

**Supplementary Table 1: Framework of Core Competencies in IR (version 1.0)**

<p><b>1. Apply a structured process to identify known bottlenecks and barriers in the health system</b></p> <p><i>Due to health system barriers and bottlenecks, often only a limited proportion of a population is able to benefit from highly efficacious interventions/tools. The first critical step in IR is to recognize the problems impeding effective implementation or uptake of an intervention. To identify bottlenecks and barriers one might take a systematic approach including, consulting local researchers, healthcare personnel and stakeholders to critically evaluate the context and existing gaps (e.g. negative attitudes of health workers), quantify and qualify the problem as much as possible (e.g. how widespread is the problem and what are the consequences), and identify factors that may have contributed to the problem (e.g. poorly trained staff due to inadequate knowledge and resources).</i></p>
<p>1.1. Describe the relationships between various organizational dimensions (e.g. climate, culture) and dissemination and implementation research.</p> <p>1.2. Identify and articulate the interplay between policy and organizational processes in dissemination and implementation (D&amp;I).</p>
<p><b>2. Identify emerging challenges related to implementation of evidence-supported IDoP interventions.</b></p> <p><i>The optimum introduction of evidence-based interventions is critical to good health outcomes and the well-being of populations. However, often, interventions that prove efficacious in controlled trial settings or high-income settings, may not be as effective when used in a resource-limited setting, such as the use of bed-nets and artemisinin-based combination therapy. It is critical to assess the need for implementing new strategies or de-implementing existing ones to avoid harmful overall effect. It is important to also consider whether the intervention is relevant, new or innovative, urgent, acceptable, ethical, and practical.</i></p>
<p>2.1. Assess, describe, and quantify (where possible) the context for effective D&amp;I (setting characteristics, culture, capacity &amp; readiness).</p> <p>2.2. Identify existing gaps in D&amp;I research.</p> <p>2.3. Identify the potential impact of scaling down (aka de-implementing) an ineffective but often used intervention.</p> <p>2.4. Formulate methods to address barriers of D&amp;I research.</p>
<p><b>3. Contextualize health systems bottlenecks and barriers relevant for addressing implementation of evidence-supported IDoPs</b></p> <p><i>Deployment of interventions may encounter previously unforeseen barriers to its uptake and penetration. These barriers may be due to the physical environment, socioeconomic and cultural contexts, or health systems and user characteristics, often come about due to deficiencies in contextualization of the country, region or community. Developing a systematic approach to recognize and address bottlenecks, as well as identify optimal implementation options for the given context may avoid in a reduced impact of the intervention, losses to the health system, as well as loss of confidence in the intervention among the population and other stakeholders.</i></p>
<p>3.1. Use evidence to evaluate and adapt D&amp;I strategies for specific populations, settings, contexts, resources and/or capacities.</p> <p>3.2. Describe how to frame and analyze the context of D&amp;I as a complex system with interacting parts.</p> <p>3.3. Determine which evidence-based interventions are worth disseminating and implementing.</p>
<p><b>4. Identify and engage relevant stakeholders</b></p> <p><i>IR is a collaborative process, from initially identifying the problem through to disseminating the results, involving a variety of relevant stakeholders and health personnel is key. Stakeholders play a crucial role in identifying pertinent contextual factors, and in disseminating IR findings through their own networks, supporting any recommended tools or changes in the delivery of an interventions and promoting uptake.</i></p>

- 4.1. Describe the importance of incorporating the perspectives of different stakeholder groups (e.g., patient/family; employers, payers, healthcare settings, public organizations, community and policy makers).
- 4.2. Identify and develop sustainable partnerships for D&I research.
- 4.3. Describe how to measure successful partnerships for D&I research.
- 4.4. Identify and apply techniques for stakeholder analysis and engagement when implementing evidence-based practices.
- 4.5. Describe the appropriate process for eliciting input from community-based practitioners for adapting an intervention.
- 4.6. List the potential roles of mediators and moderators in a dissemination and implementation study.

