# TITLE: Review of published evidence on knowledge translation capacity, practice and support among researchers and research institutions in low- and middle- income countries

Authors

Violet Ibukayo Murunga1,2,3, violet.murunga@afidep.org (Corresponding author)

Rose Ndakala Oronje3, rose.oronje@afidep.org

Imelda Bates2, Imelda.Bates@lstmed.ac.uk

Nadia Tagoe4,5, NTagoe@kemri-wellcome.org

Justin Pulford2, Justin.Pulford@lstmed.ac.uk

1. University of Liverpool, Faculty of Health and Life Sciences, Liverpool L69 3BX, United Kingdom

2. Liverpool School of Tropical Medicine, Center for Capacity Research, Pembroke Place, Liverpool L35QA, United Kingdom

3. African Institute for Development Policy, Suite #29, 2nd Floor, Royal Offices, Mogotio Road off, Chiromo Lane, Westlands, Nairobi, Kenya

4. KEMRI Wellcome Trust Research Programme, Kilifi, Kenya

5. Office of Grants and Research, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

# ABSTRACT

## Background

Knowledge translation (KT) is a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to yield beneficial outcomes for society. Effective KT requires researchers to play an active role in promoting evidence uptake. This paper presents a systematised review of evidence on low- and middle- income (LMIC) researchers’ KT capacity, practice and interventions for enhancing their KT practice (support) with the aim of identifying gaps and informing future research and interventions.

## Methods

An electronic search for peer reviewed publications focusing on LMIC researchers’ KT capacity, practice and support across all academic fields, authored in English and from the earliest records available to February 2019, was conducted using PubMed and Scopus. Selected studies were appraised using the Mixed Methods Appraisal Tool, data pertaining to publication characteristics and study design extracted and an a priori thematic analysis of reported research findings completed.

## Results

The search resulted in 334 screened articles of which 66 met the inclusion criteria. Most (43) of the articles presented original research findings, 22 were commentaries and 1 was a systematic review. 48 articles reported on researchers’ KT practice, 12 assessed institutional KT capacity of academic/research organisations and 9 reported on KT support for researchers. More than half (59%) of the articles focused on sub-Saharan Africa and a majority (93%) on health research. Most of the primary studies used the case study design (41%). The findings suggest that LMIC researchers rarely conduct KT and face a range of barriers at individual and institutional levels that limit their KT practice including inadequate KT knowledge and skills particularly for communicating research and interacting with research end-users, insufficient funding and inadequate institutional guidelines, structures and incentives promoting KT practice. Furthermore, the evidence-base on effective interventions for enhancing KT among LMIC researchers is insufficient and largely of weak quality.

## Conclusions

More high-quality research on researchers’ KT capacity, practice and effective KT capacity strengthening interventions is needed. Study designs that extend beyond case studies and descriptive studies are recommended. Furthermore, realist approaches, pragmatic trials, impact evaluations, implementation research and participatory action research are recommended for evaluating interventions.

## Keywords

Knowledge translation, evidence, research, uptake, researchers, academic, institution, capacity, evaluation, interventions, LMIC

# INTRODUCTION

Evidence-informed policy and practice can result in improved health and development outcomes, more efficient use of limited resources and greater accountability. However, decision making is a complex process, particularly in low- and middle- income countries (LMICs), and therefore achieving the ideal of evidence-informed decision making has been a challenge. Nevertheless, some success stories are starting to emerge signalling a positive shift in the trend (1). Over the past decade, several international forums have called for reforms to improve uptake of research findings into policy and practice (2-7). As a result there has been increased efforts at the local, regional, and international levels to bridge the “know– do” gap(3). Consequently, a specialised field concerned with promoting uptake of research into policy and practice has emerged, variously described as knowledge translation, knowledge transfer and knowledge exchange (8). This paper adopts the term Knowledge Translation (KT) and defines it as a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to yield beneficial outcomes for society. This definition is adapted from the Canadian Institutes of Health Research (3).

Available evidence indicates that effective KT requires researchers to play an active role in promoting evidence uptake. Various frameworks exist that conceptualise researchers’ relative role in promoting KT. Examples include the RAPID framework and The Framework for Assessing Country-level Efforts to Link Research to Action (9-12). Collectively, these frameworks emphasise three over-lapping and interacting dimensions that are critical in decision making processes and that researchers can influence, namely: 1) ‘political context’ relating to both the hard structures and ‘soft’ socio-economic, political and cultural environments which shape policy processes; 2) ‘policy actors’ that looks at key actors in a policy process including researchers, their roles and interests, networks and individuals and groups who are influential in decision making; and 3) ‘evidence’, how it is conceptualized in relation to a health issue, its credibility, methods, relevance, use, and how the message is packaged, communicated and disseminated. Specifically, researchers play a central role in producing, communicating and promoting uptake of high-quality relevant research. To achieve this, researchers are encouraged to: develop and sustain relationships and regularly interact with research end-users including policymakers, practitioners and the public; collaborate with research end-users throughout the research process; simplify and package their research findings within audience-tailored formats and platforms; and make their research more easily accessible to research end-users through publishing and sharing resources in open access journals, databases and repositories (13). For researchers to play these roles the existence of supportive institutional and national contexts and relational processes that link and promote interaction between researchers and policy actors is critical. At national level this relates the extent to which researchers and other policy actors are encouraged to participate in public policy decision making processes (12, 14-17). At institutional level it is the extent to which academic and research institutions prioritise KT including having in place policies (e.g. incentives and guidelines), budgets for KT activities, processes (e.g. institutional links with target audience institutions) and structures (e.g. KT units) to enable researchers to actively promote uptake of evidence in policy and practice (10, 15, 18-20).

Several reviews have been undertaken to better understand the KT process, including barriers and facilitators of KT, the role of context and institutions and effective KT approaches (21-24). However, to our knowledge, there are no reviews that have systematically synthesised literature on researchers’ KT capacity and practice or interventions for improving their KT capacity and practice, either in general or in LMIC settings. Therefore, there is limited understanding as to the extent to which researchers are engaged in KT or what types of supports or interventions encourage and enhance their KT practice. A LMIC-specific focus is warranted given the inherent challenges related to equity that LMIC researchers and research institutions face (25-28). Health research capacity in LMICs is insufficient (25-27). In addition, research in LMIC regions is largely funded by donors from HICs (27, 28). Typically, a requirement for accessing the funding is the formation of partnerships between LMIC and HIC researchers which are led by the HIC researchers (25-27). These issues compromise the extent to which the research produced aligns to country research priorities, is perceived as relevant and credible and is ultimately taken up in policy and practice (27, 28).

This review paper attempts to partly address this knowledge gap by describing and synthesising published evidence on researchers’ KT capacity, practice and supporting interventions in LMIC settings. The review will contribute to a better understanding of the scope, quality and primary outcomes of the available evidence-base, thereby offering guidance to interested KT practitioners, funders, researchers and research institutions on how to strengthen KT efforts in LMIC settings.

# METHODOLOGY

We conducted a systematised review of published studies as described by Grant and Booth (29). Our review modelled the systematic review process except we included all types of peer-reviewed literature without limitation to publication type and quality. This review poses the broad question: what is known about the KT capacity, practice and support among LMIC researchers and research institutions? In the remainder of this section the steps undertaken to complete the review are outlined.

## Search strategy

A list of initial search terms was agreed upon by the authors followed by a preliminary search of the literature to test and refine the search term list. The final search terms used were: knowledge translation, knowledge utilisation, knowledge utilization, research uptake, research utilisation, research utilization, evidence uptake and knowledge transfer; combined using the Boolean term ‘AND’ with the terms: researchers, academics, post graduate, faculty, research centers, research organisations, research organizations, research institutions, universities, developing country, low income, low and middle income, Africa, Asia, Middle East, Latin, Caribbean, Pacific, Eastern European and Mediterranean. An electronic search of studies published in English was undertaken in the PubMed and Scopus databases. The search included literature from the earliest records available in the databases up to February 2019.

## Inclusion and exclusion criteria

Articles were considered eligible for inclusion if they reported studies on any or all of the following:

1) Set in LMIC settings (countries and/or academic/research institutions) as the main or one of the main settings

2) researchers as the main study population, irrespective of the researcher’s nationality, or one of the main study populations

3) KT capacity of LMIC researchers and/or research institutions i.e. LMIC researchers’ interest in KT and KT knowledge and skills, and institutional policies, budgets, structures and processes for carrying out KT.

4) LMIC Researchers’ KT practice or experience i.e. implementation of KT activities

5) Interventions or support designed to enhance and/or facilitate the KT capacity and practice of LMIC researchers and research institutions.

More than one article reporting on the same study were included if they focused on different findings. Articles reporting on studies of researchers and other professions that did not disaggregate findings by participant profession were excluded. Papers were not excluded on the basis of publication type (commentary, review, original research).

