D. (1987). Comparative studies of acculturative stress. *International migration review*, *21*(3), 491-511.

Stonefish & Kwantes (2017) describe the model which is adopted above to the current study context as one the most influential advances in acculturation theory, adding that it serves as a foundation for many other models and studies. I therefore adopt it for further investigation of individual behavioural strategies in a collaboration context. Specifically, I adopt individual low-income country researchers' choice of behavioural coping strategies as a measure of their successful adaptation to conditions within groups in which they collaborate with their high-income country peers.

2.5 Statement of research problem

Collaborations are an important way for organisations to create value in the for-profit sector (Todeva & Knoke, 2005; Davis & Eisenhardt, 2011) as well as the not-for-profit sector (Arya & Lin, 2007; Huxham, 1996). In the area of global health, disparities in health funding have fuelled the growth of multiple collaborations between high-income country and low-income country researchers to conduct research in health conditions that disproportionately affect low-income countries. These collaborations are often highly beneficial to low-income country researchers because they offer resources and opportunities that support institutional and individual professional growth for low-

income country researchers in whose setting research funds are extremely scarce. Some of these researchers in turn may provide a route through which low-income country research communities get access to current knowledge (Barnard, Cowan & Muller, 2012). At the same time, they have inherent structural inequalities arising from historical, geo-political, socio-economic and cultural factors that lead to the dominance of high-income country members over their low-income country counterparts. Franzen, Chandler & Lang's (2017) meta-analysis demonstrates that despite many collaborative groups' best efforts, this inequality still affects multiple aspects of low-income country researchers' experiences in collaborative research at the individual, group, task and community levels across the collaboration cycle.

Little research has been done to identify and categorise responses at the individual, behavioural level in scientific collaborations that are structurally unequal. In explaining how individuals cope within such conditions, the current research draws on insights from extant literature on coping strategies employed by individuals facing similar conditions due to their lower status in workgroups. That literature tends to focus on how lower status individuals manage their identity when they undertake to do collaborative work with higher status individuals (Koppman, Mattarelli & Gupta, 2016; Levina & Vaast, 2008; Metiu, 2006). By contrast, this study focuses on the behaviour of individuals who, by virtue of their citizenship and location in low-income countries, are socially disadvantaged in workplace collaborations with their high-income country peers. It investigates the extent to which various conditions across the collaboration cycle enable successful coping behaviour within individual low-income country individuals so that they meet their professional and social objectives for collaboration. In so doing, the study aims to provide evidence of priority gaps and remedial action for managers and policy makers who seek to improve the outcomes of minority/non-dominant individuals in unequal collaborations.

2.6. Purpose statement and research questions

Collaborative work groups comprising of scientists from high-income countries and low-income countries are the mainstay of global public health research. Despite the egalitarian principles they espouse, they are founded on relationships with inherent structural inequalities, which may affect group and individual behaviour. Specifically, it is known that participation in these groups boosts low-income country researchers' ability to achieve their professional and social goals for collaboration. However, various features of low-income country researchers' individual characteristics, group dynamics, tasks and social context may create conditions that are enablers or barriers to realisation of these goals. This study seeks to investigate to what extent the various features of minority/non-dominant low-income country researchers' experiences influence behaviours that enable them to achieve their goals for collaboration with majority/dominant high-income country researchers.

The following key question therefore arises: To what extent do current experiences of inequality influence the coping behaviour of low-income country (LIC) researchers in structurally unequal collaborations with high-income country (HIC) researchers?

In the three papers that follow, I address three dimensions of this overarching question as follows:

- I describe specific conditions of inequality experienced by low-income country researchers across key stages of collaboration with their high-income country peers in order to quantify current progress in addressing these inequalities.
- I measure the extent to which various specific conditions that enable low-income country researchers to experience more equitable research benefits are associated with propensity for them to integrate into collaborative groups with their high-income country peers.
- I explore policy tools that low-income country actors can adopt to mitigate barriers to equitable collaborative research outcomes at each stage of research collaboration.

2.7. Importance and benefits of the proposed study

This study will contribute to the organisational behaviour and management literature on five counts.

Firstly, it will provide a baseline understanding of the current state of conditions of inequality experienced by low-income researchers in their collaborations with high-income researchers. The literature describes unequal scientific collaborations and their potential effects particularly in the low-income country setting (Aellah, Chantler & Geissler, 2016; Binka, 2005; Bradley, 2007; Costello & Zumla, 2000; Crane, 2010) as well as wide-ranging efforts over the last 30 years to address such inequalities at global, national, group, community and individual levels (Adam et al., 2011; Binka, 2005; Bradley, 2007; Franzen, Chandler & Lang, 2017; Maina-Ahlberg, Nordberg & Tomson, 1997; Matenga et al., 2021; Moyi Okwaro & Geissler, 2015; Tomlinson, Swartz & Landman, 2006) but little has been done to measure the extent to which these measures have addressed specific aspects of inequality. This study will measure specific self-described inequalities currently experienced by low-income country researchers across key stages of collaboration with their high-income country peers in order to quantify current progress in redressing such inequalities.

Secondly, it will contribute to the collaboration literature by revealing new insights on individual outcomes of collaboration. Scholars have extensively studied collaborations at the interfirm and intergroup level (Ring & Van de Ven, 1994; Thomson & Perry, 2006; Wood & Gray, 1991). Scholars of collaboration in a for-profit setting have tended to focus on the nature of, and motives for, collaborations (Colbry, Hurwitz & Adair, 2014; Davis, 2016; Kapoor, 2014; Todeva & Knoke, 2005;

Wood & Gray, 1991) and on its effectiveness and other outcomes at an inter-organisational or intergroup level (Davis & Eisenhardt, 2011; Schilling, 2015). Non-profit scholars have followed suit (Arya & Lin, 2007; Franco, 2008; Guo & Acar, 2005; Sowa, 2008).

By contrast, as noted by Colbry, Hurwitz & Adair (2014) there is a paucity of research that addresses the dynamics of such collaborations at individual, intragroup level, especially in work groups that function relatively independently across formal hierarchies. Some studies have investigated different aspects of individuals in research collaborations such as motivation for collaborating (Melin, 2000) and productivity outcomes (Lee & Bozeman, 2005) but these studies assume that collaboration terms are negotiated from a position of relative equality of the collaborators. Although some scholars have addressed individual outcomes of unequal collaborations from the private sector, they have tended to focus on psychological outcomes, including identity (Koppman, Mattarelli & Gupta, 2016; Mirchandani, 2012) and status (Leonardi & Rodriguez-Lluesma, 2013; Levina & Vast, 2008; Metiu, 2006). Thus, they frame coping behaviours as responses to psychological conditions such as identity threat (Dutton, Roberts & Bednar, 2010; Petriglieri, 2011). This study specifically investigates the extent to which non-dominant/minority members' individual adaptation to collaborative work groups is enabled by specific conditions. The study's setting is particularly suitable for studying individual adaptive behaviour because while scientific research is often done collaboratively, risks and rewards at individual level influence many key decisions and outcomes of such collaborations (Kennedy, 2003).

Thirdly, the study applies a quantitative methodology to study individual responses to inequality. There is some literature specifically on individual perceptions and behaviours of individual non-dominant low-income country researchers in such settings (Crane, 2010; Jentsch & Pilley, 2003; Modlin et al., 2023; Moyi Okwaro & Geissler, 2015; Muldooon et al., 2012; Munung, Mayosi & De Vries, 2017; Parker & Kingori, 2016; Walsh, Brugha & Byrne, 2016). However, much of this research is qualitative. Thus, it provides useful insights into the emotions, beliefs, perceptions and professional outcomes of these individuals but it does not provide evidence for predicting specific behavioural patterns in such individuals. Qualitative methodologies are typically used to uncover relationships while quantitative methodologies are useful for testing them for generalisability and to identify specific patterns in these relationships which inform managerial and policy theory and practise. By its use of a quantitative methodology therefore, this study reveals generalisable patterns in coping behaviour of low-income country researchers, which are triggered by their experiences of structural inequality at different stages of their collaborations with high-income country researchers.

Fourthly, this study applies an existing model from the acculturation literature to fill an identified gap in the collaboration literature. Various scholars have demonstrated the persistence of conditions of

structural inequality experienced by individuals from low-income countries when they collaborate with those from high-income countries (see meta-analyses by Adam et al., 2011 and Franzen, Chandler & Lang, 2017) but few conceptual tools have been provided to study their specific response patterns and the ensuing professional outcomes. The study adopts a long-established model of behavioural responses from the acculturation literature to address that gap. Specifically, it predicts conditions that trigger coping behaviour of minority/non-dominant individuals in structurally unequal collaborative work groups by utilising the conceptual parallels between the dominant/non-dominant group conditions in the study setting and similar conditions found in the acculturation setting. Managers and practitioners might derive insights from these patterns that are useful in optimising the outcomes of non-dominant participants in collaborative work that is characterised by unequal relationships.

Finally, the study applies the views of low-income country actors in recommending policy actions to make their collaboration outcomes more equitable and rewarding. Most of the existing policy recommendations in collaboration literature place sole responsibility for redressing imbalances in benefits from collaborative research on the dominant high-income country actors. Much less attention has been paid to the contribution of low-income actors whose personal experiences are likely to be useful for highlighting specific inequalities, and shaping remedial policy recommendations. By contrast, I take the view that low-income country researchers should be primary agents of change that mitigates the inequalities that they experience. Thus, I categorise qualitative comments about their individual experiences into themes and juxtapose them with existing literature to inform policy recommendations. The recommendations that emerge add depth to some existing ones, but also suggest several novel policy actions that are reasonably within low-income country actors' realm of control.

To answer the research question, I undertook a review of extant literature and utilised primary data collected from health science researchers in Uganda.

2.8 Structure of thesis

This thesis is organised as follows: Chapter 1 introduces the global health research collaboration setting of the study. Chapter 2 applies extant literature to describe the various aspects of inequality that low-income country researchers face across four stages of global health research collaboration. I then adopt a model from acculturation literature to categorise and study behavioural responses of these low-income country researchers to the conditions of inequality that potentially influence their key individual research outcomes. This leads to three chapters, each addressing an area of enquiry related to the overall question of the thesis.

Paper 1 (Chapter 3) provides a baseline description of the current experiences of inequality in high-income country/low-income country collaborations given changes that have occurred in the collaboration environment over the last 30 years, in order to verify salient gaps in low-income country researcher outcomes. Paper 2 (Chapter 4) then measures to what extent various work conditions experienced by low-income country researchers in high-income country/low-income country collaborations translate into successful individual adaptation to participation in these collaborations. Paper 3 (Chapter 5) makes policy recommendations based on non-dominant/minority low-income country researchers' qualitative views of conditions of inequality in their research collaborations. These views are juxtaposed with extant literature and the findings from Papers 1 and 2, to make policy recommendations that empower low-income country actors to be the primary agents of changes that might generate better collaboration outcomes for themselves.

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Chapter Three

Paper one

How researchers in low-income country organisations experience structural inequality in global health research collaboration

Abstract

This study examines the extent to which biomedical researchers based in low-income countries experience inequality at key stages of collaboration with researchers from high-income countries. Over the last 30 years, scholars and advocates have decried the existence of structural inequalities that disadvantage low-income country-based members of high-income country-low-income country collaborative groups. Numerous initiatives have introduced measures to address these inequalities. The extent to which these measures have addressed inequality in specific aspects of low-income country-based researchers' experiences of these collaborations has not been studied with enough granularity to understand gaps that may need to be addressed going forward. Through an online survey, this study investigated current experiences of inequality amongst 489 low-income country-based researchers who participated in collaborations with high-income country-based researchers over three stages of research; a formulation phase in which collaborators plan the research work; the sustainment phase in which the collaborators implement the research project and a conclusion phase in which the results of the collaboration are realised, followed by dissolution of the collaborative group or its extension in some form. Responses were disaggregated by stage of collaboration as well as length of individuals 'research careers and number of prior collaborations. The data was analysed using frequency distributions and summary statistics. Low-income country-based researchers still experience inequality in collaborations, but less so than might be expected, especially in relational aspects. They particularly experience more nuanced structural inequality at the conclusion of collaborative projects. I recommend mutual acknowledgement of persistent inequalities and more transparency in decisions around roles, remuneration, mentorship and other benefits to low-income country organisations. I further recommend more efforts to boost low-income country collaborators' post-project benefits so as to address persistent structural barriers to a more rewarding experience of collaborative research.

Global health collaborations

Global health is a growing academic field in which scientists from high income countries (high-income country) work in low and medium income countries (and especially in Africa) to develop expertise in addressing infectious diseases and conditions that originate and/or rapidly spread in this setting (Chu et al., 2014; Panosian & Coates, 2006) .The potential grave implications when these diseases spread globally (Chu et al., 2014; Ravi, Snyder & Rivers, 2019; Spengler et al., 2016) has elicited a great deal of attention from academia (Crane, 2010; 2011; Khan et al., 2013,) as well as philanthropists and foreign policymakers over the last 30 years (Koplan et al., 2009). This has triggered a large number of collaborations in which biomedical scientists based in high-income country institutions seek to partner (mainly as key providers of resources) with low-income country-based scientists and institutions (in whose setting much of the fieldwork of research is conducted) (ACBF, 2017; Crane, 2010, 2011; Lan et al., 2014; Pouris & Ho, 2014; UNESCO, 2015).

A robust body of literature demonstrates the importance of collaborative research groups (including transnational groups) in scientific practice (Fox & Faver, 1984; Melin & Persson, 1996; Sonnenwald, 2007; Wagner & Leydesdorff, 2005, Abraham, 2007; Collins, Morgan & Patrinos, 2003; Gray, 1989; Stillwaggon, 2005). In the global health research setting, high-income country-based and low-income country-based scientists collaboratively implement scientific projects, ostensibly as equal partners (Bradley,2007). In reality, an extensive body of literature describes inherent historical, social and economic inequalities that influence the way such groups function (Binka, 2005; Boum II et al., 2018; Chu et al., 2014; Faure et al., 2021; Gautier, Sieleunou & Kalolo, 2018; Matenga et al., 2021; Moyi Okwaro & Geissler, 2015; Munung, Mayosi & de Vries, 2017; Parker & Kingori, 2016; Walsh, Brugha & Byrne, 2016).

Those inequalities are exacerbated by status-defining attributes associated with the nationalities of high-income country-based vs low-income country-based researchers (Earley & Mosakowski, 2000). Crane (2011) thus describes the dense pattern of resulting collaborations between northern universities and sub-Saharan African partners (see Figure 2 below) as “a 21st century scramble for Africa” (p. 1388). There have been numerous calls by scholars and advocates for more equitable relationships between high-income country and low-income country-based researchers who collaborate in research (Binka, 2005; Bolshoff, 2009; Boum II, et al., 2018; Bradley, 2007; Costello & Zumla, 2000; Crane, 2010; Edejer 1999; Jentsch & Pilley, 2003; Moyi Okwaro & Geissler, 2015; Trostle & Simon, 1992; Walsh, Brugha & Byrne, 2016). In turn, multiple initiatives have been implemented over the last 30 years to address these inequalities through increasing local content, control and relevancy (Ezeh et al., 2010; Izugbara et;al, 2017; Kabiru et al., 2010; Paina et al., 2013; Trostle & Simon, 1992; Walsh, Brugha & Byrne, 2016).

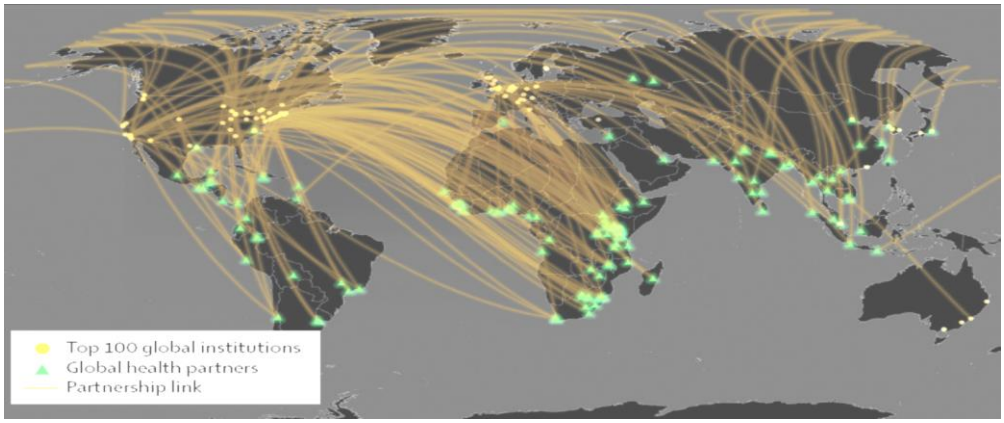

Figure 2: A dense pattern of Global Health Partnerships with African institutions
Source: Herrick & Reades (2016) Mapping university global health partnerships. *The Lancet Global Health*, 4(10), e 694.

Franzen, Chandler and Lang's (2017) meta-analysis demonstrates that a measure of inequality still affects multiple aspects of global health research. However, their focus is on the systemic dimension and implications of such inequality. Given that scholars have called for and highlighted remedies to the structural inequality (Ezeh et al., 2010; Izugbara et;al, 2017; Kabiru et al., 2010; Paina et al., 2013; Walsh, Brugha & Byrne, 2016), I am interested in understanding the experiences of individual low-income country-based researchers who participate in these collaborations, especially since collaboration in science occurs within a work, reward and career progression structure that is broadly driven by individual credit for research work (Kennedy, 2003; Whitley, 2000).

This study adopts Sonnenwald's (2007) framework to characterise and study conditions of structural asymmetry for key stages of high-income country-low-income country research collaborations. low-income country-based researchers are surveyed to describe their current experiences of inequality expressed through their workplace resources compared with their needs at three key stages of scientific collaboration. These are the formulation phase in which collaborators convene to plan the research work; the sustainment phase in which the collaborators work together to implement the objectives of the collaboration; and the conclusion phase in which the results of the collaboration are realised and disseminated. Respondents are disaggregated by length of research career and number of high-income country-low-income country collaboration experiences in order to identify differences that are more granular across individual researcher profiles.

Problem Statement and Research Questions

Little research has been done to identify and categorise individual experiences in scientific collaborations that are structurally unequal. Scholars have extensively studied the nature and outcomes of collaboration at the interorganisational and intergroup level in both for-profit and non-profit settings (Arya & Lin, 2007; Colbry, Hurwitz & Adair, 2014; Davis, 2016; Davis & Eisenhardt, 2011; Guo & Acar, 2005; Kapoor, 2014; Ring & Van de Ven, 1994; Schilling, 2015; Sowa, 2008; Thomson & Perry, 2006; Todeva & Knoke, 2005; Wood & Gray, 1991). As noted by Colbry, Hurwitz & Adair (2014) this contrasts with a paucity of research that addresses variations in individual-level experiences of collaborating.

In the global health research setting, wide-ranging efforts to mitigate inequalities over the last 30 years have addressed resource sharing and transfer, power relations, trust, knowledge transfer, research capacity building, system strengthening, ethics and the resulting effects on research policy, productivity, impact and sustainability to some extent (Binka, 2005; Bradley, 2007; Franzen, Chandler & Lang, 2017; Maina-Ahlberg, Nordberg & Tomson, 1997; Matenga et al., 2021; Moyi Okwaro & Geissler, 2015; Tijssen and Kraemer-Mbula, 2018; Tomlinson, Swartz & Landman, 2006). These aspects mainly relate to outcomes at the global, national, institutional, research group and community levels. By contrast, I am interested in understanding the lived experience of individual low-income country-based researchers relating to personal and professional outcomes. This has only been investigated in qualitative studies that do not reveal generalisable patterns (Crane, 2010; Jentsch & Pilley, 2003; Modlin et al., 2023; Muldooon et al., 2012; Munung, Mayosi & De Vries, 2017; Okwaro & Geissler, 2015; Parker & Kingori, 2016; Walsh, Brugha & Byrne, 2016; Ynalvez & Shrum 2011). I therefore examined the extent to which individual low-income country-based biomedical researchers still judge themselves to be affected by inequality at different stages of the high-income country-low-income country collaboration cycle. The following research question was addressed: To what extent do low-income country-based researchers currently experience inequality in global health collaborations?

Literature Overview

3.1 Structural Inequality across stages of the high-income country-low-income country Research Collaboration cycle

Dani and Haan (2008) define structural inequality as “a condition that arises out of attributing an unequal status to a category of people in relation to one or more other categories of people, a relationship that is perpetuated and reinforced by a confluence of unequal relations in roles, functions, decision rights, and opportunities” (p. 13). Structural inequality is deeply embedded in the

domain of science, technology and innovation, with inequalities of capacities translating into inequalities of representation and finally leading to inequalities in the distribution of benefits and costs (Bradley, 2007). Thus, it is likely that individual low-income country-based researchers will experience inequalities differently based not only on their personal attributes but also on the specific relevant stage of the collaboration.

Models of high-income country/low-income country collaboration have followed a distinct incremental pattern in progressively ceding scientific, technical, financial and administrative power to collaborating low-income country researchers (Tomlinson, Swartz & Landman, 2006). Broadly, low-income country sites have moved over the last 30 years from being mere sources of data and specimens, to annexed field sites manned by high-income country expatriate staff (Costello & Zumla, 2000) through to having long-term collaboration frameworks which reflect an implicit commitment to compensate for structural inequalities at all stages of the collaboration cycle (Boum II, et al., 2018; Costello & Zumla, 2000).This progression is widely credited with significant increases in Sub Saharan African (SSA) research output and impact (Lan et al., 2014), a trend that appears to be continuing.

However, unique variations in individual low-income country-based researchers' experiences of these changes across the collaboration cycle are not well understood. To assess the challenges and opportunities presented by these changes this study adopts Sonnenwald's (2007) four-phrase framework, which is more comprehensive and contextually relevant than similar stage-defining frameworks (Kraut, Galegher & Egidio, 1987; Maglaughlin, 2003; Tellioglu, 2008) to characterise and study conditions of structural asymmetry across the high-income country-low-income country research collaboration cycle. Sonnenwalds's (2007) framework describes four phases; a foundation phase, a formulation phase, a sustainment phase and a conclusion phase. The current study measures the extent to which key aspects of collaboration identified in the literature are experienced across these stages, in order to identify generalisable patterns that inform management of similar structurally unequal collaborative groups.

3.1.1 Structural inequalities at the foundation stage

The foundation stage is considered to be a "prehistory" stage where it is primarily "norms, policies, and relationships existing before the collaboration" (p. 650) that manifest themselves (Sonnenwald, 2007). At this stage, conditions at the research environment level (such as scientific, political, socio-economic and resource factors) shape the decision to collaborate and the generation of suitable collaborative research ideas (Beaver,2001; Bozeman & Boardman,2003; Maglaughlin & Sonnenwald, 2005) that are deemed likely to be evaluated positively (Tijssen & Kraemer-Mbula,

2018). In high-income country/low-income country collaborations, this takes place against the backdrop of factors like differences in income and scientific capacity, (sometimes) colonial histories and potentially the availability of drug-naïve populations for clinical trials.

3.1.2 Structural inequalities at the formulation stage

At the formulation stage, scientists start to conceptualise and plan the actual research, developing a shared vision and research goals (Sonnenwald, 2007). Inequalities at this stage often arise in the research planning and design (Binka, 2005; Munung, Mayosi & De Vries, 2017) in the assignment of individual roles, responsibilities, rights, and decision-making power within the groups (Boshoff, 2009; Bradley, 2007; Gaillard, 1994; Parker & Kingori, 2016, Shiffman, 2014) as well as in remuneration (Maina-Ahlberg, Nordberg & Tomson,1997; Moyi Okwaro & Geissler,2015). These may be exacerbated when acknowledgement and resolution of differences in language, research philosophies, cultures, resources and individual understanding of task responsibilities and capabilities does not fully occur (Maglaughlin & Sonnenwald, 2005) often to the disadvantage of the low-income country-based collaborators (Moyi Okwaro & Geissler, 2015).

3.1.3 Structural inequalities at the sustainment stage

The sustainment stage supports the research process over the period it takes to execute it, typically addressing issues around shared resources and working arrangements, organisational structure and management and implementation practices (Sonnenwald, 2007). Given significant technological, cultural and economic gaps that exist between the high-income country and low-income country collaborators' settings (Ager & Zarowsky, 2015) two-way, individualised capacity building using various tools such as mentorship, peer review of papers, meetings and shared report writing is greatly valued by low-income country-based researchers (Parker & Kingori, 2016). If capacity building and resource sharing expectations (for example in acquisition of equipment (Binka, 2005) and in contributing to administrative costs (Crane et al., 2018) are not met, feelings of inequality may be exacerbated (Gaillard, 1994; Parker & Kingori, 2016).

