Designing and validating a One Health Research Translation Framework through literature-based case studies in Egypt

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ABSTRACT

Within One Health, research translation is a dynamic process involving collaboration and communication between the human, animal, and environmental health sectors to create and apply research findings to address health threats at the human-animal-environment interface. Research translation is essential for the creation of evidence-based policies and programs for the prevention and control of infectious diseases and other health threats, and thus is an important component of a robust national capacity to effectively prevent, control, and mitigate biological incidents. However, there is a lack of conceptual guidance and training materials for research translation in a One Health context. To address this need, we developed a novel One Health Research Translation Framework that describes an iterative process for research and policy stakeholders to collaborate to design and implement research applications addressing One Health zoonotic disease challenges. In addition, we developed accompanying training materials to validate the Framework and facilitate capacity building for understanding and applying research translation concepts to zoonotic disease threats. The training materials consist of exercises to map One Health communication pathways and literature-based case studies on research translation to address zoonotic disease concerns. The Framework and training materials were piloted with Egyptian One Health stakeholders at a workshop in Cairo in 2018. The outcomes of the workshop validated the comprehensiveness and applicability of the Framework and training materials, as participants were able to demonstrate a firm understanding of research translation processes and successfully apply research translation and One Health concepts to real-world zoonotic disease scenarios. Overall, the Framework and accompanying training materials address an important gap in capacity building for One Health stakeholders and are valuable tools for strengthening research translation networks that promote development of innovative, evidence-based solutions to One Health zoonotic disease threats.

1. Introduction

One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems, recognizing that the health of humans, domestic and wild animals, plants, and the wider environment are closely linked and interdependent. This approach requires collaboration among multiple sectors, disciplines, and communities to effectively address shared threats and concerns [1,2]. Within the One Health approach, research translation is important for the development of evidence-based policies and programs, and is thus a component of a robust national capacity to prevent, control, and mitigate One Health threats such as zoonotic diseases [3]. The multi-sectoral nature of research translation in a One Health context presents challenges and opportunities; although the One Health landscape is complex, solutions targeting one sector may benefit another sector, and information and resources can be shared across...
sectors to address health system challenges more efficiently and effectively.

Several frameworks to address zoonotic diseases within the One Health context have been developed by international non-governmental organizations and lead experts in the field [4–6]. However, there are no existing frameworks or resources for research translation in a One Health context that can support the design and implementation of interventions to address multisectoral One Health challenges specifically arising from zoonotic disease threats. Given the complexity and important benefits of One Health research translation, a conceptual framework outlining this process for both researchers and policymakers is needed. To address these gaps, we developed a novel One Health Research Translation Framework and accompanying training materials to facilitate the process of translating research into One Health policies and programs. The Framework and training materials were tested and validated by a group of One Health stakeholders in Egypt during a pilot training workshop.

2. Development of the One Health Research Translation Framework

An evaluation of existing training materials, frameworks, resources, and programs related to research translation and One Health revealed several gaps. First, existing resources address concepts of research translation and One Health separately. As a result, these materials do not adequately address the complexities of research translation in a One Health context, particularly with respect to communication and information-sharing among diverse stakeholders. For example, One Health trainings often emphasize cross-sector communication among the human, animal, and environmental health sectors, but do not address communication between researchers and policymakers. Furthermore, research translation resources typically focus on communication within a single field, but a multi-disciplinary approach is needed to address One Health issues. Additionally, resources on research translation to address population-level health challenges are lacking. Most existing frameworks, examples, and training materials focus on research translation to patient-level challenges, such as the development of clinical practice guidelines or new medical countermeasures. Although the processes of research translation to individual- and population-level challenges are similar, developing and implementing health interventions at the population level involves distinct considerations and challenges.

To address these gaps, we developed a novel One Health Research Translation (OHRT) Framework that aligns with widely accepted concepts and practices related to One Health and research translation. First, we defined research translation in a One Health context as a dynamic and iterative process involving collaborative efforts between the human, animal, and environmental health sectors to apply research findings to address shared health threats at the human-animal-environment interface (adapted from [7–9]; additional definitions included in supplemental materials). Key features include consideration of how information from multiple sectors can inform research applications, the evaluation of cross-sectoral effects of research applications, and the refinement of research applications to maximize cross-sectoral benefits. Second and building from this definition, the project team synthesized and adapted elements from existing research translation and knowledge translation frameworks to create the OHRT Framework [5,10–17]. Third, input from Egyptian and Indonesian One Health practitioners and researchers was obtained throughout the phases of Framework development. Our Framework uniquely focuses on the application of applied research to population-level zoonotic disease challenges and accounts for the multi-sectoral nature of OHRT, thereby addressing key gaps in existing materials. The Framework considers communication and collaboration among two sets of stakeholder groups: 1) between researchers who generate research findings about zoonotic diseases and policymakers who use research findings to inform the development, implementation, and/or monitoring of policies and programs for preventing and responding to zoonotic disease threats; and among stakeholders from the human, animal, and environmental health sectors (Fig. 1).