## Screening

After removal of duplicates, the first author (VM) screened the title, abstracts and keywords of the retrieved articles against the inclusion criteria and excluded studies that were clearly not relevant. The remaining articles were read in full and screened by VM using the stated inclusion criteria. Selected articles were independently reviewed by a second author (JP). Disagreement regarding eligibility was discussed between the two authors until consensus was reached. A PRISMA flow chart of the identification, screening and selection process is presented in the results section (Figure 1).

## Quality assessment

Although, studies were not excluded based on quality, we performed quality appraisal of included publications in order to aid interpretation of the strength and applicability of the literature. The methodological quality of included primary research studies was appraised using the Mixed Methods Appraisal Tool (MMAT); the quality of commentaries and review papers was not appraised (30). The MMAT has been designed for appraisal of qualitative, quantitative and mixed methods studies and permits concomitant appraisal of all three methodological domains. The MMAT contains two screening questions for all study designs and assesses four criteria for qualitative studies or qualitative components of mixed methods studies, four criteria for each type (randomised controlled trials, non- randomised studies and quantitative descriptive studies) of quantitative study designs or quantitative components of mixed methods studies, and three criteria for mixed methods components of mixed methods study designs. Total scores range from 25% (depicting one criterion met or none met for mixed methods studies) to 100% (all criteria met). A higher percentage score indicates a higher quality rating. The overall quality of mixed methods studies cannot exceed the quality of its weakest component. Thus, if for instance a quantitative component of a mixed methods study scores 50% against 75% for a qualitative component, the overall score is 50%. Each study was independently rated by two reviewers (VM and NT). Discrepancies were discussed between the two reviewers (or with a third reviewer) until consensus was reached.

## Data extraction and analysis

Eligible full text articles were independently assigned by two reviewers (VM and JP) to one or more of three pre-determined ‘topic’ categories: 1) KT Capacity of LMIC Researchers and Research Institutions; 2) LMIC Researchers’ KT Practice; and 3) KT Capacity Development for LMIC Researchers and Research institutions. Differences in grouping the articles were discussed between the two reviewers until consensus was reached. The first author (VM) then extracted the following data using Microsoft Excel: author, year, objective, study country and region, study population, setting, study design and methods and the main findings.

The main findings extracted from each study were synthesized within each of the three topic categories. Reported findings were grouped into sub-themes emerging from the literature and summarized descriptively. Tabular presentation of the data was used in some cases. Coding to determine sub-theme identification and allocation was completed by the first author (VM) and verified by the second author (JP). Disagreements were discussed until a consensus was reached.

# RESULTS

## Search results

Our searches identified 334 potentially relevant references. Following review of the titles and abstracts, we retrieved 134 articles for full text review. From these we selected 38 articles that met the inclusion criteria. An additional 30 articles were identified through reference checks of included papers bringing the total number of papers included for review to 68. The search process and results is illustrated in Figure 1, the PRISMA flow chart.

**Figure 1. Flow chart of the identification, screening, and included articles**

Place Figure 1 here.

## Characteristics of included studies

Of the 66 articles included in the review, 43 (65%) presented original research findings, 22 (33%) were commentaries and 1 was a structured review. A majority (n=48; 73%) of the articles reported on researchers’ KT practice, 12 (18%) assessed researchers’ KT capacity and 9 (14%) reported on KT support for researchers. More than half (n=39; 59%) of the studies focused on sub-Saharan Africa as the primary study setting or as one of several study settings and a majority (n=61; 93%) focused on health.

The most common study design was some form of case study (n=27; 41%). Sampling was primarily purposive (n=39; 59%), data collection was most often by in-depth interview (n=23; 35%), survey (n=20; 30%) or document review (n=20; 30%). Data analysis was primarily thematic (n=32; 48%) or descriptive (n=21; 32%). An additional file presents a detailed list of included primary studies including study design, methods, sampling and population [see Additional file 1].

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Table 1 presents the quality assessment of the 43 original research papers according to MMAT criteria (the systematic review and 23 commentaries were not assessed for quality and are not presented in the table). 41 (95%) papers had an overall quality rating of 50% or more. Thirteen articles (30%) received a MMAT score of 100% indicative of ‘high’ reseach quality and four had a score of 25% indicative of low research quality.

**Table 1 Quality rating of reviewed original research publications**

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| **Sub-Category** | **No.** | **Overall Quality rating1** |
|  |  | **25%** | **50%** | **75%** | **100%** |
| Researchers KT Capacity and Practice  | 38 | 4 | 6 | 20 | 9 |
|  |  |  |  |  |  |
| KT Support | 5 | 0 | 0 | 2 | 3 |
| Total | **43** | **4** | **6** | **22** | **12** |

1. Lowest (25%) to highest (100%) scores on MMAT scale; KT=Knowledge translation

## Reported Findings

This section presents reported findings from all 66 articles within each of the three categories: KT Capacity of LMIC Researchers and Research Institutions; LMIC Researchers’ KT Practice; and KT Capacity Development for LMIC Researchers and Research institutions.

### **KT Capacity of Researchers’ and Research Institutions**

Twelve studies reported on KT capacity of LMIC researchers and research institutions based on researchers’ self-reports and reviews of institutional documents (31-42). About half of the studies were conducted in one or several countries in the Eastern Mediterranean Region (EMR) (31, 33, 36, 38-40). Three studies focused on sub-Saharan Africa (a total of 6 countries) (32, 34, 42) and three studies were global (35, 41) or covered more than one LMIC region including sub-Saharan Africa and the EMR (37). All the studies focused on health researchers and research institutions. A few studies used the same assessment tool (33, 36, 38, 39) and methods but in large tools and methods used varied.

From the 12 studies reviewed, five themes emerged: 1) Emphasis on research production; 2) Inadequate institutional links and interaction with target audience institutions; 3) Inadequate capacity to communicate to non-scientific target audiences; 4) Mismatch between reported and demonstrated KT competency and; 5) Influence of country income status, institutional culture and research topic and type; and 6) Improvement in institutional KT capacity.

*Emphasis on research production*

Evidence from 9 studies suggests that LMIC research or academic institutions pay more attention to the research production stage of the KT process compared to the communication and dissemination stage (33, 35-42). For example, four studies collectively assessed the KT capacity of up to 30 institutions based in 9 countries in the Eastern Mediterranean Region using the same study instrument (33, 36, 38, 39). Respondents were asked to rate three KT-related items using a five-point Likert scale (1=low, 5=high) namely: 1) research quality and timeliness; 2) the existence of KT policies (e.g. incentives and guidelines), budgets, structures (e.g. department with KT expertise) and processes (e.g. links with target organisations); 3) and researchers’ KT capacity including training. Across the four studies research quality and timeliness received a higher mean scores averaging 3.1/5 compared to the existence of KT policies, budgets, structures and processes (1.7/5) and researchers’ KT capacity (2.4/5) (33, 36, 38, 39).

Another study by Ayah and colleagues (42) that assessed the institutional capacity for health policy and systems research in 7 public academic institutions based in 5 Eastern and central African countries found a similar trend. Respondents were asked to rate three KT-related items using a five-point Likert scale (1=low, 5=high) namely: 1) Institutional capacity to disseminate research; Institutional links with research using institutions; and Research capacity. Across the seven institutions, research capacity received a higher mean scores averaging 3.6/5 compared to capacity to disseminate research (3.1/5) and institutional links with research using institutons (3.2/5) (42).

A similar trend was reported by a study by Lavis and colleagues (37) that elicited views from 308 researchers in 10 LMIC countries (China, Ghana, India, Iran, Kazakhstan, Laos, Mexico, Pakistan, Senegal and Tanzania) about their institutions’ KT support. Respondents were asked to rate their agreement, using a five-point Likert scale (1=strongly disagree, 5=strongly agree), about the following: institutional importance of KT; existence of institutional incentives supporting KT; interaction with target audiences’; funding allocation for KT; existence of KT support staff; and the credibility of the institution. Respondents represented 4 distinct research areas including malaria prevention (n=72), contraception (n=94), childhood diarrhea (n=50) and tuberculosis treatment (n=92) (37). Respondents were more likely to report that they agreed or strongly agreed that their institution supports research on their research topic (n=242; 81%) compared to researchers’ KT efforts (n=205; 69%) (37).

Shroff and colleagues (35) assessed knowledge generation processes in 101 institutions engaged in health policy and systems research, which are either part of the Alliance for Health Policy and Systems Research (the Alliance) network and/or were represented at the Second Global Symposium on Health Systems Research. A total of 56 countries were represented in the sample. More than three-quarters (n=79; 78%) of the institutions were based in in low- and middle- income countries and a quarter (n=25; 25%) were based in sub-Saharan Africa (35). The assessment explored the extent to which academic incentive structures were inclusive of other formats of research products in addition to peer review scientific journals. Respondents were more likely to rank publication record as the most important criteria for promotion (n=44; 48%) compared to the ability of research to impact policy (n=24; 26%) (35).

