research

'Maybe we can turn the tide': an explanatory mixed-methods study to understand how knowledge brokers mobilise health evidence in low- and middle-income countries

Theresa C. Norton, tnorton1@jhu.edu
Baltimore, USA

Daniela C. Rodriguez, drodri17@jhu.edu
Johns Hopkins Bloomberg School of Public Health, Baltimore, USA

Catherine Howell, Kate.Howell@jhpiego.org
Charlene Reynolds, Charlene.Reynolds@jhpiego.org
Jhpiego/Maternal and Child Survival Program, Washington, DC, USA

Sara Willems, Sara.Willems@UGent.be
Ghent University, Belgium

Background: Little is known about how knowledge brokers (KBs) operate in low- and middle-income countries (LMICs) to translate evidence for health policy and practice. These intermediaries facilitate relationships between evidence producers and users to address public health issues.

Aims and objectives: To increase understanding, a mixed-methods study collected data from KBs who had acted on evidence from the 2015 Global Maternal Newborn Health Conference in Mexico.

Methods: Of the 1000 in-person participants, 252 plus 72 online participants (n=324) from 56 countries completed an online survey, and 20 participants from 15 countries were interviewed. Thematic analysis and application of knowledge translation (KT) theory explored factors influencing KB actions leading to evidence uptake. Descriptive statistics of respondent characteristics were used for cross-case comparison.

Findings: Results suggest factors supporting the KB role in evidence uptake, which include active relationships with evidence users through embedded KB roles, targeted and tailored evidence communication to fit the context, user receptiveness to evidence from a similar country setting, adaptability in the KB role, and action orientation of KBs.

Discussion and conclusions: Initiatives to increase evidence uptake in LMICs should work to establish supportive structures for embedded KT, identify processes for ongoing cross-country learning, and strengthen KBs already showing effectiveness in their roles.

key words knowledge brokers • knowledge translation • evidence-informed decision making • low- and middle-income countries

key messages

- Little is known about how knowledge brokers mobilise evidence in low- and middle-income countries.
- A multi-country study of knowledge brokers identified promising practices for evidence uptake.
- Embedded brokers who adapted messaging and evidence to context in active relationships worked well.
- Capacity building should use KB promising practices and facilitate multi-country evidence exchange.

Background

Insufficient use of research evidence for health policy and practice poses a global challenge that affects the quality of care and ultimately health outcomes (Bornbaum et al, 2015; Dagenais et al, 2015; Wong, 2017). The health burden of insufficient evidence use in health care is particularly felt in low- and middle-income countries (LMICs): there were an estimated 303,000 maternal deaths worldwide in 2015, most of which were in LMICs and preventable (Alkema et al, 2016). While there is widespread agreement that contextually relevant research has the potential to address health challenges for the world's most disadvantaged, opinions vary on who can best galvanise evidence use and how (Commission on Health Research for Development, 1990; Global Forum for Health Research and Nuyens, 2005; Paudel, 2015; Conalogue et al, 2017).

Because uptake of health research evidence takes place in complex health systems, one mechanism that has emerged in evidence advocacy is linkage agents or intermediaries between evidence producers and users who help navigate the complexities of evidence-to-action. Organisations or individuals in these linkage roles are often referred to as knowledge brokers (KBs). They facilitate the translation of knowledge into evidence-informed decision making (EIDM) in health policy and practice (Canadian Health Services Research Foundation, 2003; Van Kammen et al, 2006; Lomas, 2007; Dobbins et al, 2009; Pennell et al, 2013; Dagenais et al, 2015; Jessani et al, 2016; Norton et al, 2016; Kim et al, 2018). A key value of KBs is their ability to raise awareness of relevant evidence, which might not otherwise occur with passive dissemination (for example, publishing alone).

How the KB role exists varies. KBs may be embedded in organisations, such as in Knowledge Translation (KT) units, or function as consultants for the duration of a project. Individuals with a primary professional role to which KB duties are added may work as policy advocates, health programme implementers, faculty members, or ministry of health staff. KB activities often include building relationships and professional networks among research users and producers to foster the flow and use of evidence (Van Kammen et al, 2006; Dobbins et al, 2009), critically appraising evidence (Weiss and Bucuvalas, 1980; Lind and Persborn, 2000; Jessani et al, 2016; Van Eerd et al, 2016), and mobilising change based on evidence (Van Eerd et al, 2016). In fulfilling their role, KBs operating in LMICs may face more challenges than in higher-income settings, such as greater resource

and infrastructure limitations and international pressures (Malla et al, 2018). The extent and nature of challenges influencing KBs and their ability to function in their role vary with the country's level of development, organisational contexts, access to resources, and political agendas (Orem et al, 2014). Moving evidence to action in a low-resource country such as Ethiopia may require different strategies for overcoming challenges than in a country with more resources such as India, in addition to addressing other contextual issues. Decisions on evidence uptake in LMICs often lie at the intersection of science, politics, environment, and beliefs. Political stakeholders may drive priorities in health care, populations may exert pressure on decision makers, and political approval processes may slow progress (Datta et al, 2016; Parkhurst and Abeysinghe, 2016). Examining a traditional scientific hierarchy of evidence may influence decisions less than a decision maker's own values, knowledge gained from experience, or locally derived knowledge (Datta et al, 2018; Nugroho et al, 2018; Rushmer et al, 2019).

Even when evidence informs decisions in health policy and practice, operationalisation may stall due to factors such as workforce capacity, resource allocation, natural disasters, and political changes (Datta et al, 2018; Dobbins et al, 2018). Policy research organisations and units may need strengthening to ensure regular engagement with policy makers and assessments of research use (Datta et al, 2016). Leadership support for research generation and use presents a need shared by both higher-income and LMIC settings (Datta et al, 2016; Dobbins et al, 2018).

The literature paints an uneven picture of the approaches, circumstances, and individual attributes leading to knowledge brokering positive outcomes and impact on health care. Systematic reviews have been divided, with some saying that leveraging KBs is a useful KT strategy for EIDM and others saying that – though promising overall – more research is needed to determine the circumstances under which KBs are effective (Bornbaum et al, 2015; Elueze, 2015; Dobbins et al, 2018).

