Bridging the gaps between research, policy and practice in low- and middle-income countries: a survey of researchers

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Abstract

Background: Many international statements have urged researchers, policy-makers and health care providers to collaborate in efforts to bridge the gaps between research, policy and practice in low- and middle-income countries. We surveyed researchers in 10 countries about their involvement in such efforts.

Methods: We surveyed 308 researchers who conducted research on one of four clinical areas relevant to the Millennium Development Goals (prevention of malaria, care of women seeking contraception, care of children with diarrhea and care of patients with tuberculosis) in each of 10 low- and middle-income countries (China, Ghana, India, Iran, Kazakhstan, Laos, Mexico, Pakistan, Senegal and Tanzania). We focused on their engagement in three promising bridging activities and examined system-level, organizational and individual correlates of these activities.

Results: Less than half of the researchers surveyed reported that they engaged in one or more of the three promising bridging activities: 27% provided systematic reviews of the research literature to their target audiences, 40% provided access to a searchable database of research products on their topic, and 43% established or maintained long-term partnerships related to their topic with representatives of the target audience. Three factors emerged as statistically significant predictors of respondents' engagement in these activities: the existence of structures and processes to link researchers and their target audiences predicted both the provision of access to a database (odds ratio [OR] 2.62, 95% CI 1.30–5.27) and the establishment or maintenance of partnerships (OR 2.65, 95% CI 1.25–5.64); stability in their contacts predicted the provision of systematic reviews (OR 2.88, 95% CI 1.35–6.13); and having managers and public (government) policy-makers among their target audiences predicted the provision of both systematic reviews (OR 4.57, 95% CI 1.78–11.72) and access to a database (OR 2.55, 95% CI 1.20–5.43).

Interpretation: Our findings suggest potential areas for improvement in light of the bridging strategies targeted at health care providers that have been found to be effective in some contexts and the factors that appear to increase the prospects for using research in policy-making.

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The need to bridge the gaps between research, policy and practice appears to be a global phenomenon. Three recent, highly visible resolutions — the Mexico Action Statement on Health Research in 2004 (58 countries),[1] the related World Health Assembly resolution in 2005 (193 countries)[2] and the Bamako Call to Action on Research for Health in 2008 (53 countries)[3] — urged researchers, policy-makers and health care providers to collaborate in efforts to bridge these gaps. These efforts can range from bringing research-based evidence to the attention of those who could use it, to making research-based evidence available so that it can be readily retrieved when needed.

We are not aware of a survey having been conducted in a range of low- and middle-income countries about researchers' bridging activities related to specific high-priority health topics. Researchers and research organizations have been surveyed about their bridging activities in single high-income countries such as Canada.[4–6] Guideline-producing organizations and health technology assessment agencies have also been surveyed about their bridging activities;[7] only in one case was the focus on bridging activities in low- and middle-income countries.[8] Select research funding agencies have been studied in low- and middle-income countries.[9] Yet the Millennium Development Goals and the goals of many countries call for topic-focused efforts to bridge the gaps between research, policy and practice.

We studied efforts to bridge the gaps between research, policy and practice in 10 low- and middle-income countries (China, Ghana, India, Iran, Kazakhstan, Laos, Mexico, Pakistan, Senegal and Tanzania). In this article, we describe the findings from

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a survey of researchers in these countries who conducted research in one of four clinical areas relevant to the Millennium Development Goals: prevention of malaria (Ghana, Laos, Senegal and Tanzania), care of women seeking contraception (China, Kazakhstan, Laos and Mexico), care of children with diarrhea (Ghana, India, Pakistan and Senegal) and care of patients with tuberculosis (China, India, Iran and Mexico). In a related article, we describe the findings from a survey of health care providers in these countries who were practising in one of these clinical areas about their awareness of, access to and use of research-based evidence in these clinical areas and the influence of such evidence on their professional practice.[10]

The challenges associated with documenting such efforts include cross-country differences in the capacity to conduct surveys of researchers; the visibility of researchers depending on their alignment with priorities of government, development agencies, research funding agencies and industry (and hence their likelihood of being identified to participate in these surveys); and researchers' familiarity with and attitudes toward the bridging activities asked about in these surveys.

Methods

Study participants

We surveyed researchers in 10 low- and middle-income countries (China, Ghana, India, Iran, Kazakhstan, Laos, Mexico, Pakistan, Senegal and Tanzania) who conducted research in one of the four clinical areas described earlier in the article. Within each area, a particular emphasis was placed on an intervention that was supported by strong evidence from international and local research: insecticide-treated materials to prevent malaria; intrauterine devices for family planning; oral rehydration therapy to prevent dehydration in children with diarrhea; and the DOTS strategy (directly observed treatment, short course) to control tuberculosis.

We purposively sampled countries to achieve breadth in levels of economic and health care systems development, political systems and geographic locations. In addition, all country teams had to have demonstrated (through collaborations with the World Health Organization [WHO]) a strong interest in bridging the gaps between research, policy and practice and in further developing the capacity to evaluate such efforts. The selected countries differ in their health status indicators, rates of coverage for the interventions under study, and access to the Internet or computers with a CD-ROM (Appendix 1, available at www.cmaj.ca/cgi/content/full/cmaj.081164/DC1).

We identified researchers using three sources: lists of authors identified through a search of MEDLINE and ISI Web of Science for each combination of country and topic; lists of researchers identified by WHO staff; and lists of researchers identified by country teams. We defined researchers as those who spent at least 10% of their time doing research, including the production, synthesis and sharing of research. Our definition could include clinician scientists, university professors, research managers in nongovernmental organizations and civil servants with program-evaluation responsibilities.

We did not calculate the sample sizes needed because we sought to survey, whenever possible, all researchers involved in conducting research on each topic in each country. In only four countries — Ghana, Iran, Pakistan and Senegal — was a sample selected because the number of eligible researchers was significantly more than 25.