El Jardali and colleagues (40) assessed the KT capacity of 223 institutions in 22 countries also in the Eastern Mediterranean Region.. Respondents were asked to score the following four items using a five-point scale (1=never, 5=always): institutional characteristics; institutional planning for research; national planning of health re­search; and knowledge management, translation and dissemination. A quarter of respondents reported that their institutions frequently or always assess health policymakers use of their institution’s research results (n=59; 27%) and the impact of their research outcomes (n=52; 23%) suggesting that KT is not a strategic priority (40). Block and colleagues (41) assessed the institutional capacity for health policy and systems research in 108 research institutions based in 39 LMICs within the Alliance network. The assessment explored six strategic and interrelated groups of variables: institutional/country context and characteristics, institutional capacity and engagement with stakeholders, attainment of critical mass of researchers to produce quality, sustainable research, and the process of knowledge production. Three-quarters (75%) of respondents reported assessing the impact of research on policy, however, 15% reported that their efforts were unsuccessful (41).

*Inadequate institutional links and interaction with target audience institutions*

Evidence from 7 studies suggests that LMIC research or academic institutions do not always interact or collaborate with target audiences and/or do so with a narrow range of target audiences (33, 35, 36, 39-42). For example, in three studies (33, 36, 39) that assessed institutional KT capacity using the same assessment tool, described earlier, efforts to interact with target audience were scored in the mid- to low-range of the scale. The average of the reported mean scores for various levels of interaction were 2.2/5 for interaction during research priority setting, 2.3/5 during research design and implementation, 2.3/5 during research dissemination, and 2.2/5 within a network and 2.7/5 government technical committee (33, 36, 39). Ayah and colleagues (42) (described earlier) reported mixed findings in relation to formal relationships between academic institutions and target audience institutions. The average of the reported mean scores in the institutions assessed for the existence of institutional links with government policy institutions was higher (3.6/5) than that reported for links with NGOs (3.3/5), health facilities (3.1/5) and media (2.5/5) (42). In addition, the average of the reported mean scores for institutional capacity in individual interaction and communication with decision makers/policy makers was 3.2/5, which appears high in relation to other studies but falls in the lower range of the scale when compared to the average of the reported mean scores for research capacity (42).

El Jardali and colleagues (40) reported similar trends in their study that assessed the institutional KT capacity (described earlier). The study found that less than half of respondents reported that their institution frequently or always involves policy-makers and stakeholders when setting priorities for research on health (n=79; 41%) and translates high priority policy concerns into priority research questions (n=84; 43%) (40). In addition, around a third (n=67; 34%) of respondents reported that their institution involves policymakers and stakeholders in research projects including in the development of joint proposals, study design and data collection tools, analysis and writing up of publications (40).

Similar trends were found in the institutional assessment by Shroff and colleagues (35), described earlier. The study assessed the existence of formal (Memoranda of Understanding or Commissioned Research) or informal (personal interactions) linkages. A majority (n=94; 93%) of respondents reported the existence of either formal or informal linkages (35). However, less than half (n=46; 46%) of the respondents reported the existence of formal linkages that bring researchers and decision-makers together to identify relevant research areas (35).

Block and colleagues institutional caoacity assessment explored engagement with stakeholders and found that a majority (70%) of respondents reported interaction using external boards or advisory bodies (41). However, the types of groups involved in these platforms was narrow. Out of the 11 key groups that were explored, respondents mainly reported the involvement of health authorities and their staff (35%) and government, international experts and other government bodies (25%) (41). Financing agencies (8%) and NGOs (7%) were among the least reported groups engaged (41). Furthermore, 95% of respondents reported continuously communicating with stakeholders, involving stakeholders in research and securing the presence of researchers in key health policy debates (41). However, in relation to these activities, they reported having lower capacity to implement them relative to activities involving simply raising awareness of research results and recommendations among stakeholders (41).

*Inadequate capacity to communicate to non-scientific target audiences*

Evidence from 6 studies suggests that the capacity of LMIC research institutions to tailor communication of research to different non-scientific target audiences is inadequate (33, 34, 36, 39, 40, 42). For example, in three studies (33, 36, 39) that assessed institutional KT capacity using the same assessment tool, described earlier, skills for communicating research and use of accessible communication formats were scored in the mid- to low-range of the scale. The average of the reported mean scores in the three studies was 2.4/5 for the existence of research communication skills among researchers, 2.6/5 for the extent that researchers convert research findings into actionable messages appropriate to the target audience, 2.3/5 for the extent that of use of websites or electronic databases to make research available, and 2/5 for the extent of regular communication with media and target audiences through non-scientific publications (33, 36, 39).

El Jardali and colleagues (40) (described earlier) reported similarly low capacity in research institutions to communicate to non-scientific target audiences. Respondents were more likely to report that their institution frequently or always disseminates research through traditional academic platforms including publishing in their institutions’ (n=99; 44.4%) or other (n=131; 59%) peer reviewed journals, seminars or conferences (n=143; 64%), their institutional websites (n=118; 53%) and newsletter, email or printed reports circulated within the institution (n=98; 44%) (40). Other platforms more accessible to non-scientific target audiences were more likely reported as never or rarely used to disseminate research findings to policy makers and other stakeholders including: letters/briefs/tailored messages (n=89; 40%); policy briefs (n=108; 48%); and policy dialogues (n=108; 48%) (40). Likewise, respondents were more likely to report that their institution frequently or always communicates research findings to other researchers (n=89; 39.9%), policy-makers in the government (n=81; 36%) and healthcare providers such as clinicians, nurses, pharmacists (n=81; 36%) (40). In turn, communication of research findings to directors in donor agencies (n=134; 64%), international agencies (n=123; 55%), non-government organisations (n=120; 54%) and the public (n=98; (44%) was reported as never or rarely done by institutions (40).

Similar trends were reported by Ayah and colleagues (42) and Simba and colleagues (studies described earlier). Across the institutions assessed, the average of the reported mean score for the existence of a strong communications staff with capacity to effectively communicate research findings to many target audiences fell in the mid-range of the scale (2.8/5) (42). However, an audit of publications produced by the institutions revealed that publication outputs were mainly peer reviewed journal articles (34). Production of tailored communication outputs such as policy briefs, reports to government agencies, press releases and media briefs and multimedia products was negligent (34).

*Mismatch between reported and demonstrated KT competency*

Evidence from 10 studies (31-34, 36, 37, 39-42) suggests that the KT skills of LMIC researchers are often inadequate. In three studies (33, 36, 39) that used the same assessment tool, described earlier, the average of the reported mean scores in the studies for the existence of KT training needs assessment (2.1/5) and KT training within research methods training programs (2/5), fell in the low-range of the scale (33, 36, 39). Nevertheless, familiarity of KT concepts and what it entails was scored in the mid-range of the scale (2.6/5) suggesting an over-estimation of KT skills among researchers or lack of knowledge of essential KT skills (33, 36, 39). El Jardali and colleagues (40) also assessed the dissemination skills of researchers in the institutions. At least two-thirds of respondents reported the existence of skills to disseminate research findings to policy makers (n=140; 63%) and directors of NGOs (n=167; 75%) (40). However, similar to other studies, these findings contradicted reported communication and dissemination formats suggesting an over estimation of researchers’ KT skills or inadequate understanding of essential KT skills (40).

In the institutional capacity assessments by Ayah and colleagues (42) and Simba and colleagues (34) (studies described earlier), the average of the reported mean scores for the availability of time to disseminate research findings (3.2/5), and motivation (3.1/5) and skills (3.2) to do so fell in the lower range of the scale in comparison to research capacity, which averaged (3.6) (42). However, similar to other studies, researchers competency in KT was scored higher in relation to the actual products and activities researchers are engaging in (34). This further supports the likely over-estimation of researchers’ KT capacity.

Block and colleagues (41) (study described earlier) also reported some efforts to enhance researchers’ KT capacity. Most respondents reported that their institution had implemented successful capacity development strategies aimed at improving researchers’ awareness of policy issues and processes (95%) and ensuring the production of HPSR dissemination materials (85%) (41). However, similar to other studies, the challenges reported in implementing some communication and dissemination activities point to gaps in competency among researchers to do KT particularly in relation to interaction with a broader range of target audiences (41).

Yousefi and colleagues (31) assessed the views of 131 iranian clinical and health care researchers, health policy and decision makers, and research policy makers (directors and managers) and support staff on how the development and usage of evidence from systematic reviews can be promoted in a country with limited resources. The article did not report the sample size by profession. Respondents were asked to select five important items from a list of 20 and suggest interventions to address them. “Competency of researchers to conduct systematic reviews’ was one of four top ranked issues needing to be improved (31).

