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Health research capacity development in low and middle income countries: reality or rhetoric? A systematic meta-narrative review of the qualitative literature

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ABSTRACT

Objectives: Locally led health research in low and middle income countries (LMICs) is critical for overcoming global health challenges. Yet, despite over 25 years of international efforts, health research capacity in LMICs remains insufficient and development attempts continue to be fragmented. The aim of this systematic review is to identify and critically examine the main approaches and trends in health research capacity development and consolidate key thinking to identify a more coherent approach.

Methods: This review includes academic and grey literature published between January 2000 and July 2013. Using a predetermined search strategy, we systematically searched PubMed, hand-searched Google Scholar and checked reference lists. This process yielded 1668 papers. 240 papers were selected based on a priori criteria. A modified version of meta-narrative synthesis was used to analyse the papers.

Results: 3 key narratives were identified: the effect of power relations on capacity development; demand for stronger links between research, policy and practice and the importance of a systems approach. Capacity development was delivered through 4 main modalities: vertical research projects, centres of excellence, North–South partnerships and networks; all were controversial, and each had their strengths and weaknesses. A plurality of development strategies was employed to address specific barriers to health research. However, lack of empirical research and monitoring and evaluation meant that their effectiveness was unclear and learning was weak.

Conclusions: There has been steady progress in LMIC health research capacity, but major barriers to research persist and more empirical evidence on development strategies is required. Despite an evolution in development thinking, international actors continue to use outdated development models that are recognised as ineffective. To realise newer development thinking, research capacity outcomes need to be equally valued as research outputs. While some development actors are now adopting this dedicated capacity development approach, they are in the minority.

Strengths and limitations of this study

- This systematic review goes beyond previous attempts that lacked reflexivity, to provide a nuanced, in-depth and enquiring critique of health research capacity development approaches.
- This review integrates diverse qualitative literature that largely lacked formal reporting procedures or empirical base, allowing the inclusion of voices that are traditionally excluded in other styles of systematic analyses.
- Some academic articles may have been missed because PubMed was the only formal database used, and there was limited inclusion of evaluation and programme-level data due to poor grey literature indexing in Google and Google Scholar.
- However, the meta-narrative method aims to develop overarching narratives through saturation of themes, rather than include every eligible article, so inclusion of additional papers would be unlikely to change the findings of the study.

INTRODUCTION

Locally led health research is critical for overcoming global health challenges in low and middle income countries (LMICs).[1] This research is needed to "propose culturally apt and cost-effective individual and collective interventions, to investigate their implementation, and to explore the obstacles that prevent recommended strategies from being implemented".[2] Such research is now the focus of key capacity development efforts, such as the regional educational centres supported by the Special Programme for Research and Training in Tropical Diseases (TDR).[3]

However, these arguments are not new; the importance of LMIC research capacity has been recognised for well over two decades. The 1990 Commission on Health Research

for Development stated that strengthening research capacity in LMICs is "one of the most powerful, cost-effective, and sustainable means of advancing health and development".[4] This marked the beginning of a 'revolution' in health research[5] where there was a surge of investment and concerted effort to conduct health research aimed at solving health problems in LMICs.[6]

Nevertheless, at the turn of the millennium LMICs accounted for 85% of the world's population, 92% of the global disease burden, but only 10% of global funding for health research was devoted to addressing these persistent health challenges.[6] Recognition of this '10/90' gap led to renewed calls for health research capacity development (HRCD) in LMICs and further investment.[5]

Yet nearly 15 years later, many LMICs still lack sufficient health research capacity to build a local evidence-base with which to inform policy and improve population health. This was recently and profoundly described in The 2013 World Health Report which argued that 'all nations should be producers and users of research as well as consumers', noting that this was not yet the case.[1]

Therefore, despite years of international collaborations and investment, development of LMIC nation's capacity to address their own health problems appears enduringly problematic. Where there has been progress, such gains often do not appear sustainable without continued strong foreign support,[7 8] which is itself questionable in light of recent austerity and bilateral aid agency restructuring.[1 9 10]

Although there is a large and diverse body of literature on HRCD, it remains confusing, controversial and poorly defined, with various contradictory understandings[11] and conceptualisations.[1] Because capacity development is now something that most research actors are expected to participate in, or at least be knowledgeable on,[5 12] this is problematic. To increase the likelihood of future capacity development efforts being effective, there is a need to take stock of past experiences and learn from successes and failures. Such an exercise would not only provide a unifying picture to appraise previous capacity development efforts, but also encourage discussion and reflection that could lead to fresh thinking.

The aim of this systematic review is to identify and critically examine the main approaches, strategies and trends in HRCD and consolidate key thinking in order to identify a more coherent approach. This review should prove useful to all stakeholders interested in learning how to undertake the complex business of capacity development and will be of particular interest to actors working to make locally led and sustainable health research capacity in LMICs a reality.

METHODS

Our systematic review followed the six stages of the meta-narrative methodology developed by Greenhalgh *et al*.[13] The meta-narrative method is a "systematic, theory-driven interpretative technique, which [was] developed to help make sense of heterogeneous evidence about complex interventions applied in diverse contexts in a way that informs policy".[14] Since the HRCD literature shares these characteristics, the meta-narrative method was highly suited to the purposes of this study.