Theories, models, and frameworks relevant to the field of Dissemination and Implementation Research help understanding of when and where knowledge brokering may foster evidence uptake in the complex, constantly evolving settings of health systems in LMICs (Tabak et al, 2012; Nilsen, 2015). These theories, models, and frameworks include ones that address how innovations spread and the influences on uptake, both from an individual and systems standpoint (Harvey and Kitson, 2016). The often cited Diffusion of Innovations Theory (Rogers, 2003) contributes to understanding by depicting change agents as drivers of adoption and the importance of social networks as conduits for dissemination (Green et al, 2009). The Knowledge-to-Action Framework, another frequently noted framework, depicts the crucial activities of synthesising, tailoring, and adapting knowledge to inform decisions that are both evidence- and context-appropriate (Graham et al, 2006). Behaviour change theory such as the Theoretical Domains Framework provides insight into how beliefs and motivations may influence evidence uptake among individuals (Cane et al, 2012). Applying theories, models, and frameworks to predict a path of evidence to informed policy in LMICs resulting from knowledge brokering, however, needs to acknowledge that the path is seldom linear nor may it be exactly replicable.

While helpful in understanding evidence dissemination and uptake, most theories, models, and frameworks omit specific discussion of how KBs fill their role. One of the few theories addressing how KBs operate originates outside of health. It proposes that KB functions can be better understood by characterising the modalities of their interactions: transactional in making connections, regulatory in addressing norms, or strategic in

leveraging established social structures (Taylor, 2015). Even with this additional attempt to explain knowledge brokering, insufficient attention has been given to how KBs think about their roles, their contexts, and the possible abundance of relevant evidence, which may influence their decisions in brokering knowledge and positive outcomes.

This paper describes the findings of a study on KBs in multiple countries aimed at filling a gap in understanding KB decisions in acting upon and effectively mobilising evidence. The authors view their methodological orientation as pragmatic realism (Miles et al, 2014). They focused on useful applications of evidence for improving the health of populations and accepted the accounts provided by KBs as representing the complexity of their contexts and interactions.

Study context

The authors used an international health conference – the Global Maternal Newborn Health Conference (GMNHC) 2015 – as a way of accessing KBs in global health. The GMNHC was held in Mexico City on October 18–21, 2015. Mexico's Secretariat of Health hosted the gathering, and organisers included the United States Agency for International Development's flagship Maternal and Child Survival Program, the Maternal Health Task Force at the Harvard T. H. Chan School of Public Health, and Save the Children's Saving Newborn Lives Program. More than 1000 participants from 75 countries attended in-person by invitation of the organisers to prioritise actions for addressing unrealised millennium development goals (Paudel, 2015). Health system actors present included policy makers, global health programme implementers, technical experts, clinicians and other health workers, and health faculty and trainers. Key presenters advocated for reducing preventable deaths by increasing access to and use of evidence in health policy and practice (Paudel, 2015).

Two studies in 2012 and 2013 explored evidence use and sharing following participation in similar international conferences and found that many participants reported activities common to the KB role (Norton et al, 2016). The current study builds on methods and findings of those previous studies to increase understanding of the KB experience and how it leads to evidence uptake.

Research methodology

Design

The research team used a mixed-methods explanatory sequential study design (Creswell, 2015), first to quantitatively describe characteristics of the KBs and their evidence-sharing and use behaviour, and then qualitatively develop insights into the quantitative data to explain the decisions made by KBs in their intermediary role.

Study implementation began with the collection of quantitative data and a limited amount of qualitative data, using a self-administered online survey. The survey was followed by semi-structured interviews with a subset of survey respondents. Review of conference materials, such as the programme and presentations, supported the triangulation of quantitative and qualitative data during collection and analysis. Throughout data collection and analysis, the lead author served as a focal point for documenting insights and decisions and maintaining logs of the process.

Instruments

The survey and interview instruments used most of the same questions as the 2012 and 2013 studies (published separately) (Norton et al, 2016), with minor changes to multiple choice options to include choices previously supplied as 'Other' responses. The online survey, delivered through the SurveyMonkey web platform (www.surveymonkey.com), asked questions about participant demographics and characteristics and examples of post-conference knowledge (that is, evidence) sharing and use. The semi-structured interviews collected additional qualitative data such as examples of sharing and using knowledge from the conference and reasons for not doing so.

Selection of respondents

Researchers worked with conference organisers to reach conference participants by using an email distribution list previously used by organisers to promote the conference. Because the list included recipients who did not attend the conference, the first survey question eliminated respondents who indicated that they did not participate in the conference either in person or online. Organisers sent the email with the survey invitation approximately nine months after the conference. Survey respondents could indicate that they would be willing to participate in a follow-up interview. Of the 1000 in-person conference participants, 252 plus 72 online participants (n=324) from 57 countries completed the survey (fully or partially), and 124 answered that they would be willing to be interviewed.

The lead author purposively selected 20 respondents to contact for 30-minute phone interviews based on diversity of demographics (for example, country, type of work), conference experience (for example, in-person versus online participation), and self-reported use or non-use of conference knowledge to capture broad perspectives. Practical considerations (study timeline and budget) limited the number of target interviews; however, data saturation appeared to have been reached. Interviewers (the study lead and interns trained for the purpose) used an interview guide and study guidelines for conducting the interviews. The principal investigator conducting some of the interviews and training the interns on standard procedures was a senior professional working in global health with formal training in qualitative research and holding a master's degree. The interns were bachelor- and master's-level college students with professional or volunteer experience in global health programmes. All interviewers were female and based in the United States. The lead author replenished the list of interview candidates, as some were eliminated after not responding to three email contacts for unknown reasons. A total of 64 contacts were needed to yield 20 interviews, which were completed between 10 and 14 months after the conference. Interviewers recorded and transcribed interviews, sharing the responsibility for quality checking transcriptions. Interviewers did not previously know the respondents and did not return transcripts to them.

Data analysis

Researchers exported survey data from SurveyMonkey to a Microsoft Excel (.xls) file for further analysis. Transcripts and open-ended survey responses were imported into MAXQDA qualitative data analysis software, version 18, for coding and cross-tabulation of demographic characteristics.

Qualitative data coding took both a deductive and inductive approach (Miles et al, 2014). Because the study aimed to increase understanding of KB decisions and actions, researchers used theory and frameworks in the analysis that addressed internal and external factors.

Deductive codes came from the Theoretical Domains Framework of psychological theory (Cane et al, 2012), the literature on barriers and facilitators to evidence use, and categories of knowledge use and sharing from the survey. Inductive codes came from qualitative data. At the beginning of the coding process, an experienced qualitative researcher also coded two transcripts selected by the lead author to compare coding approaches and refine a qualitative codebook (MacQueen et al, 1998).

Thematic analysis (Fereday and Muir-Cochrane, 2006) was used to identify themes of KB actions on evidence from the conference. Two experienced qualitative researchers reviewed interim summary reports of findings and provided feedback and guidance during the analysis process. In analysing data obtained both early and late in the study, researchers estimated that data saturation had been achieved as no new themes occurred later in data analysis. Participant checking of findings was invited, but no comments were received.