Lavis and colleagues (37) (study described earlier) assessed researchers’ attitudes towards KT practice. Respondents agreed or strongly agreed that KT activities should be done collaboratively with target audiences (71%) suggesting a positive attitude to collaboration with target audiences and an understanding of its value(37). Similarly, Uneke and colleagues (32) assessed the KT practice of six Nigerian senior academic researchers. Respondents were asked to score their preparedness to partner with policy makers in the policy making process using a four-point Likert scale and score it high (3.8/4) suggesting that they a positive attitude to collaboration with target audiences and an understanding of its value.

*Influence of country income status, institutional culture and research topic and type*

Evidence from 6 studies suggests an influence of several factors that facilitate or hinder KT practice including country income status (36, 40), institutional culture (35, 41, 42), research topic and research type (37).Maleki and colleagues (36) (study described earlier) found that institutions based in low-income countries had lower scores across all KT items assessed compared to those based in middle- income countries. El Jardali and colleagues (40) (study described earlier) found that respondents from institutions based in upper middle-income countries were more likely to report a lack of national research priorities whereas those from institutions based in low middle-income countries were more likely to report not knowing whether their countries had national health research priorities. These findings suggest less interaction and collaboration between policy making and academic and research institutions in low-income countries compared to higher income countries.

In the study by Ayah and colleagues (42), the institution with the lowest scores was based in the same country as one of the three higher scoring institutions suggesting an influence of institutional culture. In addition, the higher scores for a number of items similarly measured by other studies (using a five-point Likert scale) and in comparable institutions (undertaking public health research or health policy and systems research) also suggests an influence of context. Notably, the assessment tool used by Ayah (42) differed to that used by the other studies (33, 36, 38, 39) making it to discern whether this is an actual difference. Studies by Shroff and colleagues (35) and Block and colleagues (41) also tended to report more positive findings in relation to other studies reviewed in this section particularly in relation to incentives (35) and capacity development and systematic assessment of the impact of KT efforts (Block (41). In both studies, the study population were part of the Alliance for Health Policy and Systems Research network suggesting an influence related to being a part of the network. Lavis and colleagues (37) found that respondents undertaking childhood diarrhea research consistently faired worse than other researchers on most of the KT capacity items that the study assessed and yet were also more likely to believe that their research was ready for application, suggesting an influence of research type.

*Improvement in institutional KT capacity*

Evidence from a few studies (35, 37), described earlier, suggests that KT prioritisation in research institutions is improving over time. Lavis and colleagues reported an increase in the support for KT by research institutions at the same rate as increasing support for research production. Two-thirds of respondent reported that they agreed or strongly agreed that there had been a positive shift over time in their institution’s support for the research being undertaken (n=202; 68%) and researchers’ KT efforts (n=188; 64%) (37). The study by Shroff and colleagues (35) found that a third (n=36; 36%) of respondents reported the existence of incentives for individuals to carry out policy-relevant research and two institutions reported the creation of alternative career tracks for policy-relevant research with career advancement not linked to publication in high impact journals. Furthermore, around a third (n=30; 30%) of respondents reported being required to convert research findings into recommendations for policy-makers (35).

### **LMIC Researchers’ KT Practice**

Fourty eight articles reported factors influencing researchers’ KT practice. From the 47 papers reviewed, five themes emerged: 1) KT activities undertaken by LMIC researchers (n=6; 13%); 2) factors influencing LMIC researchers’ KT practice (n=40; 85%); 3) barriers to LMIC researchers’ KT practice (n=39; 83%); 4) facilitators of LMIC researchers’ KT practice (n=38; 81%) and; 5) strategies recommended for improving LMIC researchers’ KT practice (n=38; 81%).

*KT activities undertaken by LMIC researchers*

Six studies quantified LMIC researchers’ KT activities using different assessment tools and methods (32, 37, 43-46). Two studies were global studies covering of which had a mix of HIC and LMIC regions (46) and countries and one focused on LMIC regions and countries (37). The remaining studies were based in one one country each in LMIC countries in Africa (32), Asia (43, 45) and Eastern Mediterranean region (44). All except one study focused on health research (45). The findings suggest that researchers are undertaking a narrow range of KT activities and in particular investing little time to interact with and tailor and target their findings for different target audiences. Across the studies, the most frequently reported dissemination formats are scientific publications and conferences. Media is the least reported dissemination avenue. In addition, the extent to which researchers are involved in KT activities is influenced by the type of research they are involved in.

For example, Nedjat and colleagues (44) assessed the frequency of ‘passive’ and ‘active’ KT activities implemented by 208 researchers involved in basic (n=46; 22%), clinical (n=101; 49%) and health systems (n=61; 29%) research based at the Tehran University of Medical Sciences (TUMS) in Iran. Respondents were more likely to report undertaking passive KT activities than active KT activities. Among the ‘passive’ activities assessed most respondents reported publishing articles in domestic (n=130; 63%) and international (n=101; 49%) peer-reviewed journals and presenting findings in conferences, seminars and domestic meetings (n=100; 48%) (44). Among the ‘passive’ activities targeting non-scientific audiences, sending either the full or summaries of research reports to users was the most commonly reported approach used by respondents (n=93; 45%) (44). Respondents were least likely to report displaying their research results on a website (n=39; 19%) or mailing or e-mailing articles or reports or summaries to stakeholders (n=15; 7%) and/or publishing research results in newspapers (n=8; 4%) (44). Among the active KT activities assessed, only 15% (n=32;) of respondents reported producing user-friendly products such as plain writings for patients, special texts for managers, practical reports for clinical and lab colleagues, special reports for industrial managers or academics (44). 10% or less of respondents reported presenting results to media including reporters, radio and TV (n=16; 8%) and holding briefings with stakeholders for presentation of research result (n=21; 10%) (44). Health systems researchers were more likely to report undertaking the passive KT activities targeting non-scientific audiences and all the assessed active KT activities than basic and clinical researchers suggesting an influence of research type (44).

Similarly, Lavis and colleagues (37) found that researchers were engaging more in KT activities that were less interactive and requiring less effort. They assessed the KT activities of 308 researchers in 10 LMIC countries (China, Ghana, India, Iran, Kazakhstan, Laos, Mexico, Pakistan, Senegal and Tanzania). The study explored three broad categories of KT activities namely: 1) “producer-push” efforts (what is communicated to target audiences outside the research community; to whom; by whom; how; and with what effect); 2) efforts to facilitate “user pull” (strategies used to provide access to research and to develop target audiences’ capacity to use research); and (3) exchange efforts (target audience involvement in research and KT activities). Half (n=161; 52%) of the respondents reported that they actively conduct KT activities. The study found that respondents more frequently undertook “producer push” KT activities than facilitate “user pull” and exchange activities. Respondents reported undertaking the following KT activities most frequently: developing research products that used language appropriate to specific target audiences (n=167; 57%); messages specifying specific actions (n=174; 57%); reviewing information that described the needs or goals of specific target audiences (n=165; 55%); involving target audiences in the research process including implementation (n=182; 60%), analysis (n=170; 56%), development of research products (n=177, 59%) and in KT activities (n=173; 57%); and attending conferences and workshops (n=168; 55%) and events organized by target audiences (n=162; 54%) (37). Less than half of respondents reported undertaking interactive activities outside the research process such as participation in government-sponsored meetings (n=123; 41%) and expert committees or groups (n=126; 42%) (37). The least frequently reported KT activities included publishing research on non-scholarly publications (n=68; 23%), accepting requests from journalists to participate in interviews or debates (n=73; 25%), mailing or emailing research to target audiences (27% or less), making research available on a website (19% or less); providing systematic reviews of research literature (n=79; 27%); and maintenance of some reserve (financial or human resources) capacity to conduct short-term research projects in response to target audience requests (n=58; 20%) (37).

Little interaction between researchers with target audiences, specifically policymakers, was also reported by Uneke and colleagues (32) who assessed the KT practice of six Nigerian senior academic researchers. Respondents were asked to rate several KT practice items using a four-point Likert scale (1= low, 4=high). Only one item, the relevance of research to health policy making in Nigeria, received a perfect score of 4/4 (32). The rest of the items received scores of 2 or less out of 4 including the existence of a partnership between researchers and health policy makers (1.5/4), the frequency of previous research findings being made available to policy makers (1.67/4) and the frequency of being consulted by policy makers for research evidence partnership between researchers and health policy makers (2/4) (32). In addition, only one of the six researchers reported having experience participating in policy making processes (32).