Inclusion criteria

This review considers the perspectives of all actors involved in HRCD that have published within academic and grey literature from the year 2000 onwards. We included any papers that broadly discussed HRCD or its more specific components. Papers that mentioned HRCD but did not discuss the issue further were not included. Non-English language publications were excluded due to lack of resources for translation. Papers published before the year 2000 were initially included, but after screening it became clear that paradigm shifts in global health at the turn of the millennium[5 6] meant that much of their content was not relevant to current day. Furthermore, many papers published post-2000 effectively summarised historically important issues. Therefore, all papers published pre-2000 were excluded.

Search strategy and study selection

The search and study selection process is presented in figure 1. We searched PubMed using the search terms presented in box 1 for all papers published up to 20 June 2013. This search yielded 1668 potentially relevant papers. The titles and abstracts of these papers were then screened for eligibility, resulting in 1376 papers being excluded based on prescreening, with an additional 75 papers excluded after it was decided that papers published before 1 January 2000 should not be included.

The PubMed search was complemented by a search of Google and Google Scholar using the terms 'Health AND research AND capacity AND strengthening OR Building OR Development'. All literature added from Google were found in the first 10 pages (n=30). After the first 10 pages, no search results were relevant to the study. Literature collections of the authors and other experts were also hand searched and references snowballed (n=45). A total of 292 papers were read in full and considered for eligibility. On the basis of this screening, the final synthesis involved 240 papers. The full list of papers included in this review can be found in online supplementary file S1.

Relevant papers published between 20 June 2013 and 14 December 2014 were scanned and read to determine if the synthesis findings were still valid postsearch. Although there were some pertinent new articles, their content would not have changed the findings of this synthesis.

Quality assessment

No papers were excluded based on assessment of quality because the majority of papers lacked an empirical or

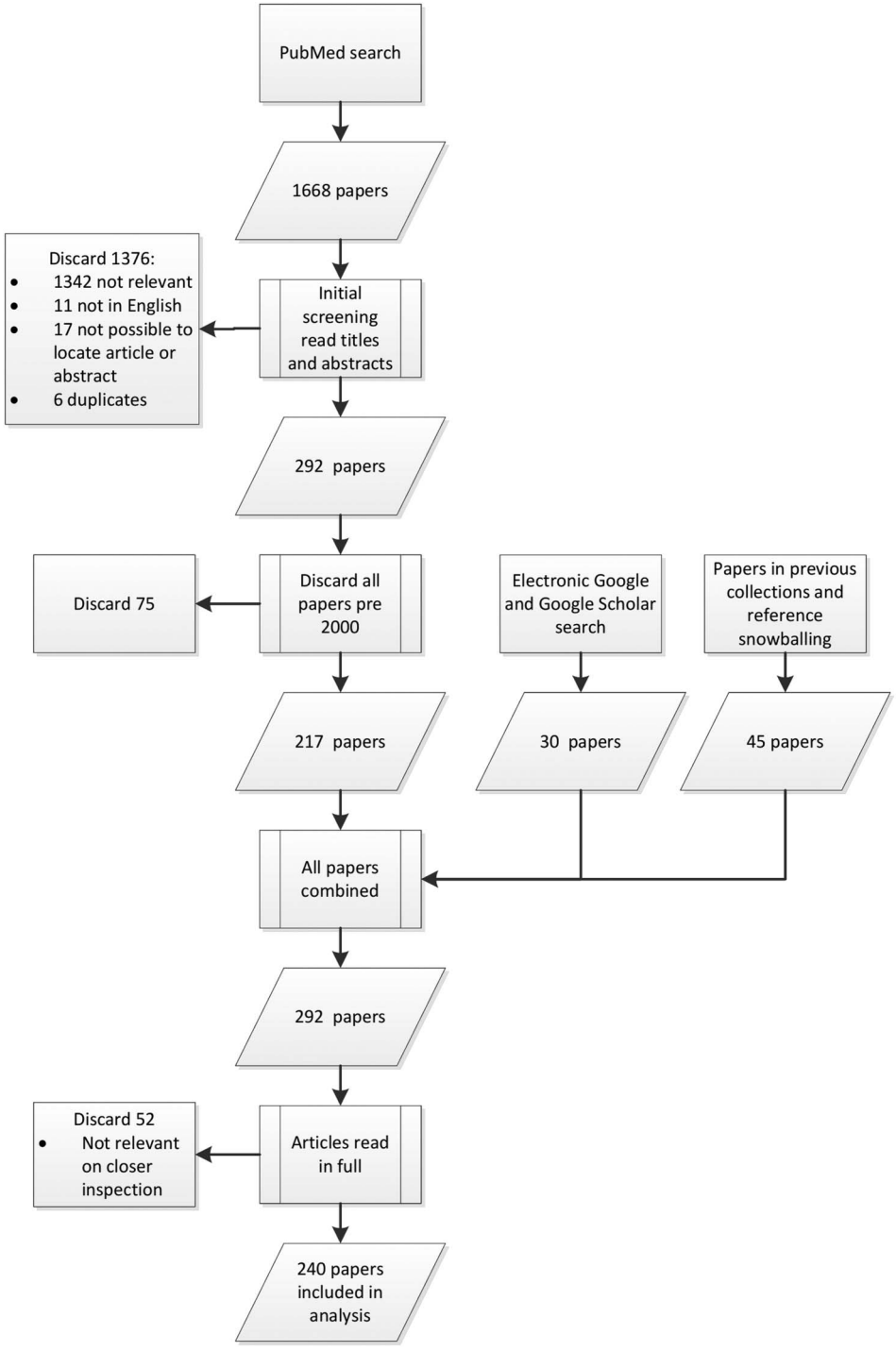

Figure 1 Search and study selection process.

explicit study design, and all stakeholders' views regardless of their perceived validity were considered important. Furthermore, capacity development discussion is inherently political and most contributions are based on personal opinion informed by theoretical, ethical or experiential standpoint. Accordingly, much of it is biased. Rather than attempt to remove the bias, assumptions and motivations were explicitly studied to undercover authors' implicit logic, so that readers can make their own informed opinion.