Similarly, high-income country-based collaborators may fail to interpret and/or acknowledge and respond to various aspects of the prevailing low-income country context such as the cultural and ethical standards or socio-economic conditions (Fairhead, Leach & Small, 2006a; Garrafa & Lorenzo, 2008; Molyneux, & Geissler, 2008; Moyi Okwaro & Geissler, 2015) or to professional limitations (such as when poor infrastructure delays key project milestones) (Jones et al., 2004). For example, host community expectations regarding benefits not only from the research itself (Mondain, 2010) but also from the practical aspects of its implementation, such as free medical services, drugs, basic incentives, jobs or supplemental income for community members (Fairhead, Leach & Small, 2006b; Parker & Kingori, 2016) may not be met.

3.1.4 Structural inequalities at the conclusion stage

At the conclusion stage, collaborators finalise the research, and evaluate project success, usually through publications and citations (Stokols, et al., 2005). Low-income country-based researchers facing internal collaborative group limitations and/or editorial practices which disadvantage them may not get a fair authorship role (Binka, 2005; Jentsch & Pilley, 2003). Even when they publish, there is a tendency for their research to be evaluated through the lens of their high-income country peers as disproportionately lower quality and less impactful (Tijssen & Kraemer-Mbula, 2017) They may not be supported to disseminate locally relevant research findings (for example those that have local policy and/or practice implications) (Lombe, et al., 2013; Paina ,2013) or to benefit fully from post-project benefits such as access to technology, training, and networks, which may help to advance their careers (Maswime, Masukume & Chandiwana, 2018). Low-income country-based researchers may therefore experience these benefits as unequal to those of their high-income country-based counterparts (Duque et al., 2005).

3.2 Methods

3.2.1 Empirical context: Biomedical research collaborations in Uganda

The current study was conducted in Uganda. Uganda is classified by the World Bank as a low-income country, typically appearing in the fifteen lowest ranked African countries by GDP (World Bank, 2021). Since economic status is generally a predictor of scientific research output, Uganda's relatively low GDP does not intuitively match its consistent ranking amongst the ten countries in Africa with the highest biomedical research output as measured by publications, and third-highest ranking in clinical trial activity (Xu, Boggio & Ballabeni, 2014). Given its low resource environment, it is not surprising that almost 90% of Uganda's relatively high biomedical research output results from high-income country resources (Brar et al., 2010). Thus, it offers a particularly suitable context in which to study inequalities between low-income country-based biomedical researchers and their high-income country counterparts and to benchmark results of attempts to address these inequalities.

3.2.2 Research design

Sample

The study sample was drawn from the Uganda National Council for Science and Technology (UNCST) database. It is a legal requirement for all persons and organisations carrying out systematic investigations of any form in Uganda to seek final ethics approval from the UNCST. UNCST guidelines require all international collaborative research projects to have at least one local qualified, competent co-principal investigator so evidence could be obtained of the entire population of active

researchers in a low-income country setting. UNCST records were only partially digitalised, so three research assistants were stationed at the UNCST offices for three months to manually compile data which was combined with the available electronic data to create a full list of all health sciences researchers who were registered as active by UNCST over the last five years. I generated a cumulative list of 12,772 individuals listed as key participants in projects across all research areas in the UNCST database over the last five years. 6,033 entries for health Sciences researchers were recorded representing 47% of the cumulative number of active individual researchers (77% of researchers in the "hard" sciences).

The sampling frame represented all researchers who have conducted a health research project in Uganda over the last five years. A five-year period was used because when the question "how long is/was your current or latest project?" was asked, less than 3% of respondents responded with a period more than 5 years. Questions focused on collaborative research projects, which tend to be highly salient professional life events for low-income country-based researchers and are thus likely to trigger accurate recall over a relatively long period (Beckett et al., 2001). Out of 6,033 cumulative UNCST entries of individuals involved in research, 4,324 were for health researchers. Out of this number, I identified a population of 1,873 unique individual health science researchers. I checked this list against another list generated from clinicaltrials.gov, one of the largest publicly available databases of global clinical trials and found only three individuals who were not on the list generated from the UNCST database.

The names, organisational affiliations and contacts of the population of 1,873 potential respondents were listed in alphabetical order in an Excel sheet tracker and I attempted to reach them telephonically to request individuals' co-operation and to obtain updated e-mail addresses before sending out the link to the online survey. I was able to reach 728 individuals telephonically and to send them e-mails with links to the questionnaire, representing the sample frame. The other phone numbers were incomplete or inaccurate, no longer valid or individuals did not take calls after two attempts separated by a period of about one month. Data gathering was conducted during the COVID pandemic when many health practitioners were extremely busy but this balanced out with the fact that many had no regular teaching duties. Teaching duties are common for health researchers because they tend to have parallel academic and clinical positions.

Two reminder emails were sent one month apart if the first e-mail failed to generate a response. Response status of all 1,873 individuals in the population were tracked using an Excel sheet. The tracker was updated daily after checking the online database to confirm which individuals had responded, which ones had deferred or declined and to include new contact details. I used Yamane's (1967) method for sample size calculation for cross-sectional studies where sampling is from a finite

population, stated as n= N/ (1+N (e) 2) giving a minimum sample size of 363 respondents. Survey progress was tracked in detail up to the point when a sample of more than 500 responses was achieved (after about 3 months).

Screening questions were used to confirm respondents' eligibility and to obtain informed consent before proceeding to the main survey. Where respondents did not fit the inclusion criteria or declined to participate, the survey terminated with the appropriate message. A response rate of 73% of the sample reached researchers was achieved, representing 29% of the population of active Ugandan health science researchers. This represents a very high response rate that engenders confidence in the findings as shown in Table 1.

Table 1: Participation rates for the online survey

# of unique individual health sciences researchers in the UNCST database	# of researchers reached by phone	% of individual researchers reached	# of complete responses received	Response rate to sample	Total % of population of health sciences researchers reached
1,873	728	39%	532	73%	29%

3.2.3 Measures of inequality

Measures of structural inequality in the literature predominantly address differences in economic rewards and attributes (such as income, wealth and health) between nations, groups or individuals based on demographic characteristics such as race, gender, and class and using measures such as the Gini, Theil, and Atkinson indexes (Firebaugh, 1999; Cowell, 2000; Schultz, 1998; Yitzhaki & Schechtman, 2013). This study's view of structural inequality is much more through the lens of work group structures and social conditions that may both perpetuate and result in inequitable outcomes *in the workplace domain*. Thus, this study adopted measures from the broader workplace and equity literature rather than from extant structural inequality literature.

Within that literature, several scales exist to measure aspects of individual experiences of inequality in the workplace, notably the workplace status scale (Djurdjevic et al., 2017) and various workplace justice and fairness scales ably reviewed by Colquitt and Rodell (2015). While these address workplace equitability and fairness to an extent, the only scale I found that was specifically aimed at measuring workplace inequality was van der Werf's (2019) Workplace Inequality Scale (WIS). The Workplace Inequality Scale (WIS) was selected because it is designed to measure individuals' assessment of workplace inequality. It combines the related aspects of organisational justice with

individual experiences of broader group structural, organisational, individual and interpersonal outcomes to give a parsimonious but comprehensive scale for perceived workplace inequality. The scale is also rigorously validated.

Van der Werf (2019) conceptualises workplace inequality as an attitude towards the distribution of resources on the one hand being "aspects of the work context such as pay, time, decision-making power, equipment, friendship, information or status that help people to meet their personal and work-related needs". On the other hand, it involves the distribution of demands; "aspects of the work context that require ongoing mental, emotional, or physical effort" and might include physical labour, solving difficult problems, frequent interruptions, interpersonal conflict, poor supervision and time pressure (van der Werf, 2019, p. 266-267).

The instrument uses six items to measure aspects of how an individual experiences perceived workplace inequality along a seven-point scale (1=strongly disagree, 7=strongly agree) and aspects of distribution along another seven-point scale (1=*strongly dislike, 7=strongly like*). These together constitute how respondents experience workplace inequality. The WIS scale was adapted to conditions of inequality (represented by resources and demands) drawn from the literature on high-income country-low-income country research collaborations. Various modifications of this scale were made to fit with the items that describe general conditions at three stages of collaboration. The final scale for the current study had 36 items; four items for each of three key features/conditions at the second, third and final stages of collaboration (see Table 2 below) using a 7-point Likert scale. The first stage was omitted, because it primarily represents conditions and individual collaboration experiences that extend beyond the start of specific projects.

Construct	**Definition**	**No. of items**	**Citations**
Experiences of workplace structural inequality at the formulation stage of high-income country-low-income country collaborative research projects	The extent to which low-income country-based researchers experience differences in resources available and demands faced relative to their high-income country-based counterparts in relation to participation in **conceptualisation and design of the research, assignment of an appropriate role in research implementation** and **fair remuneration**	12	van der Werf (2019); Okwaro & Geissler, 2015; Ager & Zarowksy, 2015; Bradley, 2007
Experiences of workplace structural inequality at the sustainment stage of high-income country-low-income country	The extent to which low-income country-based researchers experience differences in resources available and demands faced relative to their high-income country-based counterparts in relation to **organisational benefits, community benefits** and	12	van der Werf, 2019; Okwaro & Geissler, 2015; Parker & Kingori, 2016; Costello & Zumla,

collaborative research projects	**respect for their local professional, ethical and cultural setting**		2000; Fourie, 2018; Chu et al., 2014;
Experiences of workplace structural inequality at the conclusion stage of high-income country-low-income country collaborative research projects	The extent to which low-income country-based researchers experience differences in resources available and demands faced relative to their high-income country-based counterparts in relation to **authorship positions, dissemination practices** and **post-project career growth**	12	van der Werf, 2019); Okwaro & Geissler, 2015; Ager & Zarowsky, 2015; Franzen, Chandler & Lang (2017)

Table 2: Questionnaire Items for measurement of experiences of inequality at three stages of collaboration

I identified twelve randomly selected researchers to review the questionnaire for relevance, appropriateness and time commitment. I randomly selected another group of ten colleagues from my organisation to test the online version for functionality. A pilot study was then conducted using a population of 38 Natural Sciences researchers. This generated twenty full responses. Preliminary analysis was performed on the data collected at this stage, including performance of reliability tests using Cronbach's alpha (α). Computations for reliability were done using Stata Version 14. Cronbach's alpha (0.95) was relatively high, so it was concluded that the data collection tool holds reliable questions in both form and flow for the study. However, the pilot study's non-statistical results were concerning. In spite of the efforts that have been made over three decades to make global health research more equitable, the results indicated an extreme sense of inequality. My concern was whether this was in fact what the participants experienced, or whether the scale was predisposing them to a more negative judgement. The questions about workplace inequality could be understood as suggesting that researchers based in low-income country organisations were always disadvantaged in all aspects of collaboration.

This highlighted the need to capture a wider variety of experiences of individuals affiliated to low-income country organisations without assuming that they necessarily felt they are worse off. For example, originally responses were required for statements like "low-income country researchers have/had less decision-making power" and "low-income country researchers have/had less access to important scientific networks". Responses in the pilot study strongly tended towards the "I strongly agree" choice.

To mitigate any risk of priming participants to respond negatively, the questions were rephrased so that it was possible to answer on a range from negative-neutral-positive, and not simply between negative and neutral. For example, the statement "low-income country researchers have/had less decision-making power" was rephrased to read "high-income country and low-income country

researchers have/had equal decision-making power". Similarly, "low-income country researchers have/had less access to important scientific networks" was rephrased to read "low-income country and high-income country researchers have/had equal access to important scientific networks. Responses were then rephrased to range from "Unequal: low-income country researchers are in a much worse situation "to "Unequal: low-income country researchers are in a much better situation" or similar phrasing.

I added a section at the end of the questionnaire that asked participants the question "Is there anything else about your experience of research collaborations with high-income country organisations that you would like to add?". This provided rich insights into key aspects of their experience and their overarching views.

3.3 Findings

The data analysed for this study relates to 489 respondents (91% of the 532 respondents) who had been in a collaboration with researchers from organisations in high-income country in the last five years and thus had recent first-hand experience (as opposed to perceptions or observations) of the conditions in such collaborations.

The majority of them (about 54%) were university-based which suggests that research output is a major professional metric for them. 308 individuals (62.9%) described themselves as research staff (on top of any other roles within their organisations); the same number additionally described themselves as academic staff. The majority of individuals (n=238) (48.6%) had been involved in research for 10 to 19 years and a comparable number (n= 177) (36.1%) had been doing research, for 0 to 9 years indicating a reasonable measure of research experience overall. Respondents for this study had all participated in collaborative projects with high-income country-based researchers, with the majority (n=261) (53.2%) having had collaboration experience ranging from 1 to 4 projects, 155 (31.6%) having had 5-10 collaborative projects and 74 (15.1%) having had over 10 collaborative projects. The median number of collaborative projects ever participated in was 10.

Details of these data are shown in Table 3 below:

Table 3: Descriptive Statistics

Variable	**Frequency N=489**	**Percentage**
Personal Characteristics		
Gender		
Female	184	37.6

Variable	Frequency N=489	Percentage
Male	305	62.4
Age (in years) ; mean (std dev)	42.2	8.62
Grouped age		
Less than 35 years	110	22.4
35 to 60 years	363	74.3
61 and above years	16	3.3
Duration in research (in years) ; mean (std dev)	11.7	6.8
Duration in research grouped		
1 to 9 years	176	36.1
10 to 19 years	238	48.6
>=20 years	75	15.3
Highest level of education		
Bachelor's degree	37	7.6
Master's degree	304	62.2
PhD.	148	30.2
Collaboration history: number of collaborative research projects (grouped)		
1-4 collaborations	260	53.2
5-10 collaborations	155	31.6
Above 10 collaborations	74	15.1

The majority of individuals who reported that they experience some inequality overall perceived themselves to be only slightly worse off (rather than worse and much worse off). For purposes of analysis the two most extreme responses (both on the positive and negative side) within the 7-point scale were grouped together. The three medium responses were similarly grouped together to represent relative equality. Individual experiences of inequality across the 3 stages were grouped into three categories: "significantly worse", "relatively equal" and "significantly better". Using these categories, I analysed the data in three stages, leading to the three parts that describe the findings. In the first part, I describe the general experiences of the respondents at each of the three key stages of the collaboration cycle in order to measure which stage is judged to have the highest levels of in/equality and which variables contribute the most to this judgement. To reveal more granular differences across individual researcher profiles, I then disaggregated responses based on two attributes of individual low-income country-based researchers; length of research career (described in part 3.3.2) and number of collaborations with high-income country-based researchers (described in Part 3.3.3).

3.3.1 Overall experience of inequality across the three stages of collaboration

The figure below shows a summary of the findings on overall experience of inequality across stages

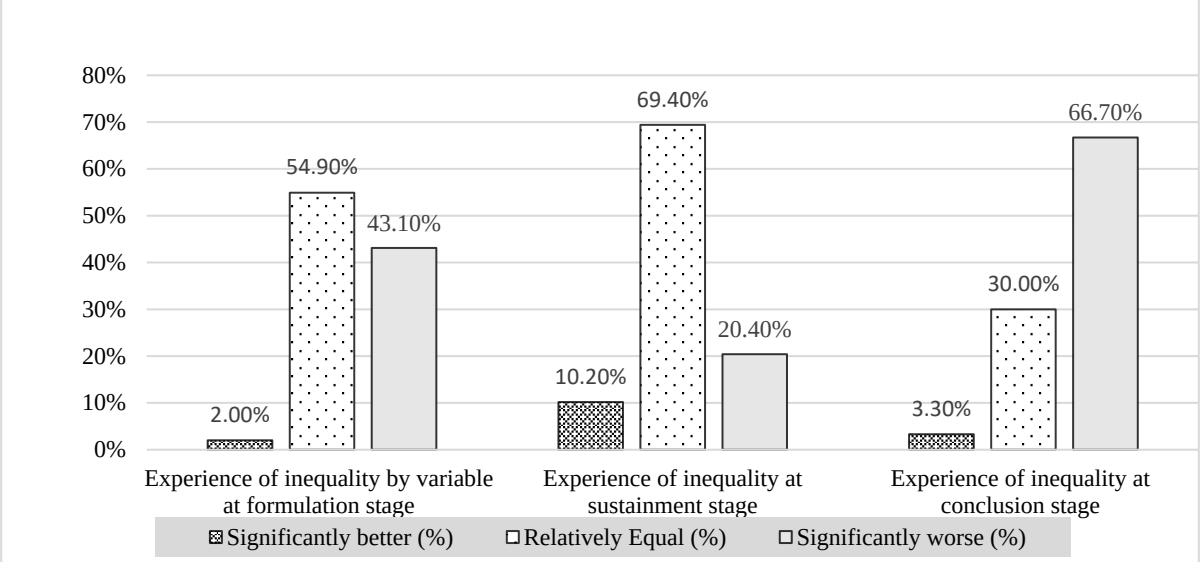

Figure 3: Overall experience of inequality by collaboration stage

The conclusion stage of collaboration has the highest overall experience of inequality, followed by the formulation stage

Consistent with the literature, low-income country-based researchers who had ever collaborated with high-income country-based researchers across demographic profiles and collaboration histories reported a measure of inequality overall, relative to their high-income country counterparts at all three stages of collaboration studied. However, the percentage of respondents (66.7%) whose experience of the conclusion stage was significantly unequal was much greater than those who felt the same overall for the formulation stage (43.1%) and the sustainment stage (20.4%).

Table 4 below shows the experience of inequality for specific variables across the stages of collaboration

Table 4: Experience of inequality for all researchers who have experienced collaboration (n=489)

Experience of inequality by variable at formulation stage	**Significantly worse**	**(%)**	**Relatively Equal**	**(%)**	**Significantly better**	**(%)**
Research conceptualisation and design	54	11.00%	428	87.60%	7	1.40%

Role assignment	101	20.60%	380	77.80%	8	1.60%
Remuneration	190	38.80%	295	60.40%	4	0.80%
Experience of inequality by variable at sustainment stage	**Significantly worse**	**(%)**	**Relatively Equal**	**(%)**	**Significantly better**	**(%)**
Local organisation benefits	103	21.00%	383	78.40%	3	0.60%
Benefits to the local community	18	3.70%	422	86.30%	49	10.00 %
Professional, ethical and cultural standards	21	4.30%	453	92.60%	15	3.10%
Experience of inequality by variable at conclusion stage	**Significantly worse**	**(%)**	**Relatively Equal**	**(%)**	**Significantly better**	**(%)**
Authorship	72	14.70%	411	84.10%	6	1.20%
Dissemination	43	8.80%	435	89.00%	11	2.20%
Post -project benefits	319	65.10%	164	33.70%	6	1.20%

The experience of post-project benefits within the conclusion stage stood out as the most unequal across all variables measured in all the stages, with 65.1% of respondents reporting significant inequality, significantly more than the 14.7% and 8.8% of respondents who reported significant inequality in authorship and dissemination experiences – the other two variables that are salient at this stage.

The formulation stage was experienced as less unequal overall. Remuneration and role assignment were experienced as the most unequal at this stage, with 38.8% and 20.6% of respondents respectively reporting significant inequality. High-income country-based collaborators' opaqueness when discussing remuneration seems to increase awareness of possible disparities, with comments like "Frequently one may not know what resources are available to researchers from high-income countries…for example how much they are paid" and "they (high-income country-based researchers) tend to hide information regarding funding to themselves" emerging. The inequality in assignment of suitable roles for low-income country-based researchers seems to be closely related to setting the agenda, with low-income country-based researchers often being introduced to the research questions and potential or actual funders very late in the conceptualisation process rather than being co-creators of the design.

In contrast, experiences at the sustainment stage were considered to be better and relatively equal overall by 10.2% and 69.4% of respondents respectively compared to only 20.4% who experienced significant inequality. Notably 95.7% and 96.3% of respondents respectively felt their experience at the sustainment stage was equal to or better than that of their high-income country counterparts with

respect to their local conditions and benefits to their local communities (but less so for their organisations).

Thus, the conclusion stage exhibited the highest overall experience of inequality amongst low-income country-based researchers relative to other stages, followed by the formulation, then the sustainment stages.

3.3.2 Experiences of inequality are strongest amongst low-income country-based researchers who have done research for a longer time

I assumed that distinct patterns might emerge in the experiences of each of three groups of low-income country researchers who had started their research careers at three different time points, conveniently separated by ten years over the 30-year time horizon in which the literature describes progressive changes occurring in the research environment. The first group therefore comprised of those who had done research for 0-9 years (categorised as a short time). These would be expected to have started their research experience in conditions of much greater equality. The second group represented individuals who had done research over a fairly long period (10- 19 years, categorised as a long period) over which conditions had changed significantly. The 3rd group represented researchers who had experienced the most significant changes, having started their research careers 20 and above years ago, before major initiatives to address inequality had taken root (categorised as a very long time). Table 5 below shows the distribution of experiences of inequality across the 3 stages of research collaboration based on length of research careers.

Table 5: Experience of inequality by length of research career

Length of research career	**Mean (SD) of overall experience at formulation stage**	**Mean (SD) of overall experience at sustainment stage**	**Mean (SD) of overall experience at conclusion stage**
Experience of inequality amongst individuals who have done research for a short time (0-9 years) (n=261)	2.9 (0.7)	3.5 (0.7)	2.9 (0.8)
Experience of inequality amongst individuals who have done research for a long time (10-19 years) (n=155)	2.8 (0.7)	3.4 (0.7)	2.8 (0.7)
Experience of inequality amongst researchers who have done research for a very long time (20 and above years) (n=74)	2.7 (0.9)	3.4 (0.7)	3.0 (0.9)

F(P-value) ¥	2.45(0.087)	1.24(0.289)	1.74(0.176)

¥ Analysis of Variance (mean comparison test)

Overall, experience of inequality across stages was only very slightly more amongst low-income country-based researchers who had done research for a longer time (73.3%) than those who had done it for medium (71%) and shorter (70.6%) time periods. However, this trend became more pronounced when specific aspects of different stages of collaboration were considered.

At the formulation stage, there was a higher experience of inequality among Individuals who had done research for the longest time (50.7%) compared to those who had done research for a medium period (41.6%) and for a short period. (41.8%). Relatively older researchers tended to express particular dissatisfaction with role assignment. Comments like a call to" Co-design projects with local investigators ", "high-income country tend to use local researchers as data collectors and don't let them be a part of the entire process" and "they (low-income country-based researchers) are often overshadowed by those from high-income country even when they have similar research prowess". "I would love to participate even more in terms of study design" and "" It is important to discuss the terms of the collaboration and agree on what each team is to contribute and also benefit right from the planning stage" were notably more frequent in this group. Experience of inequality in role assignment did not have a statistically significant difference from other variables, but it followed a distinct trend. It fell up to the point where researchers had medium experience (at the 20-year experience mark), then plateaued and rose after that, reaching a peak for those with the longest experience (up to 30 years), suggesting that more senior researchers most acutely felt that their research competencies were under-utilised by their collaborative groups. At the sustainment and conclusion stages, low-income country-based researchers with longer research careers had about the same experience overall of inequality as those with shorter careers with two exceptions. One exception was related to equality of authorship roles, which they experienced as relatively more unequal than those in other categories. The other exception relates to experiences of inequality in dissemination practises, in which individuals with long research careers reported divergent outcomes. 13.3% of these individuals reported a much more favourable experience for high-income country-based researchers while 8% experienced much more favourable outcomes for low-income country-based researchers; both outcomes were notably higher than those reported by other low-income country-based researchers in the short and medium length research career categories. Since senior researchers are likely to have reasonable research experience, this variation at the conclusion stage might be due more to group specific dynamics such as more inclusive authorship and dissemination practices in some groups than in others. Indeed, comments made specifically by older researchers notably acknowledge group specific differences, attributing them mostly to aspects of

culture and nationality of high-income country collaborators, as well as to the maturity or immaturity of different collaborations.

3.3.3 No significant differences in experiences of inequality amongst researchers based on number of collaborative projects participated in

Low-income country-based researchers were divided into three groups comprising of those who had collaborated on 1-4 projects (categorised as not experienced), 5-10 (categorised as experienced) and more than 10 projects (categorised as very experienced). Table 6 below shows the distribution of experiences of inequality across the 3 stages of research collaboration based on number of collaborative projects participated in.

Table 6: Experience of inequality by length of collaboration experience

Collaboration record	**Mean (SD) of overall experience at formulation stage**	**Mean (SD) of overall experience at sustainment stage**	**Mean (SD) of overall experience at conclusion stage**
Experience of inequality amongst researchers who are relatively little experience of collaboration (1-4 projects) (n=261)	2.8 (0.7)	3.4 (0.7)	2.9 (0.8)
Experience of inequality amongst researchers who are moderately experienced in collaboration (5-10 projects) (n=155)	2.8 (0.8)	3.4 (0.7)	2.8 (0.8)
Experience of inequality amongst researchers who are very experienced in collaboration (over 10 projects) (n=74)	2.9 (0.8)	3.5 (0.6)	2.9 (0.8)
F(P-value) ¥	0.56(0.571)	0.67(0.513)	0.83(0.438)

¥ Analysis of Variance (mean comparison test)

There were only slight differences in the overall experience of inequality amongst low-income country-based researchers who had a longer record of collaboration (73%), those who had been part of fewer collaborations (72.3%) and those who had the least number of collaborations (70.1%). Slightly more low-income country-based researchers with little collaboration experience found the formulation stage to be relatively equal or better (58.3%) than those with moderate (55.5%) and long experience (55.4%) but these differences were not significant (see Table 5).