#### **5. Constitute an IR team to lead the research enterprise**

*A diverse composition of the IR team helps encourage and facilitate collaboration by bringing people who represent different disciplines, sectors, strengths, and knowledge bases together. IR's multidisciplinary approach is essential at every step, from identifying bottlenecks to the choice of study design and research methods, conducting the research, and communicating the findings.*

- 5.1. Describe the range of expertise needed to conduct D&I research (e.g., mixed method experience, economic, organizational, policy, clinical).
- 5.2. Articulate the strengths and weaknesses of participatory research in D&I research.
- 5.3. Determine when engagement in participatory research is appropriate with D&I research.

#### **6. Formulate appropriate IR questions**

*IR questions should be of interest to the researchers, policy-makers, decision-makers, funding agencies, healthcare providers, and the community the research will affect. Research questions should aim to describe the health situation and intervention, provide information required to evaluate ongoing interventions, introduce new ones or make adjustments, and analyze possible causes for missed targets in order to find solutions. It is equally important to prioritize IR questions, ensuring efficiency and responsible practice.*

- 6.1. Differentiate between D&I research and other related areas, such as efficacy research and effectiveness research.
- 6.2. Identify common D&I measures & analytic strategies relevant for your research question(s).
- 6.3. Apply common D&I measures & analytic strategies relevant for your research question(s) within your model/framework.
- 6.4. Identify and measure outcomes that matter to stakeholders, adopters and implementers.

#### **7. Determine the applicable study design**

*The research design is a blueprint describing your research methods, the steps you will take to collect and analyze data, determine sample size and participants, ensure quality management, and how ethical considerations will be addressed. The study design should be determined based on the team's knowledge regarding the problem – knowing a problem exists, suspecting factors contributing to the problem, establishing the extent to which a particular factor contributes to the problem, and having sufficient knowledge to develop and assess an intervention to prevent, control, or solve the problem.*

- 7.1. Describe a range of D&I strategies, models and frameworks.
- 7.2. Describe the application and integration of mixed-methods (quantitative and qualitative) approaches in D&I research.
- 7.3. Identify appropriate conceptual models, frameworks, or program logic for D&I change .
- 7.4. Incorporate methods of economic evaluation (e.g., implementation costs, cost-effectiveness) in D&I study design.
- 7.5. Identify and articulate the trade-offs between a variety of different study designs for D&I research.

- 7.6. Explain how knowledge from disciplines outside of health (e.g. business, marketing, and engineering) can help inform further trans-disciplinary efforts in dissemination and implementation research.
- 7.7. Identify possible methods to address external validity in study design reporting and implementation.
- 7.8. Effectively explain and incorporate concepts of de-adoption and de-implementation into dissemination and implementation study design.
- 7.9. Effectively integrate the concepts of sustainability/sustainment and the rationale behind them in D&I study design.

## **8. Articulate a proposal to help leverage required resources**

*Successful IR requires adequate and well managed human, logistic, technical, and financial resources. At the outset a detailed assessment of all resources required to accomplish a project should be carried out. This should include an evaluation of the number and experience in human resources required, equipment and material required, and estimated costs. All existing resources should be identified with the help and knowledge of local experts, while additional resources required should be leveraged prior to beginning IR.*

- 8.1. Identify core elements (effective ingredients) of effective interventions and recognize risks of making modifications to these.
- 8.2. Identify sites to participate in D&I studies and negotiate or provide incentives to secure their involvement.

## **9. Conduct and monitor IR in a robust, rigorous and ethical manner**

*As interventions are tailored or adapted to specific contexts, it becomes more difficult to generalize the findings to other populations and settings. It is thus important to apply scientific rigor, with the implication that processes leading to outcomes will be well-documented. As any other type of scientific investigation, IR must comply with good research practices, including clear presentation of data collection and analysis methods, clearly defined and logically consistent concepts and propositions, and well-evaluated findings. Additionally, ethical integrity in IR is of special concern, as the autonomy and understanding of participants are likely to be limited in high-burden and vulnerable populations. Ethical integrity should be maintained by taking special note to address issues around power relationships, literacy, disruption of routine health services, inequitable selection of participants, over-burdening staff in the health system etc.*

- 9.1. Describe the concept and measurement of fidelity.
- 9.2. Explain how to maintain fidelity of original interventions during the adaption process.
- 9.3. Describe the core components of external validity and their relevance to D&I research.
- 9.4. Describe gaps in D&I measurement and critically evaluate how to fill them.