Instead of using quality criteria, similarity of arguments within the literature was used as an indicator of current agreement on a topic or popularity of an idea. This allowed a comprehensive analysis of all the HRCD narratives, while still highlighting and giving emphasis to the most widely accepted opinions.

Data extraction and synthesis

To synthesise the literature, papers need to be framed within a 'storyline' that recognises where the contribution came from.[13] Greenhalgh *et al*'s[13] method explicitly catalogues these storylines as 'meta-narratives'. Developing meta-narratives provides context to contributions whose underlying assumptions and interests would

Box 1 Search terms used in PubMed search

((((((((((((((((capacity building[MeSH Terms]) OR (((“developing” [Title/Abstract]) OR “develop”[Title/Abstract]) OR “capacity”[Title/Abstract]))))) OR “strengthen”[Title/Abstract]) OR “strengthening” [Title/Abstract])) AND ((((developing country[MeSH Terms]) OR Africa) OR Asia) OR Latin America))) AND (((“trial”[Title]) OR “trials”[Title]) OR “research”[Title]))))) NOT clinical trial[Publication Type]) NOT informed consent[MeSH Terms]) NOT waste management[MeSH Terms]) NOT air pollution[MeSH Terms]) NOT agriculture[MeSH Terms]) NOT (“$Na_6(H_2O)_8(ZnAsO_4)_6$” [Supplementary Concept] OR “$K_3Zn_4O(AsO_4)_3$” [Supplementary Concept]).

otherwise be opaque. Although less prescribed than a quantitative systematic review, this approach pragmatically allows a plurality of ideas, recognising that there may be no single correct answer.

To ensure that source content was interpreted alongside its context, even when broken into themes and narratives, a tagging system was used instead of a traditional extraction form. All sources were organised in EndNote X7 (Thomson Reuters), and associated citations, metadata and PDF copies of the documents were attached. These data were then imported into Nvivo V.9 qualitative analysis software (QSR International) where the sources were given tags using deductive codes for key characteristics.

Meta-narratives were then identified inductively by reading each paper and coding for meta-narratives where several authors in the literature discussed and presented topics similarly. This is an interpretive approach similar to that used in thematic coding analysis, where reoccurring themes that are conceptually related are grouped into concepts. Once the meta-narratives had been finalised, they were systematically applied to all relevant papers. No prior theory beyond the guidance presented by Greenhalgh *et al*[13] was explicitly used to help identify and categorise the meta-narratives. Instead, iterative rounds of open data-driven inductive coding were used.

Role and position of the authors

This systematic review was undertaken, in part, to inform the design of a larger body of empirical research on HRCD in LMICs. All authors have backgrounds in social science and global health. Initial coding was conducted by Samuel Franzen and then refined based on face-to-face discussions with other authors around the coding framework and preliminary findings. The authors of this paper do not include individuals from LMICs, but this paper was reviewed and commented on by individuals from LMICs who collaborated on and participated in the parallel empirical research, and discussed with other relevant experts at meetings and conferences. These team processes represent a deviation from the meta-narrative method presented by Greenhalgh *et al*,[13] because the authors did not constitute a multidisciplinary team and input from external peers was largely ad hoc, rather than through regular planned inputs. These methodological deviations were required to enable the systematic review to feed into the evolving parallel empirical research.

RESULTS

Definitions and actors

The concept of capacity development can be confusing because there are multiple and conflicting terminologies for development activities and actors. To assist the reader, typologies of key definitions and development actors were produced. Online supplementary file S2 presents these definitions alongside reasons for adopting them, and online supplementary file S3 categorises and provides background to development actors’ activities.

Characteristics of included papers

Table 1 summarises the main characteristics of the papers included in the review. On the basis of first author characteristics, the greatest number of articles came from LMIC academic and healthcare institutions (31.3%), closely followed by high income countries’ (HIC) academic and healthcare institutions (29.6%). Contributions from funders were very low (0.8%), and industry and civil society were absent, potentially reflecting the sampling from academic databases. Europe was the greatest contributing region (32.9%) followed by sub-Saharan Africa at 23.8% and North America at 13.8%. Contributions from Latin America (2.5%), Middle East (1.7%) and North Africa (0.8%) were low. Although most articles were concerned with capacity development across all LMICs (42.1%), sub-Saharan Africa dominated the regional specific discussions (34.6%). The main basis for viewpoints were opinion, debate or personal perspectives (34.2%); sharing experiences represented 21.7%, and empirical work 20.8%.

Meta-narratives in HRCD

Three key narratives ran though the literature: the effect of power relations on capacity development; demand for stronger links between research, policy and practice and the importance of a systems approach to HRCD. Each narrative is described below with reference to the key papers that discussed these narratives in detail.