Similarly, a study by Lashari and colleagues (45) assessed the KT efforts of 24 PhD faculty members from eight Indian universities offering degrees in field of environmental engineering and environmental sciences. Respondents were asked to score the frequency of several KT activities using a scale of 1 (never) to 3 (at most) including: KT through publications; KT through networking; KT through mobility of researchers; KT through joint research projects; KT through intellectual property; KT through co-operations; and KT through infrastructure of the university. Survey respondents reported scored disseminating their research via peer reviewed scientific publications (2.9/3) higher than through professional publications less frequently (2.1/3) (45). The article did not define what professional publications refer to. However, elsewhere they are described as articles written for specific audiences such as managers or administrators in business, finance, and industry, often published on a weekly or monthly basis (47). Respondents also scored their interaction with industry staff in conferences and workshops (2.3/3) higher than having ‘personal (informal) contacts of industry (2.1/3) (45). They also scored their co-operation with other universities or higher education institutions (2.4/3) and other departments within their university (2.6/3) higer than with commercial laboratories or enterprises (1.7/3) and commercial manufactures or service providers (1.4/3) (45). Respondents also scored their university sharing facilities with industry (2.3/3) higer than their university's technology/knowledge transfer office organising KT activities (1.5/3) and established spin-offs (1.2/3) (45).

Likewise, Walugembe and colleagues (43) explored KT activities of 13 reproductive health researchers’ based at the the International Centre for Diarrhoeal Disease Research (ICDDR) in Bangladesh. A majority (n=12; 92%) of respondents reported using dissemination workshops to share their evidence and half (n=7; 53%) reported publishing scientific papers (43). All researchers reported undertaking other activities to package their findings and to ensure that their key findings were made accessible to stakeholders. These included production of fact sheets, sharing findings on the website, engaging service providers, joining advocacy networks, and producing wind banners, among others (43). However, few respondents reported developing policy briefs (n=6; 46%), having one-on-one meetings with policymakers (n=3; 23%), providing technical assistance to policymakers (n=3; 23%), producing research reports (n=3; 23%) and engaging the media (n=2;15%) (43). The study also found that few of the researchers knew how and at what stages of the policymaking process their findings were utilized, suggesting that they do not systematically assess the impact of their KT activities (43).

Cheung and collaeagues (46) conducted a print media analysis in the 44 countries in Africa, the Americas, Asia, and the Eastern Mediterranean that host (or have signalled their intent to host) a local EVIPNet or similar type of KT platform. The analysis aimed to whether and how policymakers, stakeholders, and researchers talk in the media about three topics: policy priorities in the health sector, health research evidence, and policy dialogues regarding health issues. The assessment identified 5.5 and 5 times more articles describing health research evidence (1468) compared to articles describing government policy priorities (264) and policy dialogues (290), respectively (46). Of the 264 articles mentioning policy priorities, researchers were least likely to mention government policy priorities (n=6;2%) compared to government officials themselves (n = 208; 79%) and stakeholders (n = 27; 10%) (46). This suggests that researchers’ ensuring alignment of their research to government policy priorities is an uncommon practice. Of the 1468 articles describing health research evidence, 569 (39%) described the type of study (46). Systematic reviews were the least mentioned study type (n=31; 5%) compared to basic science (n=226; 40%), observational studies (n=185; 33%) and randomized control trials (n=115; 20%) (46). This suggests that not much efforts is going into synthesising the evidence-base on issues to inform policy and practice decisions, processes that should ideally be based on this kind of evidence. Of the 290 articles describing policy dialogues addressing issues in the health sector, researcher involvement in the dialogues was least mentioned (n=27;9%) compared to involvement of government officials (n=287; 99%) and stakeholder (n=283;98%) (46). This suggests that active interaction between researchers and policy actors is uncommon.

*Factors influencing LMIC researchers’ KT practice*

Table 5 presents factors influencing LMIC researchers’ KT practice most commonly cited across 40 papers included in this sub-theme. As shown, a few papers illustrate successful examples of LMIC researchers getting their research used by target audiences (43, 48, 49). Most papers that reported on the extent of use of evidence by target audiences stated that it is an uncommon practice. Researchers’ interest in KT and institutional incentives promoting KT were the most commonly cited factors influencing researchers’ KT practice. Equally, the credibility of researchers, their institution and the research they produce as as perceived by target audiences was cited as critical.

**Table 5. Reported factors that influence KT, as reported by LMIC researchers**

|  |  |
| --- | --- |
|  | **Papers citing issue** |
| **Research use** |  |
| Research not always used to inform policy and practice decisions | 48-56 |
| Examples of LMIC researchers successfully getting evidence used | 43, 48, 49 |
| **Factors influencing knowledge translation** |  |
| Researchers’ reputation/credibility/contextual understanding | 32, 49, 57-69 |
| Relevance and credibility of research evidence  | 32, 49, 53, 54, 58, 60, 62-68, 70-73 |
| Contrasting views, demands and incentives among researchers and policymakers in relation to research, its use, policy actor roles and policymaking  | 32, 49, 57, 59-61, 67, 68, 71, 74-79 |
| Nature of policy issues (technical versus contested versus interest of policymaker) | 49, 58-62, 67, 71, 77, 80 |
| Political context  | 32, 48, 49, 51, 53, 58, 59, 62, 64, 67, 68, 70, 81, 82 |
| Decision makers’ research background | 51, 55, 57, 65, 78 |
| Donor influence | 51, 54, 55, 57-60, 70-72 |
| International influence e.g. WHO | 54, 58, 59, 65, 67, 71, 72, 76, 78, 81, 83-85 |

*Barriers to LMIC researchers’ KT practice*

Table 6 presents barriers to LMIC researchers’ KT practice most commonly cited across the 39 papers included in this sub-theme. As shown, limited funding for production of policy relevant research and undertaking KT activities and researchers’ inadequate KT capacity were the most frequently mentioned barriers to KT practice among LMIC researchers.

**Table 6. Reported barriers of research use, as reported by LMIC researchers**

|  |  |
| --- | --- |
| **Barriers** | **Papers citing issue** |
| **Political context** |  |
| Short window for responding to policy demands  | 49, 51, 57, 59, 67, 71, 78, 79, 81 |
| High turnover of government officials and politicians | 49, 53, 59, 62, 64, 67, 68, 70, 82, 86 |
| Unfavorable political environment | 49, 53, 58, 60-62, 64, 67-71, 75, 81, 82 |
| Policy implementation challenges | 49, 53, 58, 64, 68, 79, 81, 82 |
| **KT knowledge and skills of target audiences** |  |
| Target audiences lack knowledge/understanding and skills related to research and policy development | 31, 49, 51, 52, 57-59, 64, 67, 69, 79, 83, 85, 87, 88 |
| **Research availability, accessibility and relevance** |  |
| Limited access to and/or inadequate relevant evidence  | 31, 48, 51, 52, 58, 60, 61, 68, 70, 71, 78, 79, 89, 90 |
| **Researcher/target audience collaboration and networking** |  |
| Inadequate interaction between researchers and policymakers | 37, 49, 51, 52, 68, 75, 78, 90 |
|  |  |
|  |  |
|  |  |
| **Researchers KT knowledge, attitudes and skills** |  |
| Researchers’ inadequate research and KT skills  | 31, 49, 52, 55, 61, 67, 68, 70, 73, 79, 89 |
| Researchers’ fear of, or limited engagement of, media | 52, 67, 75, 78 |
| Challenges with simplifying research findings | 49, 55, 59, 60, 64, 67, 68, 72, 75 |
| Researcher not interested in KT | 48, 49, 59-61 |
| **Research institutional support** |  |
| Inadequate institutional support and incentives for KT | 31, 32, 44, 49, 51, 63, 67, 68, 75, 79, 91 |
| **Funding** |  |
| Limited funding for production of relevant research and KT activities | 31, 32, 37, 44, 49, 51, 52, 56, 57, 59, 60, 63, 67, 68, 79, 81, 82, 92 |

*Facilitators of LMIC researchers’ KT practice*

Table 7 presents facilitators of LMIC researchers’ KT practice most commonly cited across 38 papers included in this sub-theme. Collaborating and networking with target audiences were collectively the most frequently cited facilitator of LMIC researchers KT practice. How researchers communicate their research i.e. whether it is tailored and targeted for different audiences and provided at opportune times was the second most cited facilitator of KT practice.