Across the three stages of collaboration, the sustainment stage was considered to be the most equal overall again, with the one exception as earlier reported experienced in generating benefits for low-income country organisations. At this stage, those who had participated in more collaborations experienced respect for local standards and communities even more favourably than others. In fact, none (0%) of the most experienced collaborators perceived themselves to experience any inequality at all related to the observance of local ethical, cultural and professional standards. This reflects changes in the principles of respect for local norms that have been progressively ingrained into high-income country-low-income country collaboration research practise. No significant differences in experiences of inequality were reported at the conclusion stage when respondents were disaggregated by number of collaborations.

3.4 Discussion

The great majority of low-income country-based researchers reported experiencing some level of inequality across all aspects of collaboration with high-income country-based researchers at all three stages. Encouragingly, most low-income country-based researchers felt that their experience was only slightly worse off relative to their high-income country-based counterparts, suggesting that actions taken to address imbalances in high-income country/low-income country research collaborations have had some success, consistent with trends reported in qualitative studies. However, relatively stronger experiences of inequality seem to persist at the conclusion and formulation stages, possibly because, there may be less deliberate inclusion of low-income country -based researchers' inputs at these stages.

It is noteworthy that the experience of role assignment as the research is formulated continues to be particularly unequal, as this sets a tone for roles across the rest of the collaborative project cycle. This is made even more critical by the fact that the researchers who have had longer careers and have experienced the greatest number of positive changes in the high-income country-low-income country collaboration environment over the last 30 years still regard this aspect of collaboration as particularly unequal. However, there are complexities around this apparent inequality. For example, African researchers contributed 0.6% of global COVID 19-related research output even though key questions specific to the African context that could be answered with relatively minimal resources remained unanswered, (Gwenzi & Rzymski, 2021), suggesting a lack of initiative or motivation. Indeed, one respondent states that "local researchers often do not take initiative to start research projects or write grants, or are marginalised when grants are being awarded". A persistent reluctance especially amongst the more senior researchers to initiate and lead research on important research questions that generate local solutions (Gwenzi & Rzymski, 2021) using the limited available resources (including collaboration networks) to support African-led research may be aggravated by

a tendency to evaluate applied research that is aimed at contextual problem solving in low-income settings as lower quality (Chalmers & Glasziou, 2009; Tijssen and Kraemer-Mbula, 2018)

This study thus supports Gautier, Sieleunou & Kalolo's (2018) suggestion that more robust research capacity would be generated by empowering younger, junior low-income country-based researchers in particular to contribute meaningfully to conceptualisation and design of research that is grounded in their local context. Younger researchers however may face their own barriers within low-income country organisations stemming from a culture that may not value internal mentorship and growth, probably due to time pressure on more experienced researchers. One young researcher remarked that "most of the local researchers (local PIs) rarely mind about the career of the early career researchers" while others referred to high-income country-based collaborators as "better mentors", "helpful", "willing to mentor", ""open to new contexts… and great at knowledge sharing", "more committed and better to work with", "respond in time", "they help us understand research better ", "(they) bring in important perspective" among many other similar comments. Clearly, high-income country-based researchers are important resources to subsequent generations of scholars. Future research is needed to understand how this benefit can be better acknowledged, harnessed and institutionalised.

The relative equality experienced by low-income country-based researchers at the sustainment stage across individual collaboration and research experience profiles points to a cultural shift that accommodates local perspectives and needs in conducting collaborative research. Not surprisingly, this stage revolves around tasks that may benefit more from local knowledge and rely on local conditions for success. The most positive view of these changes is evident amongst the researchers who have had the longest careers and those who have collaborated the most. These overwhelmingly have a positive experience with regard to their high-income country-based counterparts' acknowledgement of local cultural and professional conditions and community needs. One researcher commented for example, that high-income country-based collaborators tend to be more receptive to issues around ethics, which attract a lot of their compassion and attention, and compares that with financial issues to which he finds them to be much less receptive.

Researchers with longer experience report much more inequality with regard to benefits to their organisations, such as equipment, administrative support and capacity building opportunities. This may be a recognition that while collaborations may provide underfunded low-income country-based researchers with various types of assistance to improve research capacity, this assistance continues to be predicated on the high-income country-based researchers' priorities. Those are typically centred around immediate programme results rather than long term needs for low-income country

organisational capacity. More experienced low-income country-based researchers are particularly disillusioned by this phenomenon, possibly having observed it over many years of research collaboration. For example, one senior researcher points to high-income country-based researchers' lack of interest in supporting the purchase of capital equipment that would enable critical analysis to happen locally. Another senior researcher comments that "low level of access to state-of-the-art equipment is a hindrance to our ultimate choice of topics".

At the conclusion stage, the majority of low-income country-based researchers surprisingly do not report finding the authorship experience as particularly unequal relative to other outcomes across the research cycle, even if it is usually understood to be the ultimate objective of research work. This is perhaps because the widespread outcry against the exclusion of African authors has led to deliberate efforts to make authorship more inclusive as reported by Binka (2005). However, it might equally point to the difficulty identified by various scholars (Chataway & Daniels, 2020; Tijssen & Kraemer-Mbula, 2017) in maximizing African researcher productivity by breaking away from the dominant view of research excellence based on traditional measures such as impact factor and reimagining it through wider lens that encompass local embeddedness and socio-economic impact. Senior researchers report divergent inequality outcomes particularly in their experiences of how local dissemination is prioritised and how they are given opportunities to meaningfully contribute to it. Such divergence can be observed in the varied extent to which various high-income country/low-income country collaboration groups genuinely discuss and develop a deliberate dissemination strategy from the onset, based on a common understanding of their targeted audiences. This in turn seems to determine the extent to which low-income country-based researchers find dissemination of collaborative research outputs to be impactful from their perspective. Thus, dissemination experiences seem to be influenced more by group-specific dynamics than the general structural features of collaborative work, perhaps because it is an activity that is fairly independent of the core research implementation cycle and might demand a different skill set.

Across all measures of inequality, stages of collaboration and researcher profiles individual post-project benefits such as acceptance into research networks and generation of follow-on work were perceived to be particularly unequal in individuals' experiences of high-income country/low-income country research collaborations. This suggests that even as the more obvious relational barriers are addressed within different collaborations, structural barriers still make it hard for individual African researchers to break into wider global researcher networks which lead to more consistent long-term professional growth. This supports Paina et.al (2013) in advocating for collaborative programs to be larger and of longer duration in order to be have better long-term cohesion

3.5 Conclusions

The study findings have implications for the management of collaborations between low-income country-based and high-income country-based researchers, especially since biomedical research comprises 45.2% (close to half) of all sub Saharan research output (Lan et al., 2014). It reveals patterns that are generalisable to other scientific domains and provides a benchmark for the management of similar structurally unequal collaborations.

The study findings suggest that self-reported equality of low-income country-based researchers in collaboration with high-income country-based researchers has improved even more than one might surmise from the existing qualitative literature. It suggests that substantial progress has been made over the last 30 years in addressing inequalities, particularly in the relational aspects of collaboration, such as respect for low-income country-based researchers, their communities and their values. These are particularly important in the sustainment stage of collaboration. The more nuanced, often unintended and less acknowledged structural inequalities and their consequences are more acutely felt at the conclusion and formulation stages. Greater equality should be sought particularly in areas such as research conceptualisation, remuneration and role assignment (at the formulation stage) as well as in generating follow-on work that could build on specific completed projects (at the conclusion stage). These are stages where low-income country-based researchers' inputs might be less acknowledged, thus limiting their acceptance into longer term professional networks. Acknowledgement of these inequalities is important, as it engenders transparency and dispels misunderstandings around remuneration, financial arrangements, and in setting realistic, mutually agreed goals for low-income country organisational capacity building and infrastructure support within the limits of individual projects. This is particularly important for the more experienced researchers and collaborators. For younger researchers, collaborations should additionally incentivise internal capacity building within low-income country organisations (for example by institutionalising local mentorship programmes and explicitly rewarding successful low-income country-based mentors) in order to build sustainable internal capacity which generates more meaningful research roles. Young researchers should equally be empowered to explore more locally relevant, socially impactful areas of research, for example through access to journals that have adopted more progressive research evaluation practices. This might gradually mitigate some structural barriers.

This study had a number of limitations. The study used a cross-sectional design, so it captured only the experiences that existed at a specific point in time. It is possible that individuals report different experiences in different collaborative groups that they join, experience changes in group conditions

over time in the same collaborative group or find differences in collaborators' cultures, personalities, incentives and working styles. Many respondents for example singled out the high-income country country/region of origin as a predictor of how much commitment high-income country-based individuals have to equality within collaborations. Future studies could consider personal attributes and conditions, as well as the perceptions of other key parties affected by low-income country-high-income country collaborations (notably high-income country collaborators and non-collaborating low-income country researchers). Studies could also consider outcomes such as effects on productivity arising from experiences of in/equality and experiences in other (non-biomedical) research domains. However, by providing robust evidence from a large population, this study highlights progress made from low-income country-based researchers' perspectives, in addressing structural inequalities in global health collaborations, identifies gaps and recommends specific actions for practitioners and policy makers to address them.

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Chapter Four

Paper two

Citizen professionals: global health research collaborations and the integration orientation of researchers from low income countries

Abstract

The Integration of researchers based in low income countries (LIC) into global health collaborations with those from high income countries (HIC) is particularly challenging because of inherent inequalities and different social constructions of their collaborations. I surveyed 532 low-income country-based researchers. I applied the conceptual parallels between the high-income country-low-income country collaboration setting and the acculturation setting to measure the extent to which conditions that enable research citizenship outcomes of collaboration (those that relate to more equitable low income country community-level research benefits relative to high-income country benefits) to be realised translate into better integration outcomes than those that enable individual, group level and task-level benefits to be realised. The results, including structural equation analyses support my hypotheses that research citizenship outcomes are a more significant predictor of their integration into these collaborations than other enablers of research. The study thus extends acculturation theory to a context where non-dominant individuals' integration into a dominant in-group is strongly associated with meeting their wider community-level goals, beyond their individual benefit. It also supports recent suggestions that the majority /dominant society should bear more responsibility for creating conditions for integration. I therefore recommend that practitioners and policy makers renew their focus on boosting low-income country community outcomes of collaboration to facilitate the integration of low-income country-based researchers into collaborative global health research.

Keywords: collaboration, global health research, low-income country researchers, integration, research citizenship.

Introduction

Research collaborations are critical in stimulating interaction among knowledge producers (Fleming, Mingo, and Chen 2007; Sonnenwald, 2007). They integrate ideas across organisations and geographies to facilitate high quality research (Singh & Fleming 2010; Wuchty, Jones & Uzzi, 2007).

Research collaboration is particularly important in global health research, because high income country and low-income country collaborators in this setting depend on each other for successful implementation of research projects. Biomedical scientists based in high-income country institutions are typically the key providers of resources such as funds, technology, research capacity, and credibility that are critical for the research to be implemented and globally recognised (ACBF, 2017; Crane, 2010, 2011; Lan et al., 2014; Pouris & Ho, 2014; UNESCO 2015). Low-income country-based scientists and sites on the other hand have the attributes (such as access to relevant populations and health conditions) that provide the ideal conditions for the field work of the research. However, these low-income country attributes are relatively substitutable – there are multiple countries with a high prevalence of malaria or tuberculosis for example - and this causes inequalities to persist in favour of high-income country-based researchers.

This study extends acculturation theory (Sam & Berry, 2006) to investigate conditions under which low-income country-based researchers integrate within these unequal collaborations. Individual low-income country-based researchers were surveyed to measure the extent to which enablers for meeting their individual, group-level, task-level and community-level aspirations (which I identify as research citizenship) each predict their propensity to integrate within these collaborations.

The findings reveal that perceived enablers of community-level benefits which meet research citizenship objectives are a more significant predictor of integration of low-income country-based researchers than other enablers, regardless of conditions in individual research groups. Increased investments in enablers of low-income country community benefits of collaborative research such as research infrastructure and local mentoring capacity are recommended.

Inequalities in global health research collaboration

Scholars have extensively studied the nature and outcomes of collaboration at the interorganisational and intergroup level in both for-profit and non-profit settings (Ring & Van de Ven, 1994; Thomson & Perry, 2006; Wood & Gray, 1991, Davis, 2016; Kapoor, 2014; Todeva & Knoke, 2005; Wood & Gray, 1991: Eden & Huxham, 2001 ;Davis & Eisenhardt, 2011; Schilling, 2015, Arya & Lin, 2007; Franco, 2008; Guo & Acar, 2005; Sowa, 2008) but as noted by Colbry, Hurwitz & Adair, (2014) not much has been done at the individual level. The paucity of research is even more evident

in addressing behaviour in conditions of inequality amongst individual collaborators. Where extant management literature addresses individual coping strategies in unequal collaborative work, it tends to adopt an identity management framework (Koppman, Mattarelli & Gupta, 2016; Levina & Vaast, 2008; Metiu, 2006) rather than a behavioural approach. It is clear, for example that high-income country/low-income country scientific collaboration groups favour the dominance of individual high-income country-based researchers over low-income country-based researchers in many aspects of collaborative work (Boum II, et al., 2018; Crane, 2010; Gautier, Sieleunou & Kalolo, 2018; Shiffman, 2015; Tijssen & Kraemer-Mbula, 2017) but little has been done to study the resulting individual behavioural outcomes outside qualitative studies that do not reveal generalisable patterns (Faure et al., 2021; Matenga et al., 2021, Munung, Mayosi & De Vries, 2017; Moyi Okwaro & Geissler, 2015; Parker & Kingori, 2016; Walsh, Brugha & Byrne, 2016; Ynalvez & Shrum 2011).This is an important gap given the predominantly individual nature of professional benefits and costs associated with scientific research work even when it is done within collaborations (Bikard, Murray & Gans, 2015; Lee & Bozeman, 2005; Milojevic´ et al., 2018). Understanding individual behaviour in this setting is especially of benefit to management practitioners and scholars because it is characterised by a unique interplay of systemic inequalities (Ager & Zarowsky, 2015; Franzen, Chandler & Lang, 2017; Tomlinson, Swartz & Landman, 2006). A wide range of authors has offered perspectives on various aspects of these inequalities and how to address them. However, they have not gone as far as investigating the extent to which addressing each of these inequalities enables better adaptation of minority low-income country individuals to such groups. I contribute to filling this gap by investigating the extent to which perceived benefits that accrue to individual low-income country-based researchers' communities are associated with their integration into research collaborations with their dominant high-income country-based counterparts. This is important because such integration suggests greater potential for low-income country -based researchers to surmount the challenges of inequality within these collaborative research groups so as to achieve greater personal and professional success, while at the same time catalysing improved health outcomes in their local setting.

Structural inequality in a professional context

It is likely that individual low-income country-based individuals seeking professional growth as researchers within global health collaborative groups will be challenged by conditions of structural inequality across the entire cycle of collaboration. Structural inequality is defined by Dani & Haan (2008) as conditions that arise "out of attributing an unequal status to a category of people in relation to one or more other categories of people, a relationship that is perpetuated and reinforced by a confluence of unequal relations in roles, functions, decision rights, and opportunities" (p. 13). Such conditions often become so pervasive that they are accepted as a normal part of life (Dani & Haan,

2008). In science such structural inequalities can be framed as inequalities of capacities, which translate into inequalities of representation (Cozzens, 2007). At a global scale these inequalities are compounded because different nationalities within transnational teams are associated with different status-defining attributes (Earley & Mosakowski, 2000) with most research benefits concentrated around a few dominant high-income countries even when they are attained through collaboration with low-income country partners (Chinchilla-Rodríguez, Sugimoto & Larivière, 2019).

High-income country/low-income country collaborators plan their research work against the backdrop of significant inequality in income, geo-political power, scientific capacity, and access to funds, networks and technology (Franzen, Chandler & Lang, 2017). This is sometimes exacerbated by huge disparities in infectious diseases burdens and by distortions caused by colonial histories. In these conditions, low-income country-based researchers seek to integrate their own professional aspirations within high-income country funders and collaborators' expectations of a competent, productive partner to benefit from coveted collaborative group resources (Binka, 2005; Moyi Okwaro & Geissler, 2015). Their efforts to integrate are influenced by inherent inequalities in choices about whom to collaborate with, generation of suitable research ideas, research planning and design (Binka, 2005; Munung, Mayosi & De Vries, 2017), assignment of individual roles, responsibilities, rights, and decision-making power within the groups (Parker & Kingori, 2016, Shiffman, 2014) as well as setting of remuneration rates (Moyi Okwaro & Geissler, 2015). Low-income country-based researchers further face considerable challenges in securing acknowledgement and resolution of differences in language, research philosophies, cultures, resources, responsibilities and capabilities (Fourie, 2018; Moyi Okwaro & Geissler, 2015) as the research is implemented. Finally, as research projects are concluded low-income country-based researchers are often disadvantaged in securing key authorship roles (Mbaye et al., 2019), more positive research evaluation (Tijssen & Kraemer-Mbula , 2017) , more impactful knowledge translation and dissemination opportunities (Lombe et al., 2013; Murunga et al., 2020) and in accessing post-project benefits such as access to technology, skills training, and networks, which could advance the completed research work further (Maswime, Masukume & Chandiwana, 2018).

The ability to navigate these inequalities and integrate within specific collaboration groups is likely to be influenced by each low-income country-based individual's demographic characteristics as well as group-level, task-level and community-level conditions which enable integration. While previous research has identified the motivation for non-dominant low-income country-based researchers to integrate professionally within collaborative groups, I identify integration orientation as a measure of individuals' propensity to integrate given the unique multi-level enablers which characterise their collaboration with high income country counterparts.

Structural Inequality in a research citizenship context

As much as 90% of low-income country researchers' scientific output may depend on collaborations with high-income country-based counterparts (Pouris & Ho, 2014) whose experience of conditions within these collaborations may be significantly different from theirs. High-income country collaborators tend to view global health as "a growing academic field" (Chu et al., 2014, p. 1) in which scientists from high income countries work in low-income countries (and especially in Africa) to develop expertise in addressing infectious diseases and conditions that originate and/or may spread in this setting (Chu et al., 2014; Panosian & Coates, 2006). Crane's (2010) ethnographic account suggests that high-income country-based academia construct "global health" around these endeavours. In contrast, their low-income country-based counterparts live it as citizens within a social setting that not only carries the largest infectious diseases burden by far, but also largely provides other conditions (such as drug-naïve populations and environmental and social conditions that facilitate transmission) (Bhutta et al., 2014) for conducting global health research. Researchers in the biomedical sciences have a higher "propensity to collaborate" because the relative resource-intensive needs of their field encourage more sharing (Birnholtz, 2007). At the same time, the relative concentration of individual biomedical scientists within specific collaboration groups (Newman, 2001) makes entry into these collaborative groups and access to the associated benefits even more exclusive than in other scientific fields. Given overwhelming high-income country dominance of research resources, low-income country communities and organisations are likely to look to low-income country-based researchers in collaborations with high-income country peers as a resource that reconciles the dominant high-income country construction of collaboration with their low-income country social reality to access professional, financial, technical and community benefits from these collaborations.

Low-income country organisations expect access to collaboration group benefits such as new capacities ranging from technical skills, technology and equipment to mentorship and peer review, to enhancement of grant writing, presentation and scientific writing skills (Binka, 2005; Franzen, Chandler & Lang, 2017; Parker & Kingori, 2016) as well as administrative cost contributions (Crane et al., 2018).

Low-income country-based researchers further aspire to meet their communities' expectations of benefits not only from the research itself (Mondain, 2010) but also from the practical aspects of its implementation. These typically include medical services, drugs, basic incentives, jobs or supplemental income for community members (Parker & Kingori, 2016). In disseminating research results, low-income country-based researchers might aspire to go beyond fulfilling obligations to funders and/or the wider global scientific community, so that they seek opportunities to impact policy and/or practice in the local setting (Tijssen & Kraemer-Mbula, 2017) (for example, when research

results reveal the efficacy of a different approach to tackling a common health condition (Paina et al., 2013). By the same token, low-income country-based collaborators seek to facilitate mutual acknowledgement and accommodation of local professional, cultural and ethical standards as well as contextual limitations such as poor infrastructure and local researchers' parallel teaching and clinical workloads (Crane et al., 2018; Fourie, 2018). I identify research citizenship as the extent to which individual low-income country-based researchers aspire to generate community-level benefits from their collaborations. Individual low-income country-based researchers are likely to have different views on the extent to which their unique experience in collaborative groups enables their research citizenship goals, and impacts the ensuing benefits from research. I suggest that these views will be a significant factor in their willingness and ability to integrate into collaborative groups.

Literature Review

Integration in the acculturation setting

The current study adopts a model from the acculturation literature to examine the extent to which conditions experienced in the low-income country research setting lead to specific behavioural patterns of low-income country-based researchers who participate in collaborations with their high-income country counterparts. The high-income country/low-income country collaboration context mirrors the acculturation context in which complex psychological, sociocultural, and economic changes occur amongst people who have developed in one cultural context (their "original" or "heritage" culture) when they attempt to immigrate into a new context that is numerically, socially and politically dominated by the "receiving" or "settlement" culture (Berry, 2001).

Acculturation typically leads to varying levels of mutual adaptation of languages, diets, dressing and social interactions among other aspects of the original and receiving cultures (Berry, 2005). The acculturation literature describes a long-established model of adaptation behaviour that is observed within the non-dominant individuals as the 2 cultures interact (reviewed in Sam & Berry, 2006). The model comprises of four coping strategies namely separation (largely maintaining an individual's culture of origin, with little or no effort to adopt any aspect of the settlement/dominant/receiving culture), assimilation (complete immersion into the dominant/receiving culture), marginalisation (in which individuals choose or are compelled to cut ties with both cultures) and integration (in which non-dominant individuals seek to optimise co-existence of the cultures, linking them through parallel social behaviours).

I note further that numerous studies in the acculturation context show that minority/non-dominant members overwhelmingly prefer to adopt an integration strategy (see Brown & Zagefka's (2011) review) in their interactions with a dominant culture. An integration strategy in that context

has been shown to be not only the most viable (Nesdale & Mak, 2000; Verkuyten, 2005) but also to have the most positive psychological and social adaptation outcomes for individuals from non-dominant cultures (Berry & Sam, 1997; Berry, Phinney, Sam, & Vedder, 2006). For example, it is associated with lower acculturative distress (Scottham &Dias, 2010), higher self-esteem (Wang, Schwartz, & Zamboanga, 2010), more pro-social behaviours (Schwartz, Zamboanga, & Jarvis, 2007), positive workplace well-being (Peeters & Oerlemans, 2009), improved life satisfaction (Pfafferott & Brown, 2006), and reduced likelihood of socially undesirable behaviours (Fosados et al., 2007; Sullivan et al., 2007). Given the dominance of high-income country resources on one hand and the long-term conditioning of low-income country researchers within their local community structures, they will similarly seek, whenever possible, to integrate the key elements of their professional life, at individual, group and task levels with those of the communities in which they are long term citizens.

In an acculturation context, successful integration is greatly influenced by the majority society's preferences for how minority members acculturate into their society (Arends-T´oth & Van de Vijver, 2003; Kunst, Thomsen, Sam, & Berry, 2015) as well as by national policies (Blinder & Richards, 2020; Grigoryev, van de Vijver, & Batkhina, 2018). For example, while minority/non-dominant members generally prefer integration strategies, majority /dominant members have sometimes shown a preference for minority members to assimilate into the majority culture (Arends-T´oth & Van de Vijver, 2003; Van Oudenhoven et al., 1998). In contrast, the high-income country/low-income country collaboration literature suggests a strong preference within the dominant high-income country research community at individual, group, national and global level for collaboration based on the principles of integration. This can be observed in requirements for collaborative projects to demonstrate progressively stronger indicators of local embeddedness such as extended residence of high-income country scientists at low-income country sites, contributions to low-income country equipping, training and mentorship, inclusive practises and adequacy of local funding (Hedt-Gauthier, 2018). These developments are likely to reinforce the preference amongst low-income country-based researchers to adopt an integration strategy.