Effect of power relations on capacity development

The effect of power relations on capacity development was the most common narrative running through the literature (present in 29% of papers). The main concerns of this topic are that research agendas in LMICs are set more by international funders than by LMIC institutions, and research conducted in LMICs is predominantly led by HIC researchers with little involvement of LMIC individuals or institutions. This is argued to erode national sovereignty,[15] prevent capacity development[16 17] and

Table 1 Characteristics of papers included in this review

Category* of development actor (for first author)	Per cent	Location of first author's institution	Per cent	Region of interest	Per cent	Main topic of development interest	Per cent	Main disease of interest	Per cent	Basis for viewpoint	Per cent
LMIC academic and healthcare institutions	31.3	Europe	32.9	All LMIC countries	42.1	Multiple broad issues discussed	24.6	Not disease specific or address multiple	72.5	Opinion, debate, perspective	34.2
HIC academic and healthcare institutions	29.6	Sub Saharan Africa	23.8	Sub Saharan Africa	34.6	Individual level development	15.8	HIV	6.3	Experience report	21.7
Multilaterals	10.4	North America	13.8	South Asia	10	Partnerships networking, consortia	15.8	Malaria	5.8	Empirical research	20.8
Consortia and networks, NGOs and public–private partnerships	8.8	South Asia	10	East Asia	6.7	Operational challenges and opportunities	11.3	Other	4.6	Literature review, summary or synthesis	7.9
Academic journals	5.4	East Asia	9.2	All Asia	2.9	System approaches and macrolevel development	9.2	Mental health and addiction	2.5	Proceedings or conference report	7.5
LMIC governmental	4.6	Australia	2.9	Latin America	1.7	Agenda and priority setting	6.3	Maternal child health and paediatrics	2.5	Organisation document	4.6
LMIC funders, research councils and institutes of health	4.6	Latin America	2.5	Pacific	0.8	Institution level development	5.4	Tuberculosis	2.1	News report	3.3
Bi-lateral aid agencies	2.1	Not specific	2.1	Middle East	0.8	Monitoring and evaluation	2.9	Non-communicable diseases	2.1		
HIC research councils and institutes of health	2.1	Middle East	1.7	Central Asia	0.4	Research and development	2.1	Dental or oral health	1.7		
Private foundations or charity funders	0.8	North Africa	0.8			Ethics and regulations	1.7				
Industry	0	Pacific	0.4			Knowledge cycle	0.8				
Civil society and media	0										

*Some categories have been merged because they could not be separated.
HIC, high income countries; LMIC, low and middle income countries; NGOs, non-governmental organisations.

create research priorities that more closely match funder agendas than countries' needs[18–20] leading to a situation of 'he who pays the piper calls the tune'.[20 21] Examples include 'spotlight issues', which receive funding regardless of relative need,[22] and 'parachute' research where data are collected in LMICs but all other work is conducted in HIC institutions.

'North–South' collaborations between HIC and LMIC research institutions are considered to be better mechanisms for developing research capacity,[8] but many authors still thought that they comparatively disadvantage the LMIC partner.[9 12 15] The perceived situation of 'treating Africa as a repository of raw materials for expatriate-driven research'[9] led to the development of guidelines for research collaboration. To reflect the change in approach, there was a rhetorical shift to using the term 'partnership' to describe collaborations that were equitable.[17] These partnerships should be built on mutual trust and shared decision-making, national ownership, early planning for translation of research findings and development of national research capacity.[17] Importantly, it is now expected that all partnerships should have capacity development at their forefront.[12] However, despite discussion for well over a decade, a good proportion of the international community still feels that partnerships are not yet equal,[12 23 24] and they cannot be until the power divide is addressed[15] because LMICs are unable to negotiate for a fairer deal.[15 25 26]

In an effort to adjust the power balance, there have been conscious efforts towards recognising local research capacity in LMICs.[12 20] This change is again reflected in rhetoric through the evolution of the term 'capacity development' which gradually places stronger emphasis on extant capacity; changing from 'capacity building' to 'capacity strengthening'[20] to 'capacity utilisation',[27] 'unleashing' and 'releasing'.[20] Many authors now propose that research and capacity development in LMICs should be locally owned and led.[17 20 28 29] This is because LMIC researchers have the best understanding of evidence gaps[17] and can present research to policymakers with an understanding of the political and cultural context which increases the chance of evidence uptake.[30 31] Locally led studies are also thought to be better aligned with national agendas[32] and address more applied implementation topics than foreign-led research.[17]

Most stakeholders now agree that research and capacity development should, at a minimum, include the local research community in the design and conduct of research studies.[33] Development actors are also advised to be more sensitive to the power dynamics they create and ensure they strengthen, not weaken, the role of national governments by responding specifically to their priorities[20 29 34] and including the 'recipients' in any agenda setting.[35] However, others argue that this situation will inevitably continue so long as foreign countries are the majority financiers of research in LMICs;[36] only through greater national investment and commitment will LMICs have a stronger voice to make relations more equitable.[7 9 37] Nevertheless, the vast majority of development efforts reportedly still focus on international collaborative research meaning local investigator-led studies are largely ignored.[38] This is evidenced by only three papers in this review being focused on supporting locally led clinical trials, compared to 33 papers aimed at developing international clinical trials.