**Table 7. Reported facilitators of KT, as reported by LMIC researchers**

|  |  |
| --- | --- |
| **Facilitators** | **Papers citing issue** |
| **Political context** |  |
| Political and institutional requirements to use evidence  | 49, 51, 57, 58, 61, 64, 65, 68, 73 |
| Favourable political environment | 49, 51, 57-59, 64, 68, 69, 81, 85 |
| **KT knowledge and skills of target audiences** |  |
| Training/sensitisation of target audiences e.g. policymakers, communities, media etc. | 56-58, 60, 62, 64, 75, 79, 82, 83 |
| Technical support to policymakers and implementers | 48, 82, 91 |
| **Research availability, accessibility and relevance** |  |
| Timely research | 48, 49, 58, 61, 64, 65, 70, 72, 73, 86, 89 |
| Availability of policy relevant research | 57, 64-66, 68, 72-74, 78, 81-83, 89, 91 |
| **Researcher/target audience collaboration and networking** |  |
| Researchers collaborating with policymakers and other stakeholders | 49, 51, 53, 54, 56-64, 66-70, 72, 74-76, 78, 79, 81-83, 85, 89, 92 |
| Researchers interacting with target audiences through existing network or strategic alliances and championing issues | 49, 51-53, 57-62, 64, 65, 67, 68, 70-73, 75, 76, 78, 79, 81, 83, 85, 86, 91 |
| Researcher interacting with research users through informal networks and personal relationships  | 37, 49, 50, 58, 59, 62, 72, 73, 75, 86 |
| Trust between policymakers and researchers  | 49, 62, 66-68, 72, 74, 75, 83 |
| Target audiences involved at various stages of the research process  | 48, 53, 56-58, 63, 64, 66-69, 71, 72, 74, 79, 82, 83, 86, 91 |
| Researchers involved in policy formulation and implementation  | 58, 61, 67, 71, 73, 85 |
| Researchers placed in key decision-making positions in government or in close proximity with national programme | 59, 67, 71, 76 |
| **Research communication** |  |
| Targeted dissemination of research findings  | 49, 51-53, 56-58, 62, 63, 65, 69, 72, 75, 78, 81-83 |
| Tailored messages for various audiences  | 53, 57, 58, 63, 64, 67, 68, 71-73, 75, 76, 78, 82, 83 |
| Framing of research findings in context  | 53, 57, 58, 64, 67, 68, 70, 72, 78, 82, 83 |
| Media engagement activities e.g. newspaper articles, TV and radio shows | 62, 67, 68, 83, 91 |
| Use of credible messengers/knowledge intemediary | 48, 49, 57, 58, 71, 72, 78, 85, 86 |
| Use of policy windows  | 48, 58, 67, 68 |
|  |  |
|  |  |
| **Funding** |  |
| Funding available for research and KT | 53, 56, 58, 59, 61, 62, 64, 66, 68, 79 |

*Strategies recommended or used to improve LMIC researchers’ KT practice*

Table 8 presents strategies used or recommended to improve LMIC researchers’ KT practice commonly cited across 38 papers included in this sub-theme. The most cited were collaboration and networking between researchers and target audiences, tailored and targeted communication of research, strengthening of researchers KT capacity through training, sensitisation and partnership and availability or allocation of more funding for production of relevant research and KT activities.

**Table 8. Recommended strategies to KT, as reported by LMIC researchers**

|  |  |
| --- | --- |
| **Strategies** | **Papers citing issue** |
| **KT knowledge and skills of target audiences** |  |
| Sensitise and train target audiences on the value of research use in decision making and research methods | 31, 51, 56, 57, 62, 64, 67, 68, 71, 75, 76, 79, 85, 86 |
| **Research availability, accessibility and relevance** |  |
| Rapid response service, strategic consultancy and research commissions for policy institutions and donors/funders | 49, 53, 57, 59, 61, 64, 67, 70, 78, 89 |
| Produce a mix of research evidence including operations research, systematic reviews, effectiveness and cost-effectiveness research, develop low cost innovations to improve practice etc. | 49, 53, 57-59, 61, 64, 67, 71-73, 75, 76, 78, 81, 82, 86 |
| **Researcher/target audience collaboration and networking** |  |
| Establish strong links with institutions involved in the decision-making process in research process | 49, 57, 58, 60, 61, 64, 67, 73, 75, 76, 86, 90 |
| Involve target audiences in research process  | 53, 56, 58, 61, 62, 64, 73, 76, 78, 86, 92 |
| Establish KT platforms or participatory workshops for discussing research findings | 31, 53, 57, 76, 79, 90 |
| **Research communication** |  |
| Tailor and target dissemination of research  | 53, 55, 57, 58, 61-63, 72, 75, 78, 81, 88 |
| Stakeholder analysis/analysis of policy making process  | 49, 53, 61, 64, 67, 73, 81 |
| Identify and seize windows of opportunity | 53, 58, 62, 64, 67, 72, 76 |
| Develop communication strategy | 73, 83, 92 |
| **Researchers KT knowledge, attitudes and skills** |  |
|  |  |
| Strengthen research and KT capacity | 31, 49, 57, 58, 67, 68, 75, 86, 90, 92 |
| Forge strategic partnerships with international research institutions | 31, 71, 79, 85 |
| Forge strategic partnerships with influencial people, media and knowledge brokers | 54, 57, 61, 67, 75, 81, 90, 92 |
| **Research institutional support** |  |
| Strengthening institutional support and incentives for KT  | 57, 73, 75, 78, 79 |
| **Funding** |  |
| More funding allocated to KT and production of policy relevant research | 31, 44, 49, 51, 52, 56-58, 62-64, 67-70, 75, 76, 79, 81, 92 |

### **KT Capacity Development for LMIC Researchers and Research institutions**

Nine studies described and/or evaluated interventions or tools aimed at enhancing LMIC researchers’ KT practice (93-101). A summary of each study is presented in Table 9. Six studies reported either the formation or evaluation of KT interventions, which varied considerably in terms of the interventions used, target populations, length and outcome measurements reported as described below (93, 95-99). Two studies reported on the same intervention but focused on different aims, assessment/evaluation duration and outcomes measured (feasibility assessment versus process evaluation) (96, 97). Three studies presented tools for enhancing KT practice and recommended their application and evaluation by researchers and research institutions (73, 100, 101). Collectively, the interventions/tools focus on enhancing KT at various levels including systems level (95, 99), institutional level (94, 96, 97), individual level (98), and activity level (93, 100, 101). Systems level interventions represent government-led interventions with substantial involvement of academic or research institutions. Institutional level interventions represent those initiated and implemented by academic or research institutions. Individual level interventions aim to improve individual KT knowledge and skills. Activity level interventions are guidelines for implementing specific KT activities such as development of policy briefs, organising policy dialogues and pairing researchers with policymakers to enhance their interaction.

Of the five studies that presented evaluation results of interventions (93, 96-99), three studies used a qualitative case study design (95, 96, 99), one used a case study design drawing on both quantitative and qualitative data (97) and one used a before and after study design using a survey questionnaire (98). Two studies assessed the impact of the intervention in improving links and use of research evidence in health decision-making (93, 99). One of the two studies validated claims of research impact with a document review (93), the other did not (99). One study assessed the feasibility of implementing the intervention (97), one focused on understanding factors that would facilitate or hinder uptake the intervention (96) and one assessed improvement in training participants’ (including health researchers’) KT knowledge (98). Four focused on the African context (93, 96-98) and one on the Arab context (99).

Across the studies that aimed to link researchers and policymakers and promote dialogue and exchange (93, 96, 97, 99) an enabling policy and political environment such as support from government leadership/policymaker champions emerged as critical to success of researchers KT efforts. Other factors cited as critical for success were researchers’ reputation and perceived credibility, including knowledge of the context, and researchers investing time and effort to nurture relationships with research end-users. A further, one study cited a preference for KT platforms to be placed in the policy-making institution to improve researchers’ understanding of the policymaking process (96). However another study illustrated the challenge of this from the research/research institution perspective in relation to their independence as researchers and the quality of research generated, which was cited as diminished in this approach (99). Nevertheless, having in place a structured mechanism for promoting interactions between researchers and decision-makers, that is supported by target research end-users, resulted in some benefits including improving interaction between researchers and decision-makers, raising awareness on issues among decision-makers, informing policy decisions and in some cases policy changes, and increasing policy relevant research.

**Table 9. Summary of papers describing/evaluating KT interventions/tools**

Place Table 9 here.

# Discussion

This review presents an overview of published literature on LMIC researchers’ KT capacity and practice and interventions for enhancing their KT practice. To our knowledge no similar review exists. In fact, researchers’ KT practice has been described as understudied in the context of increased pressure for researchers to illustrate the policy and practice impact of their research (102-104).

This review reveals some efforts to document researchers’ KT capacity, practice and capacity strengthening initiatives but a need to strengthen the evidence-base. 66 relevant publications were identified from earliest records available in the databases that were searched up to February 2019. More than half (59%) of the studies focused on sub-Saharan Africa (SSA) as either a primary or one of several target study settings. Most of the publications focused on health research and a sizeable proportion of these were case studies, descriptive cross-sectional surveys based on participant self-reports or commentary articles. Research designs used in primary studies that sought to assess levels or extent of capacity and practice were varied making it difficult to compare and contrast across studies. For instance, some studies, particularly institutional KT capacity assessments, reported integrated data from both researchers and policy makers while some studies gathered and reported data just from researchers. A majority of the papers reported LMIC researcher’s KT practice. Very few studies assessed or reported on interventions aimed at enhancing LMIC researchers’ KT capacity as well as their effect on KT practice. Most studies reporting KT practice were based on analyses of specific policy processes that explored the roles, influencing factors and strategies of various actors as opposed to an in-depth look at researchers’ efforts, gaps and influencing factors.