Anticipating unique integration behaviour in the high-income country/low-income country collaboration context

There are likely to be some conceptual differences between integration behaviour in the acculturation context and in the high-income country/low-income country collaboration context. Acculturation theory deals with situations where the native context is typically much more salient for individuals wishing to acculturate into the dominant culture. Indeed, some naturalised citizens have been shown to distance themselves from their original identities and communities to prove the strength of their

commitment to the host/native community (Just & Anderson, 2015) and/or to identify more with their acquired high status group and distance themselves from their original low-status group (van Veelen et al., 2020). It is unlikely to be mirrored in a setting where low-income country-based researchers are physically located and immersed for the long term in their low-income country setting (notwithstanding its challenges) even as they seek to generate professional benefits within a high-income country dominated group. This context therefore calls for acculturation theory to be extended to cases where individuals are indeed non-dominant, but where their integration into the dominant collaborative in-group might depend, to an extent on meeting their citizenship goals. To study this further, I adopt a model that acknowledges the interaction between dominant and non-dominant acculturation orientations (Bourhis et al., 1997). However, noting the concordance between low-income country and high-income country collaborators in endorsing an integration strategy, I focus on the extent to which the non-dominant low-income country individuals in these collaborations then exhibit a propensity to integrate within these collaborative groups given their experiences of conditions (or lack thereof) that enable realisation of professional and community benefits of research. I name this propensity integration orientation.

Hypotheses

Enablers of research benefits

Low-income country-based researchers' unique individual attributes, as well as conditions they encounter in collaborations at the group, task and community levels are likely to trigger various responses to the unique opportunities and challenges that they face and thus, their propensity to integrate within their collaborative groups, which I identify as integration orientation. I developed formal hypotheses that reflect these various conditions.

Demographic and historical enablers of integration orientation

In the acculturation context, the time spent living in a new society is one of the most significant predictors of successful adaptation (Beck, Corak & Tienda, 2012) and increased preference for integration (Ho, 1995; Berry, Phinney, Sam, & Vedder, 2006). The ability to integrate is further enhanced if migrants have the necessary pre-acculturation experiences (such as knowledge of the host country language and a suitable education) which ease their integration within the dominant group (Berry, 2005). Similarly, age and time spent as an active member of the research community is likely to predict biomedical research productivity (Falagas, Ierodiakonou, & Alexiou, 2008) as is level of education (since biomedical research is primarily of an academic nature). Thus:

H1: Low-income country collaborators whose demographic and historical attributes (age, collaboration history and academic qualifications) are enablers of benefits from collaborative research will have higher levels of integration orientation than those who lack those attributes

Group- level enablers of integration orientation

The collaborative group comprising of low-income country-based and high-income country-based researchers is the primary social context for collaborative research. As such it is the context for individuals' experiences of the socio-psychological conditions of collaborative research. In the acculturation setting, factors such as family life, ability to make friends (Kaufmann, L. 2021; Yoo, 2021) and social support (Ng, Wang & Chan, 2017) provide mechanisms through which an individual appraises changes associated with acculturation negatively (as problems) or positively (as opportunities) which can ease their integration into the dominant social group (Berry, 2005). Individuals may also face barriers to integration ranging from objective barriers such as competition and non/availability of social networks as well as subjective barriers such as prejudice, lack of social capital and information sources, unfamiliarity with the settlement culture and lack of settlement resources (Heilbrunn, Kushnirovich & Zeltzer-Zubida, 2010). Indeed, recent scholarship has placed a greater burden for determining acculturation outcomes on receiving societies, because they control significant enablers and barriers to acculturation (such as discrimination, language barriers, and social support) (Bierwiaczonek & Kunst, 2021). Similar social enablers and barriers are likely to influence the integration orientation of low-income country-based researchers into collaborative groups that are dominated by their high-income country counterparts. Specifically, a low-income collaborator's access to his/her collaborative group's resources are likely to be influenced by his/her previous relationships with his/her/their collaborative group, leadership roles he/she assumes within the group, the quality of and frequency of interaction and the overall quality of leadership within the group. Thus:

H2: Low-income country collaborators who experience group conditions (role in group, frequency of interaction, the extent to which their contributions are taken seriously, and quality of group leadership) that enable benefits of collaborative research will have higher levels of integration orientation than those who do not

Task-level enablers of integration

I considered that task-level enablers relate to the core competencies of researchers and are therefore more likely to trigger higher levels of integration orientation than group-level, demographic or historical enablers which, while important, do not relate directly to individual affirmation of self-efficacy in research. The acculturation literature clearly describes a mismatch between the abilities

and experience of skilled migrants (typically those with at least a tertiary degree) and their professional outcomes in the host/receiving society (Hajro et al., 2019). Skilled migrants often have education and skills that are comparable to natives but are often perceived as having low quality education and being low-skilled and low status (Zikic, 2015) They are often paid less, compelled to work in worse conditions and have less job security (Hajro et al., 2019). These challenges are particularly compounded when migrants self-initiate their movement from a low-income country to settle and work for the long term in a high-income country without any guarantees of organisational or social support. ((Dietz et al., 2015). These conditions are mirrored in the global health setting, where low-income country health science professionals aspiring to develop a career in research make a long-term commitment to work in an environment that is dominated by their high-income country collaborators, with limited organisational and social support. This is evident in collaborative research work which is often implemented through projects; unique time-bound, interconnected tasks which are set out in a plan, then progressively re-calibrated to achieve the intended objectives relatively free of formal organisational structures (Chiocchio, et al., 2012). Low-income country researchers are often excluded from full involvement in the planning of collaborative projects and this not only sets a tone for other devalued roles across the rest of the collaborative project cycle but further disadvantages them when decisions on appropriate remuneration are made. Thus:

H3: Low-income country collaborators who experience task-level conditions (involvement in research conceptualisation and design, appropriate implementation role assignment and fair remuneration) that enable benefits of collaborative research will have higher levels of integration orientation than those whose do not

Focusing on the "causes of the causes": community-level enablers of integration

The lack of fulfilling roles in the early stages of collaboration sets the stage for less technical depth and local relevance in downstream implementation (Ager & Zarowksy, 2015) which is the core of researchers' professional research competence. Since the research is implemented within a community and organisational setting where these individuals are held in high esteem, non-reinforcement of their ability to contribute to broader community goals may lead to a sense of social injustice that colours their collaboration experience. I juxtaposed that setting with recent developments in the acculturation literature that point to a gap arising from a focus on individual and group level determinants of acculturation such as psychological, behavioural, and interpersonal/interpersonal/intergroup processes, at the expense of the social conditions which lie at the root of acculturation outcomes- the "cause of the causes" (Szabo, 2022). These developments have led to calls for a deeper look at immigrants' lifelong "accumulation of disadvantage" (p.1) due to limited access to resources, coupled with repeated exposure to adversity (Szabo,2022). These conditions predict more negative socio-economic outcomes for immigrants compared to their non-

immigrant peers over their life course even though these may be mitigated by individual and psycho-social factors (Klokgieters, van Tilburg, Deeg, & Huisman, 2020; Liversage & Jakobsen, 2016). I argue that this has parallels with the high-income country-low-income country collaboration setting, where individual low-income country-based researchers in collaborations attach great importance to stakeholder involvement as well as local social, economic and policy impact and relevance of research alongside the traditional indicators of rigour and novelty (Tijssen & Kraemer-Mbula, 2018). This is likely to make them more acutely aware of the tendency to invest in their "lone researcher" status (Ager & Zarowsky, 2015, p. 5) rather than in commitments to community and organisational structures that sustain their research ecosystem for the longer term (Ager & Zarowsky, 2015; Davies & Mullan, 2016). I draw on these parallels to argue first that commitments to task-level and community-level enablers, unlike individual and group enablers are most directly within specific collaborative groups' decision-making power (for example with regard to resource allocation). Second, I argue that even though collaborative groups may boost low-income country individuals' sense of competence through task-level enablers, these individuals' experience of benefits to the communities in which they are located/embedded for the long term is likely to be the most significant determinant of their integration outcomes. Thus:

H4: Low-income country collaborators who experience more community-level enablers of research benefits will exhibit higher levels of integration orientation than those who experience task level enablers of research benefits

The effect of individual project-specific research outcomes on integration orientation

Researchers are subject to a work, reward and career progression structure that is broadly determined by individual credit for research leadership (Bol, de Vaan & van de Rijt, 2018), productivity and impact (McKiernan et al., 2019). The current study's setting is particularly suitable for measuring individual outcomes because while scientific research is increasingly done collaboratively, rewards are perceived to accrue primarily at individual level (Kennedy, 2003). Regardless of their experience of the various enablers of research benefits, low-income country researchers' propensity to integrate within collaborative research groups and their preference for continued collaboration with high-income country peers will be influenced by the final individual outcomes (authorship and dissemination opportunities) of specific collaborative projects they are involved in. Thus:

H5: Individual research outcomes of low-income country researchers (authorship and dissemination) are predictors of both individual integration orientation and preference for continued collaboration with high-income country researchers

Methods

Empirical context: Biomedical research collaborations in Uganda

The current study was conducted in Uganda. Uganda is classified by the World Bank as a low-income country, typically appearing in the fifteen lowest ranked African countries by GDP (World Bank, 2021). Since economic status is generally a predictor of scientific research output, Uganda's relatively low GDP does not intuitively match its consistent ranking amongst the ten countries in Africa with the highest biomedical research output (as measured by publications) and third-highest ranking in clinical trial activity (Xu, Boggio & Ballabeni, 2014). Given its low resource environment, it is not surprising that almost 90% of Uganda's relatively high biomedical research output results from high-income country resources (Brar et al., 2010). Thus, it offers a particularly apt context in which to study the outcomes of inequalities between low-income country-based biomedical researchers and their high-income country counterparts.

Sample

The study sample was drawn from the Uganda National Council for Science and Technology (UNCST) database. It is a legal requirement for all persons and organisations carrying out systematic investigations of any form in Uganda to seek final ethical approval from the UNCST. UNCST guidelines require all international collaborative research projects to have at least one local competent co-principal investigator, so evidence could be obtained of the entire population of active researchers in a low-income country setting. UNCST records were only partially digitalised, so three research assistants were stationed at the UNCST offices for three months to manually compile data. This data was combined with the available electronic data to create a full list of all health sciences researchers who were registered as active by UNCST over the last five years. I generated a cumulative list of 12,772 individual entries of key participants in projects across all research areas in the UNCST database over the last five years. The total number of health sciences researchers recorded was 6,033 representing 47% of the cumulative number of active individual researcher entries (77% of researchers in the "hard" sciences).

The sampling frame represented all researchers who have conducted a health research project in Uganda over the last five years. A five-year period was validated by asking the question "how long is/was your current or latest project?" to which less than 3% of respondents responded with a period more than 5 years. Questions on collaborative research projects are likely to be highly salient professional life events for low-income country-based researchers, which trigger accurate recall over a relatively long period (Beckett et al., 2001). Out of 6,033 cumulative entries, 4,324 were for health science researchers working on various projects. Out of this number, I eliminated multiple entries of the same individual over different projects and identified a population of 1,873 unique health science

researchers. I checked this list against another list of Ugandan health science researchers generated from clinicaltrials.gov, one of the largest publicly available databases of global clinical trials and found that the UNCST database was much more comprehensive for purposes of the study.

The names, organisational affiliations and contacts of all 1,873 potential respondents were listed in alphabetical order in an Excel sheet tracker. To maximise response rates, I attempted to reach each individual telephonically to request his/her co-operation and (where necessary) to obtain updated e-mail addresses before sending out the link to the online survey. I was able to reach 728 individuals telephonically (representing my sample frame) and to send them e-mails with links to a Google Forms online questionnaire. The other phone numbers were incomplete or inaccurate, no longer valid or individuals did not take calls after two or three tries separated by a period of about one month. Data gathering was conducted during the COVID pandemic when many health practitioners were extremely busy but this balanced out with the fact that many had no regular teaching duties. Teaching duties are common for health researchers because they tend to have parallel academic and clinical positions.

Two reminder emails were sent one month apart if the first e-mail failed to generate a response. Response status of all individuals in the population were tracked using an Excel sheet. The tracker was updated daily after checking the online Google Forms database to confirm which-individuals had responded, which ones had deferred or declined and (where necessary) to include new contact details and/or to indicate a target date for the next call or e-mail. I used Yamane's (1967) method for sample size calculation for cross-sectional studies where sampling is from a finite population, stated as n= N/ (1+N (e) 2) giving a minimum sample size of 363 respondents. Survey progress was tracked in detail up to the point when a sample of more than 500 responses was achieved (after about 3 months).

Screening questions were used to confirm respondents' eligibility and to obtain informed consent before proceeding to the main survey. Where respondents did not fit the inclusion criteria or declined to participate, the survey terminated with the appropriate message. A total of 1,873 unique Ugandan health sciences researchers were identified in the UNCST database. I reached 728 (39%) of these by phone and subsequently sent them e-mails with links to the survey. I received 532 complete responses, representing 73% of the sample and equating to 28% of the population of active Ugandan health science researchers. This represents a very high response rate that engenders confidence in the findings

Measures

Demographic attributes and historical experience of respondents

The first section of the study instrument captured individual demographic attributes of respondents. Seven items captured demographic attributes such as age, gender, education and previous research and collaboration experience.

Items representing group-level conditions experienced by individual low-income country-based researchers

Ten items captured the nature and period of existence of each respondent's current/latest collaborative research project group and its attributes including scientific leadership roles within the group, nature, and quality of interactions with other members of the group and quality of group leadership. These items equate to measures of socio-psychological conditions in the current or latest high-income country-low-income country collaboration group that individuals were involved with. These items therefore measured the potential to generate benefits from accessing collaborative group resources.

Items measuring inequality in high-income country/low-income country research collaborations

Measures of structural inequality in the literature predominantly address differences in economic rewards and attributes (such as income, wealth, and health) between nations, groups or individuals based on demographic characteristics such as race, gender, class and nationality (Firebaugh, 1999; Schultz, 1998; Milanovic & Yitzhaki , 2002). This study's view of structural inequality is much more through the lens of work group structures and social conditions that may both perpetuate and result in inequitable outcomes *in the workplace domain*. Thus, this study adopted measures from the broader workplace and equity literature rather than from extant structural inequality literature.

Within this body of literature, several scales exist to measure aspects of individual experiences of inequality in the workplace, notably the workplace status scale (Djurdjevic et al., 2017) and various workplace justice and fairness scales ably reviewed by Colquitt and Rodell (2015). While these address workplace equitability and fairness to an extent, the only scale I found that was specifically aimed at measuring individuals' experience of workplace inequality was van der Werf's (2019) Workplace Inequality Scale (WIS). The WIS combines aspects of organisational justice with individual experiences of broader group structural, organisational, individual and interpersonal outcomes. These aspects are appropriate for the study setting where the workplace comprises of relatively loose multi-country, multi-organisational workgroups formed to implement specific research projects. It provides a parsimonious but comprehensive scale for perceived workplace inequality and is rigorously validated. I thus adopted it to measure low-income country-based researchers' experience of inequality in workplace collaborations with high-income country-based researchers.

Van der Werf (2019) conceptualises workplace inequality as an attitude towards the distribution of resources on the one hand being “aspects of the work context such as pay, time, decision-making power, equipment, friendship, information or status that help people to meet their personal and work-related needs” (p. 266) among others that may be relevant to a specific workplace. On the other hand, it involves the distribution of demands which are “aspects of the work context that require ongoing mental, emotional, or physical effort” (p. 267) and might include physical labour, solving difficult problems, frequent interruptions, interpersonal conflict, poor supervision, time pressure and similar factors that are relevant to a specific workplace (van der Werf, 2019).

The instrument uses six items to measure aspects of how an individual experiences workplace inequality along a seven-point scale (1=strongly disagree, 7=strongly agree). For this study, four items were generated to describe conditions of inequality identified from the literature across each of eight elements of the cycle of active collaboration with high-income researchers ranging from research conceptualisation and design to dissemination (totalling to 32 items).

12 out of the 32 items measuring inequality represented the respondent’s self-reported experience of benefits that accrue/accrued from task-related conditions that underlie their involvement in collaborative research relative to those experienced by their high-income country collaborators. These include involvement in research conceptualisation and design (4 items), role assignment (4 items) and the resulting remuneration rates (4 items)

Another twelve items represented individual low-income country-based researchers’ views on the extent to which they experienced inequality with respect to how their collaborative group interacted with their local social structures. These items measured organisational benefits (4 items), community benefits (4 items) and respect for their local professional, ethics and cultural standards (4 items). I argue that these represent conditions that do not explicitly benefit low-income country-based researchers’ individual professional growth but promote the interests of their local stakeholders and the communities in which their research is located. I refer to the propensity amongst individuals to value and promote these conditions as research citizenship.

Eight items represented respondents’ self-reported key outcomes from research, which largely occur within the conclusion stage of the collaboration cycle and include, authorship positions (4 items) and dissemination practices (4 items).

Items representing individual expectations of the continuing benefits of collaboration

The last section had 9 items that measured expected benefits from 3 potential post-project collaboration trajectories; collaboration only with researchers based in local low-income country

organisations, continued collaboration with researchers based in high-income country organisations or seeking to do research work primarily as an independent, non-affiliated researcher.

The final scale for the current study therefore had 32 items to measure inequality in collaboration and another 9 items to represent possible collaboration choices following the conclusion of the current/latest collaboration project that individuals were involved with, bringing the total number of items measuring independent variables to 41 items.

Measures of integration

The study's dependent variables primarily measured the level of individual integration. I referred to a model that is widely used in the acculturation literature to study coping behaviour of non-dominant individuals and adapted its measures of integration to study individual low-income country behaviour in research groups characterised by structural inequality. I specifically consulted Celenk & Vijver's (2011; 2014) systematic review of over 25 available acculturation instruments. The review has checklists to guide researchers and policy makers on the appropriate use of each instrument. I selected the Acculturation Attitudes Scale (non-dominant group version) (Berry, 2010) as recommended by the review for the type of questions that I sought to answer. My selection of this scale was thus based on its recency, reliability, question types (4 statement items with Likert scales), inclusion of acculturation orientation measures, preference for measuring socio-cultural outcomes and a bidimensional conceptual base (which leads to a four-strategy matrix consistent with the literature review). The items in the scale were modified to suit the study context and research questions. Unlike the other sections, respondents to this section of the questionnaire included both low-income country-based researchers who had ever collaborated with high-income country-based researchers and those who had never collaborated with them. Non-collaborators nonetheless expressed views based on their perceptions formed outside the collaboration experience, that placed them into one of the four coping strategies thus constituting a control group.

Four items were adopted to represent an integration strategy. A midpoint split procedure was adopted to identify integrators following a recommendation by Arends-T´oth & van de Vijver (2006) that it has a more robust theoretical basis, notwithstanding the lack of consensus on how to resolve any emergent ambiguities. Participants were grouped into integrators and non-integrators considering the midpoint cut off score so that those with a score ≤12 were classified as non-integrators and those with >12 were classified as integrators after factoring in the disjoint element between integration and other forms of acculturation (marginalisation, separation and assimilation).

Final questionnaire design elements

I added a section at the end of the questionnaire that asked participants "Is there anything else about your experience of research collaborations with high-income country organisations that you would like to add?". Their comments provided rich qualitative insights into key aspects of their experience and their overarching views. I identified twelve randomly selected researchers to review the questionnaire for relevance, appropriateness and time commitment. I randomly selected another group of ten colleagues from my organisation to test the online version for functionality. These aspects triggered only minor changes to the questionnaire. Finally, a pilot study was conducted using a population of 38 Natural Sciences researchers. This generated twenty full responses. Preliminary analysis was performed on the data collected at this stage, including performance of reliability tests using Cronbach's alpha (α). Computations for the reliability were done using Stata Version 14. Cronbach's alpha (0.95) was relatively high, so it was concluded that the data collection tool holds reliable questions in both form and flow for the study. However, following my observation that questions seemed to prime participants to respond negatively I rephrased questions to capture a wider range of responses from negative to neutral to positive.

Data analysis

Descriptive statistics were generated using frequencies and percentages for categorical variables and means or medians, standard deviations and inter-quartile ranges for continuous variables. A bivariate analysis was conducted using Fishers and Pearson chi- square tests and Wilcoxon rank sum tests. A bivariate logistic regression model was used to assess for associations between participants' individual level enablers, group level enablers, task enablers, and community-level enablers and integration orientation. Variables with a p-value of <0.3 of the unadjusted odds ratio were further analysed at multivariable logistic regression level to find out factors that are significantly associated with integration orientation among low-income country-based researchers. Analysis was performed using Stata version 15.0 (StataCorp, College Station, Texas, USA).

Table 7: Demographic attributes and collaboration history of respondents

	Non-integrator (N = 87)	Integrator (N = 402)	Total (N = 489)	p-value
Age (in complete years)				0.761[β]
Mean (SD)	42 (9)	42 (9)	42 (9)	
Years spent as a researcher				0.765[μ]
Median (Q1, Q3)	11 (6, 15)	11 (7, 15)	11 (7, 15)	
Gender				0.857*

Female	32 (36.8%)	152 (37.8%)	184 (37.6%)	
Male	55 (63.2%)	250 (62.2%)	305 (62.4%)	
Age (in complete years)				0.681**
less than 35 years	15 (17.2%)	81 (20.1%)	96 (19.6%)	
35 to 60 years	70 (80.5%)	307 (76.4%)	377 (77.1%)	
61 and above years	2 (2.3%)	14 (3.5%)	16 (3.3%)	
Highest completed academic qualification				**0.222***
Bachelors degree	10 (11.6%)	26 (6.5%)	36 (7.4%)	
Doctorate	26 (30.2%)	122 (30.3%)	148 (30.3%)	
Masters degree	50 (58.1%)	254 (63.2%)	304 (62.3%)	
Years in collaboration				0.486$^{\mu}$
Median (Q1, Q3)	5 (2, 10)	5 (2, 10)	5 (2, 10)	
Number of low-income country-high-income country collaborations				0.987$^{\mu}$
Median (Q1, Q3)	2 (1, 5)	2 (1, 4)	2 (1, 4)	

***SD**= Standard deviation; (**Q1, Q3**): interquartile range*

***β** comparison done using t- test for independent samples*

***μ** comparison done using Wilcoxon ranksum test for differences in medians*

*** comparison done using Pearson chi-square test*

**** comparison done using fisher's exact chi-square test*

Findings

Descriptive Statistics

The data analysed for this study relates to 489 respondents (92% of the total of 532 respondents) who had been in a collaboration with researchers from organisations in high-income countries in the last five years and thus had recent first-hand experience of the conditions in such collaborations (as opposed to perceptions or observations). Details of descriptive data are shown in Table 3.

There is relative workplace equality between low-income country-based and high-income country-based researchers in collaborative research

Low-income country-based researchers' self-reported experience of inequality was measured using a 7-point workplace inequality scale (WIS) adapted from Van der werf (2019) and applied to 8 sub-themes, each having 4 items. Factor analysis was conducted on each of the subthemes to generate a factor that would best describe each of the 4 items that measured inequality for each of the 8 sub-themes. All items loaded well on all the factors implying that all items under a given sub-theme were strongly correlated with that sub-theme ($\lambda>0.75$). There was a strong correlation between the underlying/identified factor per sub-theme and the average score of the 4 items in each sub-theme. Because of this, the average score per sub-theme was grouped into three categories of equality: "significantly worse", "relatively equal" and "significantly better". Respondents broadly experienced

relative equality across the 8 sub- themes, with only specific items such as role assignment, remuneration, and realisation of benefits to local organisations being relative exceptions.

Integration behaviour was adopted by the majority of respondents

The preliminary analysis showed that an integration strategy was adopted by 82.2% (402/489) of respondents demonstrating that the integration strategy was dominant across all low-income country-based researchers.

My analysis at a bivariate level showed that low-income country-based researchers predominantly preferred to integrate within the collaboration group, with 402 (82%) of respondents exhibiting an integration orientation. A larger percentage of respondents with doctorate degrees were integrators than those with Bachelors and Masters degrees. At the bivariate analysis stage there was no other major difference in integration orientation patterns across demographics (age, gender, highest academic qualification) and previous collaboration history.

Enablers of integration orientation of low-income country researchers in collaborative groups

Self-reported nature and quality of low-income country-based researchers' experiences across the collaboration cycle from foundation through to their research outcomes at the conclusion of a specific project was measured against integration orientation outcomes. Table 1 below shows the results of the multivariate regression of variables determining integration orientation outcomes.