## **10. Feed the solutions/adaptations back into the health system**

*At its core, IR is dynamic and adaptive. It is an ongoing process that requires continuous feedback of results back to the team, the study design, and ultimately into the health system, allowing for adaptations to the intervention as required.*

- 10.1. Identify a process for adapting an intervention and how the process is relevant to D&I research.
- 10.2. Identify the potential impact of disseminating, implementing and sustaining effective interventions.

## **11. Communicate and advocate effectively throughout the IR process**

*Engaging the target audience and relevant stakeholders via consultation, education, communication, participation, and partnerships throughout the IR process is critical. Engagement allows the IR team to draw on the collective contextual knowledge of the community, as well as their understanding of existing strengths and resources in the area. Engagement should therefore be facilitated throughout the IR cycle – from pre-intervention, to intervention and continuous monitoring to the final evaluation. Through*

*effective communication and advocacy, it is important to promote ownership of the research among key stakeholders, and ultimately help promote and facilitate uptake of research results into related policies and programs.*

- 11.1 Define and communicate D&I research terminology.
- 11.2 Define what is and what is not D&I research.
- 11.3 Evaluate and refine innovative scale-up and spread methods (e.g., technical assistance, interactive systems, novel incentives and 'pull' strategies).
- 11.4 Describe a process for designing for dissemination (planning for adoption, implementation and sustainability during the intervention development stage).

Supplementary Table 2: Changes made to the framework between version 1.0 and version 2.0

Category of changes	Reason	Relevant domain/competency
<b>1. Addition/Deletion of domains and/or competencies</b>		
<ul style="list-style-type: none"> <li>Added competency '<i>Develop comprehensive knowledge of the local healthcare system and health policies to ensure feasibility and appropriateness of interventions.</i>'</li> </ul>	Survey respondents agreed it was important to include a competency on studying and developing a deeper understanding the local context, the intervention will be situated within.	Competency 1.1 (v2)
<ul style="list-style-type: none"> <li>Added competency '<i>Assess organizational readiness before implementation.</i>'</li> </ul>	Being able to assess organizational readiness was identified as a key construct to be explicitly treated.	Competency 1.2 (v2)
<ul style="list-style-type: none"> <li>Added competency '<i>Identify relevant, innovative, and practical interventions to address emerging challenges related to a health outcome.</i>'</li> </ul>	Respondents highlighted the need to include a specific competency on identifying relevant, innovative and/or practical interventions, as was described in the Domain description.	Competency 2.2 (v2)
<ul style="list-style-type: none"> <li>Added competency '<i>Identify how inequities (gender, race, social class) affect IR.</i>'</li> </ul>	Under the purview of ethics in IR, the need to include a competency on identifying inequities across IR processes was highlighted.	Competency 2.4 (v2)
<ul style="list-style-type: none"> <li>Added competency '<i>Identify and develop successful opportunities for obtaining resources from different sources.</i>'</li> </ul>	In addressing an issue, respondents identified there isn't always the need to acquire new resources, instead one might study the context and obtain existing resources.	Competency 7.3 (v2)
<ul style="list-style-type: none"> <li>Added competency '<i>Apply ethical principles in conducting IR.</i>'</li> </ul>	IR draws on a wide variety of disciplines and research approaches to address diverse problems, therefore awareness of ethical principles throughout the IR process was identified as critical to acceptable, sustainable, scalable and safe implementation.	Competency 8.5 (v2)
<ul style="list-style-type: none"> <li>Added competency '<i>Identify key facilitators for developing strategies to support the implementation of efficacious interventions and overcome health system barriers.</i>'</li> </ul>	In addition to identifying bottlenecks and barriers, it is also useful to identify facilitators and what has been successful so far.	Competency 4.3 (v2)
<ul style="list-style-type: none"> <li>Added competency '<i>Manage complex situations and different people when conducting IR.</i>'</li> </ul>	Respondents highlighted the need to be able to manage complex situation when conducting IR, especially when different stakeholders are involved and responsible for different aspects of implementation.	Competency 4.4 (v2)
<ul style="list-style-type: none"> <li>Added competency '<i>Identify appropriate methods and tools for measuring implementation outcomes</i>'</li> </ul>	The existing framework didn't include competencies on methods and tools for measuring implementation outcomes, which was determined to be a key process and competency by the respondents.	Competency 6.5 (v2)
<ul style="list-style-type: none"> <li>Added competency '<i>Describe the resources for implementing the core elements of the</i></li> </ul>	In addition to having a competency on identifying core elements of effective interventions, it is also important to describe	Competency 7.2 (v2)