Development of the questionnaire

We developed a self-administered questionnaire comprised of two main sets of questions: one set addressed researchers' activities in bridging the gaps between research, policy and practice; the other addressed potential system-level, organizational and individual correlates of researchers' engagement in these bridging activities. For the first set of questions, we drew on the WHO's "World Report on Knowledge for Better Health"[11] and four existing questionnaires[4,5,12,13] to identify conceptual domains to be covered by the questionnaire. We retained the wording and order of the questions whenever possible.

We grouped the domains into three broad categories: (a) "producer-push" efforts (what is "pushed," or communicated, to target audiences outside the research community; to whom; by whom; how; and with what effect); (b) efforts to facilitate "user pull" (i.e., what strategies are used to provide access to research and to develop target audiences' capacity to use research); and (c) exchange efforts (i.e., how target audiences are involved in research and bridging activities). The development and testing of our questionnaire are described elsewhere.[14] WHO's translation service translated the questionnaire for China, Kazakhstan, Mexico and Senegal; country teams translated the questionnaire for Iran and Laos.

Survey administration

We mailed the questionnaire or used a drop-off and pick-up approach in all countries except China (for one of its two topics [family planning] and Iran (for its one topic [tuberculosis treatment]), where for each topic we administered the questionnaire at a meeting where all eligible researchers were expected to be present. We used several approaches to increase the response rate: personalized letters, follow-up of contacts and provision of a set of WHO publications as an incentive.[15] Survey work was completed in all 10 countries between April 2004 and April 2005.

Statistical analysis

We checked, coded and managed all data centrally in order to permit the analysis of pooled data from all 10 countries. We calculated proportions for most surveyed researchers' characteristics, bridging activities and potential correlates of engagement in these bridging activities. We combined the top two categories whenever an ordinal scale was used (e.g., frequently or always undertaking an activity, agreeing or strongly agreeing with a statement).

For the dependent variables in the logistic regression models, we selected three bridging activities, one from each broad category of the organizing framework, that offer particular promise. For one of the three bridging activities, we selected "providing systematic reviews" as a promising producer-push effort because reviews can reduce bias and the play of chance in estimating effects and can save time for those those who can draw on them rather than have them identify, select,

appraise and synthesize the research literature on their own.[16] We selected "providing access to a searchable database of research products about the topic" as a promising bridging activity to facilitate user pull because timeliness was one of only two factors identified with some consistency in a systematic review of factors that increase the prospects for use of research in policy-making.[17] For the third bridging activity, we selected "establishing or maintaining long-term partnerships related to the topic with target audience representatives" as an exchange effort because interaction was the second of the two factors that emerged in the systematic review.[17]

Based on a combination of the research literature and our own knowledge of the field and the contexts in which researchers function, we selected 20 potential system-level, orga-

Table 1: Characteristics of 308 researchers in 10 low- and middle-income countries who responded to a survey about their engagement in activities to bridge the gap between research, policy and practice in defined clinical areas

	Defined clinical area; % (no.) of respondents*				
Characteristic	Total *n = 308*	Insecticide-treated nets to prevent malaria *n = 72*	Intrauterine devices for contraception *n = 94*	Oral rehydration therapy to prevent dehydration in children with diarrhea *n = 50*	DOTS to treat tuberculosis *n = 92*
Countries where researchers were surveyed	All	Ghana, Laos, Senegal, Tanzania	China, Kazakhstan, Laos, Mexico	Ghana, India, Pakistan, Senegal	China, India, Iran, Mexico
Area of research specialization					
Biomedical research	12 (37/300)	16 (11/68)	10 (9/90)	8 (4/50)	14 (13/92)
Clinical research	35 (104/300)	7 (5/68)	52 (47/90)	40 (20/50)	35 (32/92)
Health policy and systems research	20 (61/300)	29 (20/68)	14 (13/90)	18 (9/50)	21 (19/92)
Population and public health	30 (91/300)	43 (29/68)	22 (20/90)	34 (17/50)	27 (25/92)
Other	2 (7/300)	4 (3/68)	1 (1/90)	– (0/50)	3 (3/92)
Target audiences for whom researchers frequently or always undertake bridging activities related to the topic					
General public and civil society groups	61 (177/290)	67 (48/72)	59 (52/88)	76 (37/49)	49 (40/81)
Patients and their families	61 (179/292)	42 (30/71)	60 (52/86)	73 (36/49)	71 (61/86)
Health care providers (e.g., nurses, doctors)	69 (209/301)	42 (30/71)	80 (74/92)	73 (36/49)	78 (69/89)
Managers in hospitals, health districts, nongovernmental organizations, insurance companies, etc.	58 (171/297)	46 (33/71)	52 (46/89)	60 (30/50)	71 (62/87)
Managers in donor agencies and international organizations	33 (92/281)	46 (33/72)	26 (20/78)	34 (17/50)	27 (22/81)
Managers in pharmaceutical or biotechnology companies	18 (50/279)	17 (12/70)	21 (16/76)	24 (12/49)	12 (10/84)
Public policy-makers (elected officials, political staff and civil servants) in local and national governments	42 (124/292)	49 (35/71)	33 (29/87)	31 (15/49)	53 (45/85)
Personal and organizational involvement in bridging activities					
Own work time involved in bridging activities, %, median (IQR)	*n = 262* 20 (10–30)	*n = 62* 20 (10–30)	*n = 75* 20 (10–30)	*n = 41* 25 (10–35)	*n = 84* 20 (10–30)
Own work time involved in bridging activities, %, mean (SD)	*n = 262* 25 (19)	*n = 62* 23 (18)	*n = 75* 24 (18)	*n = 41* 25 (14)	*n = 84* 25 (22)
Worked with or for an organization that undertook bridging activities with them or on their behalf	84 (207/247)	82 (59/72)	86 (49/57)	83 (39/43)	85 (60/71)
Other characteristics					
Sex, male	58 (176/305)	69 (49/71)	33 (30/92)	66 (33/50)	70 (64/92)
Age, yr, mean (SD)	*n = 300* 48.1 (9.6)	*n = 71* 43.8 (6.5)	*n = 88* 50.2 (10.7)	*n = 49* 47.1 (8.9)	*n = 92* 49.8 (9.9)
Actively conducts research on the topic	47 (145/308)	17 (12/72)	59 (55/94)	38 (19/50)	64 (59/92)
Last conducted research on the topic in 2000 or earlier	31 (92/299)	51 (36/70)	28 (25/89)	31 (15/49)	18 (16/91)
Actively undertakes bridging activities related to the topic	52 (161/308)	24 (17/72)	60 (56/94)	50 (25/50)	68 (63/92)
Last conducted bridging activities related to the topic in 2000 or earlier	20 (58/288)	25 (17/69)	25 (21/85)	20 (10/49)	12 (10/85)