Demand for stronger links between research, policy and practice

Arguments for stronger links between research, policy and practice were present in 16% of sources. These emerged due to concerns that much research was failing to be translated into policy[25 39] and was too narrowly conceived and disease-specific to have impact.[40]

Accordingly, applied fields now deemed to be highly relevant to decision makers and those that promote sustainable adoption and implementation of evidence-based medicine have been called for.[30 41 42] These include health policy and systems research,[43] health services research,[44] implementation research and operations research.[45–47] These arguments formed the backbone of the WHO strategy on 'research for health' which "gives priority to research and innovation that has the greatest potential to improve global health security, accelerate health-related development, redress health inequities and help to attain the Millennium Development Goals".[48]

Despite these discussions, much research is still regarded as uncoordinated and concentrating on a few high profile diseases[49] such as the 'big 3': HIV/AIDS, malaria and tuberculosis. Furthermore, the majority of research is critiqued as largely technology development focused, even though many argue that the impact of this research is low[44] and more lives could be saved by improving service delivery of existing interventions.[25 43 50]

The importance of a systems approach to capacity development

The importance of taking a systems approach to HRCD was discussed in 24% of sources. Conceived in the 1990s and popularised after the Ministerial Summit on Health Research in Mexico in 2004,[25] systems approaches to HRCD emerged in response to perceived failings of capacity development targeted at only one level. Particular weaknesses cited included: lack of provision for trained individuals to use their skills[6] leading to 'brain drain' of LMIC researchers to HICs;[51 52] exclusively focusing on high performing individuals[53] rather than strengthening local institutions to develop researchers;[54] absence of national bodies to coordinate priorities, develop policy and translate evidence into action[55] and the fragmentation of capacity development activities.[56 57]

Proponents of systems approaches argue that for capacity development to be effective and sustainable,[8 58] new approaches to addressing all three levels of the national

research system are needed; macro, institutional and individual[58] (for definitions of these levels, see online supplementary file s2). Macrolevel capacity development should include: priority setting, planning and coordinating research, governance and regulation and knowledge translation and dissemination.[48 57 59] Individual development should include a broader range of stakeholders than just research producers (eg, policymakers, administrators, medical personnel and ethics board members) and teach a wider variety of skills and disciplines, particularly 'soft skills' such as organisation, management and leadership.[55] Institutional development should focus on the ability to generate, retain and use individual capacity through improving curricula, training support, mentorship and research resources.[60–62]

Although presented as a complex task with long time frames,[63] taking a systems approach is said to result in more dynamic capacity development that produces endogenous change, greater local ownership and removal of perennial system barriers[20] which helps countries to effectively target their own health needs.[19] This is in stark contrast to previous approaches that established parallel structures to deliberately bypass local systems because they were deemed to be chronically ineffective.[24] However, despite the accepted importance of research systems development, little is known about how health research systems can be formed,[19] there are few successful examples of research system strengthening and little guidance is available.[64]

A summary of modern HRCD modalities

After attempts at aligning human, material and technical capacities failed in the 1980s, research models that directed funds and technology through HIC institutions became the preferred HRCD mechanism.[5] These mechanisms are now the most common approach to HRCD. The justification for requiring LMICs to collaborate with HICs is that knowledge transfer and HIC expertise are required to achieve capacity development.[65 66] However, others argue that such development models propagate inequities in research and development.[17 36] Discussions on development modalities are therefore contentious. The following sections summarise the justifications, benefits, drawbacks and controversies of the main development modalities.

Vertical research projects

One of the earliest and most persistent research models arising from the HIC fund channelling mechanism was vertical research projects.[5] This involves a HIC research collaborator working in a LMIC to conduct applied, normally short-term research projects with narrow objectives.[54] The theoretical advantage of a vertical strategy is that it maintains focus on a specific scientific mission.[67] This allows the necessary capacity to be developed more rapidly and can quickly produce research outputs[5] even where major expansion of R&D is required.[35] These approaches now account for the biggest share of health research funding.[58] Examples include product development partnerships such as The Global Alliance for TB Drug Development, and many commercial or non-commercial clinical trials.[68]

HRCD is often included in these programmes, but development of capacity is usually not the primary objective.[59] Rather it is designed to develop capacities that will benefit the successful completion of the project[60] and result in high-quality research outputs.[54] Vertical projects often have strong expatriate leadership and are frequently managed by external institutions,[54] which is argued to result in parallel structures that bypass local research institutions.[69] Where individual-level development is provided, it is typically short term and project specific.[70]

Critics of vertical projects argue that local researchers often only have support roles,[16] samples may be shipped abroad for analysis[23] and there can be little investment in local institutions because they are bypassed.[15 69] Therefore when these short-term projects finish, research sites and individuals are rarely left with the skills or resources to run their own studies.[41 68] Another criticism is that vertical approaches force the research community to work separately on overlapping issues[71] leading to fragmentation of national research systems.[55]

Proponents of vertical interventions are however mindful that there is a trade-off between the speed and quality of research, and capacity development.[72] They argue that in the case of health emergencies, investment should be made in excellent research, not excellent capacity development.

Centres of excellence

A common modality for developing long-term capacity to conduct advanced research in LMICs is 'centres of excellence'. These have taken various forms, but the approach generally concentrates investment within a few institutions that show potential to excel and become high-quality self-sustaining sites. These models are reportedly useful because they increase the likelihood of high-quality research and renewed investment in an otherwise challenging environment.[52 55 73]

Early forms of this concept were criticised as being 'annexed' research sites, effectively led and managed by expatriate staff.[74] Others argue that they create parallel research structures outside of the national system that further depletes the local resource pool by diverting investment and human resources towards these better funded sites.[17 24 44] More recent forms of 'centres of excellence', such as those championed by the European and Developing Countries Clinical Trials Partnership, strive for greater Southern leadership and better integration with local research systems.[75]

North–South partnership

Another common development model is North–South partnerships. They are distinct forms of collaboration between HIC and LMIC researchers because unlike

'centres of excellence', they are usually project specific rather than institution building, and they put more emphasis on sustainable research, shared leadership and mutual benefit than vertical research projects. However, depending on the nature of the partnership, these demarcations can become blurred.