Limitations of the study

Limitations of the study included the small sample of interview respondents and difficulty in reaching participants after the conference to complete interviews, even though, as with the survey, email reminders were sent multiple times. A self-selecting respondent pool may have resulted in over-representation of some characteristics (for example, motivation). Selection of one conference instead of multiple conferences may have missed mediating factors of the specific conference (for example, satisfaction with conference logistics, content selection, feelings about conference organisers and sponsors). Studying participation in a conference rather than other knowledge-sharing contexts posed a limitation in that findings may have varied if participants had been exposed to knowledge in other ways. Respondents may have been exhibiting social desirability bias by reporting knowledge use and sharing because they equated the interviewers with the conference organisers and feared that negative responses would jeopardise future conference participation. The use of student interns for interviewers may have affected the richness of data collected during some interviews as interns may not have felt comfortable in prompting respondents for additional details.

The wording of survey questions may have posed limitations, even though most questions had been used in the previous related studies. For example, the survey question restricting respondents to choosing one type of work may have hindered revealing factors that help explain the KB experience, an issue that did not surface with research questions from previous studies. With one of the questions that was new to the current study – rating knowledge use from specific conference activities – the wording of the question may have confused respondents and resulted in misleading data about preference for interpersonal sharing. In addition, the omission of a gender question may have led to missing dynamics involved in evidence sharing that were related to gender.

While methodological triangulation through multiple sources of data (survey and interviews) aimed to reach an adequate depth of data saturation (Fusch and Ness, 2015), the researchers' assessment that no new information would have been elicited from additional interviews could not be verified.

Research findings

Quantitative results

A total of 324 survey responses were received. Table 1 presents demographic data of the survey participants and the subset who were interviewed, showing a variety of regions, types of organisations, and types of work, among other characteristics.

Table 1: Demographics of survey participants and the subset interviewed

Demographics	Survey respondents	Subset interviewed
	(n=324)	(n=20)
Mode of attendance		
In person	252 (77.8%)	17 (85.0%)
Online	72 (22.2%)	3 (15.0%)
Region		
Africa	108 (33.3%)	6 (30.0%)
Americas	102 (31.5%)	3 (15.0%)
Asia	83 (25.6%)	9 (45.0%)
Europe	15 (4.6%)	2 (10.0%)
Oceania	5 (1.5%)	0 (0.0%)
Unknown	11 (3.5%)	0 (0.0%)
Type of organisation		
Academic/research institution	83 (25.6%)	4 (20.0%)
Consultant	4 (1.2%)	0 (0.0%)
Donor	14 (4.3%)	0 (0.0%)
Failth-based organisation	2 (0.6%)	0 (0.0%)
Government/ministry	39 (12.0%)	5 (25.0%)
Media	2 (0.6%)	1 (5.0%)
Medical/health organisation	32 (9.9%)	2 (10.0%)
Non-governmental organisation/private voluntary organisation (local and international)	118 (36.4%)	7 (35.0%)
Private sector (for-profit)	4 (1.2%)	1 (5.0%)
UN system	15 (4.6%)	0 (0.0%)
Unknown	11 (3.6%)	0 (0.0%)
Type of work		
Advocacy	19 (5.9%)	2 (10.0%)
Combination	3 (0.9%)	0 (0.0%)
Health/medical service delivery	36 (11.1%)	5 (25.0%)
Health communication	14 (4.3%)	0 (0.0%)
Policy making	12 (3.7%)	1 (5.0%)
Programme development/management/ implementation	131 (40.4%)	4 (20.0%)
Research/evaluation	72 (22.2%)	6 (30.0%)
Student	5 (1.5%)	0 (0.0%)
Teaching/training	20 (6.2%)	2 (10.0%)

Table 1: Continued

Unknown	12 (3.8%)	0 (0.0%)
Years in profession		
0–5 years	72 (22.2%)	3 (15.0%)
6–10 years	86 (26.5%)	6 (30.0%)
11–15 years	70 (21.6%)	6 (30.0%)
16 or more years	85 (26.2%)	5 (25.0%)
Unknown	11 (3.6%)	0 (0.0%)
Abstract accepted to conference		
Do not know	4 (1.2%)	1 (5.0%)
No	149 (46.0%)	8 (40.0%)
Yes	140 (43.2%)	11 (55.0%)
Unknown	31 (9.6%)	0 (0.0%)

The majority of respondents said they shared (92.8%; n=292) and used (93.6%; n=279) knowledge gained from the conference. When asked with whom they shared knowledge, respondents mostly selected recipients suggestive of personal association (for example, members of their own organisation), as opposed to recipients likely unknown to them (for example, readers of their publications). Figure 1 presents the options selected and the wording of the question about sharing. Most ways in which knowledge was shared were also consistent with personal association, such as passing along conference materials to