Table 8: Bivariate and Logistic regression estimates of factors associated with integration orientation

Participants' characteristics	Non-integrator (n=87)	Integrator (n=402)	P value	Un adjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
Individual-level demographics and collaboration history							
Gender							
Male	55 (18.0%)	250 (82.0%)	0.857*	1			
Female	32 (17.4%)	152 (82.6%)		0.96(0.59-1.55)	0.857	0.87(0.52-1.44)	0.585
Age (in complete years)							.
less than 35 years	15 (15.6%)	81 (84.4%)	0.681**	1			
35 to 60 years	70 (18.6%)	307 (81.4%)		0.81(0.44-1.49)	0.503	0.49(0.24-1.01)	0.055
61 and above years	2 (12.5%)	14 (87.5%)		1.3(0.27-6.3)	0.748	0.59(0.11-3.14)	0.537

Highest completed qualification							.
Bachelor's degree	10 (27.8%)	26 (72.2%)	0.222*	1			
Master's degree	50 (16.4%)	254 (83.6%)		1.8(0.78-4.19)	0.17	2.29(0.86-6.06)	0.096
Doctorate degree	26 (17.6%)	122 (82.4%)		1.95(0.89-4.3)	0.096	2.5(1.04-6)	0.04
Years of collaboration							
Median (Q1, Q3)	5 (2, 10)	5 (2, 10)	0.486µ				.
Period in research							
1-9 years	34 (19.3%)	142 (80.7%)	0.806*	1			
10-19	40 (16.8%)	198 (83.2%)		1.19(0.71-1.96)	0.51		
>=20 years	13 (17.3%)	62 (82.7%)		1.14(0.56-2.31)	0.71		
Number of LIC-HIC collaborations participated in							
Short experience of collaboration (<5)	58 (22.3%)	202 (77.7%)	**0.023***	1			
Moderate experience of collaboration (5-10)	20 (12.9%)	135 (87.1%)		1.94(1.15-3.37)	**0.019**	1.99(1.12-3.54)	**0.02**
Long experience of collaboration (>10)	9 (12.2%)	65 (87.8%)		2.07(0.97-4.42)	0.059	2.02(0.92-4.46)	0.082

Experience of group-level enablers							
Role in most recent research group							
Other roles	57 (20.7%)	218 (79.3%)	0.054*				
PI/Co-PI	30 (14.0%)	184 (86.0%)		1.6(0.99-2.6)	0.056	1.42(0.83-2.41)	0.197
Frequency of electronic meetings							
Daily/weekly	33 (19.6%)	135 (80.4%)	0.555*				
Monthly/twice a month	45 (17.6%)	210 (82.4%)		1.14(0.69-1.88)	0.605		
Less than once monthly	9 (13.6%)	57 (86.4%)		1.55(0.7-3.44)	0.284		
Frequency of routine physical meetings			0.358**				
Daily/weekly	19 (22.1%)	67 (77.9%)					
Monthly/twice a month	35 (18.6%)	153 (81.4%)		1.24(0.66-2.32)	0.503		
Less than once monthly	33 (15.3%)	182 (84.7%)		1.56(0.83-2.94)	0.164		
Contributions to meetings are/were taken seriously							
Never	0 (0.0%)	2 (100.0%)	0.931**				

Almost always/Frequently	25 (17.4%)	119 (82.6%)					
Occasionally/seldom	62 (18.1%)	281 (81.9%)					
Group leadership in achievement of objectives							
Poor/bad	7 (50.0%)	7 (50.0%)	**0.001***				
Fair/Good	80 (16.8%)	395 (83.2%)		4.94(1.69-14.56)	0.004	2.94(0.97-9.92)	0.083
Experience of task-level enablers of collaboration							
Research Conceptualization & Design							
Significantly worse	37 (18.1%)	167 (81.9%)	0.861*	1			
Relatively equal	43 (18.1%)	195 (81.9%)		1.01(0.62-1.63)	0.985		
Significantly better	7 (14.9%)	40 (85.1%)		1.27(0.53-3.05)	0.599		
Role assignment			0.317				
Significantly worse	49 (15.9%)	260 (84.1%)		1			
Relatively equal	35 (21.5%)	128 (78.5%)		0.69(0.43-1.12)	0.131		
Significantly better	3 (17.6%)	14 (82.4%)		0.88(0.24-3.18)	0.845		
Remuneration							
Significantly worse	69 (17.9%)	316 (82.1%)	0.809				
Relatively equal	17 (18.1%)	77 (81.9%)		0.99(0.55-1.78)	0.971		
Significantly better	1 (10.0%)	9 (90.0%)		1.97(0.24-15.77)	0.525		
Experience of local organisation and community enablers of collaboration							
Local organisation benefits							
Significantly worse	53 (16.7%)	265 (83.3%)	0.663				
Relatively equal	28 (20.1%)	111 (79.9%)		0.79(0.48-1.32)	0.371		
Significantly better	6 (18.8%)	26 (81.3%)		0.87(0.34-2.21)	0.764		
Benefits to the local community							
Significantly worse	30 (25.6%)	87 (74.4%)	**0.016***				
Relatively equal	36 (17.7%)	167 (82.3%)		1.6(0.92-2.77)	0.094	1.49(0.78-2.83)	0.227
Significantly better	21 (12.4%)	148 (87.6%)		2.43(1.31-4.51)	**0.005**	2.38(1.13-5)	**0.022**
Respect for local Professional, ethical and cultural standards							

Significantly worse	23 (24.2%)	72 (75.8%)	0.147				
Relatively equal	49 (15.6%)	266 (84.4%)		1.73(0.99-3.03)	0.054	1.19(0.6-2.38)	0.615
Significantly better	15 (19.0%)	64 (81.0%)		1.36(0.66-2.84)	0.407	0.75(0.31-1.83)	0.524

Experience of individual outcomes of collaboration							
Authorship							
Significantly worse	44 (19.8%)	178 (80.2%)	0.373				
Relatively equal	36 (15.3%)	199 (84.7%)		1.37(0.84-2.22)	0.207		
Significantly better	7 (21.9%)	25 (78.1%)		0.88(0.36-2.17)	0.786		
Dissemination							
Significantly worse	36 (20.8%)	137 (79.2%)	0.316				
Relatively equal	43 (17.0%)	210 (83.0%)		1.28(0.78-2.1)	0.321		
Significantly better	8 (12.7%)	55 (87.3%)		1.81(0.79-4.13)	0.161		
Preferred primary post-project collaboration status							
Local collaborations only	16 (23.2%)	53 (76.8%)	0.172**				
Continued collaboration with HIC researchers	68 (17.7%)	316 (82.3%)					
Independent/consultant research	3 (8.3%)	33 (91.7%)					

*(**Q1, Q3**): interquartile range*

µ *comparison done using Wilcoxon ranksum test for differences in medians*

***** *comparison done using Pearson chi-square test*

****** *comparison done using fisher's exact chi-square test*

Integration orientation broadly increases with more collaboration experiences

The most significant individual demographic or historical attribute in predicting integration of low-income country researchers within research groups in which they collaborate with high-income country-based researchers is the number of collaborations in which individuals have participated. Respondents with doctorate degrees tended to have a greater propensity to integrate but this was not surprising, given the predominantly academic nature of biomedical research in this setting.

There was also a positive correlation between the middle-age bracket of 35 to 60 and integration orientation. This generally falls within the age bracket that is most productive for biomedical researchers even in other settings (National Institutes of Health, 2016) but some age-specific differences were noted in the comments section. For example, an overwhelmingly large number of

younger researchers faulted low-income country-based senior researchers for having little interest in building their capacity relative to their high-income country-based counterparts - or even actively blocking their progress. In contrast with previous research which suggests that senior low-income country-based researchers generally strive to mentor their junior colleagues (Paina et al., 2013), I noted ccomments like “high-income country mentors give very good one on one mentorship than most low-income country researchers” (42-year-old male), “Research supervisors / monitors from high income countries are more committed and better to work with” (37-year-old female), “Most of the local researchers (local PIs) rarely mind about the career of the early career researchers (32 year old male)” and ‘’They (high-income country-based researchers) are very helpful… they meet the time and respond in time unlike the low-income country” (45-year old male), and “Fewer local than high-income country collaborators are willing to mentor their juniors (37, male). Such comments were particularly common in the age bracket up to 40. There were also calls for senior researchers to help early career researchers in navigating power inequalities while negotiating terms with high-income country-based collaborators. Older, more senior researchers on the other hand expressed more concern about technological and equipment transfer with comments like “low level of access to state of the art equipment is a hindrance to my ultimate choice of topics” (59-year-old female) and “funders (are) not interested in purchase of capital equipment, so no capacity is built in some critical analytical procedures” (from a 58-year-old female). Remarkably, senior low-income country-based researchers did not mention institutionalised research and leadership mentorship opportunities for younger researchers as an overarching high priority for redressing inequalities.

Length of research career and length of collaboration history in years (as opposed to number of collaborations) did not have a significant effect on integration orientation. Thus, H1 was partially supported with age, academic qualifications and number of previous collaborations proving to be the more significant individual demographic and/or historical predictors of integration orientation.

Group-level enablers have minimal effect on integration

Overall, low-income country researchers’ group-level experience did not predict integration orientation. The most notable group-level enabler associated with integration orientation was the quality of collaborative group leadership with individuals who experienced good or fair leadership being almost 3 times more likely to integrate than those who found it to be poor (OR= 2.94; p-value=0.083). Similarly, low-income country researchers with the research group leadership designation of Principal Investigator (PI) or Co-Principal Investigator were 40% more likely to integrate than those without the PI/Co-PI designation (OR= 1.42; p-value= 0.197) but both these relationships were not statistically significant. Thus, H2 was not supported.

Role assignment is the task-level enabler that is most associated with integration orientation

Task-level enablers of integration orientation measured included substantial involvement in research conceptualisation and design, assignment of a suitable research implementation role, and commensurate remuneration. Of these, equality in role assignment was the most associated with integration orientation but the association was not statistically significant (p-value=0.131). Thus, H3 was not supported.

Community-level enablers are the most significantly associated with integration orientation

The most significant variable associated with integration orientation was low-income country-based researchers' experiences regarding how much their communities benefitted from their projects relative to high-income country collaborators' communities and stakeholders. Low-income country-based researchers who had a better experience of benefits flowing to their communities from collaborative research work were more than twice as likely to integrate than their counterparts who had a significantly unequal experience (OR=2.38; p value=0.022). Similarly, those with an equal experience were more likely to integrate but this association was not statistically significant (OR=1.49; p-value=0.227). There was no association between integration orientation and experience of equality amongst low income collaborators regarding respect for local structures, standards and norms (OR=1.19; p-value= 0.615) or equality in securing organisational benefits. Respondents' comments pointed to a general acknowledgement that sensitivity to such local benefits had improved greatly over time with one respondent commenting that "Unlike in the past, there are now regulatory bodies that try to ensure that the collaborations are beneficial to the low-income country partners as well. (37 yrs, male, Masters)". Other comments highlighted transparency, equitable agreements, prioritisation of locally relevant research agendas and acknowledgement of and respect for, local abilities and skills as particularly important areas for collaborations to address. Ethical conduct of research (including appropriate safety measures) was pointed out both as an important area and as one which most collaborative groups tended to give a lot of attention. On the other hand, respecting and strengthening long term local organisational, infrastructural and human capacity (for example for analytical work to be localised) was noted to be a recurring, salient gap. Thus, H4 was supported proving that local community-level enablers were the variables that were most significantly associated with integration orientation far outstripping the experience of task-related enablers and indeed, any other enablers.

Individual low-income country researchers' outcomes from individual projects (publication and dissemination) have minimal effect on integration orientation but they are associated with continued collaboration with high-income country researchers

I considered that the key tangible individual outputs at the conclusion of a specific research project, would be authorship and dissemination opportunities since they signify ownership of the results and define the scholarly contribution to the research community regardless of individual researcher experiences. H5 thus hypothesised that these outputs would be significantly associated with both integration orientation and a preference for continued collaboration. My analysis found no association between these research outputs and integration behaviour outcomes. I then measured the association between research outputs and the perceived professional benefits of continued collaboration with high-income country researchers compared with non-collaboration. Such benefits included control over career decisions, access to research resources, consistent availability of work and less stakeholder pressure. I found an association between a preference for continued collaboration and both better authorship outcomes ($p=0.037$) and better dissemination outcomes ($p=0.014$). Thus, low-income country researchers who had good research outcomes from their latest/current projects perceived benefits of future collaboration with high-income country peers to outweigh those that they would secure from collaborating only with local researchers or opting to be non-affiliated, independent researchers. My analysis therefore partially supported H5, finding that there was an association between research outputs and the preference for continued collaboration with high-income country researchers, but not between research outputs and integration orientation .Though not formally hypothesised, the analysis further found a significant association between individuals' experience relating to research outputs and their experience of both positive task and community enablers when measured collectively.

Discussion

As expected, given the interdependence between their professional and research citizenship roles, the great majority of low-income country-based researchers adopted an integration strategy within unequal collaborations with high-income country-based researchers across all demographics, group characteristics and types of research. However, levels of integration orientation varied.

The first formally predicted relationship between individual-level demographic attributes and historical experience with collaboration (being age and educational level, length of collaboration history in years and number of collaborations participated in) and integration orientation for low-income country-based researchers was partially confirmed. However, across the variables of age,

academic qualifications and length of collaboration history, which tend to represent seniority in research, there was tendency for the middle measures to translate into greater integration orientation. For example, the low-income country-based researchers I surveyed had been active researchers for periods ranging from 1 year to 50 years. I anticipated that older, more experienced researchers who were exposed to extremely unequal conditions at the beginning of their careers would experience these changes more positively than younger, early career researchers who started their collaborative work in conditions of relatively greater equality. Contrary to my expectations, older age predicted integration orientation only up to the 35-60 age bracket, after which it declined. This may be because researchers in that age group generally tend to be the most active and productive. However, it may also be at least partially due to disillusionment for more senior researchers, regarding their experience of individual and societal outcomes from collaborations, regardless of their experience of various enablers so that their propensity to integrate plateaus and/or declines over time. By contrast, participating in a higher number of collaborations was consistently associated with integration behaviour, implying that it is not how many years individuals have participated in collaborative research, or indeed their seniority overall but rather how many actual collaborations they have participated in that enable a more consistent positive collaboration experience.

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H2 predicted that group-level enablers (specifically the extent to which an individual is assigned a group leadership/PI role, the frequency of interaction and the quality of group leadership (measured through the extent which it is perceived to support successfully meeting group objectives) would engender an integration orientation. This was not supported by my analysis. However, a strong association was found between the quality of group leadership and integration orientation. I suggest that this is important in as far as a credible leader in a research environment represents professional recognition which the entire group benefits from, but that this is less significant for individual integration of low-income country collaborators. Notably, 214 (43%) of low- income country collaborators had the key research group leadership designation of Principal Investigator (PI) or Co-Principal investigator (co-PI) though this was not significantly associated with integration orientation ($p=0.197$). These conditions support literature that suggests that group-level enablers represent relational factors that have been better addressed in recent times. This might explain why they are not typically experienced as particularly advantageous for professional achievement relative to other enablers and thus, they might not necessarily trigger better integration behaviour even when they create a more positive group environment.

H3 predicted that individuals who experienced task-level enablers of rewarding research were more likely to integrate within collaborative research groups. This was not supported as expected given the assumed importance of involvement in research conceptualisation and design, role assignment and appropriate remuneration in reinforcing a self-perception of research competency. However, I

identified role assignment as the most significant task-level enabler of collaborative research for individual low-income country researchers. I suggest that this is because of its foundational contribution in establishing the relevance and competency of the individual at the formulation stage of the research, which positions him/her to play more meaningful roles across the rest of the collaborative research implementation cycle.

As predicted by H4, I found that low-income country-based researchers' integration orientation was more associated with their experience of inequality in their local community outcomes than with their experience of task-related inequalities or any other inequalities in the collaboration research cycle. This reflects what I identified as research citizenship; a commitment to direct benefits from collaborative research at community level. Notable enablers of integration orientation at this level related to direct and indirect benefits of research to the local community, including transfer of technical and physical capacity. This extends to a lesser extent to respect for local professional and cultural standards and norms. The results demonstrated the paramount importance of meeting research citizenship objectives in encouraging the integration of low-income country-based researchers in a setting in which they are disadvantaged by conditions and perceptions within their collaborations with high-income counterparts and within the wider global research community. This contrasts research in this setting with other settings where individuals tend to peg their benefits from collaborative research primarily to their individual-level outcomes (Gans & Murray, 2014; McKiernan et al., 2019). Similarly, it contrasts with existing literature which treats individual low-income country-based researchers' success in integrating professionally as distinct and relatively independent from (albeit complementary to) community outcomes of high-income country/low-income country scientific collaboration (Ezeh et al., 2010; Izugbara et al., 2017; Kabiru et al., 2010; Paina et al., 2013; Walsh, Brugha & Byrne, 2016). It reinforces current calls for societal/community relevance to be an integral part of research evaluation so as to inform more optimal allocation of research resources by external funders, local science granting councils and other stakeholders in low-income settings (Tijssen & Kraemer-Mbula, 2018). Thus, it demonstrates that research citizenship outcomes are even more predictive of integration orientation within collaborative research groups than task-level enablers which relate to individual core professional research competence. These outcomes are therefore particularly salient for low-income country researchers to be fully integrated into collaborative research whose implementation is primarily located in their community and organisational setting.

Finally, H5 considered the importance of securing the final individual outcomes of a collaborative research project in the form of key authorship and dissemination opportunities. A first or last author position as well as significant dissemination opportunities signal leadership of, and/or substantial technical involvement in the relevant global health research work (Busse et al., 2022) and potentially transitions individuals to further research leadership roles (Chinchilla-Rodríguez, Sugimoto &

Larivière, 2019). My findings through H5 demonstrate that while these key outcomes do not directly enable integration orientation, they are fundamental goals for researchers which, when fulfilled, raise their expectations of post-project benefits for their careers following a collaborative project. This suggests that even where enablers may be lacking or of minimal effect on integration, favourable authorship and dissemination outcomes from specific collaborative projects are still likely to encourage individual low-income country researchers to seek future collaboration with high-income country partners. This finding may also point to the greater role of high-income country collaborators (as opposed to individual low-income country collaborator's integration behaviour) in catalysing better low-income country researchers' outcomes. This mirrors a growing line of thought in the acculturation literature that suggests greater acknowledgement that receiving cultures determine major contextual factors whose effect on minorities' adaptation may be stronger (relative to individual minority acculturation orientations and strategies) than previously thought. (Bierwiaczonek & Kunst, 2021).

Conclusions and recommendations

My findings collectively suggest that there has been more progress in addressing barriers to integration of low-income country-based researchers than the existing high-income country-low-income country collaboration qualitative literature might suggest. I find however that there are significant barriers at individual level. I further find that addressing conditions that affect low-income country social structures in the form of low-income country communities and organisations is a major underlying mechanism for catalysing the integration of individual low-income country-based researchers in unequal collaborations with high-income country-based researchers. This is because it appeals to their research citizenship which is expressed through community-level outcomes rather than purely through their individual professional interests, which are more salient at task level. I recommend that research practitioners, funders and policymakers aiming for greater integration of low-income country-based researchers take advantage of that citizenship by continuously and consciously investing in the low-income country communities and organisations in which research collaborations are located. Such investment could take the form of infrastructure to localise high level scientific analysis and mentoring, among others.

Fostering research citizenship can also be a vehicle for addressing two gaps that stand out in my findings; less integration orientation amongst more senior researchers and the lack of low-income country-based mentorship for younger researchers. I did not find evidence of the level of willingness of senior low-income country-based researchers to mentor their junior low-income country-based colleagues that I expected from previous literature (Paina et al., 2013). I argue that such mentorship should be better framed as a societal need rather than a task-level competence and more

consciously embedded into collaborative research planning, monitoring and evaluation and into related reward mechanisms (for example by paying explicitly for local supervision time) in order to appeal to research citizenship intentions. This will incentivise efforts to overcome the time and resource limitations associated with local mentorship and contribute to building long term research capacity in low-income countries.

Other appropriate roles should be sought for keeping more senior researchers integrated within collaborative research even when a direct leadership role may not be feasible. Such roles include for example, contributing to local ethics and research quality review for low-income country research products so as to enhance more contextual evaluation, which is likely to promote local research. These might not translate directly into individual professional growth but might appeal to their sense of citizenship and increase the likelihood of integration both by themselves and by younger researchers who wish to address locally relevant issues that may not be attractive to high-income country researchers. This would have an exponential effect on long term, structural capacity for low-income country research leadership and integration into the global health research community.

Limitations and suggestions for future research

The findings of this study must be interpreted against the backdrop of its limitations, which at the same time serve as directions for future research. First, its cross-sectional design does not definitively infer any causal relationships between conditions of inequality at individual, group, organisational or community levels and the extent to which low-income country-based researchers integrate. Although the study was backed with significant qualitative work, future research using a longitudinal design should aim at illuminating the causal status of these relationships. Relatedly, the study relied on a single source being the low-income country-based researchers in collaborations with high-income country-based researchers at a single point in time. Future research could collect data on some of the variables that are salient from the viewpoint of other major stakeholders in high-income/low-income country collaboration such as high-income country-based researchers. Data could also be collected at multiple time points to facilitate interrogation of causal relationships given that low-income country-based researchers may collaborate with different groups of high-income country collaborators over time or experience different conditions or personalities in the same collaborative group over time. Studies could also consider the motivations and outcomes of individuals who opt not to integrate and investigate whether an integration orientation actually has a positive effect on other individual outcomes such as research productivity or impact. However, by providing robust current evidence from a large population, this study identifies research citizenship as a possible determinant of integration of low-income country-based researchers into the global health research community and recommends specific actions to facilitate it.

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Paper three

How low-income country actors can influence policy to achieve more equitable global health research collaborations

Abstract

A large proportion of global health research is conducted through groups comprising of collaborators from low-income countries and other collaborators from high-income countries. Many of these research groups are characterised by significant historical, social and economic inequalities which skew the benefits of collaboration to the high-income country collaborators. Policy recommendations to address these inequalities have tended to target high-income country actors. In this paper, I used the views of low-income country actors to shape policy recommendations that they can spearhead. I used qualitative comments from 168 respondents and juxtaposed them with current literature to recommend policy actions that redress inequity across four stages of high-income country and low-income country research collaboration. My key recommendations centre on reconfiguring low-income country resources in order to optimise research investments that spur relevant, sustainable regional research collaboration. Further recommendations then address building of capacity for self-regulation of collaborators and for a broader range of low-income country actors to be deliberately involved in collaborative research in order to boost its benefits for low-income country actors.

Introduction

The complex nature of scientific work increasingly requires the collaborative work of large numbers of individuals with distinctive expertise across nations and organisations (Newman, 2001). Collaborations are particularly critical in global health research. Koplan et.al (2009) define global health as “an area for study, research, and practice that places a priority on improving health and achieving equity in health for all people worldwide” (p. 1995). In low-income countries and particularly in Africa where national expenditure on research and development (R&D) is negligible, a large share of global health research is conducted through collaborations with partners from high-income countries (ACBF, 2017). Through these partnerships, groups comprising of high-income country and low-income country-based scientists typically co-implement projects in areas of common scientific interest (Crane, 2010).

Yet many of these research groups are characterised by significant historical, social and economic inequalities which disadvantage low-income country collaborators (Franzen, Chandler & Lang, 2017; Boum II, et al., 2018; Chu et al., 2014; Parker & Kingori, 2016; Munung, Mayosi & de Vries, 2017). Policy actions have been recommended that high-income country actors should take to redress inequalities in global health collaborations (e.g. COHRED, 2023). Much less attention has been paid to the contribution of low-income actors whose personal experiences are likely to highlight specific inequalities and recommend potential remedies. This paper takes as point of departure that policy recommendations to mitigate inequalities must consider the views and actions of low-income country-based actors. The central research question therefore is: What policy actions can low-income actors take to achieve more equitable global health research collaborations?

Background: the context for low-income country actors’ policy actions

In Africa, as much as 90% of scientific output (measured by authorship) is attributable to collaborations with high-income country peers (Pouris & Ho,2014). These collaborations between high- and low-income country scientists provide resources and opportunities that are often the only available route for low-income country researchers’ professional growth (Moyi Okwaro & Geissler, 2015) and their ability to facilitate their local research communities’ access to current knowledge (Barnard, Cowan & Muller, 2012). However, these collaborations are founded on relationships with well-documented structural inequalities which negatively affect low-income country-based researchers’ professional outcomes (Faure et al., 2021) across the collaboration cycle as developed by Sonnenwald (2007). This cycle includes the foundation phase in which collaboration is conceived; the formulation phase in which collaborators convene to plan the research work; the sustainment

phase in which the collaborators work together to implement the objectives of the collaboration; through to the conclusion phase in which the results of the collaboration are realised and disseminated (Sonnenwald, 2007).

A considerable literature on policy actions to improve low-income country outcomes from collaborations between high- and low-income country researchers has been generated over the last thirty years. (COHRED, 2023; Gautier, Sieleunou & Kalolo, 2018; Groves Williams, 2016; Larkan et al., 2016; Plamondon & Bisung, 2019; Stöckli, Wiesmann & Lys, 2012). These have tended to emphasise actions to be taken by high-income country actors. In contrast, there is a dearth of policy recommendations articulated by or addressed to low-income country actors. This is a consequential oversight: Low-income country researchers are direct beneficiaries of such policies, can directly participate in shaping appropriate policies and can choose to support (or not) policies aimed at increasing equitable scientific collaboration.