Since the millennium, North–South partnerships and have been heavily promoted by organisations such as The Global Forum for Health Research[6] and The European and Developing Countries Clinical Trial Partnership (EDCTP).[75] Such partnerships are said to be responsible for increasing resource flows to LMICs[31] and have been advocated for: increasing scientific productivity,[76] training of graduates, staff exchange and knowledge sharing, exposure to cutting edge technology,[52] strengthening local education programmes and moderate levels of institutional strengthening.[6 77 78] This is argued to result in more sustainable development,[54] greater cost-efficiency and a broader research scope than exclusively expatriate-led or locally led research could achieve alone.[17 20]

Despite their popularity, a greater proportion of the literature is dedicated to discussing problems with North–South partnerships than their benefits. Many authors still feel that despite much guidance for entering into partnerships,[12 17 53 79 80] too few benefits are accrued by the Southern partner[9 12 23 24 81] because they are forced to collaborate with HIC institutions to meet funding requirements.[82] Accordingly, LMIC partners are reported to sometimes receive little financial benefit, go unrecognised in publications and release intellectual property rights.[9 12] Proposed amendments to this model have involved adapting partnerships to be driven by LMIC demand,[60] led by the Southern partner[20] or supporting more South–South partnerships.[28 83]

Networks and consortia

Networks and consortia development models emerged in the mid-1990s. By the mid-2000s, they were used to tackle whole programmes of research[60] and are now very popular with funders.[60] Actors adopting network models are highly diverse and can sometimes be hard to separate from partnership models or vertical programmes. However, they all involve linking multiple research departments, groups or institutions.

Networks are considered advantageous because they encourage less-hierarchical leadership and competitive and individualistic attitudes. They are therefore reportedly useful for working cooperatively on shared problems at regional or global levels.[84 85] Because networks facilitate information exchange and pooling of resources to achieve a critical mass,[86] they are seen as particularly important where groups may be isolated[87] or when one group alone would have insufficient capacity to address an issue.[88] Networks are also thought to: help focus on common research priorities;[60 89] increase knowledge exchange and speed diffusion of innovations[57 64] and help forge long-term relationships[5 87] and sustainability.[37 86 90 91] However, some authors point out that most networks focus on highly thematic research projects[60] and only develop capacity of individual research groups, not research systems.[87]

Specific development strategies

The reviewed literature contained a multitude of development strategies targeted at all levels of the health research system; macro, institutional and individual. These are presented in table 2 and grouped according to the barrier that they address. The research barrier groupings were identified by the authors through thematic coding of the literature content. The popularity of the development strategies are indicated as a percentage of the reviewed sources that proposed them as a solution to a health research barrier.

Reported success and effectiveness of development efforts

Broadly, authors consider capacity to conduct health research in Africa to have increased considerably since the millennium[12] with potential to leverage further gains from current efforts.[59] This is best exemplified by increases in the number of clinical trials conducted in LMICs[103 123] with reports of enhanced trial capacity,[68] particularly laboratories[124] and quality standards,[38 115 125] and greater LMIC inclusion.[105 126] Such institutional strengthening is also thought to have helped reduce brain drain in specific cases.[107] Although some countries still lag behind in regulatory and ethical review capacity, several publications indicate that LMICs have made good progress.[89 127]

The increase in research capacity is thought to have been driven by recognition of the importance of health research over the last 20 years,[5] a revised strategic focus[30] and the expansion of networks and partnerships for addressing research needs.[60 67 91] However, it is not possible to attribute success to these development approaches due to lack of monitoring and evaluation data; in Africa, positive outcomes in the quality and quantity of published research have been recorded,[60 107 128] but their connection to development inputs and outputs is not established.[129] Operational research and sharing of on-the-ground experiences is thought to be a useful learning resource, but with the exception of a few examples,[42 130] little published material on operations is thought to exist.[131] This is argued to make it hard to learn from previous efforts and experience[60] and determine why and how successes were achieved.[28]

The paucity of monitoring and evaluation data is a recognised problem,[5 58 60] with authors attributing it to long time-lags to achieve objectives,[11] outcomes such as organisational culture being difficult to measure,[11] lack of commonly agreed and conceptually robust indicators,[59 60 102] and most evaluation data not being published.[129] To remedy this situation, guidance on

Table 2 Summary of capacity development strategies designed to address specific barriers to health research

Barrier to research	Strategies designed to address barriers to research	Popularity (% of sources)
Fragmented research systems	Undertake a situational analysis and build on existing assets[28 29 57 92] Collaboratively develop research agendas with LMIC stakeholders[55 70 75] Create a research coordinating body or scientific councils[29 64 93]	Recently gaining popularity (12)
Insufficient research funding	Establish a research finance system using innovative revenue generation[52 94 95] Provide long-term funding and flexible grants[8 63 96] Advocate for funding through shared causes and engaging with the media[68 97]	Growing popularity (21)
Limited use of research evidence	Build capacities of policymakers to demand and scrutinise research[25 84 98] Develop evidence repositories and use Research-to-Action-Groups as knowledge brokers to package findings appropriately[39 99] Create knowledge translation platforms to support evidence dissemination and dialogue between research producers and users[30 39 64 100]	Consistent popularity (11)
Limited governance and regulatory capacity	Work research into a legislative framework[64 101 102] Clarify guidelines, map review capacity and streamline procedures[74 103] Strengthen regulatory and ethical review capacity[42 64]	Growing popularity (21)
Insufficient networking	Develop and share a database of researchers and their expertise[31] Use or develop professional networks, especially web-based communities[42 71] Organise conferences and working groups on locally important topics[2 104]	Very popular (26)
Inefficient admin and research management	Train management and research support staff[29 105] Set up a research support office to help with grant management, reporting and contracts, and develop information and finance systems[20 28 72] Develop transparent and accountable policies and procedures[69 106]	Unpopular but increasing (8)
Inadequate material capacity	Upgrade libraries and journal availability and invest in laboratories[28 89 91] Improve information technology, particularly internet[6 78] Ensure stable power and water supplies[89]	Widely recognised (20)
Insufficient human capacity with research knowledge and skills	Develop LMIC university research training capacity using 'train the trainer' programmes, LMIC-HIC 'sandwich' courses or visiting research fellowships[20 70 92 96 107–109] Make research principles and skills key components of undergraduate and continuing professional medical education[37 70 110] Develop a variety of research roles: nurses, data managers, statisticians, laboratory personnel, managers, data collectors[9 63 70 107 111–113] Increase distance learning via e-technologies or e-learning resources[26 41 70 114 115] Training in major skills gaps: data collection, data management, data analysis and statistics, GCP, laboratory skills, computer literacy and ethics[46 51 54 107 116] Training in core capabilities: protocol development, writing for grant applications and publication, grant management and budgeting and policy dialogue[29 45 55 63 117]	Extremely popular (41). Training in core capabilities less popular (15)