Figure 1: Types of recipients with whom KBs shared knowledge from the conference
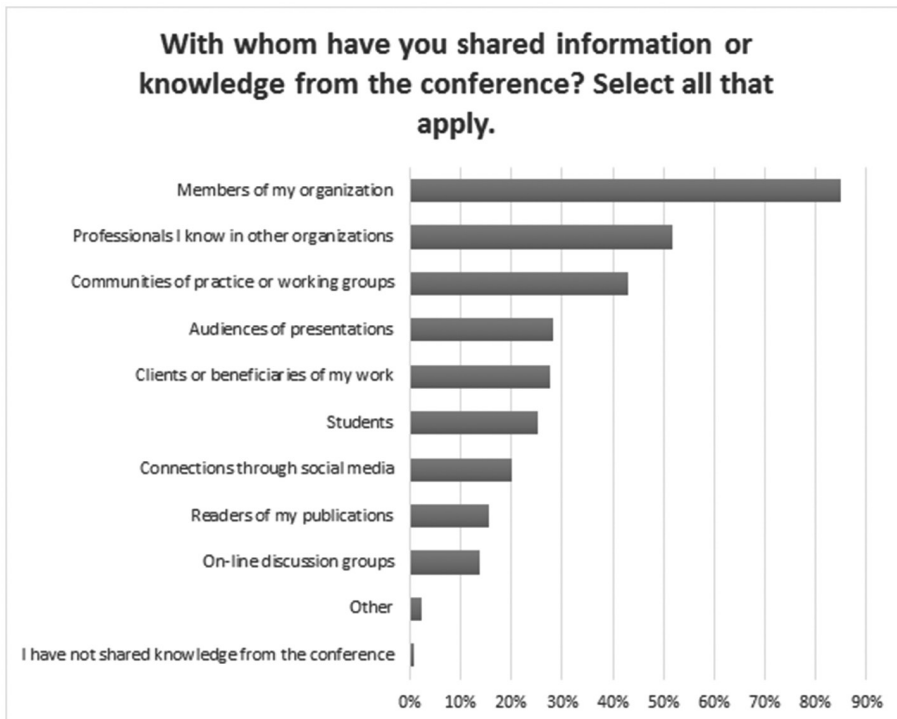
colleagues and sharing in communication with members of the same organisation (73.0% and 71.9%, respectively; n=267). In response to a question asking the ranking of the top three reasons for attending the conference, answers suggested an interest in both sharing knowledge (abstract/presentation accepted: 61.0%; n=293) and receiving knowledge of possible relevance to the participant's country setting (learn about new evidence from global experts: 34.2%; learn best practices: 32.0%; n=293). Types of information that were shared were more often types associated with an individual, such as expert opinion and experience from another participant (62.2% and 60.3%, respectively; n=267), as opposed to information without personal context, such as information about a journal article or publication (36.3%; n=267).
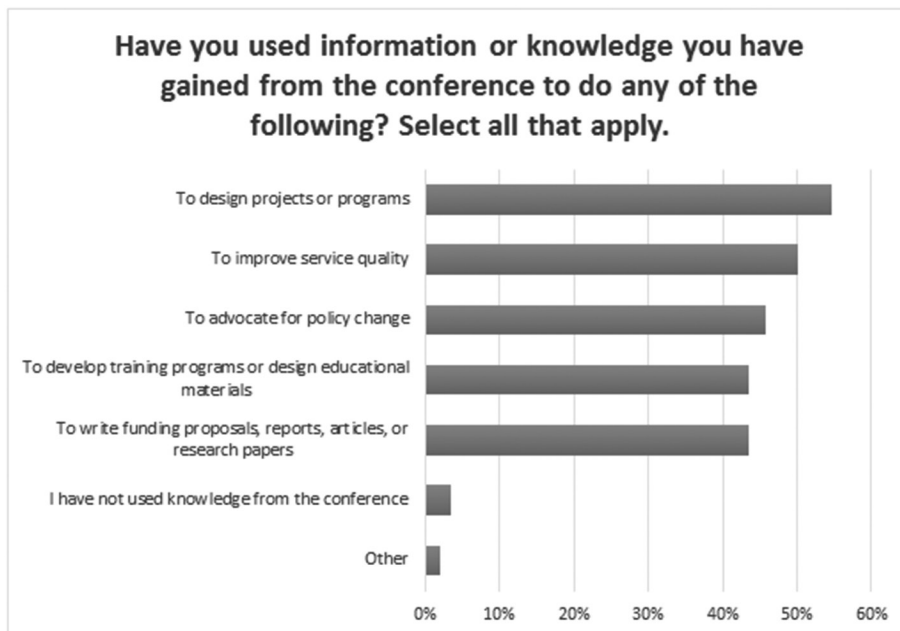
How knowledge from the conference was used reflected various types of work and levels in the health system. A respondent's primary type of work did not appear to limit knowledge use to a corresponding type. For example, a respondent selecting a primary type of work as health care service delivery also selected types of knowledge use associated with other job roles such as advocacy and programme development, in addition to service delivery. Figure 2 shows the survey question and responses about types of use.

In the few cases where respondents reported not sharing or using conference knowledge, most reasons given were 'not enough time' and 'nothing was new to me'.

Qualitative results

Data analysis identified five themes of KB actions and decisions that they reported led to evidence uptake: (1) maintaining active relationships through embedded roles; (2) tailoring messages and communications to fit context; (3) leveraging

Figure 2: Uses of knowledge from the conference that KBs reported

Have you used information or knowledge you have gained from the conference to do any of the following? Select all that apply.

user receptiveness to evidence from comparable settings; (4) adapting approaches in the KB role; and (5) exhibiting an action orientation. Across the themes, the respondent's type of work appeared to be the most important personal characteristic explaining decisions and actions on evidence, as type of work was mentioned repeatedly during interviews (for example, health workers describing changes to their service delivery practices).

Maintaining active relationships through embedded roles

KBs reported relying upon their existing roles embedded in organisations, health programmes, and multi-organisational groups (for example, Latin American and Caribbean Regional Task Force for the Reduction of Maternal Mortality) for providing opportunities to promote evidence uptake through active relationships. Multiple KBs expressed a feeling of responsibility in their professional role for both acquiring new knowledge to address health challenges in their settings and for mobilising its use to the extent of their authority. Respondents seemed to associate their capacity to access evidence, understand its implications for their setting, and ability to envision its application with driving adoption of changes in their networks. This theme could be seen across social or professional roles and demographics. Types of structures in which relationships developed included service delivery units in health care facilities, university departments, government-sponsored technical working groups, and local partnerships for health programme implementation. Professional meetings with appropriate types of health system actors appeared to be crucial to respondents in gaining consensus on and sharing new evidence, as illustrated by the following example:

> We have what we call clinical meetings, and during those clinical meetings, we update each other on the latest practice which is research-based. And such information is like what was actually presented during the conference. (Health/medical service delivery, government/ministry, Sub-Saharan Africa)

Professional roles involving interaction with multiple types of organisations and settings correspondingly widened the relationship network and potential reach of shared evidence. For example, a programme manager who also worked in the community and made presentations at conferences mentioned multiple opportunities for sharing and promoting evidence:

> [I shared knowledge with the] community, the stakeholders here, and the local conferences back home. [Programme development, academic/research institution, Sub-Saharan Africa]

KBs in a position of authority or engaging those in authority as part of evidence discussions reported an easier time mobilising evidence uptake, as mentioned in this example of a country team attending the conference:

> At the conference… family health division director and policy people in the ministry were there, and they realised the importance of the integration. So, it is easy for me to advocate the importance of integration of these newborn

health activities at the division level. [Programme development, NGO/PVO, Southern Asia]

Tailoring messages and communications to fit context

KBs emphasised the importance of tailoring messages and communications about evidence to maximise acceptability by users. KBs seemed to assess drivers of acceptability based on the type of health system actor most needing to be influenced. For example, several KBs mentioned the importance to families of cultural norms for applying substances to newborn cord stumps and the need to reframe chlorhexidine (used on cords to avoid infection) so that it was acceptable to families:

> Because it is a cultural practice that people apply something on the umbilical cord of a newborn child. And if you provide them with something which is safe and which will prevent sepsis, so that's why it was a decision that instead of one day it should be a seven-day application. [Policy making, government/ministry, Southern Asia]

KBs also mentioned tailoring evidence to fit actors by their health system level, such as community health workers. For example, one KB described sharing in the community only locally applicable evidence (versus global trends) that could be implemented with available tools and supplies. In another case, a KB reworded an evidence topic – using 'respectful maternity care' instead of 'preventing obstetric violence' – to avoid offending physicians, whose acceptance was crucial in setting standards of care.