The Framework has two components: a Research Translation Cycle and the OHRT Roadmap.

2.1. Research translation cycle

The Research Translation Cycle (Fig. 2) illustrates an iterative process for designing and implementing research applications to address One Health zoonotic disease challenges. Both researchers and policymakers from all relevant One Health sectors contribute to the steps of the Research Translation Cycle, which are:

Step 1: Design and perform research. Researchers design and perform research to address gaps in scientific knowledge about zoonotic disease threats at the human-animal-environment interface.

Step 2: Identify potential applications of research findings. Researchers and policymakers identify applications of the research findings that address priority zoonotic disease challenges. This process is collaborative, as policymakers communicate policy and practice needs to help identify opportunities for and shape research applications.

Step 3: Adapt to local context. Researchers and policymakers adapt the research application to the needs, culture, and systems of the target jurisdiction(s). A key aspect of this step is integrating research and policy knowledge and experience to identify solutions for circumventing or overcoming research limitations and health systems barriers to the application of research findings. This involves identifying limitations and strengths of the research methodology and findings that influence its potential for application, and identifying factors within the local health systems that may impede or support application of the research findings, such as local policies, health systems infrastructure, and culture.

Step 4: Optimize benefits across One Health sectors. Researchers and policymakers adapt the research application to maximize its benefits to all One Health sectors. This involves incorporating research...
Step 5: Apply research findings. Policymakers implement, monitor, and evaluate the research application.

Step 6: Jointly identify future research needs. Researchers and policymakers identify outstanding scientific knowledge gaps and zoonotic disease challenges to prioritize future research needs.

After Step 6 is completed, researchers design and perform studies to address high-priority research needs (Step 1), beginning the cycle anew. Stakeholders may enter the Cycle at various steps (see main text). The light blue arrow is a step primarily carried out by researchers, which falls within the “Research Evidence” pillar in the OHRT Roadmap (Fig. 3). The intermediate blue arrow is a step primarily carried out by policymakers, which falls within the “Policy” pillar in the OHRT roadmap. The dark blue arrows are steps that require input from researchers and policymakers, which fall within the “Integration” pillar in the OHRT Roadmap. The green ring depicts communication and coordination supporting all steps in the cycle. The dual-tailed arrow at step 1 and the dual-headed arrow at step 6 indicate that conduct of research and implementation of applications occur outside the cycle, but generate information that feeds into the cycle. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

findings from other disciplines or One Health sectors that could inform the application, determining how the application may impact other sectors, and identifying expertise or resources from other sectors that could aid in the implementation of the application. For instance, public health policymakers using agricultural animal surveillance data to determine zones of high zoonotic disease prevalence and generate policies to prevent spillover may identify wild animal surveillance datasets that also could inform policy development, and both the human and animal health sectors can promote implementation of the policies.

2.2. One Health Research Translation Roadmap

The OHRT Roadmap (Fig. 3) provides additional details about the stakeholders, concepts, and processes informing each step of the Research Translation Cycle. Particularly, the Roadmap includes additional sub-steps for Steps 2, 3, 4, and 6 describing the specific research and policy activities involved. The steps and sub-steps of the Roadmap are organized into pillars (columns) depending on the stakeholders involved: the Research Evidence pillar, Policy pillar, and Integration pillar, which requires inputs from both.

2.2.1. Research evidence pillar

These elements draw from the scientific literature and researchers’ experience to allow assessment of the relevance and strength of research findings.

2.2.2. Policy pillar

These elements draw from existing policies and policymakers’ knowledge and experience to enable evaluation of health system needs and governance structures.

2.2.3. Integration pillar

These elements involve synthesizing the knowledge and experience of both researchers and policymakers to apply research findings in a locally relevant, effective, and beneficial manner. Outputs from research evidence and policy pillar activities feed into the integration pillar, which involves two-way communication and information-sharing between researchers and policymakers and across the human, animal, and environment sectors about research findings, applications, and health system needs.

Together, the Cycle and Roadmap are useful tools to guide researchers and policymakers in collaborating to use research findings to inform the development, implementation, and/or monitoring of policies and programs for addressing One Health zoonotic disease concerns. Both are conceptual, describing the relationships between universal elements of research translation to help stakeholders understand and explain factors that influence research translation to One Health zoonotic disease challenges. The universality of these elements allows stakeholders to adapt the Framework and the steps therein to their specific jurisdiction (regional, national, or sub-national) and disease concerns.