Note: DOTS = directly observed treatment, short course; IQR = interquartile range; SD = standard deviation.
*Unless stated otherwise.

nizational and individual correlates to examine in each logistic regression model. For missing values, we used multiple imputation, whereby each missing value was replaced by the mean of 10 different estimates. We adjusted standard errors according to Rubin's rules.[18] We excluded observations when the dependent variable was missing. We estimated all models using Stata/SE 9.2 for Macintosh with robust variances.[19]

We present results by topic rather than by country so that sample sizes would be larger and because the Millennium Development Goals, and most national health goals, focus on topic-specific bridging activities.

Results

We received 368 completed questionnaires from the 544 researchers who were contacted, for an overall response rate of 67.6%. Sixty of the 368 respondents were deemed ineligible either because they did not undertake bridging activities or because their objective in undertaking such activities was exclusively related to commercial interests. Response rates at the level of single countries ranged from 30% to 100%. For the majority of variables, data were missing for less than 5% of respondents. For only two variables, data were missing for more than 10% of respondents.

Overall, 35% of the surveyed researchers conducted clinical research and 30% conducted research on population or public health. There was a link between the area of focus and the area of research specialization (e.g., research related to intrauterine devices tended to be conducted by those engaged in clinical research) (Table 1). Overall, 69% of the respondents targeted health care providers among others in their bridging activities, and 42% targeted public (government) policy-makers among others. Most (84%) of the respondents reported that they worked with or for an organization that undertook bridging activities with them or on their behalf, although they still spent on average a day or more of their own work time involved in bridging activities (median 20%, mean 25%).

Only a few bridging activities were undertaken by more than half of the surveyed researchers: developed messages for target audiences that specified possible action (57%); obtained or reviewed information that described the needs or goals of specific target audiences (55%); and interacted with target audiences both through and outside the research process (51%–59%) (Table 2). Likewise, few bridging activities were undertaken by less than a quarter of the respondents: mailed or emailed research products without an explicit request (15%); and developed capacity of target audiences to acquire research on the topic (23%).

Between a quarter and half of the respondents said that they engaged in what we identified as three particularly promising bridging activities: provided systematic reviews of the research literature to their target audiences (27%); provided access to a searchable database of articles, reports, syntheses or systematic reviews on the topic (40%); and established or maintained long-term partnerships related to the topic with representatives of their target audiences (43%). For 13 of 20 bridging activities, there was a difference of 20% or more in the spread of proportions across topics (i.e., at least one in five researchers differed in whether they engaged in a bridging activity). Researchers in diarrheal disease accounted for the highest proportion for 7 of these 13 activities; researchers in malaria prevention accounted for the lowest proportion for 9 activities. Researchers in tuberculosis treatment were mixed, accounting for the highest proportions for 5 of these 13 activities and the lowest proportions for 4 activities.

Only six facilitators of engagement in bridging activities were reported by more than half of the respondents (Table 3). Three potential correlates were reported by more than two-thirds: have access to a personal computer with a functional Internet connection at all times to conduct and download searches (72%); their research coincides with the needs and expectations of their target audiences (85%); and researchers and target audiences are jointly responsible for bridging activities related to the topic (71%). No potential correlates were reported by less than one quarter of the surveyed researchers. For five potential correlates, there was a difference of at least 20% in the spread of proportions across topics. Researchers in family planning accounted for the highest proportions for four of these five correlates; researchers in diarrheal disease accounted for the lowest proportions for four of them.

From a pool of 20 potential correlates examined, three factors emerged as statistically significant predictors of respondents' engagement in three promising bridging activities (Table 4). Stability in researchers' personal and organizational contacts among their target audiences predicted the provision of systematic reviews (OR 2.88, 95% CI 1.35–6.13), as did having managers and public policy-makers among their target audiences (OR 4.57, 95% CI 1.78–11.72). The existence of structures and processes to link researchers and their target audiences predicted the provision of access to a searchable database of research products on the topic (OR 2.62, 95% CI 1.30–5.27), as did having managers and public policy-makers among their target audiences (OR 2.55, 95% CI 1.20–5.43). The existence of structures and processes to link researchers and their target audiences was a significant predictor of researchers establishing or maintaining long-term partnerships related to the topic with representatives of their target audiences (OR 2.65, 95% CI 1.25–5.64).

Interpretation

Engagement in a variety of promising bridging activities was reported by less than half of the surveyed researchers. In particular, targeted dissemination of research products and the development of the capacity of target audiences to find and use research were rarely undertaken. The variability in engagement in bridging activities across topics cannot be readily explained by level of economic development: the groups with the highest proportions (researchers in diarrheal disease) and the lowest proportions (researchers in malaria prevention) of engagement in particular bridging activities were all based in low-income countries. A number of facilitators of engagement in bridging activities were reported by more than half of the respondents, including increasing the support for bridging activities over time within their organiza-

Table 2: Engagement of respondents in activities to bridge the gap between research, policy and practice in defined clinical areas (part 1 of 4)