Leveraging user receptiveness to evidence from comparable settings

KBs described the value that they and decision makers placed on evidence generated in a comparable setting (such as a similar LMIC) and how KBs used this perception as a bargaining aid. Their accounts suggest a view that adapting the successful implementation of evidence from a similar context might yield equally successful outcomes in the user's own context. One such account came from a community advocate and health care provider who was suggesting solar-powered lighting in health care facilities:

> Public health officials… ask us… have you any good success stories, where from you collected this kind of idea? So, we suggest to them that… we come to know about such kind of practices being used in other countries, and their economic situation and their electricity situation is the same as ours. [Health/medical service delivery, local NGO, Southern Asia]

The comparable setting-comparable success viewpoint surfaced in both narrow descriptions of specific health care practices and with broad comparisons among LMICs overall, as with this passionate expression from a faculty member and researcher for whom the comparison was a motivator to act:

> Because most of them were like success stories from other countries…
> since our maternal mortality and morbidity is related… I assume maybe
> we can turn the tide if we try maybe to do what other people have done in
> other parts of the world. [Teaching/training, academic/research institution,
> Sub-Saharan Africa]

Most KB accounts implied measures of comparability related to resource availability,
infrastructure status, and cultural norms. Comparisons did not mention geographic
proximity as a factor.

In one atypical example, the respondent noted a common public health issue even
though the settings were economically non-comparable and explained his thinking
about the underlying implementation problem that needed to be addressed in his
country:

> So it is quite comparative that I have the problem of newborn screening
> [as with other African or Asian countries] because it is not democratically
> distributed in the whole country, for the wealthy countries as well.
> [Health/medical service delivery, private sector, Western Asia]

He noted that while much of the conference was focused on lower-resource
settings, the maternal and newborn issues presented were comparable to those in his
higher-resource country (where 'lack of money' was not an issue), and so he selected
the information because it was 'coming from different countries all over the world'.
The KB gave the specific example of learning about simple approaches using little
equipment to ensure safe delivery, which he said he practiced himself and then taught
to his residents in Obstetrics and Gynecology in his country. He noted that he was
able to make use of materials and visuals from the conference in training residents.
He also expressed that he expected the number of caesarean sections and obstructed
labours to decrease as a result of applying these delivery approaches, which prompted
him to 'push people to know it and to practice it'. The interviewer and transcriber
identified in their notes the KB's excitement about taking time while on vacation to
share the knowledge from the conference by teaching midwives at the same university
from which he graduated.

Adapting approaches in the KB role

KBs described facilitating evidence-to-action in ways that adapted to the realities
of their limit of authority and the political and economic environment. Accounts of
evidence uptake often referred to adjustments in practice that were achieved within
the KBs sphere of influence, as noted in this quote:

> I've actually gotten a few points from the conference that we've actually
> included in our practice. Like the change of the postnatal visits: instead…
> the way we used to do it previously that after six hours or on discharge
> we do a postnatal visit and the next time to actually see a woman it
> would be after six days. But instead now, this time around we are able to
> actually see the woman back within 24 hours, again for a postnatal re-visit.
> [Health/medical service delivery, government/ministry, Sub-Saharan Africa]

In another example, the KB applied knowledge of budgetary processes in local health care facilities to advocate for acquiring resources for implementing improvements:

> They have some special budgets and they have some dispensary… some authority powers there. And they can purchase, just like the health contingency bill finds them such kind of funds, they are available. So, they can purchase these things. So, we meet hospital administration to look at the administrative budget. [Health/medical service delivery, local NGO, Southern Asia]

Other reported adaptations included re-purposing supplies to implement service delivery improvements and modifying advocacy approaches to overcome resistance to evidence.

Exhibiting an action orientation

Most KBs in the study did not limit their brokering to sharing evidence but actively sought opportunities to mobilise evidence for changes in health policy and practice. In describing their actions on evidence, KBs alluded to their motivations to act, such as passion for helping their country and alleviating suffering. Accounts from respondents based in LMICs expressed enthusiasm for learning about new evidence and the opportunity it presented to bring about change, as with this KB concerned about maternal and newborn mortality rates in her country:

> I felt like I can do something with this for my country and contribute to improve the maternal and newborn care. I felt like I could make this… from what I saw at the conference… if you have the will and the good attitude you can change something. [Teaching/training, academic/research institution, Sub-Saharan Africa]

Discussion and conclusions

The study findings present a view of KBs working in a variety of health system roles through which they share and mobilise evidence for improved health policy and practice. The label of KB arose from researchers recognising typical KB activities among the accounts, rather than from respondents using the term to describe themselves. This view of a KB differs from ones in the literature that depict knowledge brokering as a library service or convening function, separate from acting on evidence to bring about change. Since all conference participants were invited to complete the survey and made their own decision about responding, the study team anticipated having a respondent pool that was motivated and action-oriented regarding evidence from the conference – and findings suggest that was the case. By collecting data from KBs with these characteristics, the study was able to capture a view of KB outcomes by examining successful approaches through their eyes and accepting their accounts of evidence uptake.

The approaches used by KBs in the study illustrate a creative variety of modalities in advancing evidence uptake (Taylor, 2015), ranging from faculty member-to-student interactions, to adaptations of health care practice to fit cultural norms, to making