This review identified three key issues relevant to understanding LMIC researchers’ KT capacity and practice and identifying interventions that improve their KT practice. These include: the need for more high-quality research on LMIC researchers’ KT capacity and practice and interventions for enhancing their KT capacity and practice; the need for multifaceted interventions that address both LMIC researchers’ individual and institutional KT practice gaps; and the need for better designed studies that evaluate interventions seeking to enhance researchers’ KT capacity and practice.

This review reveals a need to generate and publish high-quality research focusing on in-depth analyses of LMIC researchers’ KT capacity, practice and influencing factors. In addition, KT capacity and practice assessment tools and methods could benefit from standardisation to aid comparison across research type (basic versus applied), research topic, institutions and contexts. This would help confirm the findings of this review that suggest an influencing role of research type, topic, institutions and contexts in researchers’ KT. The need for high quality KT literature is not unique to LMIC contexts having also been expressed in the global KT literature focusing on high income country (HIC) contexts (8, 105). Study designs that extend beyond case studies and descriptive studies, use participant observation and documentary evidence, are theory-based, draw on policy analysis literature from political science and provide nuanced intepretations of ‘context’, ‘policy’ and ‘research’ have been recommended to improve the KT evidence-base in general (8, 106, 107). A notable gap in studies that reported KT capacity assessments was their investigation of researchers’ interest in KT’ despite being considered an important predictor of practice (108). Therefore, studies exploring LMICs researchers’ KT capacity and practice should also investigate the role of their attitudes towards KT.

Despite the noted gaps in the evidence-base, the review suggests that suggests that more investments are allocated to research roles and functions relative to KT roles and functions. In addition, inadequate competency among researchers to undertake KT and lack of or little support for KT by research institutions were cited as the main barriers to LMIC researchers’ KT practice. Specifically, the review found inadequate skills for, and inadequate communication and collaboration or interaction between researchers and research end-users. Furthermore, studies that assessed the researchers’ interaction and collaboration with research end-users revealed that some critical groups are left out. Interaction and collaboration also referred to as ‘stakeholder engagement’ is being increasingly promoted as an important pathway to achieving research to policy and practice impact (109). It involves working with diverse groups of stakeholders in the research process, giving them shared decision-making authority, and thus taking into consideration interests and values into research design, implementation and dissemination (109, 110). This in turn increases the relevance and credibility of the research produced and the chances of its upotake in policy and practice decisions (109, 110). This is not a unique challenge to the LMIC context and is a challenge that has also been reported in studies in HIC settings (24, 103, 104, 107, 111-115). Researchers’ KT knowledge and skills, particularly in relation to communicating research, and their interaction and collaboration with research end-users were the most cited/reported individual level factors that influence researchers’ KT practice. At institutional level, funding for KT and institutional support and incentives promoting KT, were the most commonly cited factors that influence researchers’ KT practice. Among studies in this review that assessed KT capacity using a quantitative survey, institutional KT capacity emerged worse than individual KT capacity. Specifically, the existence of training courses focusing on KT, funding, guidelines, incentives, institutional linkages with end-user organisations and staff with KT expertise to support researchers were consistently scored in the low range of the measurement scales used.

The most commonly suggested strategies for enhancing researchers’ KT practice in this review align well to the identified researchers’ KT practice gaps, barriers and facilitators and include allocating/increasing/access to funding for KT, researchers’ skills development and establishment of institutional links and enhanced interaction between researchers and research end-users and their organisations. Establishing or strengthening institutional incentives to encourage KT did not emerge as one of the top suggested interventions but is nevertheless important to address as expressed elsewhere (103). Notably, a few publications recommended strategic partnerships between LMIC and international research institutions as an approach for transferring knowledge and skills and sharing resources in areas where capacity gaps exist such as skills and resources for conducting systematic reviews. Gaps in tertiary education systems in LMICs are widely documented and include insufficient numbers of qualified academic faculty and budgetary constraints (116). This limits the capacity of LMIC academic institutions to provide high quality graduate education. The benefits of partnerships between LMIC and international research institutions (North-South partnerships) has been cited elsewhere although with the caveat that for these collaborations to work they need to be equitable (26, 117). Others have argued for adaptations to the model to be led by the Southern partner (27).

Whilst this review identified few published evaluations of KT capacity strengthening interventison for researchers, we acknowledge previous or currently capacity strengthening efforts being implemented across LMICs although not published in peer reviewed journals. These interventions have largely focus on improving individual KT capacity (103, 107, 118-120) including: training on KT theory and its application, barriers and facilitators; KT strategies and plans; research communication skills; systematic review training; and skills for developing and sustaining relations with policymakers and media (103, 107, 118-121). Some have focused on strengthening collaboration and supporting establishment and operation of KT support networks (8, 122, 123). Examples include EVIP-Net and the Consortium for Health Policy and Systems Analysis in Africa (122, 123). A few examples of efforts by some academic institutions to improve recognition of KT in tenure and promotion processes exist but largely in HIC contexts (103, 104) and the extent to which these policies are promoted, recognized, applied, and evaluated is unclear (103). There are no examples of multi-pronged interventions that aim to concurrently enhance individual and institutional KT capacity. Yet, this review reveals the need for multifaceted interventions that address both LMIC researchers’ individual and institutional KT practice gaps. One study in this review illustrated that structural changes promoting KT practice by researchers and policymakers in the absence of policies, legislature and guidelines that mandate and guide institutional behavior change hindered improvement in KT practice (99). There is increasing recognition among KT practitioners of the importance of multi-pronged to achieve sustainable improvement in KT practice (103).

Finally, the review revealed very few published evaluations of KT interventions for improving researchers KT practice which, given the range of researcher-focused KT capacity strengthening initiatives that have been implemented (as described above), reflects a missed opportunity for learning about the effectiveness of KT interventions. We found only nine papers on KT interventions and tools for improving researchers’ KT capacity and practice and of these only five reported evaluations of interventions (93, 96-99). Furthermore, the studies employed heterogenous study designs and methods and had varied objectives and focused on a range of contexts. Despite these differences, the review drew some common findings from five of the nine studies that focused on interventions aimed at linking researchers and policymakers. These interventions reported a range of benefits including instrumental, symbolic and conceptual changes in policy decisions. The importance of a supportive leadership in government/policymaker champions, researchers’ reputation and credibility and researchers putting in time and effort to build relationships and trust were identified as facilitative. The studies found differences in preferences on the ideal host of a KT platform –government or a non-state institution. These findings are useful but are based on a few studies that have mainly used case study and descriptive designs. As a result, these findings fall short of providing stron evidence on the effectiveness of various intervention models on LMIC researchers KT practice. The findings point to the need for more evaluation studies to better understand for whom and under what circumstances KT interventions work. KT practice/intervention evaluations is consistently identified as either underrepresented across the global KT evidence-base or largely poorly designed where they exist (21, 103, 121, 124-129). KT practitioners and scholars are advised to employ realist approaches, pragmatic trials, impact evaluations, implementation research and participatory action research, which are more suitable for evaluation of social and contextually sensitive interventions like those associated with KT (8, 21, 130, 131). In addition, more attention to the variety of impacts and effects resulting from research is also been recommended (106).

 contexts

# Conclusions

The available evidence suggests that LMIC researchers rarely practice KT mainly because they face capacity constraints and barriers at individual and institutional levels. Increased access to funding for KT, researchers’ KT skills development including partnerships with international research institutions, improved links and interaction between researchers and research users and their institutions and institutional incentives promoting KT practice is recommended. More in-depth, high quality research on researchers’ KT capacity, practice and effective KT capacity strengthening interventions is needed including standardisation of methods and assessment tools. Study designs that extend beyond case studies and descriptive studies, are theory-based, draw on policy analysis methods, provide nuanced interpretations of ‘context’, ‘policy’ and ‘research’ and pay attention to a range of impacts and effects are recommended. Furthermore, realist approaches, pragmatic trials, impact evaluations, implementation research and participatory action research are recommended for evaluating interventions. Notably, the findings in this review are largely consistent with what has been reported in the HIC settings.

## List of abbreviations

KT Knowledge Translation

LMIC Low- and middle-income country

HIC High income country

EVIP-Net The Evidence-Informed Policy Network

MOHME Ministry of Health and Medical Education

MOHFW Ministry of Health and Family Welfare

NKP National Knowledge Platform

MoH Ministries of Health

FHS Future Health Systems

STP SUPPORT Tools for evidence-informed health Policymaking

HIV/AIDS Human Immunodeficiency Virus/Acquired immunodeficiency syndrome

NGOs Non-government organisations

SSA sub-Saharan Africa

WHO The World Health Organization

MMAT Mixed Methods Appraisal Tool

PRISMA Preferred Reporting Items for Systematic Reviews and Meta-Analyses

RAPID Research and Policy in Development programme

## Declarations

**Ethics approval and consent to participate**

Not applicable.

**Consent for publication**

Not applicable.

**Availability of data and material**

All data generated or analysed during this study are included in this published article.