Literature Review

Low-income country actors' motivation to influence research outcomes

Individual low-income country-based researchers, the organisations in which they are primarily based and the networks to which they belong (of which there are a great number and variety across Africa (Söderbaum, 2001) can collectively be termed low-income country-based actors. Low-income country-based actors' experience of inequalities in global health research are shaped by a social context in which their communities face a disproportionate burden of communicable diseases, often the subject of global health research (Emadi, Delavari & Bayati, 2019). Many of these actors are responsible not only for academic and/or research work, but are also at the forefront of providing health services. This is done under environmental and social conditions that facilitate disease transmission amidst severely resource-constrained health systems (Bhutta et al., 2014). This has a further negative effect in that they have less ability to pursue independent research careers as well as train and mentor new clinicians and health science researchers, further aggravating negative community health outcomes. Thus, global health issues and challenges represent a far greater part of their lived experience than it does for their high-income country collaborators (Chu et al., 2014; Crane, 2010).

The literature consistently shows that these experiences spur low-income country actors not just to advance their individual research careers but also to maximise benefits that their wider communities collectively obtain from all stages of the collaboration cycle. This can be observed, for example in efforts to secure greater involvement in research design and implementation planning in order to

better ground research in the low-income country context (Binka, 2005; Munung, Mayosi & De Vries, 2017) and to advocate for the transfer of research skills, capacity and technology to low-income country sites (Binka,2005; Franzen, Chandler & Lang, 2017; Parker & Kingori, 2016). As collaborative projects are implemented, low-income country actors further seek to generate organisational and community benefits (Fairhead, Leach & Small, 2006; Parker & Kingori, 2016) and to demonstrate the impact of collaborative research on local policy and/or practice (Bennett et al., 2013).

It is clear that low-income country scientists are active agents who seek to take (wider) responsibility for the scientific collaborations in which they participate. Given that these scientists are primary agents in their research environments, I argue that they should also be seen as key agents for changing their research collaboration environment. Using the perspectives of health researchers in Uganda as a guide, I thus recommend a variety of policy actions.

Policy challenges at key stages of the collaboration cycle

Over the last 30 years, various scholars and practitioners have proposed remedial actions to address inequalities in high- and low-income country collaborations across the research cycle (Faure et al., 2021; Gautier, Sieleunou & Kalolo, 2018; Matenga et al., 2021). However, significant resource limitations and related barriers such as limited research supply and communication, unstable governance, the influences of external players and civil society (Young, 2005), as well as packaging and dissemination strategies that are not appropriate for a low-income country audience (Hennink & Stephenson, 2005) often make it quite hard to translate recommendations into actions in the low-income country context (Murunga et al., 2020). Moreover, health research policy priorities tend to be fragmented across multiple government agencies (IJsselmuiden et al., 2012).

Policy recommendations would therefore benefit not only from harnessing low-income country actors' research citizenship efforts, but also from focusing such efforts on key actions that are reasonably within low-income country-based actors' collective realm of control. As such, they need to maximise individual and collective benefits that low-income country actors can generate at each specific stage of the research collaboration cycle (the foundation, formulation, sustainment and conclusion stages), each of which presents unique opportunities for policy actions.

The foundation stage is the "pre-history" stage of research that sees the development of "norms, policies, and relationships existing before the collaboration is formulated" (Sonnenwald, 2007, p. 650). During the foundation stage, research collaborators also develop mutually compatible broad

goals and objectives as well as reasons and criteria for collaborating with a key challenge at this stage being that low-income country-based actors struggle with disadvantageous pre-existing scientific, political, socio-economic, resource and personal factors (Sonnenwald, 2007). An important example is the tendency for research ties between African low-income countries and their colonial high-income country masters (typically described as Anglophone, Francophone or Lusophone) to be stronger than those with other low-income countries with similar socio-economic, epidemiological and cultural profiles (Olufadewa, Adesina & Ayomide, 2021). As a result, the power dynamics between current collaborators tend to be inequitable and prioritise research that may not be the most relevant for the low-income country setting (Ager & Zarowsky, 2015; Olufadewa, Adesina & Ayorinde, 2021).

In Africa, this anomaly is compounded by very low levels of intra-African research collaboration, Olufadewa, Adesina & Ayorinde, 2021) despite the fact that over 50% of the African diseases burden is due to diseases that are found either exclusively or disproportionately on the continent (De Vré, Rial Verde & da Silva, 2010). African researchers are disadvantaged by the tendency for global networks of researchers to define research productivity (and by extension, resource generation and collaboration potential) primarily through publication and citation records (Iglic, et al., 2017; Tijssen & Kraemer-Mbula,2018). Databases of individual scientific activity (such as Google Scholar, Clarivate and Scoups) are often citation-based (Ioannidis et al., 2019) and by that measure alone, few African scientists can attract attention to their interests and capabilities for purposes of collaboration both from their African peers as well as the global research community (Confraria, Blanckenberg & Swart, 2018).

At the second stage, formulation, collaborators start to conceptualise and plan the actual research and to articulate specific goals (Sonnenwald, 2007). At this stage, research planning may not reflect mutual acknowledgement and resolution of differences in research priorities (Ager & Zarowksy, 2015), language, research philosophies, allocation of roles, capabilities, resources (Walsh, Brugha & Byrne, 2016), practices (Chompalov, Genuth & Shrum, 2002) and contract negotiation power (Sack, et al., 2009). This is particularly true because geographical, cultural and economic differences between high income and low-income country collaborators' settings are significant. Differences are further exacerbated by perceived historical injustice or prejudice that may affect feelings of trust, inclusiveness and equity in research idea generation, planning and design (Munung, Mayosi & De Vries, 2017; Parker & Kingori, 2016).

The sustainment stage involves the execution of collaborative research work after formulation is largely concluded (Sonnenwald, 2007). Some of the challenges for equitable participation at this

stage include inequitable working arrangements, lack of respect for low-income country organisational structures, research management and implementation practices, (Wintrup, 2022) as well as sub-optimal mutual skill transfer and knowledge creation (Franzen, Chandler & Lang,2017). Many attempts have been made to establish principles of equitable implementation of collaborative research, but these have not fully addressed the technological, cultural and economic gaps that disadvantage low income collaborators (Franzen, Chandler & Lang, 2017).

Following the sustainment stage, collaborative research typically goes to the conclusion stage (Sonnewald, 2007) At this stage low-income country actors are relatively disadvantaged in reaping longer term career growth benefits from collaborative research (Maswime, Masukume & Chandiwana, 2018). This is because high-income country collaborators tend to take the first and last authorship positions in publications resulting from the research and these represent leadership of collaborative research efforts (Busse et al., 2022). There are further challenges for low-income country collaborators in institutionalising research leadership (Chinchilla-Rodríguez, Sugimoto & Larivière, 2019) that builds on the scientific work that is being concluded. Thus, low-income country researchers' current and future contribution to creation of new knowledge, which is primarily measured through authorship positions in the resulting publications and citations is often undermined. This, along with much lower scientific journal coverage and quality within the continent (Siegfried, Busgeeth & Certain, 2006) is one of the key causes for the extremely low contribution of African scientific research (estimated at 1%) to global scientific research output (Blom, Lan & Adil, 2015). Measures to address equity in quality scholarly output and/or attribution have had some effect (Blom, Lan & Adil, 2015) but they need to be strengthened in order to overcome key structural limitations (Busse et al., 2022).

These challenges represent opportunities to identify policy actions that can be undertaken specifically by low-income country-based actors to change conditions at each of these stages so as to maximise individual and collective benefits from collaborative research.

Methods

I started the study by reviewing the literature on professional and personal outcomes for low-income country-based researchers who collaborate with high-income country-based researchers at each stage of research. The emerging themes at each stage were explored further using recent research collaboration literature to identify gaps in collaboration practise in various settings and to explore approaches that have been applied to mitigate them. I further explored literature from research and non-research contexts that relates to addressing power imbalances (such as labour relations

literature) and to optimal configuration of limited scientific resources. This generated recommendations that could be tailored to empower low-income country partners to mitigate resource limitations and inequalities in research collaboration. I explored further how such approaches might inform actions to close gaps in regional policy and practice across the collaboration cycle in low-income country settings. These approaches generally fitted into two themes. The first theme relates to how gaps at the initial (foundation) stage might be addressed through identifying priority collective actions to maximise the impact of regional investments in collaborative research. The second theme relates to overlapping collective actions which are aimed at broadening the range of global health disciplines and competencies as well as the range of actors that benefit from such investments across the formulation, sustainment and conclusion stages of collaboration.

I then developed a questionnaire to gather the views of low-income country-based researchers in Uganda. The study sample was drawn from the Uganda National Council for Science and Technology (UNCST) database. It is a legal requirement for all persons and organisations carrying out systematic investigations of any form in Uganda to seek final ethics approval from the Uganda National Council for Science and Technology (UNCST), which meant that the entire population of active health science researchers in Uganda could be polled. The study sample was drawn from the UNCST database. A total of 1,873 unique Ugandan health sciences researchers were identified in the UNCST database. I reached 728 (39%) of these by phone and subsequently sent them e-mails with links to a Google Forms survey. I received 532 complete responses, representing 73% of the sample. A series of Likert-style questions about their experience of scientific collaboration largely confirmed prior research. The survey closed with a section titled “Other views and preferences” with one open-ended question asking “Is there anything else about your experience of research collaborations with high-income country organisations that you would like to add?”. To my surprise, a total of 168 respondents gave qualitative responses, with a number of the responses several paragraphs long. At first glance, many commented about inequalities they had experienced when collaborating with high-income country researchers, and a number made recommendations about how to ensure more equitable collaborations.

Respondents were typically under severe time constraints; the survey was distributed during the COVID-19 pandemic, and with most health research in Uganda involving clinical trials, respondents had to be individually contacted to ask them to give their views. The fact that respondents at the end of a detailed questionnaire were keen to express their own views gave me cause to reflect. The comments were thematically analysed, and responses were then juxtaposed with the themes emerging from the collaboration literature. Although many of the comments underlined known

challenges faced by respondents across all stages of collaborative research, a number also suggested or implied novel policy actions to address those issues.

I also observed the professional profiles of the respondents and noted that they represented a variety of research career stages and health professions ranging from undergraduate to post-doctoral staff, including academic, clinical and allied health workers employed in organisations ranging from private for profit, private not-for-profit and public facilities to academic organisations. This gave me cause for further reflection regarding how aspects of individuals' professional life and growth within the sample might help to identify policies that enable wider participation in collaborative research.

Findings

I present findings as a model that follows the well-known collaborative research cycle model (Sonnenwald, 2007; Tellioglu, 2008). The opportunities for policymaking follow prior literature in that there are two main areas in need of attention. The first relates to re-configuring resources at the foundation stage. This is critical because it creates foundational conditions for benefits from all subsequent stages to be realised. The second relates to building capacity for a broader range of low-income country research competencies and resources to be utilised, and for a wider range of low-income country actors to be engaged across the research collaboration cycle.
The resulting model is as follows.

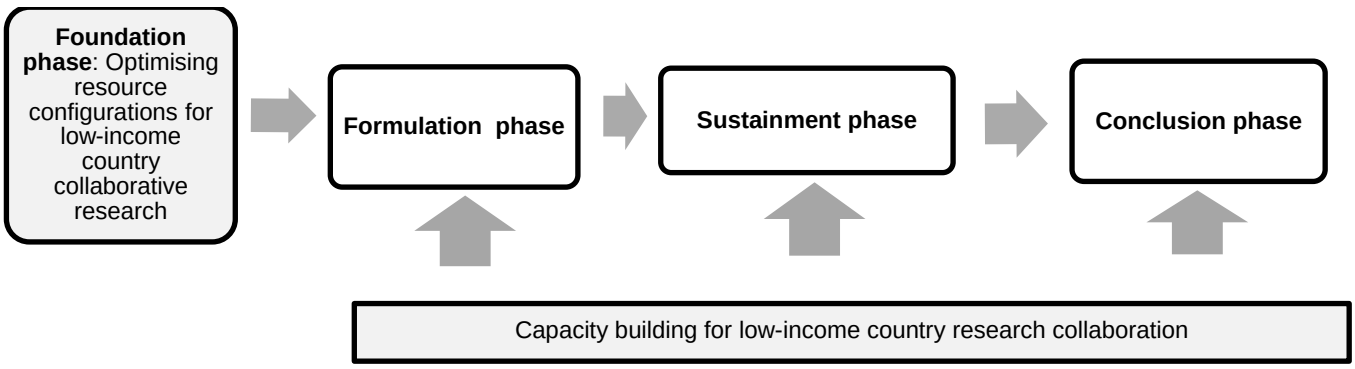

Figure 4: Model for policy action across the collaboration cycle

The two shaded sections (on the foundation phase and on capacity building in other phases) represent the two areas where most policy recommendations were concentrated.

Conditions for low-income country actors at the foundation stage

It is well-known that the foundation stage of collaborative research is greatly influenced by multiple and often conflicting perspectives on priority setting for African research and how they might guide national and regional research-related investment (Chataway et al., 2019; Khan, Qureshi & Hayee, 2007). About a third of the qualitative responses referenced the lack of funding and resources, and related them to imbalances in high- and low-income country collaboration dynamics, particularly in driving the research agenda.

> "High-income country collaboration entails usually a research agenda that is already pre-determined and local or low-income country researchers largely play a supportive role" (54yrs, male, Masters)

> "Research funding to and by local organisations and institutions is poor and so collaboration with high-income country drives most research" (45 yrs, female, Masters).

> "The funding provided by a lot of the research projects is from the high-income countries so collaborations with them are generally better paying than the purely local organisations hence the preference to work with collaborations even if the advancement of the individual research career i.e first author publications, manuscripts etc may be slow/rare" (33 yrs, female, Masters)

There was consensus that not having control over their research agenda was an issue regardless of whether researchers experienced collaborations positively or negatively:

> "My involvement with high-income country researchers (not organisations) has been great. They are open to learning new contexts in the African setting, and are great at knowledge sharing. That said I would prefer a mix of high-income country and local collaborators to stay on course with the local research agenda" (32 yrs, male, Masters)

> "Low-income country researchers can lose their careers, dreams and direction by working exclusively with high-income country collaborators. Low-income country researchers are better off working on small projects within their communities. They can thus make a big and long-term difference in their community and still be happy. I have found the actions of many high-income country collaborators both mercenary, discriminatory and oppressive. More oppressive, especially as the seniority and efficiency of the collaborative low-income country researcher increases" (52 yrs, female, doctorate)

Opinions on how to redress this imbalance ranged. Some researchers echoed extant research in urging high-income countries to be more mindful of how their funding drives priority setting: “High-income country organisations need to consider funding priorities of low-income countries other than imposing their own agenda because they have the funds” (41 yrs, male, Masters). Another participant commented:

> “Low-income country collaborators should prioritise the local research agenda and attract high-income country collaborators whose interests intersect so no research is done as a money making and individual academic growth venture without leading to a reasonable impact on local policy and local community wellbeing” (36, male, Masters)

A number of respondents pointed out that high-income country partners drive the agenda in global health because of their resources rather than expertise:

> “He who pays the piper calls the tune. This imbalance can only be shifted when low-income country governments start funding their own research” (36 yrs, male, Masters).

> “The organisation that controls the funding will always play the dominant role even though they lack expertise” (56, male, Masters)

By far the most prevalent view was that low-income country governments needed to prioritise funding their own projects:

> “Low-income countries should put more money in research to support their own and build a good base” (32 yrs, male, Masters)

> “It is very hard not to adopt the research agenda of the one who injects in more money. In these collaborations, to have mutual standing both parties need to have equal contribution to the investment. Low-income country researchers need to push their governments to put aside funds for the local research agenda. Otherwise we will keep blowing the Whiteman's horn!!” (41 yrs, female, Masters)

> “Governments in low-income countries should set aside funds for research in their countries” (51, male, Masters)

> “Low-income country researchers need to get more support and resources from their home country governments and non-governmental entities in order to develop and explore a local research agenda that addresses the needs of their communities. This will also contribute to

more local research capacity and make collaborations with high-income country researchers more equal" (44 yrs, male, Masters)

There was little acknowledgement of the financial constraints under which low-income country governments virtually per definition work and of any creative ways to optimise resource use. The mentioned comment on "non-governmental entities" is one exception. The potential for reaping benefits from regional resources was acknowledged, with one respondent remarking that "Results from one neighbouring country should be scaled in a neighbourhood for regional benefit" (64 yrs, male, Masters)

Low-income country actors' outcomes from collaborative research

The responding scientists named a large number of more granular details about aspects like trust and transparency, fair contracting, role assignment, capacity building, capital equipment and authorships that influence outcomes from collaborative research. These comments were categorised according to the subsequent three research stages, namely formulation, sustainment and conclusion.

5.2.1 Low-income country outcomes at the formulation stage

The formulation stage requires collaborators to cultivate trust and inclusiveness through negotiating research priorities and practises, individual roles and responsibilities, remuneration, resource use and the benefits thereof as partly or fully captured in agreements/sub-agreements. Respondents reported both the need for, and the lack of transparency and/or trust underlying some collaborative relationships

"Trust and respect of values, agenda at personal and organisation level is an important aspect for these kinds of projects whether local or international" (32 yrs, female, Masters)

"High-income country organisations need to consider and respect the agenda, ability and integrity of low-income country researchers/communities" (44, male, Masters)

"The tendency of high-income country collaborators to consider everyone from the low-income country as corrupt, it pains" (36 yrs, male, Masters)

"Cultural differences make the collaborations difficult" (37yrs, male, Masters)

Respondents generally appreciated the need to take advantage of an improved regulatory environment to negotiate fairer access to benefits of collaborative research

> “Unlike in the past, there are now regulatory bodies that try to ensure that the collaborations are beneficial to the low-income country partners as well” (37 yrs, male, Masters)

> “Win-win collaborations where contributions of each partner are clearly spelt out are the most beneficial and sustainable” (49 yrs, female, doctorate)

> “Negotiate expectations, deliverables and authorship upfront instead of waiting for the end of the project” (53 yrs, male, doctorate)

However, more respondents expressed various concerns relating to gaps in the content and/or enforceability of agreements between high-income and low-income collaborators amidst conditions of unequal power.

> “There should be long-term MOUs for engagement between low-income country and high-income country researchers. Short term MoUs are harder to negotiate and manage”. (36 yrs, male, doctorate)

> “The leverage of low-income countries in collaborations, especially for infectious diseases is the study population and we should use it to push for equality. We also need tougher regulations on collaborative work” (33 yrs, female, doctorate)

> “It is important to discuss the terms of the collaboration and agree on what each team is to contribute and also benefit right from the planning stage. When the Lead researcher from the low-income country is assertive about what has been agreed on from the beginning the team is more likely to benefit more” (61 yrs, female, doctorate)

There were specific concerns, for example around loss of locally generated research resources. One respondent (36 yrs, male, Masters) specifically named “Intellectual property and patents” as their most pressing concern. Others had the following related concerns around enforcement of benefits from locally generated data.

> “The sharing of data during the collaborations, especially with the guidance of the UNCST. The collaboration (should) depend (s) on the context i.e. institutional policies and negotiations”(45 yrs, male, Masters)

> “They create remote data bases in there [sic] countries, thus acting against the research and country data management (laws). They lack formal and transparent ways of signing legal MoUs and data sharing agreements with MDAs” (35 yrs, male, Masters)

Some respondents acknowledged gaps in low-income country technical and administrative capacity to efficiently conduct research, e.g. that “Inefficient local admin and financial system related challenges such as lengthy procurement systems can significantly impact collaborations with high-income country” (42 yrs, male, doctorate). But many more also found that opportunities to use such capacity were limited and did not match local potential.

> “Often high-income country collaborators may not recognise the capabilities of low-income country collaborators and that they bring a lot to the table especially senior researchers” (44 yrs, female, Masters)

> “High-income country collaborators sometimes come to look for data collectors, not collaborators. High-income country funders prefer high-income country collaborators to lead studies” (42 yrs, male, doctorate)

> “There is need for High income countries to be more cognizant that low income countries have research agendas as well as administrative systems to conduct research” (56 yrs, female, doctorate)

> “Resources for local logistics and local positions on the research project should be left to local researchers/personnel” (64 yrs, male, Masters)

There was no specific mention of how the various technical and administrative capacities within different types of local organisations hosting respondents and/or their research (for example universities, health facilities and NGOs) might best contribute to overall collaboration outcomes. Criticism was not reserved for high-income countries only. Notably, many junior low-income country researchers perceived the benefits they derive from collaborative research projects to be inequitable not only relative to their high-income country partners, but also relative to their senior low-income country counterparts.

> “Senior local and re-known researchers tend to play as manipulators of the young local researchers by not compensating and lacking transparency in terms of funds management” (35 yrs, male, Masters)

> “Most of the local researchers (Local PIs) rarely mind about the career of the early career researchers” (32 yrs, male, Masters)

> “Most time the local PIs represent their personal interests not for the entire group especially the junior staff who end up benefiting less yet the ensure proper implementation of the projects” (33 yrs, male, Masters)

These perceived inequalities were mainly attributed to seniority, measured in terms of differences in age, education and research experience, rather than profession (for example nurse versus doctor) or organisational base (for example NGO, private health or public health unit). These responses pointed to a lack of documented best practise in fostering equitable opportunities and benefits and in managing expectations thereof not only in relation to high-income country collaborators, but also between individual low-income country researchers within the same collaborative group across professions, research career stage/experience and organisations.

5.2.2 Low-income country researchers’ outcomes at the sustainment stage

At the sustainment stage, which follows the formulation stage, collaborators should ideally overcome technological, cultural and resource gaps to establish equitable, mutually respectful implementation and knowledge exchange practices. It is evident from the experiences of respondents that the extent to which these gaps are fully resolved in collaborations between low income and high-income country researchers varies widely. As one respondent explained: “Not all collaborations are the same …some are terrible while others are fairly cordial” (61 yrs, female, doctorate). Indeed, differences were attributed to a number of idiosyncratic individual and group characteristics.

> “Different research collaborations have different dynamics and the experiences vary widely based on the institutions and seniority of the staff involved. Some collaborations are more beneficial than others” (46 yrs, male, doctorate)

> “Some high-income country collaborators are more flexible than others. For instance, those in the USA always want to take the lead and dictate most of what is done. Those in the UK prefer shared leadership roles while those in Scandinavia allow low-income country leadership even on research funded by high income countries. So it’s not one size fits all” (48 yrs, female, doctorate)

> “Individual characteristics/personalities of the scientists from high-income countries matter a lot and influence the success of the collaboration (e.g. willingness to share vs exploitative)”(40 yrs, female, doctorate)

Not surprisingly, a number of respondents called for standards to be set in order for the environment at this implementation stage to be more predictable, for example that “low-income country collaborating institutions should set standards for reference by high-income country collaborators” (36 yrs, male, Masters).

A major motive and priority for collaborative research appeared to be access to cutting-edge technology, with one respondent (36 yrs, male, Masters) explaining that “Transfer of appropriate technology between low-income country and high-income country settings” was his primary issue of concern. Other respondents expressed similar views:

> “Collaborations are vital as they enhance transfer of skills, improvement in research and learning. The technology, knowledge and expertise we acquire from the high-income countries are key to our research progress” (50 yrs, female, doctorate)

But the extent to which the knowledge and technology exchange objectives of collaborative research are documented and met appears to be a major gap. For example, unsatisfactory capacity building outcomes were a major concern for various respondents:

> “I tend to think that our low level of access to state of the art equipment is a hindrance to our ultimate choice of topics. but collaborations are possible with creativity” (59 yrs, female, Masters)
>
> “Capacity building validation is always compromised by high-income country superiority” (44 yrs, male, Masters)
>
> “Also, to consider in these collaborations should be local infrastructure development and capacity building of staff to reduce on specimen shipment” (48 yrs, male, doctorate)
>
> “Because they in most cases have the funding, they tend to make most of the financial decisions and they are also reluctant to fund technology transfer” (36 yrs, male, Masters).

While respondents highlighted the need for more regulation to redress inequalities, there was little acknowledgement that these efforts would benefit from region-wide efforts to standardise and continuously assess collaborative research implementation. Thus, even though other low-income country actors are likely to have similar challenges across the region, there was little explicit recognition of the potential for region-wide advocacy to present a stronger, common voice for long term change.