strategic use of health system administrative processes. Also, the flow of knowledge through the KBs and how they chose to fill their intermediary role coincides with the popular KT theories, models, and frameworks mentioned earlier in this paper (Rogers, 2003; Graham et al, 2006; Cane et al, 2012). The crucial aspect of interpersonal sharing in the KB role also agrees with literature about knowledge flow through intermediaries in LMICs (Datta et al, 2016).
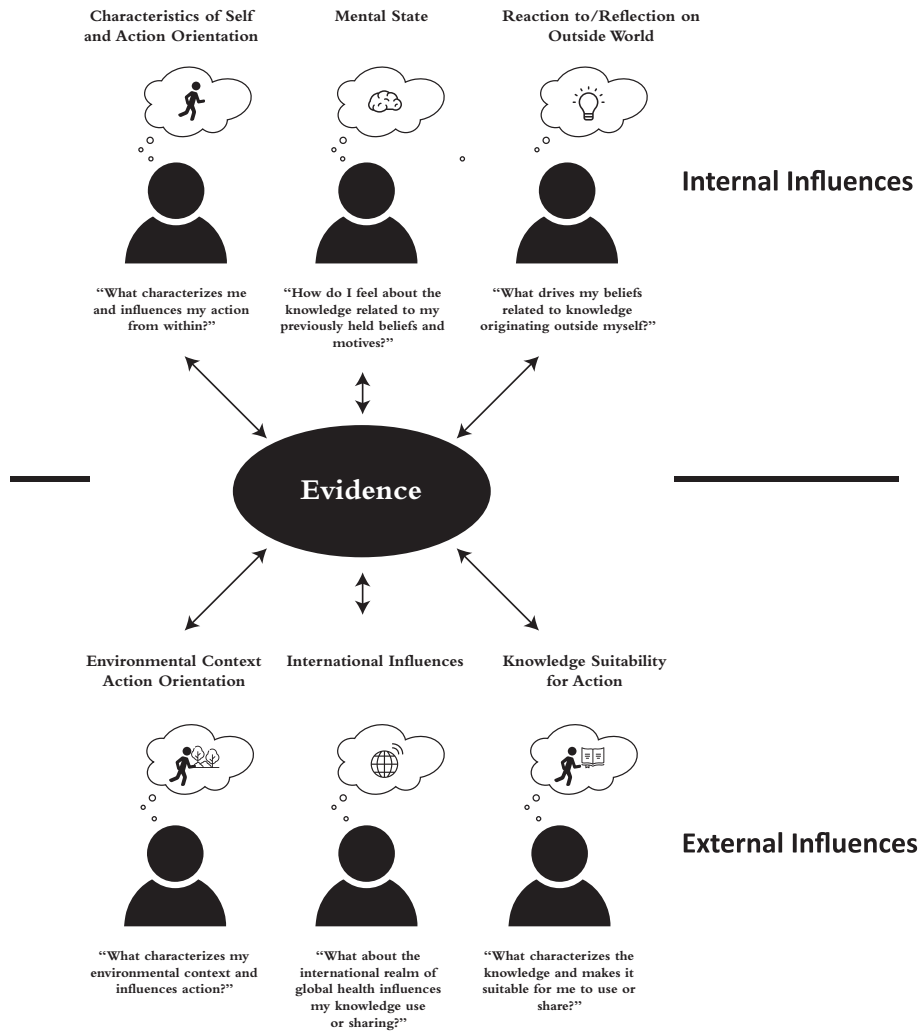
As suggested by the literature and supported by this study, the ability to function as a KB can be attributed to a combination of individual characteristics, promising KT practices, and supportive (or at least adaptable) structures in which KBs operate. The analysis of the responses we received for this study highlights the following characteristics, which are also confirmed by the literature. For example, findings suggest that KBs must have the professional expertise to access and appraise evidence for a given use and context, soft skills in relationship building and networking, and commitment to improving public health by brokering the use of evidence. Making use of promising KT practices, such as tailoring messages and communications to fit the users and context, also contributes to functioning as a KB. Structures that support KBs operating in their roles, such as participation in professional meetings and conferences and time for evidence-brokering activities, also support the aims of knowledge brokering. Receptiveness to new evidence by decision makers and other users also figures prominently.

Findings also provided insights into how KBs think about the multitude of evidence to which they may be exposed (by possibly conflicting sources), what they might do about it and with whom, and how they would do it – a process that distinguishes them from being one-directional disseminators of knowledge (that is, distributors who do not interact with users). The ability to think through the various possibilities in their brokering approach and adapt to a variety of factors, leading to evidence uptake, may distinguish the KBs in this study as both connectors and mobilisers of change.

Figure 3 depicts a proposed framework derived from the findings of the interviews and survey of a reflective comparative decision process that KBs undergo in judging evidence for action. Internal influences and external influences broadly categorise the drivers for judgment, which the KBs consider in a non-linear and iterative process. Internal Influences appear as three dimensions: Characteristics of Self and Action Orientation, Mental State, and Reaction to/Reflection on Outside World. External Influences present as three dimensions: Environmental Context Characteristics and Action Orientation, International Influences, and Knowledge Characteristics and Suitability for Action. Each dimension's characteristics are represented by a hypothetical question that KBs might ask themselves about new knowledge. The concept of comparing and judging evidence using a set of internal criteria appears elsewhere in the literature, notably in research describing the thought processes of decision makers in assessing evidence by putting it through an intellectual truth test and utility test (Weiss and Bucuvalas, 1980). Such research has been found to be useful in understanding evidence uptake. The proposed framework will need further testing, research, and refinement to validate it and better understand the balance among influences.

The atypical example of the health/medical professional in Western Asia who compared public health problems in non-comparable economic settings illustrates how the reflective comparative decision process occurs with factors outside the norm. The KB was the only respondent to offer that 'lack of money' was not the reason

Figure 3: KB reflective comparative decision process in selecting evidence for sharing and use

Characteristics of Self
and Action Orientation

Mental State

Reaction to/Reflection on
Outside World

Internal Influences

"What characterizes me
and influences my action
from within?"

"How do I feel about the
knowledge related to my
previously held beliefs and
motives?"

"What drives my beliefs
related to knowledge
originating outside myself?"

Evidence

Environmental Context
Action Orientation

International Influences

Knowledge Suitability
for Action

External Influences

"What characterizes my
environmental context and
influences action?"

"What about the
international realm of
global health influences
my knowledge use
or sharing?"

"What characterizes the
knowledge and makes it
suitable for me to use or
share?"

for newborn mortality challenges in his country but instead implementation was the issue, exhibiting consideration of Environmental Context Characteristics and Action Orientation. His view that information applicable to his country's challenges was 'coming from different countries all over the world' suggested the role of International Influences and Reaction to/Reflection on Outside World. In learning, practising, teaching, and advocating approaches for safe delivery in his country, the KB demonstrated his view on Characteristics of Self and Action Orientation. His use of conference materials to conduct training suggests a positive decision on Knowledge Characteristics and Suitability for Action. Finally, his excitement in sharing his new knowledge while visiting his former university exhibited a positive Mental State regarding the evidence.

Survey results suggested alignment with the internal influences and external influences dyad of the reflective comparative decision process. Overall, respondents

shared and used knowledge from the conference in ways that aligned with their professional roles (for example, programme development in NGOs/PVOs), but allowing for the flexibility needed in LMIC settings. Reported interest in expert opinion from global experts and learning best practices illustrates the bridging between reaction to the outside world and international influences. The high levels of reported knowledge use from the conference and reported types of use suggest that respondents assessed the knowledge they encountered and decided that it was suitable for their uses.