Activity	Defined clinical area; % (no.) of respondents				
	Total *n = 308*	Insecticide-treated nets to prevent malaria *n = 72*	Intrauterine devices for contraception *n = 94*	Oral rehydration therapy to prevent dehydration in children with diarrhea *n = 50*	DOTS to treat tuberculosis *n = 92*
Producer-push*					
What is transferred frequently or always to target audiences outside the scholarly community?					
Provided articles published in scientific journals	44 (133/303)	28 (20/72)	48 (43/90)	54 (27/50)	47 (43/91)
Provided project reports	43 (125/294)	39 (28/72)	43 (36/83)	45 (22/49)	43 (39/90)
Provided syntheses of the research literature (not including formal systematic reviews)	33 (96/295)	27 (19/70)	37 (32/87)	47 (23/49)	25 (22/89)
Provided systematic reviews of the research literature†	27 (79/296)	24 (17/70)	28 (24/87)	42 (20/48)	20 (18/91)
Developed brief summaries of articles or project reports	46 (137/300)	36 (25/70)	45 (41/91)	58 (28/48)	47 (43/91)
Developed brief summaries of syntheses or systematic reviews	33 (99/296)	23 (16/69)	32 (28/88)	47 (23/49)	36 (32/90)
Developed messages for target audiences that specified possible action (i.e., recommendations, take-home messages, actionable messages)	57 (174/303)	57 (41/72)	59 (54/91)	69 (34/49)	49 (45/91)
To whom is research being transferred frequently or always and with what investments in fine-tuning the approach to them?					
Obtained or updated contact information for target audiences	59 (179/303)	55 (39/71)	59 (53/90)	62 (31/50)	61 (56/92)
Obtained or reviewed information that described the needs or goals of specific target audiences	55 (165/300)	57 (41/72)	57 (49/86)	56 (28/50)	51 (47/92)
Developed research products that used language appropriate to specific target audiences	57 (167/293)	52 (37/71)	60 (49/81)	58 (29/50)	57 (52/91)
Developed research products appealing to specific target audiences (e.g., graphics, colour, humour and packaging)	48 (141/293)	42 (30/71)	54 (45/83)	49 (24/49)	47 (42/90)
Developed research products that provided examples or demonstrations of how specific target audiences could use the research	43 (125/292)	35 (25/71)	49 (40/81)	49 (24/49)	40 (36/91)
Tailored the content of mailings or emails to specific target audiences	27 (77/290)	21 (15/71)	35 (28/81)	38 (18/48)	18 (16/90)
Tailored other aspects of bridging approach to specific target audiences	36 (107/296)	32 (23/71)	40 (35/87)	44 (21/48)	31 (28/90)
By whom is research being transferred frequently or always and with what investments in supporting their efforts?					
Reviewed the research literature about effective approaches to bridging	40 (117/294)	28 (20/72)	51 (42/82)	40 (20/50)	39 (35/90)
Reviewed information from websites, list-serves, etc., about effective approaches to bridging	38 (112/297)	26 (19/72)	40 (34/85)	41 (20/49)	43 (39/91)
Participated in activities to build bridging skills (e.g., conferences or courses about bridging)	42 (125/301)	36 (26/72)	45 (40/88)	44 (22/50)	41 (37/91)
Shared experiences with people performing bridging roles in other organizations like your own	40 (120/302)	36 (26/72)	43 (39/90)	42 (20/48)	38 (35/92)
Identified and worked with bridging specialists outside the organization	31 (91/295)	26 (19/72)	35 (29/83)	24 (12/50)	34 (31/90)
Identified and worked with knowledge brokers‡ outside the organization	21 (62/298)	14 (10/72)	26 (22/85)	34 (17/50)	14 (13/91)
Identified and worked with credible messengers§	32 (92/287)	24 (17/70)	35 (27/78)	46 (22/48)	29 (26/91)
Developed relationships with print, radio or television journalists	33 (96/295)	38 (27/72)	32 (26/82)	36 (18/50)	27 (25/91)
How is research knowledge being transferred frequently or always to particular target audiences, and specifically using passive strategies?					
Provided at cost and upon request articles, reports, syntheses or systematic reviews	19 (55/295)	6 (4/70)	23 (19/84)	18 (9/50)	25 (23/91)

Table 2: Engagement of respondents in activities to bridge the gap between research, policy and practice in defined clinical areas (part 2 of 4)