5.2.3 Low-income country researchers' outcomes at the conclusion stage

At the conclusion stage, scientists aim to reap long term benefits from projects including authorship, and ongoing utilisation of acquired skills, technology and professional networks. Respondents suggested that these aspirations are often frustrated by immediate and long-term limitations that are deeply ingrained in global health research structures. One major limitation they voiced is the extent to which they can overcome unequal power dynamics to negotiate authorship positions that reflect their contribution to concluded research

> "Most times they (high-income country collaborators) want to own the research which is demeaning in collaboration" (35 yrs, female, Masters)

> "The local researchers should be included more frequently in the authorship" (42 yrs, female, Masters)

> "Authorship ethics should be followed" (33 yrs, female, doctorate)

> "It is important to agree on rules of authorship beforehand, and to have goodwill and trust between the two groups of collaborators" (34 yrs, male, Masters)

> "Low-income country researchers need mentorship from their own colleagues on how to handle tough discussions like authorship when dealing with people from high-income country" (32 yrs, male, Masters)

Other limitations are imposed by the lack of resources to sustain technological and skill transfer beyond the conclusion of specific projects as noted in the following comment:

> "Collaborations with high-income countries always dictate on how research money can be spent i.e., they will dictate on where to buy supplies and materials to use, this later affects the sustainability of the project, reason is that after the end of the funding for the research, the equipment procured then cannot be integrated in into the government mainstream hence they become white elephants" (35 yrs, male, Masters)

5.3 Low-income country individual participation in biomedical research

Beyond qualitative comments, I reviewed the professional profiles of individuals in my sample, which represents the entire population of professionals in Uganda involved in health research, in comparison with profiles of the general population of health workers with potential to participate in research. I found few explicit mentions of the potential for low-income country actors to actively shepherd more early stage health science students into a research track and even less evidence of involvement of such students in ongoing collaborative research in any capacity.

Low income countries often have significant health worker staffing gaps. For example, Uganda loses over 30% of its doctors to migration (Dambisya, 2004). Similar gaps can be observed across all health worker cadres, leading to a 44% health worker vacancy rate (Namaganda et al., 2015). At the same time, fewer than 8% of doctors work in academia (Dambisya, 2004) where research is routinely conducted. The same trend can be observed across Africa (Pang, Lansang & Haines, 2002). This not only reduces the potential health researcher pool significantly but also means that workloads will not permit even those health workers of all cadres with an interest in research to commit much time to it. I did not find as much expressed interest in getting more non-specialist health workers involved in research as I expected, probably because responses focused on individual outcomes, but this pointed to an area for further policy action.

Similarly, there was little expressed interest in harnessing non-traditional research platforms, infrastructure and networks in collaborative research. This is surprising given that in my survey of 534 low-income country-based researchers, 118 (22%) were NGO staff and another 75 (14%) had an NGO designation in parallel with other employment.

Thus, I identified gaps in the extent to which participation in research could be deliberately enhanced by addressing the contribution of various education levels, cadres/specialities and organisational affiliations of the entire population of health workers.

6. Policy recommendations

6.1. Optimising resource configurations for low-income country collaborative research

As one respondent (46 yrs, male, doctorate) remarked “low-income countries have challenges finding adequate resources for their research priorities”. Various permutations of that point were made by numerous respondents, and evidence suggests that many African scholars would prefer to partner in collaborations with both high-income country-based researchers and other low-income

country-based researchers if they had more resources that they could contribute, with the greater say in decisions that such resources would likely bring. It is definitional that low-income countries have limited resources, whether financial, in terms of technology or skilled people. To address that concern, the main policy recommendation is to pool resources regionally. The next section explains how that could be done.

Low-income country-based actors can create researcher databases that enhance collaboration mapping and competence matching amongst individuals and organisations by highlighting a wider range of self-reported multi-dimensional research contributions, interests and aspirations beyond citations without relying on existing interpersonal relationships. These might include experience in teaching and mentoring, cocreation of scientific knowledge with industry, community engagement, dissemination and communication of research and its translation into practise/implementation, public outreach and government policy. Additionally, low-income country actors can describe other research assets and resources that they have at their disposal such as datasets, specialised equipment, analytical capacity and clinical platforms that complement their capabilities without the pressure of a competitive call. This can inform decisions to channel resources to specific individuals and organisations who will best advance specific areas of national and regional strategic research and development interest and thus help to address an apparent mismatch between priorities, capacities and investments in a low-income country research setting .These actors could also provide specialised expertise such as health policy reviews and research ethics reviews based on their expertise in specific disease domains, health disciplines or research methodologies, which would further enhance African research capacity building.

Data from such databases would support recent attempts by some research funding agencies to define research contribution more broadly and inclusively (Davies et al., 2021) and could potentially be consulted to inform evaluation criteria for competitive applications. Similar data bases such as the European Union’s funding and tender opportunities portal and the US CTSA platform (CTSA Principal Investigators, 2012) that are routinely used by high-income country actors to find complementary individual and organisational partners for collaboration on specific research projects could be used as models.

Data sharing platforms can support clinical trials that are the gold standard for answering questions in the biomedical sciences and improving clinical practices (Concato, Shah & Horwitz, 2000). Clinical trials are prohibitively expensive and technically hard to execute to the required standard (Fogel, 2018). Africa is home to 16% of humanity (Schäferhoff et al., 2019) and has the widest genetic diversity of any region, making it ideal for generalisation of clinical trial results (Taylor-Robinson,

Spearman & Suliman, 2021). As one respondent remarked “most research interests in Africa rotate around doing clinical trials (so) therefore there is need to build capacity to monitor clinical trials in Africa as large populations are likely to be used as guinea pigs (41 yrs, male, Masters)”. However, resource constraints limit Africa’s share of global clinical trial activity to 3.9% and even the existing trials located in Africa are often not the most pertinent for its health setting (Glickman et al., 2009) or may abet what one respondent (35, male, masters) describes as high-income country exploitation in the form of “mining and siphoning data” in the absence of strong regulation.

Low-income country actors might mitigate this by applying new trial methods that aggregate regional datasets such as those from routinely collected electronic health records (EHRs) (Rogers, et al., 2021). Low-income country-based researchers can create central databases that standardise, pool, map and transform passive clinical data from EHRs at multiple sites to answer specific questions of interest to the low-income country setting across biomedical fields of expertise. As one respondent noted “Results from one neighbouring country should be scaled in a neighbourhood for regional benefit” (64 yrs, male, Masters). For example, research-enabling modules may be added onto the DHIS2 platform which has been adopted in over 70 countries worldwide of which at least 40 are LMICS and at least 12 are African (Byrne & Sæbø, 2022; Dehnavieh et al., 2018). DHIS 2 and similar portals may be designed to support collection of longitudinal data for sustainable low-income country-low-income country collaborative research. Research tools can be attached to such platforms with appropriate eligibility, informed consent, data quality, archival and audit safeguards to meet research integrity requirements (Senerchia, 2022). Additionally, low-income country actors can advocate for regional adoption of common tools that have been proved to be relatively cheap, accessible and adaptable (for example REDCap) (Bangdiwala & Boulware, 2022) to catalyse regional standards of health research data collection and to facilitate interinstitutional and interdisciplinary data exchange in low-income country settings.

The same general approach can be used in building shared regional platforms to provide opportunities for regional exploitation so as to reduce the African genomic data gap (Omotoso et al., 2022) while allowing such data to benefit African researchers and communities before it is shared with the wider world.

Low-income country actors can take advantage of such shared platforms to pre-approve and pre-position protocols in multiple countries to conduct research that addresses gaps in real-time, and organise context-specific responses to emergency health crises such as the COVID pandemic. This could be modelled along similar platforms like the European Preparedness Against (Re-emerging Epidemics) (PREPARE) clinical research network platform which enabled European experts on

infectious diseases to overcome administrative, regulatory and logistical barriers to access 'on-demand' clinical data from over 600 primary care sites and over 600 hospital sites in 27 countries in real time (PREPARE Consortium, 2023). Low-income country researchers should be advocates for their governments to prioritise investments in the skills and infrastructure that are necessary for such big data sets to be pooled and analysed and for bodies with a regional mandate such as the Africa CDC (Africa CDC 2023) and the African Medicines Agency (AMA) (Hwenda, Sidibe & Makanga, 2022) to harmonise protocols and approvals, broker collaborative relationships and tools and maximise interoperability in order for regional data to generate local scientific benefit.

These recommendations are summarised in Table 9 below:

Table 9: Policy actions to optimise resource configurations in low-income countries

Focus of recommendations	Recommendations	Low-income country actors
Develop researcher database	Develop a multi-dimensional regional database of researchers	National and regional Scientific authorities
	Identify individual attributes, interests and research-related competencies (e.g. community work)	Individual researchers
	Communicate access to datasets, specialised equipment, clinical platforms etc.	Research institutions and universities
	Utilise databases to identify complementary partners for collaborative research	Individual researchers and research institutions
	Utilise databases in optimising research investment decisions	Governments and funding institutions
Create national and regional scientific data sharing platforms	Create scalable data platforms with standard structure and appropriate scientific /regulatory controls	National and regional Scientific authorities
	Adopt platforms at national programme level to extract key data from selected sites	Governments and individual health workers/researchers
	Utilise platforms for routine/passive data collection as well as deploy platforms for emergency use (e.g. in epidemics); grant access to data	Governments and individual health workers/researchers
	Design collaborative research projects that utilise national and regional data	Individual scientists

	Pool national and regional data to answer relevant questions	Individual scientists, national and regional scientific authorities

6.2 Building capacity for self-regulation of best practise in collaboration

Over the last 30 years, a large number of policy guidelines have been developed that represent a broad consensus on best practise in implementation of equitable high-income country-low-income country global health collaborations (Larkan et al., 2016; National Bioethics Advisory Commission, 2001; Nuffield Council on Bioethics,1999; Groves Williams, 2016; Stöckli, Wiesmann & Lys, 2012; COHRED, 2023). Some of these guidelines suggest specific metrics and indicators of good global health collaboration practise including indicators of trust, equity, inclusiveness, mutual benefit, and long-term individual and institutional capacity building (COHRED, 2023). However, these are not consistently integrated into formal contractual obligations (Olusanya & Opoka, 2017) and enforced by funders and partners (Beran et al., 2017). As a result, low-income country collaborators find that the conditions in collaborations vary widely. For example, one respondent (43 yrs, female, doctorate) states that “high-income country collaborators are different. Some dominate while others go out of their way to be all inclusive”. Another respondent (48 yrs, male, Masters) commented that “the experience at the beginning of the collaboration is somewhat different compared to a mature collaboration”. Respondents highlighted other differences based on the issue of discussion, noting that openness around financial issues is far less than for other issues such as ethical conduct. Cultural differences amongst different high-income country partners were also noted by at least four respondents, with one stating that “Additionally, there are substantial cultural and contextual differences between the high-income country collaborators (e.g. USA versus UK versus mainland Europe” (48 yrs, male, Masters).

At least ten respondents then recommended the use of consistent, standardised guidelines, terms and conditions to guide implementation of collaborative projects. Another ten respondents’ comments referenced the importance of negotiation and/or adoption of terms for specific issues ranging from data sharing and use, to salaries and benefits through to intellectual property and authorship. As one respondent puts it “Comparative studies are bound to yield better insights for positive impacts on low-income country communities, especially policy influences. Low income countries have to associate better to gain a voice that helps them negotiate better terms with high income countries, and get their study outcomes to impact local policy more significantly” (46, male, Bachelor’s). I therefore suggest that low-income country actors would benefit from building capacity to self-regulate with standardised, codified measures of equity in collaboration. This can be done by generating consensus on specific objectively verifiable, and quantifiable measures of equity and

developing tools for voluntary assessment of both high-income country and low-income country players' contributions against these measures. Such assessments could pick lessons from various industries' attempts to self-regulate in pursuit of labour and social justice (Demougin et al., 2021) through external monitoring without the pressure of sanctions (Short & Toffel, 2010). The introduction of standardised assessments, scoring tools and certification frameworks suitable for the high-income country/low-income country collaboration context could catalyse incremental skill transfer and low-income country research leadership. Assessments could also address protection of local content, local intellectual property and local representation in global health governance and could be offered for funders to refer to as part of their scoring criteria for competitive funding of research projects in low-income countries. Consistent with such self-regulated frameworks incremental improvements to these tools could be adopted to reflect their evolving context (Aragòn-Correa, Marcus & Vogel, 2020).

Guidelines and assessments could extend to the area of low-income country researchers' authorship outcomes. High-income country-based investigator domination of global health publications translates into missed opportunities to maximise the grounding of research in the low-income country context and its interpretation, dissemination and translation into low-income country policy and practise. Some international journals have tried to address this anomaly by introducing a requirement for any study with substantial involvement of a low- or middle-income country (LMIC) partner to have at least one co-author from that country (Beran et al., 2017). Other advocates have recommended that authors appear in alphabetical order with individual contributions explicitly stated in order to foster an equitable, collaborative spirit (Beran et al.,2017). Low-income country actors should advocate for a similar set of standards and guidelines to be adopted across more journals, starting with those that have the greatest output on global health issues. They should additionally build capacity to monitor and report non-adherence to these standards by creating platforms where individual journal compliance to these standards can be objectively monitored and publicly rated.

Even with such actions, I concur with Busse et.al (2022) and Sharma (2021) in advocating for research that is primarily generated and consumed by low-income country actors themselves because it is likely to be the most beneficial for low-income country productivity and health outcomes. To achieve that, policies are needed to ensure that there is local capacity to produce more high-quality African journals, more frequently with less reliance on high-income country sources for peer review. As observed in a comment from one researcher "It is easier to get a platform to publish or present at an international conference with high-income country collaboration and co-authorship" (40 yrs, male, Masters). Despite recent scholarship that demonstrates that investments that reflect the social context particularly in low-income country settings generate more inclusive, equitable and

sustainable research agendas (de Saille 2015; Arocena, Göransson, & Sutz, 2019; Schot and Steinmueller, 2018), major journals tend to deprioritise full publication of applied research articles often leaving such results to remain at abstract level at best (Chan et al., 2014). Equally, research aimed at tailoring treatment to the low-income setting is not given due attention (Adhikari, 2021). This potentially wastes scarce low-income country research resources and squanders opportunities to maximise research effectiveness through local research leadership (McLean & Sen, 2018). In this setting, establishing a set of guidelines for prioritising and concentrating scarce resources in a few high-quality journals across the region might result in more high quality, contextually relevant papers submitted more regularly per journal. Partnerships established between international and African journals have boosted the standards and outputs of a few selected African journals (Chetwood, Ladep & Taylor-Robinson, 2015; Tillett, 2005) but there are no clear criteria for scaling such partnerships to boost the capacity of journals with the greatest potential impact across the region. There have been efforts to maximise the impact of African research by targeting funds at selected universities which act as nuclei for addressing specific common regional development challenges (Tijssen & Kraemer-Mbula, 2018). In parallel, data-guided guidelines with transparent criteria (including enthusiastic, qualified editorial teams) can be established for selecting the best African journals in specific global health domains, identifying their best equivalent amongst international journals and proactively brokering efforts for them to collaborate. Collaboration might for example, include mutual peer review, support for international indexing and sharing of infrastructure, presence and visibility. There are existing models for data analytics to apply appropriate selection criteria (Duermeijer, Amir & Schoombee, 2018), which for the African setting, might include a journal's capacity to generate more intra-African research collaboration and to redress the dominance of a few countries in African scientific publishing (Goehl & Flanagin, 2008). Local LIC journals can thus be empowered to overcome powerful forces that sustain traditional evaluations of research that disadvantage African scholars (Tijssen & Kraemer-Mbula, 2018). If such journals deliberately redefine research excellence using non-conventional models (for example Lebel & McLean, 2020; Arocena, Göransson & Sutz, 2019) they can catalyse embeddedness of LIC researchers (and especially young researchers) with their context and with other LIC actors and thus provide greater social impact (Arocena, Goransson & Sutz, 2019). Thus, resources would be concentrated where there is the greatest momentum and contextualised societal impact while at the same time, maximising overall equitable and sustainable regional journal capacity.

These recommendations are summarised in Table 10 below:

Table 10: Policy actions to build capacity for self-regulation and publication

Focus of recommendations	Recommendations	Low-income country actors
Building capacity for monitoring and measuring progression in achieving equity in collaborative research implementation	Generating consensus on common definitions, objective standards and assessment tools as well as registration requirements for individual projects to aid self-regulation of collaborations	Regional research networks; research funders; national and regional scientific authorities
	Regionwide adoption of standards, definitions and measurement tools	Regional research networks; research funders; national and regional scientific authorities and organisations
	Integration of measurement tools into research design, implementation and reporting	Individual researchers
Enhancing low-income country publishing capacity	Generating consensus on minimum standards for equity in collaborative authorship (see codifying standards for self-regulation above)	Regional research networks; research funders; national and regional scientific authorities
	Creation of platform for reporting adherence to minimum standards (see integration into reporting above)	Regional research networks; research organisations
	Generating consensus on objective assessment of regional journals to aid selection of the best journals in different scientific domains	Low-income country regional research networks
	Advocating for pairing of best regional journals with suitable international journals	Low-income country regional research networks

6.3 Increasing scientific capacity by broadening low-income country actors' participation in research collaboration

The low-income country collaboration environment would be enriched if scientific capacity was built within a broader range of low-income country actors in collaborative research work, regardless of whether they eventually pursue a traditional academic research career pathway or not. Specific categories of actors might contribute in the following ways.

Early stage low-income country-based -individuals should be supported by all actors, but more especially by low-income country research collaborators to find an entry point into the global health networks that create rewarding research environments. Cultivating a research mindset in the early education stages of individuals for example, may enhance acceptability of research as a desirable career choice and entry into the research community without necessarily committing to an academic career pathway. Low-income country-based researchers need to consciously apply collaboration resources in mentoring and integrating research awareness, interest and proficiency amongst health scientists at least as early as undergraduate stage. Embedding appropriate roles for students at all levels from undergraduate level upwards, for example, by including subsidiary research questions that are appropriate for each level would maximise the long-term benefit from existing collaborative research projects but is not likely to be a priority for the high-income country collaborators. Research capacity in Africa largely develops through a 'learning by doing' approach (Owusu et al., 2017) so integrating such experiential training can expose such students not just to knowledge of research methods and process but would also generate positive attitudes, awareness, interest, motivation as well as local content and relevance. This might be of greater benefit when cultivated at early stages in the training of biomedical scientists and would help to address criticism against senior low-income country peers exemplified by comments like" Research supervisors / monitors from high income countries are more committed and better to work with" (37 yrs, female, doctorate). In turn, seamless integration into research networks and collaborations for early stage researchers, might inculcate a sense of research citizenship early in health scientists' careers regardless of whether they eventually become academic/career researchers or not.

Broadening the range of health professionals in Africa who are active in collaborative research might lead to more research productivity overall. For example, specialist health care workers dominate participation in the research projects that I sampled, and yet amidst the scarcity of doctors, other cadres of health workers are likely to be at least equally engaged in day to day clinical service delivery. They could be an untapped resource in identification of pertinent questions, in implementing studies and in applying relevant findings from collaborative research. In a high-income country setting, for example, allied health professionals in publicly funded health service organisations have been reported to have a high level of interest in undertaking research and to exhibit better job satisfaction, attitudes, critical thinking and evidence-based practise once they are involved in it (Matus, Walker & Mickan, 2018). Given the scarcity of health workers in Africa, institutionalising and rewarding similar cadres' involvement in collaboration groups that have resources to conduct research (for example as part of Continuing Professional Education (CPE) and criteria for promotion) is likely to contribute to grooming more inter-disciplinary researchers who can successfully perform key roles in that environment and ultimately, lead to higher collaborative research output.

Research can be better grounded into the national low-income country context when researchers collaborate with non-governmental organisations (NGOs). The health-financing gap continues to be particularly acute in Africa, which makes up 16% of the world population and carries 23% of the global diseases burden but accounts for only 1% of global health expenditure (Schäferhoff et al., 2019). NGOs are credited with filling many gaps in social services which governments lack sufficient resources or political will to address (Brass, 2016). This is particularly true for health services, a significant proportion of which they provide in many sub-Saharan African countries, including Uganda (Reinikka & Svensson, 2010). NGO service provision is often viewed as constituting a parallel structure, which weakens the public sector and makes governments less accountable (Springman, 2022). Nonetheless, NGOs offer significant health service platforms which low-income country-based researchers may find to be more flexible, innovative and transparent than government systems. NGO programmes not only provide health services but they also service the entire global health research cycle in Africa, typically through partnership with universities or dedicated research agencies (Delisle et al., 2005). This trend is reflected in sub-Saharan domination of published articles on NGO health-related activity (Brass et al., 2018). Notably, NGOs can generate a "field-driven research agenda" (Kidwell Drake, Hutchings & Elias, 2010) which collaborative research groups can embed into NGO service delivery to complement funding from traditional research funding mechanisms. This addresses locally relevant health issues and provides a platform for improving community-friendly research practise (Baron et al., 2018) and for immediate application of findings to improve health outcomes in low-income country settings. NGO staff themselves may engage in research, collaborate with both low-income country and high-income country researchers and/or provide access to multi-disciplinary, multi-partner networks, resources and communities. There are examples that illustrate how African NGOs have been established within university bureaucracies with relative autonomy, significantly contributing to research output. (Nakanjako et al., 2022). Such NGOs straddle academia and health service delivery to provide platforms which academic researchers from both low income and high-income countries can access to embed their research questions and utilise to test solutions and models in a real-world setting. NGOs should therefore be actively and deliberately involved in setting collaborative research agendas and in hosting collaborative research activity.

These policy recommendations are summarised in Table 11 below

Table 11: Policy actions to broaden the range of low-income country actors involved in collaborative research

Focus of recommendations	Recommendations	Low-income country actors
Making low-income country collaborative research more inclusive	Targeting students and early career scientists for inclusion in ongoing collaborative research	Low-income country academic and research organisations; individual low-income country researchers
	Incentivising involvement in collaborative research for all cadres of health workers	Low-income country academic and research organisations
	Utilising NGO health service platforms for collaborative research	Low-income country academic and research organisations; individual low-income country researchers

The key insight that emerged from this analysis is that low-income country actors' policy actions at regional level, are critical for changing conditions within, and outcomes from, their collaborations with high-income country actors. This is particularly true at the foundation stage, where scientific, political, socio-economic, resource and personal or network factors cause structural inequalities even before any specific collaborations emerge. I suggest that addressing some of these inequalities at the foundation stage maximises the impact of other remedial actions that may then be taken across the collaboration cycle.

7. Discussion

My findings confirm previous ones that attribute challenges to equitable research collaboration outcomes for low-income country players mainly to the scarcity of resources in the low-income country environment. This is compounded by tension between prioritising novel science that advances scientific fields and research that meets immediate community needs. While I acknowledge this scarcity and tension, I demonstrate that research investments in the entire Africa region have to a large extent been made in the context of collaboration. I therefore argue that empowering low-income country actors to address key barriers to regional collaboration would make a significant contribution to enhancing their benefits from research at all stages of the collaboration cycle.

I argue that such actions will have the greatest impact at the foundation stage where they might change aspects of the fundamental "pre-historic" conditions that shape high- and low-income country collaborations. Once we have effective regional bodies such as the Africa CDC with the mandate to

promote a collaborative African public health agenda among different actors (Africa CDC, 2023), then they would establish regional platforms that analyse research data to map out actual and potential collaboration potential to guide investments. I further argue that such platforms could inform standardisation, pooling and publishing of priority health data so as to mitigate resource constraints to research design and implementation. This would provide an alternative criterion for research investment priority-setting as well as unlock data assets that have hitherto been inaccessible to sustainably answer questions that are relevant for the region.

I identify the lack of capacity to assess equitable collaborative research practises using common standards around which region-wide advocacy efforts in low income countries could be centred. I therefore call for advocacy to encourage adoption of common, codified standards and objectively verifiable assessment tools for equitable research implementation. I argue that these can be the basis for adoption of self-regulation mechanisms by both low-income country and high-income country actors that objectively inform progress towards equitable outcomes for all actors across the board. I further argue that such standards should be extended to the adoption of good journal practices as well as deliberate investments in objectively selected journals from across the region to improve balanced growth in the quality, competitiveness and relevance of African journals and to enhance low-income country researchers' ownership of research products.

Finally, I advocate for incentivisation of health worker involvement in research across career stages, health worker cadres and organisations that are prevalent in low income country settings so that greater numbers of health workers get involved in research to boost overall research productivity.

8. Conclusions

This paper focused on the role of low-income country actors in mitigating inequalities in their research collaborations with high-income country partners. In contrast to current recommendations that tend to focus on policy actions that can be taken by high-income country actors, I take as point of departure that low-income country actors are best placed to identify the origins of unequal research collaborations and make recommendations about removing the barriers to achieving greater equity. I therefore drew not only on policy tools from different contexts, but especially also the views of a large sample of Ugandan health science researchers to explore both barriers to equitable outcomes and potential policy actions that can be applied to address them at each of four stages of research collaboration.

Numerous respondents suggested that countries need to fund their own research to have a meaningful say in the research agendas of their health scientists. I suggest that in addition to prioritising health research at a national level, regional collaboration can meaningfully contribute to mitigating the foundational causes of inequality, as pooling resources and capacities regionally can help overcome the resource limitations that hamstring low-income countries.