2.3. Development of OHRT training materials

We developed training materials based on the Framework designed to increase research and policy stakeholders’ capacities for understanding and applying the OHRT Framework to One Health zoonotic disease issues, for use in a workshop to validate the Framework (described in next section). To support the training materials, we developed an expanded version of the Framework with detailed guidance for each step (supplemental materials). The training materials were tailored for use in Egypt and incorporate examples of research conducted at Egyptian institutions. The training materials align with best practices in adult learning, in which the use of local research engenders buy-in from trainees, promotes greater understanding about applying research findings within local contexts, and better ensures that training lessons can be applied to participants’ own work. The target audience for the pilot training in Egypt was zoonotic disease researchers and government stakeholders involved in the development and implementation of policies and programs for zoonotic disease prevention and control.

The training package includes two literature-based case studies, one focused on highly pathogenic avian influenza (HPAI) and one on brucellosis, that guide participants through identifying and assessing potential applications of research findings to public health and
veterinary policy and practice. Each case study is based on three research publications from Egyptian authors and institutions that cover important aspects of preventing and controlling HPAI [18–20] or brucellosis [21–23] in Egypt, such as surveillance, animal vaccination, and identification of risk factors for disease transmission (additional information provided in supplemental materials). In small groups, each involving participants from the research, public health, and animal health sectors, trainees discuss questions associated with each Frame-work step, starting by identifying potential applications of the research findings in the selected publications. Participants then discuss how those applications affect other One Health sectors, research limitations that influence whether and how the application can inform policies and programs, health systems barriers that may prevent or delay application of the research, and outstanding health systems needs that could be informed by research. Discussion questions are designed so that some require research experience, some require policy experience, and some require both types of experience to answer, prompting participants to share and integrate knowledge across sectors.

The other main element of the training is a communication pathways mapping activity that focuses on the communication and coordination aspects of the Framework (adapted from [24]). Working in small groups with participants from each sector, each group selects a zoonotic disease and works collaboratively to identify institutions from the research, public health, animal health, and environmental health sectors that participate in research translation related to that disease, characterize the role of each institution in the research translation process, map existing and desired communication pathways between institutions, and describe challenges for communication and potential solutions. This activity allows participants to visualize two-way communication (or lack thereof) between researchers and policymakers and across the human, animal, and environmental sectors. The final element of the training package is an activity for participants to apply the OHRT Framework to their work, in which participants evaluate their professional role in research translation, identify specific research translation opportunities in their work, and develop concrete actions that they can take to promote OHRT.

2.4. Outcomes of validation workshop

A workshop to validate the Framework and pilot the training materials was conducted in Cairo, Egypt in November 2018 with 21 participants from the Ministry of Health and Population (MOHP), Ministry of Agriculture and Land Reclamation (MOALR), and National Research Centre (NRC). The pilot training workshop served two purposes: firstly, to validate and refine the Framework by having One Health stakeholders apply it to specific real-world scenarios, and secondly, to grow participants’ skills in OHRT to enhance national capacities for preventing, detecting, and responding to zoonotic disease concerns in Egypt. The workshop required participants to synthesize their professional expertise and experience in research and/or policy with the OHRT concepts learned through the training activities, and participants provided feedback on the Framework and training materials at the end of the workshop.

2.5. Communication pathways mapping activity

During the communication pathways mapping activity, participants were able to successfully identify national-level institutions that participate in research translation to address zoonotic disease issues, map the existing communication pathways between them, and identify...
desired future communication pathways to facilitate research translation. Based on the maps created by participant groups, the project team created an aggregate map using the open-source network mapping program Gephi [25] (Fig. 4).

This activity revealed that communication pathways within sectors are well-established, including communication pathways between institutions engaged in research and policy activities (e.g., Epidemiology Unit – Central Public Health Laboratory within the MOHP). While some cross-sector communication pathways are established, participants provided several examples of additional desired pathways. One key finding was the desire for many additional communication pathways between NRC and various MOHP and MOALR institutions, suggesting that NRC, the only multisectoral institution on the map, could serve as an important hub for communications about OHRT in Egypt. Additionally, participants suggested potential solutions for communication challenges that impede research translation, such as formalizing One Health 15 (2022) 100454