**Competing interests**

The authors declare that they have no competing interests.

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**Authors' contributions**

VM, JP, IB and RO were involved in conceptualizing and designing the review. VM led the search, screening, quality appraisal and analysis of the data. JP and NT quality checked the selection process and the extracted data and were involved in the analysis and quality appraisal. VM prepared the first draft and all authors contributed to the content, review and revisions of the manuscript.

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**Figures**

**Figure 1. Flow chart of the identification, screening, and included articles**

Figure 1 illustrates the process used to search for studies that were included in the review. Studies were searched in the PubMed and Scopus databases. ‘Identification’ shows the number of articles retrieved using the search terms (327) after removal of duplicates (334). ‘Screening’ shows the number of articles that met the study inclusion criteria (133) after screening the abstracts of the initial 334 articles against the study selection criteria. ‘Eligibility’ shows the number of articles that were excluded (201) after the full texts of the 133 articles that met that past the screening were read in full and screened against the study selection criteria. ‘Inclusion’ shows that number of articles that met the inclusion criteria (66), which includes those from the initial search (36) and those from searching the reference lists of the 36 articles (30).

**Tables**

**Table 1. Quality rating of reviewed original research publications**

Table 1 illustrates the quality ratings of the 66 primary research studies included in the review. The methodological quality of included primary research studies was appraised using the Mixed Methods Appraisal Tool (MMAT) with the final score expressed as a percentage. Studies can be assigned a quality rating that ranges from 25% (the lowest quality score) to 100% (the highest quality score).

**Table 2. Reported factors that influence KT, as reported by LMIC researchers**

Table 2 illustrates factors that were commonly cited by researchers in the studies included in the review relating to the extent of use of evidence in decision making processes including the factors influencing the practice. A listed factor was considered commonly cited if it was reported in three or more studies.

**Table 3. Reported barriers of KT, as reported by LMIC researchers**

Table 3 illustrates barriers of use of research in decision making processes commonly cited by researchers in the studies included in the review. A listed barrier was considered commonly cited if it was reported in three or more studies.

**Table 4. Reported facilitators of KT, as reported by LMIC researchers**

Table 4 illustrates facilitators of use of research in decision making processes commonly cited by researchers in the studies included in the review. A listed facilitator was considered commonly cited if it was reported in three or more studies.

**Table 5. Recommended strategies for improving KT, as reported by LMIC researchers**

Table 2 illustrates recommended strategies for improving use of research in decision making processes commonly cited by researchers in the studies included in the review. A listed recommendation was considered commonly cited if it was reported in three or more studies.

**Table 6. Summary of papers describing/evaluating KT interventions/tools**

Table 6 tabulates the 9 studies reporting on interventions or tools aiming to improve or facilitate the KT capacity and practice of researchers and researcher institutions. It organises the interventions at three levels, systems, institutional and activity. Systems level interventions represent government-led interventions with substantial involvement of academic or research institutions. Institutional level interventions represent those initiated and implemented by academic or research institutions. Individual level interventions aim to improve individual KT knowledge and skills. Activity level interventions are guidelines for implementing specific KT activities such as development of policy briefs, organising policy dialogues and pairing researchers with policymakers to enhance their interaction. The table also summarises each intervention/tool including aims, implementation period and, for interventions/tools that evaluated use, the evaluation aim, study design and results.

**Additional information**

**Additional file 1. List of included primary studies**

Additional filee 1 presents the list of included primary research studies in this review. It presents information on the study designs and methods including sampling, and description of the study population and setting.

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**Table 9. Summary of papers describing/evaluating KT interventions/tools**

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| **Intervention level/paper** | **Intervention and evaluation aims and design and results/recommendations** |
| **Systems level** |  |
| Majdzadeh 2010 | * Intervention: In 1985, the Iranian government integrated medical schools into the Ministry of Health resulting in the creation of the Ministry of Health and Medical Education (MOHME)
* Aim: To enhance translation of evidence into policy and practice
* Evaluation: Qualitative study involving interviews and focus group discussions with decision makers, non-medical professionals, researchers (from intervent and control settings) and practitioners to assess impact on MOHME decision-making process
* Results: Increased operations research but institutional policymaking culture was unchanged. Time for teaching and research compromised because of over-emphasis on service delivery.
* Recommendations: Need for establishment of clear regulations and incentives to guide and promote the integration
 |
| Sriram 2018 | * Intervention: Processes to form National Knowledge Platform (NKP) initiated in 2013, in India, by the Ministry of Health and Family Welfare (MOHFW)
* Aim: To enhance dialogue and exchange between policy-makers and health policy and systems researchers to inform generation of policy relevant evidence and decision-making
* Evaluation: Qualitative case study, entailing interview with researchers and policymakers and document reviews in 2016 to analyse the policy-making process
* Results: NKP initially established as embedded within MOHFW but evolved into an independent platform. Researchers network at fore front pushing formation of NKP including leading proposal development. Initially considered as secretariat but late Steering Committee member.
 |
| **Institution level** |  |
| Mijumbi 2014 | * Intervention: University-based (Makerere University) rapid response service (RSS) implemented from 2010 to present targeting state and non-state decision-makers including mid- and top-level officials at Ministries of Health, Civil Society Organizations and legislators
* Aim: Timely (within 28 days) development of four-page evidence briefs with clear key messages to support health systems policy and planning decision-making
* Feasibility assessment: Case study involving RSS service data and interviews with service users for the period 28 months since start
* Results: Among nearly half of the policymakers, the intervention resulted in a change the course of action based on the evidence provided in the rapid response briefs
 |
| Mijumbi-Deve 2017 | * Intervention: University-based (Makerere University) RSS implemented from 2010 to present targeting state and non-state decision-makers including mid- and top-level officials at Ministries of Health (MoH), Civil Society Organizations and legislators
* Aim: Timely (within 28 days) development of four-page evidence briefs with clear key messages to support health systems policy and planning decision-making
* Evaluation: Qualitative case study entailing interviews with researchers involved in its implementation and policymakers who used or were conversant with the service to explore the contextual factors associated with the how and why an RRS may be taken up by users in Uganda in the period 2010 to 2014
* Findings: Buy-in from MoH, consultation during design and implementation of the service, ongoing sensitization and reminders, follow-up interviews with users, sustainable funding to run the service including paying and training full time staff and RSS research staff maintaining a balance between an institutionalized system and a personal relationship
 |
| Syed 2008 | * Intervention: Development and application of the Future Health Systems (FHS) evidence-policy interface conceptual framework based on document review and iterative discussions among FHS research consortium. Framework considers four key factors including the developmental context, research characteristics, decision making processes and stakeholder engagement
* Aim: Tool for assessing research plans’ potential for strengthening research-policy links in LMIC countries and opportunities for improvement
* Evaluation: Applied to six health system research plans
* Results: Identified gaps in research plans including limited focus on the following: nurturing links with institutions involved in decision making processes, identification and participation on formal and informal networks and, stakeholder analysis to inform the design of engagement strategies
* Recommendation: Wide application and evaluation
 |
| **Individual level** |  |
| Mbuagbaw 2014 | * Intervention: Two-day training workshop targeting Cameroonian health researchers’ (university-based and independent) and policymakers’ on pragmatic knowledge translation trials including distinguishing pragmatic trials from other types of trials, and key concepts in knowledge translation, important steps in clinical trial design
* Aim: Improve knowledge
* Evaluation: Structured pre-post training test survey administered before start of training and immediately after end of training
* Finding: Statistically significant short-term improvement in the participants’ mean score (standard deviation) from 14.7 (3.75) in the pre-test to 18.27 (4.21) in the post-test
 |
| **Activity level** |  |
| Lavis 2009 | * Intervention: SUPPORT Tools for evidence-informed health Policymaking (STP) #13: Preparing and using policy briefs to support evidence-informed policymaking
* Aim: Guiding questions for preparing policy briefs for use in decision-making processes
* Description; not evaluated
 |
| Lavis 2009 | * Intervention: SUPPORT Tools for evidence-informed health Policymaking (STP) #14: Organising and using policy dialogues to support evidence-informed policymaking
* Aim: Guiding questions for organising policy dialogue
* Description; not evaluated
 |
| Young 2018 | * Intervention: The Policy BUDDIES Project in Western Cape Province, South Africa implemented in 2014 for 6 months. Paired/matched provincial policymakers one-to-one with local researchers skilled in KT skilled and knowledgeable about health policy and systems issues
* Aim: To build relationships (termed buddying) between researchers and policymakers to increase the use of evidence in provincial health policy decisions
* Evaluation: External mixedmethods evaluation using interviews with policymakers participating in the programme, focus group discussions with researcher buddies and document reviews
* Results: Various uses of evidence observed; evidence presented by researchers not always align with polcymaker evidence needs; researchers’ improved understanding of complexity of policy process, communication of evidence and flexibility; and policymaker champions and reputation of researchers facilitated programme success.
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