These actions then set the ground for addressing other conditions that affect low-income country collaboration outcomes in subsequent stages of collaboration. I recommend that low-income country regional bodies take a more active role in documenting, highlighting and pooling research assets and skill sets within their regions in order to catalyse more rewarding collaboration for low-income country actors. This enables low-income country actors in turn to utilise a broader range of actors and resources from their setting to enhance their overall collaboration outcomes.

9. Limitations

The findings in this paper have some limitations. Firstly, not all collaborations are the same and hence all views and perspectives might need to contextualise differences within and between various low-income country/high-income country collaborations. This is because of variations between individuals, between institutional policies and cultures and experiences across the board. Any interpretation of the responses above will have to take this into account. Secondly individuals' views about the collaborations in which they are involved were obtained only at one point in time, but collaborations and likely perceptions about them change over time. Thirdly, the views expressed were in response to a single question addressed to individual low-income country research practitioners. While this might have identified issues that are considered to be significant by a wide range of individuals, I did not consult other parties such as research leaders, funders and regulators, some of whom are likely to play an important role in policy formulation and implementation. I am not able to comment on how they experience these collaborations, and what policy actions they would recommend. Future research could seek to capture the insights of a wider range of collaborative research stakeholders and to compare the feasibility and cost of these recommendations with other alternative policy actions.

These policy recommendations do not negate the many useful recommendations that have been made about how high-income countries can engage with greater respect for their low-income country counterparts. However, one of the characteristics of equitable interaction is arguably that all the relevant parties have a chance to speak their views and to actively seek solutions to challenges. This paper contributes to that process by foregrounding the voices of low-income country health

scientists, and by making policy recommendations aimed at actors from their setting, around the comments they volunteered. I hope that others will follow suit.

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Appendix A

Study Instrument

Research project: Coping strategies of individuals from low-income country organisations in collaborations with individuals from high-income country organisations

"Coping with Unequal Collaborations Survey" (CUCS)

Electronic Survey Instrument

Thank you for your participation in this research titled "Coping strategies of individuals from low-income country (LIC) organisations in collaborations with individuals from high-income country (HIC) organisations". This research is conducted by Tom Kakaire (doctoral student) and Profs. Helena Barnard (Supervisor) and Johan Olivier (Co-supervisor) of the University of Pretoria's Gordon Institute of Business Science (GIBS) as part of a PhD dissertation.

The study should take no more than 30 minutes of your time and the following requirements must be met in order to participate:

- You must agree to participate
- You must be a researcher whose primary affiliation is with a low-income country (LIC) organisation
- You must be at least 18 years of age

The purpose of the study is to examine how individuals in low-income country (LIC) organisations feel about collaborating with individuals from High-Income Country (HIC) organisations across the collaboration cycle. It is conducted through an online questionnaire. The questionnaire begins with some general questions about your demographics, then moves on to questions about your general views on collaboration, before focusing on your views on specific stages and aspects of collaboration from your current or most recent collaboration with individuals from HIC organisations. It ends with some general questions on your views around collaborations with researchers from local organisations vs. collaborations with researchers from HIC organisations given your current/most recent experiences.

If you have any questions or concerns about the research, or you would like to know the results of the research should they be published, please feel free to contact Tom Kakaire (Doctoral student) at tomkak@yahoo.com , Tel: 256-706-200681) OR Prof. Helena Barnard (Supervisor) at barnardh@gibs.co.za OR Prof. Johan Olivier at Olivierjo@gibs.co.za.

There are no immediate personal benefits from participating in this study except that you will gain a better understanding of how research is conducted and of how individuals from LIC organisations feel about collaborations with individuals from HIC organisations at different stages of collaboration. In addition, every effort will be made to ensure confidentiality of any identifying information that is obtained in connection with this study. Only people associated with this research will see your responses. The data will be used for research purposes only and any publication of these data will not contain references to your identity.

You can choose whether to be in this study or not. You may withdraw your consent at any time during the study and discontinue participation without penalty. You may also refuse to answer any questions you do not want to answer and still remain in the study. You may not remove your data after the survey is submitted because the researcher will not be able to identify your responses. You are not waiving any legal claims, rights, or remedies because of your participation on this research study. The study has been reviewed and has received ethics clearance through the Research Ethics Board of the University of Pretoria's Gordon Institute of Business Science (GIBS).

CONSENT OF RESEARCH PARTICIPANT

If you wish to participate in this study, please click the "I agree to participate" button below. If you do not wish to participate, please click the "I decline to participate" button below. Please keep a copy of this consent form for your records. You may print this page.

Name of respondent: (Text)

☐ I agree to participate ☐ I decline to participate

Section 1.1 Personal details and collaboration history

This section of the survey seeks to establish essential facts about you and your history of collaboration. Please select one or more choices as requested for each question.						
Age of respondent (in years)	*(Text)*					
Gender of respondent	M [ ]	F [ ]				
For how many years have you been a researcher?	*(Text)*					
What is your highest completed academic qualification?	High School [ ]	Bachelor's degree [ ]	Master's degree [ ]	Doctorate [ ]		
Which type of local organisation do you belong to (please check all that apply)	University [ ]	Non-governmental organisation [ ]	Public organization [ ]	Private organization [ ]	Health facility [ ]	Other (please state) [Text]
What is your role in your local organisation (please check all that apply)	Masters Student [ ]	Doctorate student [ ]	Post-doc fellow [ ]	Academic staff/research staff/Faculty [ ]	Department or Unit head / organisation executive [ ]	Other (please state) [Text]
How many collaborative research projects with high income country (HIC) organisations have you ever participated in?	*(None)*		*1*	*2*	*3*	*4*
			5-10	*11-15*	*16-20*	*More than 20*

If your answer above is one or more, then please proceed to Section 1.2. If "None" proceed to Section 3.5

Section I.2 a Resources

This section of the survey seeks to establish the extent to which you feel that there is general equality or inequality in terms of the resources people have within collaborative workgroups.
Resources are aspects of the work context that help people to meet their personal and work-related needs.
Please indicate your level of agreement with each statement below.

In collaborations between researchers from high income country (HIC) organisations and researchers from low income country (LIC) organisations:

	Unequal: LIC researchers are in a much worse situation	**Unequal: LIC researchers are in a worse situation**	**Unequal: LIC researchers are in a slightly worse situation**	**Equal**	**Unequal: LIC researchers are in a slightly better situation**	**Unequal: LIC researchers are in a better situation**	**Unequal: LIC researchers are in a much better situation**
LIC and HIC researchers have equal decision-making power	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers have equal protected time that can be devoted exclusively to research tasks	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers have equal access to important scientific networks	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers have equal access to scientific information and technology	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers have equal status and scientific credibility	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Section 1.2 b Demands

This section of the survey seeks to establish the extent to which you feel that there is equality or inequality in terms of the demands made on people within your collaborative group.
Demands include any aspects of the work context that put people under pressure or stress and/or make their work challenging.
Please indicate your level of agreement with each statement below.

In research collaborations between high income country (HIC) organisations and low-income country (LIC) organisations:

	Unequal: LIC researchers are in a much worse situation	**Unequal: LIC researchers are in a worse situation**	**Unequal: LIC researchers are in a slightly worse situation**	**Equal**	**Unequal: LIC researchers are in a slightly better situation**	**Unequal: LIC researchers are in a better situation**	**Unequal: LIC researchers are in a much better situation**

Matching the objectives of their research work to their personal objectives is equally hard for LIC and HIC researchers	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Relevant research work is equally available to LIC as to HIC researchers	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers are equally competing group demands (such as administrative duties) on their time	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers experience comparable pressure from the expectations of their stakeholders (such as their groups, organisations and communities)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers face equal research-related interpersonal challenges.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

THIS SECTION AND ALL SECTIONS THAT FOLLOW IT RELATE ONLY TO ONE SPECIFIC COLLABORATION WITH HIC ORGANIZATIONS; THE ONE IN WHICH YOU ARE CURRENTLY PARTICIPATING OR THE ONE IN WHICH YOU PARTICIPATED MOST RECENTLY.

2.1 Details of Current/Most recent project

This section of the survey seeks to find out details of the <u>current or most recent project</u> in which you are collaborating/you collaborated with high income country (HIC) partners over the last five years. If you are currently involved with more than one collaborative project, then please refer to the one that started most recently. Please select one or more choices as requested for each question.					
What is the nature of your current or most recent collaborative research project with HIC organizations? (please check all that apply)	Population, epidemiologic, operations or implementation research [ ]	Laboratory research [ ]	Clinical research with human subjects [ ]	Clinical research with NO human subjects [ ]	Any other (Please state) ----------
What is/was the planned length of this project?	*(Text)*				

How long (in years) has/had this specific LIC/HIC organisational collaboration been in existence before this project?	*(To be selected from menu – 0 to 50, more than 50)*				
How many LIC/HIC collaborative projects have/had the group worked on together before the current/most recent one?	*(To be selected from menu – 0 to 50 up to more than 50)*				
What is/was your role in the project? (Please check all that apply)	PI/Co-PI [ ]	Investigator [ ]	Student /Post-doc [ ]	Project Coordinator/ Manager/ Administrator [ ]	Other (please state) ----------
How often do/did you have routine electronic/telephone meetings for the collaborative group?	Daily [ ]	Weekly [ ]	Twice a month [ ]	Once monthly [ ]	Less than once monthly [ ]
In the absence of COVID 19, how often would /did you have routine physical meetings for the collaborative group?	Daily [ ]	Weekly [ ]	Twice a month [ ]	Once monthly [ ]	Less than once monthly [ ]
To what extent do/did you feel your contributions to these meetings are/were taken seriously?	Almost never (1) [ ]	Seldom (2) [ ]	Occasionally (3) [ ]	Frequently (4) [ ]	Almost always (5) [ ]
What do you /did you feel about the way group leaders helped the group to achieve its objectives?	Very poor [ ]	Poor [ ]	Fair [ ]	Good [ ]	Very good [ ]
For how long, if at all, do you plan to visit the collaborating HIC institution?	I did not visit /do not plan to visit [ ]	Less than one week [ ]	1 week to 1 month [ ]	1 month to 6 months [ ]	Over 6 months [ ]

Section 3.1 - Stage of collaboration

This section of the survey is intended to establish which activities your HIC/LIC research collaborative group is engaged in as a rough indicator of which stage the project has reached.	
Is there any ongoing research activity related to your latest project?	
[ ] No. All project work, including publication and dissemination was completed and there is no ongoing research group activity	**[ ] Yes. There is ongoing research group activity**
If "No" then the project is at conclusion stage and questionnaire moves to Section 3.2 a. If "Yes" then it moves to section below	
Please state the frequency with which your collaborative group is currently engaged in the following randomly listed activities:	

	The research project has not yet reached this stage (0)	**Almost never (1)**	**Seldom (2)**	**Occasionally (3)**	**Frequently (4)**	**Almost always (5)**
Analysing data (conclusion)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Assigning individual roles within the group (Formulation)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Attending or conducting training activities (Sustainment)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Collecting or reviewing data (sustainment)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Conceptualising the research e.g. idea generation (Formulation)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Disseminating findings to policy makers and practitioners (Conclusion)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Generating post-project follow-on concepts (Conclusion)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Having scheduled /routine Communication (Meetings, telephone calls, conference calls) (Sustainment)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Hiring staff and Setting remuneration rates (Formulation)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Mentoring and reviewing peers' work (Sustainment)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Negotiating access to research sites and populations (Formulation)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Negotiating group norms and standards e.g. meeting times, formality vs. informality (Formulation)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Participating in post-project networking activities (conclusion)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Performing research design tasks e.g. generation possible methods (Formulation)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Performing management tasks e.g. financial and program reporting (sustainment)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Performing research administration tasks e.g. ethics applications and extensions, monitoring (sustainment)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Presenting findings at professional/academic for a (Conclusion)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Setting up group administrative structures (Formulation)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Supervising/coordinating research teams (sustainment)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Writing and submitting manuscripts (Conclusion)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Section 3.2 a Research Conceptualization & Design

This section of the survey seeks to establish the extent to which you believe that there is/was equality or inequality in terms of individuals' contribution to the research conceptualization and design process in your current or most recent collaboration with researchers from HIC organisations.
Please indicate your level of agreement with each statement below <u>with reference to your current or most recent collaboration</u>.

In my current /most recent research collaboration with researchers from high-income country (HIC) organizations:

	Unequal: LIC researchers are in a much worse situation	**Unequal: LIC researchers are in a worse situation**	**Unequal: LIC researchers are in a slightly worse situation**	**Equal**	**Unequal: LIC researchers are in a slightly better situation**	**Unequal: LIC researchers are in a better situation**	**Unequal: LIC researchers are in a much better situation**
The research needs of LIC stakeholders (such as nations, organisations and communities) and those of their counterpart high income country (HIC) stakeholders are/were given equal attention	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers' views on the research planning process are/were given equal attention	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers' contributions to the research design process are/were given equal attention	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC researchers and HIC researchers have/had equal ability to appeal group decisions related to research conceptualization, design and planning	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Section 3.2 b - Role assignment

This section of the survey seeks to establish the extent to which you believe that there is/was equality or inequality in terms of the way roles were/are assigned in your current or most recent collaboration with researchers from HIC organisations.
Please indicate your level of agreement with each statement below <u>with reference to your current or most recent collaboration</u>.

In my current /most recent research collaboration with researchers from high-income country (HIC) organizations:

	Unequal: LIC researchers are in a much worse situation	**Unequal: LIC researchers are in a worse situation**	**Unequal: LIC researchers are in a slightly worse situation**	**Equal**	**Unequal: LIC researchers are in a slightly better situation**	**Unequal: LIC researchers are in a better situation**	**Unequal: LIC researchers are in a much better situation**
LIC researchers and HIC researchers had/have equal opportunity to influence legal, contractual and financial terms of collaboration	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC researchers' roles were/are as reflective of their seniority, experience and research record as were/ are the roles of HIC researchers	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers had/ have similar decision-making power	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC researchers had/have the same ability to appeal decisions related to assignment of group roles, responsibilities and rights as HIC researchers	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Section 3.2 c - Remuneration

This section of the survey seeks to establish the extent to which you believe that there is/was equality or inequality in the way remuneration is/was determined within your current or most recent collaborative workgroup.
Please indicate your level of agreement with each statement below <u>with reference to your current or most recent collaboration</u>.

In my current /most recent research collaboration with researchers from high-income country (HIC) organizations:

	Unequal: LIC researchers are in a much worse situation	**Unequal: LIC researchers are in a worse situation**	**Unequal: LIC researchers are in a slightly worse situation**	**Equal**	**Unequal: LIC researchers are in a slightly better situation**	**Unequal: LIC researchers are in a better situation**	**Unequal: LIC researchers are in a much better situation**
LIC researchers' and HIC researchers'	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

remuneration equally reflect/reflected their seniority, experience and research record							
LIC researchers' and HIC researchers' remuneration equally reflect/reflected their contribution to meeting group goals	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers have/had equal influence on decisions related to remuneration	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers in my current or latest collaborative group have/had equal ability to appeal decisions related to remuneration	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Section 3.3a Local organization benefits

This section of the survey seeks to establish the extent to which you feel that there is/was equality or inequality in terms of the organisational benefits to local organisations relative to benefits to HIC organisations, generated by your current/latest collaborative workgroup. Please indicate your level of agreement with each statement below <u>with reference to your current or most recent collaboration.</u>

In my current /most recent research collaboration with researchers from high-income country (HIC) organizations:

	Unequal: LIC researchers are in a much worse situation	**Unequal: LIC researchers are in a worse situation**	**Unequal: LIC researchers are in a slightly worse situation**	**Equal**	**Unequal: LIC researchers are in a slightly better situation**	**Unequal: LIC researchers are in a better situation**	**Unequal: LIC researchers are in a much better situation**
There is/was comparable administrative and financial support available to my local LIC organisation compared to what is available for HIC collaborating organisations	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
There are/were comparable mentoring and professional growth opportunities for researchers from my LIC organisation compared to those available for researchers from HIC collaborating organisations	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
There are/were comparable opportunities	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

for my LIC organisation to acquire new technology and equipment for research compared to HIC collaborating organisations							
LIC and HIC researchers have/had equal ability to influence or appeal decisions related to organisational benefits	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Section 3.3 b Benefits to the local community

This section of the survey seeks to establish the extent to which you feel that there is/was equality or inequality in terms of the of the benefits to your local community relative to benefits to HIC partners, communities and stakeholders, generated by your current/latest collaborative workgroup.
Please indicate your level of agreement with each statement below with reference to <u>your current or most recent collaboration</u>.

In my current /most recent research collaboration with researchers from high- income country (HIC) organizations:

	Unequal: LIC researchers are in a much worse situation	**Unequal: LIC researchers are in a worse situation**	**Unequal: LIC researchers are in a slightly worse situation**	**Equal**	**Unequal: LIC researchers are in a slightly better situation**	**Unequal: LIC researchers are in a better situation**	**Unequal: LIC researchers are in a much better situation**
There are/were comparable benefits from group resources during research implementation to the LIC local community compared to those of HIC partner institutions	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
The benefits of the research, for LIC researchers' local host communities (for example new approaches to health care provision) compared to the benefits for HIC partner institutions (for example publications) are/were comparable in value, although different in nature.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
As an LIC researcher, I feel that enough is /was done to ensure that my local LIC community fully trusts/trusted the teams that executes/executed the research	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

LIC and HIC researchers can/could equally decide how to interact with the local LIC community	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Section 3.3 c - Professional, ethical and cultural standards

This section of the survey seeks to establish the extent to which you believe that there is/was equality or inequality in terms of the extent to which local cultural, ethical and professional views are/were respected relative to those of HIC members in your current/latest collaborative workgroup. Please indicate your level of agreement with each statement below with reference to your current or most recent collaboration.

In my current /most recent research collaboration with researchers from high-income country (HIC) organizations:

	Unequal: LIC researchers are in a much worse situation	**Unequal: LIC researchers are in a worse situation**	**Unequal: LIC researchers are in a slightly worse situation**	**Equal**	**Unequal: LIC researchers are in a slightly better situation**	**Unequal: LIC researchers are in a better situation**	**Unequal: LIC researchers are in a much better situation**
The professional standards of LIC researchers and their organisations and those of high-income country (HIC) researchers and their organisations are/were given equal attention in conducting group work	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
The cultural standards and norms of LIC researchers (for example expectations in communication and work performance) were/are given comparable attention compared to the cultural standards and norms of HIC researchers in conducting group work	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
The ethical research norms and standards of LIC researchers were/ are given comparable attention relative to those of HIC researchers	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers had/ have equal ability to shape decisions related to the adoption of professional, cultural and ethical standards for collaborative group work	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Section 3.4 a - Authorship

This section of the survey seeks to establish the extent to which you feel that there is/was equality or inequality in the way authorship positions are/were assigned to local LIC members relative to HIC members of your current/most recent collaborative workgroup. Please indicate your level of agreement with each statement below <u>with reference to your current or most recent collaboration</u>.

In my current /most recent research collaboration with researchers from high-income country (HIC) organizations:

	Unequal: LIC researchers are in a much worse situation	**Unequal: LIC researchers are in a worse situation**	**Unequal: LIC researchers are in a slightly worse situation**	**Equal**	**Unequal: LIC researchers are in a slightly better situation**	**Unequal: LIC researchers are in a better situation**	**Unequal: LIC researchers are in a much better situation**
LIC researchers are/were given as much opportunity to negotiate co-authorship positions before commencing the research as HIC researchers	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC researchers are/were likely to have equal opportunity to contribute to writing up the manuscript compared to HIC researchers	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
The authorship positions of LIC and HIC researchers are/or are likely to be/were equally reflective of their contribution to the research	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers have/had equal ability to appeal decisions related to authorship positions	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Section 3.4 b Dissemination

This section of the survey seeks to establish the extent to which you feel that there is/was equality or inequality in the extent to which dissemination activities of your current/most recent collaborative workgroup benefit/benefitted local stakeholders vs. the extent to which they benefit/benefitted HIC stakeholders. Please indicate your level of agreement with each statement below <u>with reference to your current or most recent collaboration.</u>

In my current /most recent research collaboration with researchers from high-income country (HIC) organizations:

	Unequal: LIC researchers are in a much worse situation	**Unequal: LIC researchers are in a worse situation**	**Unequal: LIC researchers are in a slightly worse situation**	**Equal**	**Unequal: LIC researchers are in a slightly better situation**	**Unequal: LIC researchers are in a better situation**	**Unequal: LIC researchers are in a much better situation**
LIC and HIC researchers have/had equal opportunity to determine dissemination	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

priorities (such as target audiences, target meetings, conferences etc.)							
LIC and HIC researchers have/had equal opportunity to disseminate research findings at academic conferences and scientific meetings	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
There is/was equal emphasis on dissemination that serves LIC stakeholders' priorities (such as impact on local policy and practise) as on HIC stakeholders' priorities	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
LIC and HIC researchers are /were equally able to appeal decisions related to dissemination priorities and choices	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Section 3.4 d Post-project organisational affiliation vs. independent consultancy

This section of the survey seeks to establish the extent to which you feel that individual local researchers would benefit/benefitted more from research work done independently than from work done through your local organisation and/or its collaborations with HIC organisations

Following the end of my current /most recent research collaboration with researchers from high income country (HIC) organisations, I am likely to have (select the single best option):

	Through local projects with my local organisation	**Through collaborative projects between my local organisation and HIC organisations**	**Through securing research work as an independent consultant**
Better control over decisions that affect my research career	[ ]	[ ]	[ ]
More protected time that can be devoted exclusively to research tasks	[ ]	[ ]	[ ]
More access to important professional/scientific networks	[ ]	[ ]	[ ]
More access to scientific information and technology	[ ]	[ ]	[ ]
Higher status and more scientific credibility	[ ]	[ ]	[ ]
More consistent/stable availability of research work	[ ]	[ ]	[ ]
Less pressure to deliver research tasks to stakeholder expectations	[ ]	[ ]	[ ]
Less pressure to deliver benefits of research work for my local organisation	[ ]	[ ]	[ ]

Less pressure to deliver benefits of research work for my local community	[ ]	[ ]	[ ]
Less interpersonal challenges with other researchers	[ ]	[ ]	[ ]

Section 3.5 Views and preferences regarding collaboration

	This section of the survey seeks to establish the extent to which you feel it is more important to collaborate with local researchers, HIC researchers, or both. Please indicate your level of dis/agreement with each statement below.					
		Strongly agree	**Somewhat agree**	**Not sure/neutral**	**Somewhat disagree**	**Strongly disagree**
1	I feel that local researchers should maintain their own research agenda and not adapt to those of HIC partners in collaborative groups	[ ]	[ ]	[ ]	[ ]	[ ]
2	It is not important to me to conduct research whether with local LIC groups or with partners in collaborative groups	[ ]	[ ]	[ ]	[ ]	[ ]
3	I don't want to take part in either local research activities or HIC collaborative group research activities	[ ]	[ ]	[ ]	[ ]	[ ]
4	I prefer research activities that involve local research group members only	[ ]	[ ]	[ ]	[ ]	[ ]
5	It is important to me conduct research with both HIC collaborative groups and local groups	[ ]	[ ]	[ ]	[ ]	[ ]
6	I prefer research activities which involve HIC collaborative group researchers only	[ ]	[ ]	[ ]	[ ]	[ ]
7	I do not feel it is important for local research groups either to maintain their own research agenda or to adopt those of HIC collaborative groups	[ ]	[ ]	[ ]	[ ]	[ ]
8	It is more important to me to conduct research with local researchers than to conduct research with HIC collaborators	[ ]	[ ]	[ ]	[ ]	[ ]
9	I feel that we local researchers should maintain our own local research agenda but also adopt the research agenda of HIC collaborators	[ ]	[ ]	[ ]	[ ]	[ ]
10	I feel that we local researchers should adopt the agenda of HIC research collaborators and put our own agenda in the background	[ ]	[ ]	[ ]	[ ]	[ ]
11	I prefer to have only HIC research collaborators	[ ]	[ ]	[ ]	[ ]	[ ]
12	It is more important to me to conduct research with HIC collaborators than with local researchers	[ ]	[ ]	[ ]	[ ]	[ ]
13	I don't want to have either local or HIC research collaborators	[ ]	[ ]	[ ]	[ ]	[ ]
14	I prefer to have only local research collaborators	[ ]	[ ]	[ ]	[ ]	[ ]
15						

	I prefer research activities which involve both local researchers and HIC researchers	[ ]	[ ]	[ ]	[ ]	[ ]
16	I prefer to have both local and HIC research collaborators	[ ]	[ ]	[ ]	[ ]	[ ]

Section 3.6 Other views and preferences

Is there anything else about your experience of research collaborations with HIC organisations that you would like to add?

Thank you for your participation in the survey. Please contact the researchers if you wish to see the results of the study.