Activity	Defined clinical area; % (no.) of respondents				
	Total *n = 308*	Insecticide-treated nets to prevent malaria *n = 72*	Intrauterine devices for contraception *n = 94*	Oral rehydration therapy to prevent dehydration in children with diarrhea *n = 50*	DOTS to treat tuberculosis *n = 92*
Provided free upon request (but not through a website) articles, reports, syntheses or systematic reviews	45 (135/303)	25 (18/71)	48 (43/90)	46 (23/50)	55 (51/92)
Provided through a website articles, reports, syntheses or systematic reviews	21 (61/296)	13 (9/71)	16 (14/85)	16 (8/49)	33 (30/91)
Provided free upon request (but not through a website) brief summaries or messages that specified possible action	40 (121/300)	34 (24/71)	34 (30/89)	47 (23/49)	48 (44/91)
Provided through a website brief summaries or messages	19 (55/295)	15 (11/71)	17 (14/84)	18 (9/49)	23 (21/91)
Provided on a website dedicated entry-points or sections for specific target audiences	15 (43/294)	10 (7/71)	13 (11/84)	21 (10/48)	16 (15/91)
Posted to a list-serve brief summaries or messages	13 (39/292)	6 (4/70)	11 (9/83)	29 (14/49)	13 (12/90)
Mailed or emailed notices that new material of potential interest had been posted to a website	14 (43/297)	6 (4/71)	16 (14/86)	27 (13/49)	13 (12/91)
Mailed or emailed articles, reports, syntheses or systematic reviews without an explicit request	15 (45/294)	8 (6/71)	13 (11/83)	22 (11/49)	19 (17/91)
Mailed or emailed (but not through a list-serve or newsletter) brief summaries or messages without an explicit request	14 (42/295)	4 (3/70)	15 (13/86)	27 (13/48)	14 (13/91)
Mailed or emailed a newsletter containing brief summaries or messages	20 (59/296)	13 (9/70)	20 (17/86)	29 (14/49)	21 (19/91)
Mailed or emailed a newsletter containing dedicated sections for specific target audiences	18 (54/293)	13 (9/70)	20 (17/85)	29 (14/48)	16 (14/90)
Submitted media releases to print, radio or television journalists	23 (68/299)	13 (9/71)	23 (20/88)	31 (15/49)	26 (24/91)
Accepted requests from journalists to participate in interviews or debates	25 (73/296)	10 (7/70)	30 (26/88)	21 (10/47)	33 (30/91)
Published research in non-scholarly publications read by specific target audiences	23 (68/301)	6 (4/70)	33 (30/90)	30 (15/50)	21 (19/91)
How is research knowledge being transferred frequently or always to particular target audiences, and specifically using interactions related to the research process?					
Interacted when developing a specific research question, objectives or hypothesis	51 (155/301)	39 (28/72)	52 (46/89)	46 (22/48)	64 (59/92)
Interacted when establishing the preferred research design and methods	51 (153/300)	38 (27/72)	49 (43/88)	54 (26/48)	62 (57/92)
Interacted when executing the research	60 (182/301)	57 (41/72)	53 (47/88)	61 (30/49)	70 (64/92)
Interacted when analyzing or interpreting the research findings	56 (170/301)	36 (26/72)	58 (51/88)	63 (31/49)	67 (62/92)
Interacted when developing research products (e.g., project reports, brief summaries or messages)	59 (177/302)	46 (33/72)	60 (53/89)	57 (28/49)	68 (63/92)
Interacted when undertaking bridging activities	57 (173/302)	57 (41/72)	57 (50/88)	56 (28/50)	59 (54/92)
Interacted when responding to individual queries resulting from your research products or bridging efforts	49 (147/297)	37 (26/71)	50 (43/86)	54 (26/48)	57 (52/92)
How is research knowledge being transferred frequently or always to particular target audiences, and specifically using interactions outside the research process?					
Interacted through government-sponsored meetings	41 (123/298)	32 (23/71)	39 (34/88)	45 (22/49)	49 (44/90)
Interacted through an expert committee or group	42 (126/299)	26 (18/70)	46 (41/90)	49 (24/49)	48 (43/90)
Conferences and workshops	55 (168/303)	39 (28/72)	60 (55/91)	54 (27/50)	64 (58/90)
Interacted through public hearings or testimonies	25 (74/294)	23 (16/69)	26 (23/87)	37 (18/49)	19 (17/89)
Interacted through formal private or public networks	29 (85/295)	30 (21/71)	28 (25/88)	36 (17/47)	25 (22/89)
Interacted through events organized by them or their organization	54 (162/299)	54 (39/72)	57 (51/89)	51 (25/49)	53 (47/89)

Table 2: Engagement of respondents in activities to bridge the gap between research, policy and practice in defined clinical areas (part 3 of 4)

Activity	Defined clinical area; % (no.) of respondents				
	Total *n = 308*	Insecticide-treated nets to prevent malaria *n = 72*	Intrauterine devices for contraception *n = 94*	Oral rehydration therapy to prevent dehydration in children with diarrhea *n = 50*	DOTS to treat tuberculosis *n = 92*
Interacted through events organized by their target audiences	32 (96/297)	22 (16/72)	35 (30/86)	39 (19/49)	34 (31/90)
Interacted through events organized by print, radio or television journalists	21 (62/294)	14 (10/70)	18 (16/87)	29 (14/49)	25 (22/88)
Interacted through informal conversations	40 (120/298)	38 (27/72)	33 (28/86)	46 (23/50)	47 (42/90)
Interacted through events organized by bilateral, regional or international organizations (e.g., World Health Organization)	31 (93/298)	35 (25/71)	27 (24/89)	35 (17/49)	30 (27/89)
What efforts are frequently or always being undertaken to evaluate bridging activities?					
Assessed the perceived usefulness of research products made available to specific target audiences (e.g., reports, brief summaries, and messages)	40 (119/299)	37 (26/71)	42 (37/89)	47 (22/47)	37 (34/92)
Assessed the perceived usefulness of their or their organization's bridging activities	40 (119/299)	30 (21/70)	47 (42/89)	48 (23/48)	36 (33/92)
Assessed any changes in their target audiences' awareness of the research on the topic that may be attributable to their bridging activities	36 (108/296)	34 (24/71)	38 (33/86)	51 (24/47)	29 (27/92)
Assessed any changes in their target audiences' knowledge of research on the topic that may be attributable to their bridging activities	36 (108/299)	28 (20/71)	39 (35/89)	51 (24/47)	32 (29/92)
Assessed any changes in their target audiences' attitudes towards research on the topic that may be attributable to their bridging activities	33 (99/296)	27 (19/71)	36 (31/86)	49 (23/47)	28 (26/92)
Assessed any changes in their target audiences' self-reported behaviour that may be attributable to their bridging activities	29 (83/291)	20 (14/71)	33 (27/82)	47 (22/47)	22 (20/91)
Assessed any changes in their target audiences' actual (i.e., objectively measured) behaviour that may be attributable to their bridging activities	31 (91/290)	30 (21/71)	38 (31/81)	47 (22/47)	19 (17/91)
Facilitating user pull*					
What passive strategies have been used frequently or always to facilitate user pull?					
Provided access to a searchable database of articles, reports, syntheses or systematic reviews on the topic	40 (120/300)	25 (18/72)	44 (38/87)	37 (18/49)	50 (46/92)
Provided access to a searchable database of brief summaries or messages that specified possible action	36 (107/300)	18 (13/72)	33 (29/88)	44 (21/48)	48 (44/92)
Clearly identified in websites, newsletters and other communication vehicles who could answer questions about a report, summary or message	28 (82/295)	14 (10/71)	31 (26/84)	27 (13/48)	36 (33/92)
Clearly identified in websites, newsletters and other communication vehicles who could answer questions more generally about the topic	25 (73/295)	15 (11/71)	29 (24/84)	23 (11/48)	29 (27/92)
Maintained some reserve (financial or human resources) capacity to conduct short-term research projects in response to target audience requests	20 (58/288)	14 (10/71)	20 (16/81)	28 (13/47)	21 (19/89)
What active strategies have been used frequently or always to facilitate user pull?					
Developed capacity of target audiences to acquire research on the topic through searchable databases (e.g., MEDLINE, Cochrane Library, Latin American and Caribbean Center on Health Sciences Information [LILACS] database)	23 (67/293)	13 (9/71)	19 (16/83)	44 (21/48)	23 (21/91)
Developed capacity of target audiences to assess the quality and applicability of research on the topic	31 (89/291)	15 (11/71)	35 (28/81)	42 (20/48)	33 (30/91)
Developed capacity of target audiences to adapt research on the topic to increase its perceived relevance (e.g., by linking it to local issues)	38 (114/297)	29 (20/70)	41 (36/87)	45 (22/49)	40 (36/91)