Continued

Table 2 Continued

Barrier to research	Strategies designed to address barriers to research	Popularity (% of sources)
Insufficient practical research experience	Supplement didactic training with research 'learning by doing' opportunities[40 47 55] Involve more LMIC institutional staff in research projects[54] Exchange visits to advanced research sites to update skills[118] Pilot or small grants for early stage researchers to gain experience[53 119]	Fairly accepted (11)
Too few research leaders	Develop leadership, project and human resource management skills[8 72] Opportunities for junior staff to take responsibility within a supportive environment[20] In collaborative projects, local staff must be involved in the entire research process[120]	Gaining popularity (13)
Too few mentors and role models	Support mentors with long-term funded positions and recognition[73 78] Where mentoring is not available locally, institutional partnerships/exchanges or peer mentorship can be used[9 11 55]	Popular (15)
Lack of research culture	Promote academic departmental leaders based on research experience[110] Set up a departmental committee to promote research[121] Journal clubs and seminars to develop interest in research and critical thinking[70 118]	Not popular (6)
Low motivation to conduct research	Protected research time and longer term contracts[54 76] Re-entry grants or guaranteed jobs to encourage 'brain drain' diaspora to return home[107 108] Higher salaries or funded research time to off-set private-practice incentives[76 122]	Popular (18)

HIC, high income countries; LMIC, low and middle income countries.

planning and implementing monitoring and evaluation for health research has been developed,[29] and one research group provides online resources to help record and share operational guidance.[41]

It was also clear from the literature that significant capacity gaps remain in many LMICs. Following the example of clinical trials, authors point out that early phase studies are still lacking[132] and there are too few quality research sites to meet demand.[103] Despite increases in some capacities, translation of findings into policy is considered an enduringly difficult outcome[60 133] and LMIC leadership and authorship in studies is still thought to be too low.[43] Reportedly insufficient political buy-in for strengthening investment in health research has also raised concerns over the sustainability of capacity development achievements.[7 8] Some authors argue that longer term projects and planning for sustainability of research staff and services are needed,[103] but little literature explores this.[63]

DISCUSSION

An evolution in HRCD thinking

This literature synthesis has objectively presented the main HRCD modalities and strategies and shows that some development actors continue to operate research models that are contrary to widely accepted views of best practice, for example, expatriate led parallel research units. Nevertheless, the literature reveals that there has been steady progress in health research capacity in LMICs. Development actors have continuously reassessed their approaches and have become much more reflexive of their actions. National stakeholders have taken on a stronger voice and greater ownership and are generally in a more self-sufficient position.

Overall, development actors now agree that there is no panacea or one-size-fits-all model to HRCD. Instead a plurality of solutions exists, the choice of which should be determined by the specific capacities constraints and research goals of LMIC institutions. However, despite progress, major barriers to health research persist, there is little evidence to support decision-making and the sustainability of HRCD achievements is questionable.

HRCD, reality or just rhetoric?

The evolution in HRCD thinking appears promising, but the literature demonstrates that good HRCD practices are not always enacted. While the requirement for short-term projects is recognised,[5] the vertical model has been the dominant model for almost 20 years.[58] This would indicate that vertical approaches have been used in situations that would be better served by longer term

systems strengthening strategies.[5] However, there are far fewer programmes dedicated to implementing systems approaches to capacity development. Other examples include focusing on a few high profile diseases, donor-led research agendas, compulsory requirements for collaboration with HICs, setting up parallel structures and fragmentary competitive research. To make the HRCD rhetoric a reality, there is a need to understand why research models that do not enhance or potentially inhibit locally led research remain the *modus operandi*, even though there is clear agreement that they are bad practice.

The literature findings clearly and frequently show that the persistence of flawed development strategies is driven by approaching capacity development within the context of a dedicated research model. This creates a trade-off between doing good research and doing good capacity development. Projects prioritising good research place research outputs as the primary goal and assume capacity will be developed through limited LMIC involvement in research activities. This means that specific development strategies designed to improve capacity are not used. This 'implicit' capacity development is known to be largely ineffective,[63 72] yet is it regularly used. As a result, local research systems may fail to develop or deteriorate,[22] and development efforts are likely to become multiplicative and fragmented,[60 92] despite overlapping interests and generic requirements.[71]

The other main alternative is 'explicit' capacity development. This refers to research projects that place more priority on capacity development and use specific strategies designed to address capacity gaps. There is wide recognition that this is a superior approach and is more likely to improve capacity sustainably.[11 63] However, because the research component is usually more valued by the research community, capacity development receives less attention and often focusses on developing project-specific capacities, not addressing systemic deficiencies. Accordingly, the capacity development component often becomes 'bolted-on' and ad hoc;[11 28] thus making it 'implicit' in disguise.