Fig. 4. Aggregate communication pathways map for research translation to address zoonotic disease issues in Egypt. Panel (A) shows the existing communication pathways map, which includes existing lines of communication between national-level institutions (solid lines). Panel (B) showed the desired communication pathways map, which includes existing (solid line) and desired (dotted line) lines of communication between national-level institutions. In each map, the circles representing institutions are colour-coded based on the institution’s sector: dark blue for the animal health sector, orange for the human health sector, green for the environmental sector, and grey for multiple sectors. The size of the institutional circles reflects the number of communication pathways emanating from that circle (with larger circles reflecting more pathways). Communication pathways are colour-coded based on whether they are intra-sectoral (blue for pathways within the animal health sector, orange for pathways within the human health sector, and green for pathways within the environmental health sector), or inter-sectoral (grey). The clustering of the circles (institutions) reflects their connectivity to other institutions in the map, with tighter clusters indicating a higher degree of connectivity among institutions. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)
Health communication protocols and developing mechanisms for sharing of pre-publication data. Overall, this activity successfully enabled participants to identify key institutions and their roles in OHRT, and to visualize important communication pathways between institutions, key gaps in communication, and potential solutions for establishing new or strengthening existing lines of communication. Collectively, this information could facilitate efforts to expand and support the identified OHRT networks.

2.6. Case study exercises

Participants successfully applied the OHRT Framework to the case study publications and identified a variety of research applications, research limitations, health systems barriers, and policy and research needs for HPAI and brucellosis. Participants discussed a wide range of policy applications that could be informed by the research, such as updating biosecurity recommendations for poultry movement, strengthening food safety policies, and developing community education initiatives on how to prevent and mitigate spread of HPAI and brucellosis. Additionally, participants discussed how limitations of the research findings or health systems factors might prevent or delay implementation of the identified applications, as well as additional research that may help overcome those barriers. For example, limited geographic coverage of surveillance research could be addressed by studies in additional areas, and cost-benefit analyses of available prevention and control strategies could help address funding limitations (additional information provided in supplemental materials).

Overall, the group discussions during the training activities confirmed the relevance and utility of the OHRT Framework to Egyptian stakeholders involved in research and policy activities. Participants consistently highlighted the need to incorporate One Health considerations and communication pathways more effectively into research and policy, further validating the need for resources such as the OHRT Framework. For example, participants showed interest in using the Framework in their professional work to design and evaluate research using a One Health approach for the development of zoonotic disease-related policies, and to bolster multi-sectoral involvement in research translation.

3. Conclusion

The outcomes of the validation workshop with One Health stakeholders in Egypt validated the comprehensiveness and applicability of the OHRT Framework, as participants were able to demonstrate an understanding of each step and successfully apply concepts to real-world scenarios. The workshop demonstrated the utility of these resources for building capacities in research translation to address One Health challenges and served to strengthen One Health research translation networks in Egypt by providing a venue for research and policy stakeholders from the public health and animal health sectors to engage with each other. Although the training materials were focused on specific diseases, participants gained skills that are broadly applicable and could enhance Egypt’s capabilities for preventing and controlling zoonotic diseases more generally.

The OHRT Framework could be used in several other ways to promote the application of research to One Health zoonotic disease challenges, such as guiding development of training materials on how to design research to address health system needs or multi-stakeholder workshops to develop research translation roadmaps for particular disease concerns. Future efforts could explore approaches for validating the Framework for use in the field to inform refinements and identify further applications. Additionally, the Framework could be expanded to include elements guiding other key facets of research translation, such as prioritization of research actions and applications to incentivize intersectoral and interdisciplinary communication and collaboration. Overall, the OHRT Framework and accompanying training materials address an important gap in capacity building for One Health stakeholders and are flexible tools for strengthening research translation networks for the prevention of, detection of, and response to One Health zoonotic disease threats. In the future, the Framework could be adapted for other One Health concerns, such as climate change and other types of health threats with environmental linkages.

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CRediT authorship contribution statement

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Declaration of Competing Interest

None.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ohi.2022.100454.

References

[1] S.A. McEwen, P.J. Collignon, Antimicrobial resistance: a one health perspective, Microbiol. Spectrum. 6 (2) (2018), https://doi.org/10.1128/microbiolspec.ARBX-0009-2017, 6.2. 10.
[2] Tripartite and UNEP support OHHREP’s definition of “One Health”. Joint Tripartite (FAQ, OIE, WHO) and UNEP Statement, https://www.who.int/news/item/01-12-2021-tripartite-and-unep-support-ohhreps-definition-of-one-health. Accessed 12/16/2021.
[3] D.M. Mirvis, From research to public policy: an essential extension of the translation research agenda, Clin. Trans. Sci. 2 (5) (2009) 379–381, https://doi.org/10.1111/j.1755-8662.2009.00144.x.