Table 2: Engagement of respondents in activities to bridge the gap between research, policy and practice in defined clinical areas (part 4 of 4)

Activity	Total *n = 308*	Defined clinical area; % (no.) of respondents: Insecticide-treated nets to prevent malaria *n = 72*	Intrauterine devices for contraception *n = 94*	Oral rehydration therapy to prevent dehydration in children with diarrhea *n = 50*	DOTS to treat tuberculosis *n = 92*
Developed capacity of target audiences to apply research on the topic (e.g., by combining research with other types of information)	40 (119/296)	24 (17/71)	51 (45/88)	51 (24/47)	37 (33/90)
Exchange*					
What exchange efforts are frequently or always undertaken?					
Established and/or maintained long-term partnerships related to the topic with target audience representatives (e.g., advisory board)	43 (129/298)	36 (26/72)	47 (41/88)	36 (17/47)	49 (45/91)
Involved representatives of target audiences in conducting a needs assessment for their target audiences	36 (106/296)	30 (21/71)	41 (36/88)	21 (10/47)	43 (39/90)
Involved representatives of target audiences in establishing the overall direction of their or their organization's research on the topic	32 (96/297)	32 (23/72)	27 (24/88)	23 (11/47)	42 (38/90)
Involved representatives of target audiences in establishing the overall direction of their or their organization's bridging activities related to the topic	31 (92/298)	29 (21/72)	27 (24/88)	30 (14/47)	36 (33/91)
Involved representatives of target audiences in assessing the progress of their or their organization's research on the topic	35 (104/299)	33 (24/72)	31 (28/89)	38 (18/47)	37 (34/91)
Involved representatives of target audiences in assessing the progress of their or their organization's bridging activities on the topic	32 (95/296)	32 (23/72)	32 (28/87)	30 (14/47)	33 (30/90)

Note: DOTS = directly observed treatment, short course.
*Producer-push efforts = strategies that involve "pushing" or communicating research to target audiences outside the research community; facilitating user pull = strategies that involve enhancing access to research and developing target audiences' capacity to use research; exchange efforts = strategies that involve engaging target audiences in research and bridging activities.
†Reviews that follow explicit rules to reduce bias in searching the literature, identifying eligible articles, extracting data, etc.
‡People who bring researchers and their target audiences together and build relationships among them that make knowledge transfer and exchange more effective.
§Individuals who are seen as credible by members of a target audience.

tion and country. Only a small number of factors, such as having managers and public policy-makers among their target audiences and the existence of structures and processes to link researchers and their target audiences, emerged as statistically significant predictors of engagement in three promising bridging activities.

Although the relatively low levels of engagement in many promising bridging activities may be disheartening to some, the survey was conducted shortly after the first wave of calls to support such activities. We did find that the surveyed researchers perceived the climate for such activities to have improved over time. With a cross-sectional survey, we cannot confirm whether engagement levels are rising. What has changed is the publication of many systematic reviews and overviews of reviews that can assist researchers in selecting activities relevant to their topic and local context.[17,20–24] These researchers can also now become connected to a range of partnerships involving policy-makers (e.g., the WHO-sponsored Evidence-Informed Policy Networks) that both constitute and create the types of structures and processes that can support bridging efforts.[25]

Limitations

Our study had four limitations worth noting. First, the potential for social desirability bias (researchers may have reported higher levels of engagement in bridging activities than might actually be the case) exists. Second, the questionnaire included questions that applied to all target audiences (even though some activities, such as disseminating clinical practice guidelines, may have been relevant only to a target audience such as health care providers) and required researchers to provide a single response even if some responses may have varied by target audience. Third, linguistic or cultural differences may have affected respondents' interpretation of select questions. Fourth, the missing or imprecise responses to an open-ended question about institutional affiliations precluded us from adjusting for clustering (at the organizational level) in the regression models; however, this would have affected the standard errors but not the point estimates.

Conclusion

Our findings indicate that researchers in low- and middle-income countries report frequent engagement in only some

Table 3: Potential system-level, organizational and individual correlates of engagement in activities to bridge the gap between research, policy and practice in defined clinical areas (part 1 of 2)