Instead, the review findings suggest that conducting research to improve health in LMICs and developing health research capacity in LMICs must be considered two, sometimes diverging objectives. Recognising this leads to a third way; 'dedicated' capacity development. This implies that developing local capacity is as equally valued as the research outputs and should be considered as carefully as the research designs. Owing to the additional resources this requires, previous efforts have been limited to individual capacity development or centres of excellence.[91] However, some capacity development actors are now attempting to do this at a more systemic level. Examples include: The Special Programme for Research and Training in Tropical Disease's (TDR) implementation research programmes,[3] ESSENCE on Health Research[134] and The Global Health Network.[135]

Implications for policy and practice

This systematic literature review provides an important synthesis of HRCD that should prove useful for policymakers and practitioners alike. It identifies the strengths, limitations and controversies of the main development approaches and summarises strategies that can be used to overcome specific research system barriers.

Dedicated capacity development appears to offer the best approach for achieving the WHO's vision of all nations becoming producers and users of research.[1] However, a key barrier to designing development strategies based on this thinking is the lack of empirical evidence. Without operational and implementation research and quality evaluation data, it is not possible to know the relative effectiveness of different development strategies and difficult to predict if they will be appropriate for a given context. The current experience of sharing data is a good start, but more systematic empirical research is required. This should be performed with the same rigorous attention to methodological design, analysis and reporting standards as any other research endeavour.

Study strengths and limitations

Previous reviews of capacity development have lacked sufficient reflexivity and questioning of assumptions implicit in many strategies.[40] This systematic review produced a nuanced and enquiring critique of HRCD approaches in LMICs and has identified dedicated capacity development as a promising strategy for future HRCD efforts. It also integrated diverse qualitative literature that largely lacked formal reporting procedures or empirical base, allowing the inclusion of voices that are traditionally excluded in other styles of systematic analyses.

Some academic articles may have been missed because PubMed was the only formal database used and non-English language articles were excluded. However, the meta-narrative method aims to develop overarching narratives through saturation of themes, rather than include every eligible article, so using additional databases would add little to the study. More problematic was the limited availability and inclusion of programme evaluations and evidence supporting operational learning. While expert opinion and the popularity of development strategies were presented, it was apparent that this is not a reliable indicator of good development practice. Searching Google and Google Scholar, hand searching literature collections and snowballing references did identify the most seminal papers, but some useful organisational documents will have been missed due to poor grey literature indexing. Furthermore, most articles had a general focus or related only to sub-Saharan Africa, meaning that context-specific and research-specific differences could not be examined in detail. The focus of the literature on sub-Saharan Africa is likely due to the high publishing rates of African authors and many papers' disease specific-focus on high burden diseases of sub-Saharan Africa (HIV and malaria). However, it may

also be possible that the English-language search restriction excluded papers from authors publishing about their region in non-English languages. Regardless, the HRCD evidence gap in other developing regions is notable.

It is also important to note that the literature search was carried out on 20 June 2013, so only articles published prior to this date were included in the analysis. A literature scan was carried out on 14 December 2014 which found that the findings were still valid up to this date. It is possible that due to the delay in publication of this article further papers may have been published that could contribute to the findings of this study. While this means that this systematic review may not contain the most up-to-date literature, it is the opinion of the authors' and peer reviewers' that the study findings continue to be valid and of important relevance to the global capacity development community. These assertions are supported by the fact that major HRCD agencies such as WHO-TDR and multiagency collaborations such as ESSENCE on Health Research continue to view the issues raised in this paper as problematic. Indeed the 2016 revised version of ESSENCE's Framework for Research Capacity Strengthening[136] reiterates the importance of the guiding principles it set out in 2011, while a contemporary WHO-TDR report on Key Enabling Factors in Effective and Sustainable Research Networks[137] would suggest that these principles have not yet been achieved.

The limited number of authors working on this review reduced the breadth of perspectives involved during analysis which could have biased interpretation towards the authors' particular knowledge paradigms and world views. However, this was mitigated to some extent by drawing on perspectives and experiences from concurrent research collaborators and participants, and seeking feedback from relevant experts at meetings and conferences. While some context-specific differences in experiences were inevitably raised, all individuals who were consulted considered the findings of this study to be relevant and consistent with their broad view of HRCD in LMICs. Although it may have been desirable to have a second coder, this would not have necessarily improved the validity of findings through intercoder reliability comparisons because regardless of the number of coders, the emerging coding scheme and findings would always be subjective. Ensuring quality of interpretation relies, rather, on being transparent in offering explanations of meanings rather than presenting definitive causations, and explicitly acknowledging the subjective nature of the analysis and the bias this creates. These principles were adhered to in the research process and the publication.

CONCLUSIONS

Despite gains in health research capacity and progress in development thinking, further work is needed to develop sustainable health research systems in LMICs. One promising option is dedicated capacity development in which capacity outcomes are as equally valued as research outputs. However, more empirical research is needed to identify the most effective strategies. If these issues are successfully addressed, health research in all nations could become a reality, rather than just rhetoric.

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