Implications from the research findings

An understanding of KBs who mobilise evidence and their decisions and actions may provide a foundation for strategically targeting capacity building in knowledge brokering to KBs already successful in driving change (as suggested in the literature (Dobbins et al, 2018)). This type of effort may also serve to formalise the KB role and its boundaries, which was noticeably absent in the KB accounts in this study. The findings of this study suggest that we can recognise these mobilisers by their characteristics such as orientation to action, facility with networking and relationship building, and creativity in adapting evidence to a given context. A good practice in capacity building may be to promote the hiring of KBs with these characteristics in embedded KT units of government, universities, and professional associations – types of organisation which may be in a position to influence evidence uptake. Strategically inviting these KBs to evidence dissemination events such as conferences and meetings that also incorporate action planning may also support KT outcomes. As demonstrated by the current study context – a global conference focusing on high-impact maternal and newborn health care practices – gathering all the types of health system actors needed for scaling-up evidence uptake (for example, health care service providers, policy makers) and equipping them to act as KBs is a promising practice.

Additional capacity building might focus on enhancing specific skills shown as critical to knowledge brokering, such as tailoring communications for audiences and contexts and appraising and adapting evidence. Skills development may be done through ongoing, short learning opportunities accessed without leaving the workplace (for example, webinars, tutorials), and through mentoring by KBs with specific expertise in aspects of the health system (for example, commodity availability).

While these capacity-building approaches can also be applied in higher-income countries, operationalising them in LMICs may be particularly beneficial because of the contextual complexities that characterise LMICs. Focusing capacity-building efforts on practical implementation of evidence to improve health care practice would help fill a gap in the KB research. A longitudinal research approach would help evaluate the sustainability of capacity-building efforts and reported evidence uptake beyond what the current study was able to achieve with its point-in-time approach.

Finally, given the finding of how decisions on uptake are influenced by perceived success in a comparable setting, additional research on LMIC-to-LMIC exchange of implementation evidence may be beneficial, particularly in the area of advancing scale-up of key life-saving interventions. Such research could explore the types of organisation and work necessary to implement a practice widely in a country (for example, supply chain, service delivery, workforce development) and how

knowledge brokering in those areas between LMICs could promote scale-up and generate ideas to test in a country before scaling up. Exploring how opportunities for LMIC-to-LMIC support and sharing of implementation successes between regions in Africa and Asia will continue in an era of decreased international funding may also merit consideration.

To conclude, global and regional organisations working to disseminate evidence in LMICs rely on local actors to use and share the evidence to influence change in multiple levels of the health system. Understanding KB decisions and actions in successfully driving change, and using this understanding to strategically design capacity building in KT, can help scale-up evidence-informed policy and practice.

Corresponding author
Theresa C. Norton, Baltimore, Maryland USA, tnorton1@jhu.edu

ORCID
Theresa C. Norton https://orcid.org/0000-0001-6716-9749
Daniela C. Rodriguez https://orcid.org/0000-0003-2523-1123
Sara Willems https://orcid.org/0000-0002-6349-7785

Conflict of interest
The authors declare that there is no conflict of interest.

References
Alkema, L., Chou, D., Hogan, D., Zhang, S., Moller, A.B., Gemmill, A., Fat, D.M., Boerma, T., Temmerman, M., Mathers, C. and Say, L. (2016) Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group, *The Lancet*, 387(10017): 462–74, doi: 10.1016/S0140-6736(15)00838-7

Bornbaum, C.C., Kornas, K., Peirson, L. and Rosella, L.C. (2015) Exploring the function and effectiveness of knowledge brokers as facilitators of knowledge translation in health-related settings: a systematic review and thematic analysis, *Implementation Science*, 10: 162. doi: 10.1186/s13012-015-0351-9

Canadian Health Services Research Foundation (2003) The theory and practice of knowledge brokering in Canada's health system, 15, www.cfhi–fcass.ca/migrated/pdf/Theory_and_Practice_e.pdf

Cane, J., OConnor, D. and Michie, S. (2012) Validation of the theoretical domains framework for use in behaviour change and implementation research, *Implementation Science*, 7(1): 37. doi: 10.1186/1748–5908–7–37

Commission on Health Research for Development (1990) *Health research: essential link to equity in development*, New York: Oxford University Press, www.ncbi.nlm.nih.gov/books/NBK209096/

Conalogue, D.M., Kinn, S., Mulligan, J.A. and McNeil, M. (2017) International consultation on long–term global health research priorities, research capacity and research uptake in developing countries, *Health Research Policy and Systems*, 15(1): 1–6. doi: 10.1186/s12961–017–0181–0

Creswell, J.W. (2015) *A concise introduction to mixed methods research*, Los Angeles, CA: Sage.

Dagenais, C., Laurendeau, M-C. and Briand–Lamarche, M. (2015) Knowledge brokering in public health: a critical analysis of the results of a qualitative evaluation, *Evaluation and Program Planning*, 53: 10–7. doi: 10.1016/j.evalprogplan.2015.07.003

Datta, A., Marpaung, L., Meirio, A., Sabri, R., Mackenzie, J. and Young, J. (2016) The Indonesian knowledge sector: a contextual analysis, 14. www.ksi–indonesia.org/files/1472809647$1$9QP0$.pdf

Datta, A., Nurbani, R., Satria, G., Antlov, H., Fatonie, I. and Sabri, R. (2018) *Policy, change and paradox in Indonesia: Implications for the use of knowledge*, 29. www.odi.org/publications/11049-policy-change-and-paradox-indonesia-implications-use-knowledge

Dobbins, M., Robeson, P., Ciliska, D., Hanna, S., Cameron, R., OMara, L., DeCorby, K. and Mercer, S. (2009) A description of a knowledge broker role implemented as part of a randomized controlled trial evaluating three knowledge translation strategies, *Implementation Science*, 4: 23. doi: 10.1186/1748–5908–4–23

Dobbins, M., Traynor, R.L., Workentine, S., Yousefi–Nooraie, R. and Yost, J. (2018) Impact of an organization–wide knowledge translation strategy to support evidence–informed public health decision making, *BMC Public Health*, 18(1): 1412. doi: 10.1186/s12889–018–6317–5

Elueze, I.N. (2015) Evaluating the effectiveness of knowledge brokering in health research: a systematised review with some bibliometric information, *Health Information and Libraries Journal*, 32(3): 168–81. doi: 10.1111/hir.12097

Fereday, J. and Muir-Cochrane, E. (2006) Demonstrating rigor using thematic analysis: a hybrid approach of inductive and deductive coding and theme development, *International Journal of Qualitative Methods*, 5(1): 80–92. doi: 10.1177/160940690600500107

Fusch, I. and Ness, L.R. (2015) Are we there yet? Data saturation in qualitative research, *The Qualitative Report*, 20(9): 1408–16. doi: 1, 1408–1416.