Correlate	Defined clinical area; % (no.) of respondents				
	Total *n = 308*	Insecticide-treated nets to prevent malaria *n = 72*	Intrauterine devices for contraception *n = 94*	Oral rehydration therapy to prevent dehydration in children with diarrhea *n = 50*	DOTS to treat tuberculosis *n = 92*
System level					
Agreed or strongly agreed with descriptions of the state of research knowledge on the topic					
No synthesis is possible because there is too much research available	11 (32/289)	6 (4/69)	12 (10/86)	13 (6/46)	14 (12/88)
One or more syntheses are available for use by specific target audiences	62 (178/286)	58 (38/65)	72 (63/88)	41 (19/46)	67 (58/87)
No synthesis is possible because research is confidential	6 (18/289)	1 (1/68)	9 (8/86)	2 (1/47)	9 (8/88)
One or more syntheses are available but not in the language(s) spoken by specific target audiences	26 (73/286)	38 (25/66)	22 (19/85)	19 (9/47)	23 (20/88)
No synthesis is possible because research is out of date	6 (18/290)	3 (2/69)	13 (11/86)	2 (1/47)	5 (4/88)
One or more syntheses are available but not in language appropriate to specific target audiences	28 (82/288)	28 (19/67)	35 (30/85)	19 (9/47)	27 (24/89)
No synthesis is possible because research is lacking on important issues	10 (28/291)	13 (9/68)	10 (9/86)	6 (3/48)	8 (7/89)
Agreed or strongly agreed with descriptions of barriers to and facilitators of bridging					
The cost for translating research on the topic into action is very low	28 (82/296)	33 (24/72)	28 (24/87)	34 (16/47)	20 (18/90)
Bridging activities could be paid for through research grants for which researchers are eligible to apply	44 (132/298)	46 (33/71)	57 (51/89)	47 (22/47)	29 (26/91)
Structures and processes exist to link researchers and their target audiences	53 (157/296)	58 (41/71)	62 (53/86)	48 (23/48)	44 (40/91)
Personal and organizational contacts among specific target audiences are stable over time (e.g., low turnover)	48 (146/302)	54 (39/72)	48 (43/89)	61 (30/49)	37 (34/92)
Perceived crises in the health system draws attention away from research on the topic	30 (90/297)	10 (7/72)	40 (35/88)	36 (17/47)	34 (31/90)
Target audiences lack the expertise for translating research on the topic into action	37 (112/302)	31 (22/72)	52 (46/89)	18 (9/49)	38 (35/92)
Target audiences have access to technical support for translating research on the topic into action	47 (141/302)	52 (37/71)	43 (39/91)	59 (29/49)	40 (36/91)
Target audiences do not make decisions about the topic on the basis of research	28 (86/303)	24 (17/72)	24 (22/91)	35 (17/48)	33 (30/92)
Target audiences create opportunities to develop joint research initiatives with researchers	47 (139/294)	44 (31/71)	53 (46/87)	52 (24/46)	42 (38/90)
Target audiences invest financial or human resources in joint research initiatives	29 (88/299)	29 (20/70)	22 (20/90)	32 (15/47)	36 (33/92)
Target audiences create events for bridging related to the topic	45 (135/302)	38 (27/71)	54 (49/90)	43 (21/49)	41 (38/92)
Target audiences invest financial or human resources in bridging activities	31 (92/301)	32 (23/71)	24 (22/90)	37 (18/49)	32 (29/91)
Access to particular sources of information					
Have full-text access to at least five scientific journals indexed in the Health InterNetwork Access to Research Initiative (HINARI)*	59 (152/257)	62 (40/65)	60 (45/75)	45 (18/40)	64 (49/77)
Have full-text access to at least five scientific journals indexed in other international reference databases (e.g., MEDLINE)	81 (223/277)	80 (52/65)	81 (67/83)	77 (33/43)	83 (71/86)
Have full-text access to at least five scientific journals published locally, nationally or regionally	84 (244/289)	70 (47/67)	94 (80/85)	85 (40/47)	86 (77/90)
Have access to the Internet at least once a month to conduct and download searches	82 (235/288)	84 (56/67)	74 (61/82)	77 (36/47)	89 (82/92)
Have access to a personal computer with a functional Internet connection at all times to conduct and download searches	72 (208/290)	65 (44/68)	64 (54/85)	76 (35/46)	82 (75/91)
System level and organizational					
Agreed or strongly agreed with descriptions of support for research and bridging activities when respondents began conducting research on the topic					
Own country's health research environment was supportive of individuals conducting research on the topic	66 (200/301)	56 (40/71)	87 (77/89)	59 (29/49)	59 (54/92)

Table 3: Potential system-level, organizational and individual correlates of engagement in activities to bridge the gap between research, policy and practice in defined clinical areas (part 2 of 2)

Correlate	Defined clinical area; % (no.) of respondents				
	Total *n = 308*	Insecticide-treated nets to prevent malaria *n = 72*	Intrauterine devices for contraception *n = 94*	Oral rehydration therapy to prevent dehydration in children with diarrhea *n = 50*	DOTS to treat tuberculosis *n = 92*
Own country's health research environment was supportive of individuals undertaking bridging activities related to the topic	61 (182/300)	59 (42/71)	73 (64/88)	55 (27/49)	53 (49/92)
Own organization was supportive of individuals conducting research on the topic	81 (242/298)	80 (57/71)	86 (76/88)	81 (38/47)	77 (71/92)
Own organization was supportive of individuals undertaking bridging activities related to the topic	69 (205/296)	72 (51/71)	85 (75/88)	50 (23/46)	62 (56/91)
Agreed or strongly agreed with descriptions of changes in support for research and bridging activities over the time that respondents conducted research on the topic					
Own country's health research environment has become more supportive of individuals conducting research on the topic	65 (195/301)	55 (39/71)	79 (70/89)	51 (25/49)	66 (61/92)
Own country's health research environment has become more supportive of individuals undertaking bridging activities on the topic	56 (168/299)	55 (39/71)	60 (52/87)	49 (24/49)	58 (53/92)
Own organization has become more supportive of individuals conducting research on the topic	68 (202/296)	68 (48/71)	78 (69/88)	49 (22/45)	68 (63/92)
Own organization has become more supportive of individuals undertaking bridging activities on the topic	64 (188/292)	61 (43/70)	76 (65/85)	57 (26/46)	59 (54/91)
Organizational					
Agreed or strongly agreed with descriptions of support for bridging activities within own organization					
Translation of research on the topic into action is hampered by lack of academic rewards for bridging activities	34 (101/301)	24 (17/72)	40 (36/90)	40 (19/48)	32 (29/91)
Translation of research on the topic into action is helped by requirements within own organization to publish findings	61 (185/302)	44 (32/72)	75 (67/89)	47 (23/49)	68 (63/92)
Translation of research on the topic into action is helped by the mix of researchers and target audiences in own organization	64 (191/300)	58 (42/72)	81 (72/89)	41 (20/49)	63 (57/90)
Own organization makes available financial and human resources to assist researchers with bridging activities	62 (188/304)	61 (44/72)	68 (61/90)	52 (26/50)	62 (57/92)
Own organization assumes responsibility for undertaking bridging activities on researchers' behalf	47 (142/303)	40 (29/72)	57 (51/90)	20 (10/49)	57 (52/92)
Own organization is not seen as credible source of research on the topic	11 (33/304)	8 (6/72)	16 (15/91)	4 (2/49)	11 (10/92)
Individual					
Agreed or strongly agreed with descriptions of own research					
Own research is not considered relevant by target audiences	6 (17/297)	9 (6/70)	5 (4/86)	4 (2/49)	5 (5/92)
Own research coincides with country's priorities (e.g., with a national research agenda)	89 (268/301)	90 (64/71)	93 (82/88)	86 (43/50)	86 (79/92)
Own research coincides with the needs and expectations of target audiences	85 (256/301)	85 (60/71)	94 (83/88)	80 (40/50)	79 (73/92)
Own research lacks credibility among target audiences	2 (6/299)	3 (2/71)	2 (2/87)	2 (1/49)	1 (1/92)
Own research is not yet ready for use	12 (35/296)	7 (5/70)	9 (8/87)	25 (12/48)	11 (10/91)
Agreed or strongly agreed with statements about who is responsible for bridging activities					
Researchers who conduct research on the topic are primarily responsible for bridging activities related to the topic	49 (148/300)	42 (30/71)	52 (46/88)	45 (22/49)	54 (50/92)
Target audiences for research on the topic are primarily responsible for bridging activities related to the topic	30 (91/300)	30 (21/71)	38 (33/88)	30 (15/50)	24 (22/91)
Both researchers and target audiences are jointly responsible for bridging activities related to the topic	71 (204/289)	70 (50/71)	80 (71/89)	59 (22/37)	66 (61/92)

*HINARI provides free national access in Ghana, Laos, Senegal and Tanzania and low-cost institutional access in Kazakhstan.

Table 4: Factors associated with the likelihood of engagement in particular bridging activities*

Factor†	Bridging activity; adjusted odds ratio (95% CI)‡		
	Provided systematic reviews on the topic	Provided access to searchable database of research products about the topic	Established or maintained long-term partnerships related to the topic with representatives of target audience
Agreed or strongly agreed with particular statement			
One or more syntheses are available for use by target audiences	0.65 (0.31–1.34)	0.77 (0.38–1.56)	1.31 (0.63–2.73)
Structures and processes exist to link researchers and target audiences	0.99 (0.44–2.25)	2.62 (1.30–5.27)	2.65 (1.25–5.64)
Personal and organizational contacts among target audiences are stable over time (e.g., low turnover)	2.88 (1.35–6.13)	1.77 (0.94–3.33)	0.88 (0.43–1.83)
Target audiences lack the expertise for translating research on the topic into action	0.75 (0.31–1.81)	1.03 (0.49–2.17)	1.17 (0.56–2.46)
Target audiences do not make decisions about the topic on the basis of research	0.96 (0.43–2.15)	1.14 (0.54–2.40)	0.92 (0.46–1.80)
Have access to a personal computer with a functional Internet connection at all times to conduct and download searches	1.05 (0.46–2.36)	1.73 (0.81–3.68)	1.44 (0.66–3.18)
Over time, own country's health research environment has become more supportive of individuals undertaking bridging activities on the topic	1.90 (0.88–4.13)	2.12 (0.93–4.81)	1.67 (0.76–3.69)
Over time, own organization has become more supportive of individuals undertaking bridging activities on the topic	0.97 (0.40–2.33)	0.76 (0.30–1.91)	0.94 (0.38–2.33)
Translation of research on the topic into action is hampered by lack of academic rewards for bridging activities	1.05 (0.49–2.25)	1.21 (0.60–2.46)	0.84 (0.42–1.70)
Own organization assumes responsibility for undertaking bridging activities on researchers' behalf	0.67 (0.31–1.44)	1.80 (0.91–3.52)	1.76 (0.87–3.56)
Own research coincides with needs and expectations of target audiences	1.08 (0.31–3.77)	0.73 (0.29–1.86)	1.04 (0.38–2.85)
Researchers who conduct research on the topic are primarily responsible for bridging activities related to the topic	1.56 (0.65–3.78)	1.24 (0.63–2.47)	0.68 (0.34–1.35)
Researchers and target audiences are jointly responsible for bridging activities related to the research topic	1.82 (0.78–4.26)	1.01 (0.47–2.18)	1.11 (0.52–2.37)
Individual characteristics			
Areas of research specialization include health policy and systems research or population and public health research	0.58 (0.26–1.28)	0.76 (0.39–1.48)	1.47 (0.72–2.98)
Managers and public policy-makers are among the target audiences for whom bridging activities are frequently or always undertaken	4.57 (1.78–11.72)	2.55 (1.20–5.43)	1.64 (0.75–3.59)
Percentage of own work time involved in bridging activities	1.00 (0.99–1.02)	1.00 (0.98–1.01)	1.01 (0.99–1.03)
Work(ed) with or for an organization that undertook bridging activities with them or on their behalf	2.38 (0.79–7.21)	1.13 (0.45–2.87)	0.77 (0.28–2.16)
Sex, male	1.28 (0.58–2.86)	1.76 (0.88–3.52)	1.00 (0.49–2.02)
Age§	1.16 (0.86–1.57)	1.02 (0.82–1.28)	0.94 (0.76–1.18)
Age squared§	0.999 (0.996–1.002)	1.000 (0.998–1.002)	1.000 (0.998–1.003)
Actively undertaking bridging activities related to the topic (not just at some point in the past)	0.67 (0.28–1.59)	1.38 (0.62–3.06)	1.53 (0.76–3.08)

Note: CI = confidence interval.
*All regression models included dummy variables for health topic and country (with tuberculosis and Tanzania as reference topic and country respectively).
†Unless stated otherwise, all variables are dichotomous.
‡Each odds ratio was mutually adjusted for all other variables in the table.
§Entered in regression models as continuous variables measured in years.

types of promising bridging activities. Future initatives could focus on supporting those bridging strategies targeted at health care providers that have been found to be effective in some contexts. They could also focus on addressing those factors that appear to increase the prospects for using research in policy-making. In light of 53 ministerial delegations calling for renewed efforts to bridge gaps between research, policy and practice,[3] our survey provides a baseline against which these future initiatives can be measured.

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