Global Forum for Health Research and Nuyens, Y. (2005) *No development without research*, www.sdh–net.eu/data/uploads/publications-library/no-development-without-research.pdf

Graham, I.D., Logan, J., Harrison, M.B., Straus, S.E., Tetroe, J., Caswell, W. and Robinson, N. (2006) Lost in knowledge translation: time for a map?, *Journal of Continuing Education in the Health Professions*, 26(1): 13–24. doi: 10.1002/chp.47

Green, L.W., Ottoson, J.M., García, C. and Hiatt, R.A. (2009) Diffusion theory and knowledge dissemination, utilization, and integration in public health, *Annual Review of Public Health*, 30(1): 151–74. doi: 10.1146/annurev.publhealth.031308.100049

Harvey, G. and Kitson, A. (2016) PARIHS revisited: from heuristic to integrated framework for the successful implementation of knowledge into practice, *Implementation Science*, 11(1). doi: 10.1186/s13012-016-0398-2

Jessani, N., Kennedy, C. and Bennett, S. (2016) The human capital of knowledge brokers: an analysis of attributes, capacities and skills of academic teaching and research faculty at Kenyan schools of public health, *Health Research Policy and Systems*, 14(1): 1–13. doi: 10.1186/s12961-016-0133-0

Kim, C., Wilcher, R., Petruney, T., Krueger, K., Wynne, L. and Zan, T. (2018) A research utilisation framework for informing global health and development policies and programmes, *Health Research Policy and Systems*, 16(1): 1–10. doi: 10.1186/s12961-018-0284-2

Lind, M. and Persborn, M. (2000) Possibilities and risks with a knowledge broker in the knowledge transfer process, paper presented at the 42nd Annual Conference of the *Operational Research Society*, 12–14 September, University of Wales, Swansea

Lomas, J. (2007) The in-between world of knowledge brokering, *BMJ*, 334: 129–32. doi: 10.1136/bmj.39038.593380.AE

MacQueen, K.M., McLellan, E., Kay, K. and Milstein, B. (1998) Codebook development for team-based qualitative analysis, *Field Methods*, 10(2): 31–6. https://mycourses.purdue.edu/bbcswebdav/pid-11607813-dt-content-rid-86004371_1/courses/wl_56239.201910/Macqueen et al codebook%281%29.pdf

Malla, C., Aylward, P. and Ward, P. (2018) Knowledge translation for public health in low- and middle- income countries: a critical interpretive synthesis, *Global Health Research and Policy*, 3(1): 29. doi: 10.1186/s41256-018-0084-9

Miles, M.B., Huberman, A.M. and Saldana, J. (2014) *Qualitative data analysis: A methods sourcebook* (3rd edn), Los Angeles, CA: Sage

Nilsen, P. (2015) Making sense of implementation theories, models and frameworks, *Implementation Science*, 10: 1–13. doi: 10.1186/s13012-015-0242-0

Norton, T.C., Howell, C. and Reynolds, C. (2016) Exploratory study of the role of knowledge brokers in translating knowledge to action following global maternal and newborn health technical meetings, *Public Health*, 140: 235–43. doi: 10.1016/j.puhe.2016.04.012

Nugroho, K., Carden, F. and Antlov, H. (2018) *Local knowledge matters: power, context and policymaking in Indonesia*, Bristol: Bristol University Press.

Orem, J.N.A., Mafigiri, D.K.A., Nabudere, H. and Criel, B. (2014) Improving knowledge translation in Uganda: more needs to be done, *Pan African Medical Journal*, 17(Supp 1): 14. doi: 10.11694/pamj.supp.2014.17.1.3482

Parkhurst, J.O. and Abeysinghe, S. (2016) What constitutes "good" evidence for public health and social policy-making? From hierarchies to appropriateness, *Social Epistemology*, 30(5–6): 665–679. doi: 10.1080/02691728.2016.1172365

Paudel, Y.R. (2015) Unfinished MDG agenda highlighted at the first global maternal newborn health conference, *Health Prospect: Journal of Public Health*, (7): 7–8. http://dx.doi.org/10.3126/hprospect.v14i2.14258

Pennell, K.G., Thompson, M., Rice, J.W., Senier, L., Brown, P. and Suuberg, E. (2013) Bridging research and environmental regulatory processes: the role of knowledge brokers, *Environmental Science and Technology*, 47: 11985–92. doi: 10.1021/es4025244

Rogers, E.M. (2003) *Diffusion of innovations* (5th edn), New York: Free Press.

Rushmer, R., Ward, V., Nguyen, T. and Kuchenmüller, T. (2019) Knowledge translation: key concepts, terms and activities, In M. Verschuuren and H. van Oers (eds), *Population Health Monitoring*, Switzerland: Springer, pp. 127–50. doi: 10.1007/978-3-319-76562-4

Tabak, R.G., Khoong, E.C., Chambers, D.A. and Brownson, R.C. (2012) Bridging research and practice: models for dissemination and implementation research, *American Journal of Preventive Medicine*, 43(3): 337–50. doi: 10.1016/j.amepre.2012.05.024

Taylor, C. (2015) Between culture, policy and industry: modalities of intermediation in the creative economy, *Regional Studies*, 49(3): 362–73. doi: 10.1080/00343404.2012.748981

Van Eerd, D., Newman, K., DeForge, R., Urquhart, R., Cornelissen, E. and Dainty, K.N. (2016) Knowledge brokering for healthy aging: a scoping review of potential approaches, *Implementation Science*, 11(1): 140. doi: 10.1186/s13012-016-0504-5

Van Kammen, J., De Savigny, D. and Sewankambo, N. (2006) Using knowledge brokering to promote evidence-based policy-making: the need for support structures, *Bulletin of the World Health Organization*, 84(8): 608–612. doi: 10.2471/BLT.05.028308

Weiss, C.H. and Bucuvalas, M.J. (1980) Truth tests and utility tests: decision-makers' frames of reference for social science research, *American Sociological Review*, 45(2): 302–313. doi: 10.2307/2095127

Wong, A. (2017) Closing the gap: applying the theoretical domains framework to improve knowledge translation, *Canadian Journal of Anesthesia/Journal Canadien d'Anesthésie*, 64(6): 569–73. doi: 10.1007/s12630-017-0846-8