<i>interventions, and any relevant strategies.'</i>	the resources and strategies which will be required to implement it.	
<ul style="list-style-type: none"> <li>Deleted competency '<i>Describe the relationships between various organizational dimensions (e.g. climate, culture) and dissemination and implementation research</i>'</li> </ul>	Respondents expressed it was more important to understand the relationships between the health system, implementation organization, and other stakeholders, and didn't see this competency as valuable in the LMIC setting.	Competency 1.1 (v1)
<ul style="list-style-type: none"> <li>Deleted competency '<i>Explain how knowledge from disciplines outside of health (e.g. business, marketing, and engineering) can help inform further trans-disciplinary efforts in dissemination and implementation research.</i>'</li> </ul>	Respondents felt the competency was better suited to HIC settings.	Competency 7.6 (v1)
<ul style="list-style-type: none"> <li>Deleted competency '<i>List the potential roles of mediators and moderators in a dissemination and implementation study.</i>'</li> </ul>	Respondents didn't think this was a valuable addition to the framework, instead it would be more important to develop the competency to mediate/moderate.	Competency 4.6 (v1)
<b>2. Merging/combining domains and/or competencies</b>		
<ul style="list-style-type: none"> <li>Domain on <i>contextualizing health systems bottlenecks and barriers</i>, merged with domain on <i>identifying known bottlenecks and barriers</i>.</li> </ul>	Both Domains 1 and 3 as they were laid out were focusing on understanding the context – identifying bottlenecks and barriers and contextualizing them and were hence merged.	Domain 1 and 3 (v1), merged into Domain 1 (v2).
<b>3. Re-wording/re-describing domains and/or competencies</b>		
<ul style="list-style-type: none"> <li>Re-wording domain '<i>Apply a structures process to identify known bottlenecks and barriers to the health system</i>' – replacing 'known' with 'existing'.</li> </ul>	A change in wording was suggested from 'known' bottlenecks and barriers, to 'existing' ones, as once it is known there is no need to systematically identify them.	Domain 1 (v2).
<ul style="list-style-type: none"> <li>Description of Domain 1 expanded to include sentence on the impact of systematically addressing bottlenecks and identifying optimal implementation options for a given context</li> </ul>	This competency was re-described to highlight the importance of systematically addressing bottlenecks, and how this may vary from context to context	Domain 1 (v2)
<ul style="list-style-type: none"> <li>Re-worded competency '<i>Effectively explain and incorporate concepts of de-adoption and de-implementation into dissemination and implementation study design</i>' to '<i>Identify the potential impact of scaling down (aka de-implementing) an ineffective</i></li> </ul>	This competency was re-worded to focus on identifying the impact of scaling down and de-implementing ineffective interventions, and systematic methods to achieve it.	Competency 7.8 (v1), now Competency 2.3 (v2)

<i>but often used intervention for addressing that outcome.'</i>		
<ul style="list-style-type: none"> <li>• Re-worded competency '<i>Formulate methods to address barriers of D&amp;I research</i>' to '<i>Train members of the team in IR methodology.</i>'</li> </ul>	The competency was re-worded to reflect the training of teams in diverse IR methodologies, and moved to Domain 4 on building an IR team to lead the research.	Competency 2.5 (v1), now Competency 4.2 (v2)
<ul style="list-style-type: none"> <li>• Re-worded competency '<i>Identify possible methods to address external validity in study design reporting and implementation.</i>' to '<i>Describe the core components of external validity and their relevance to IR.</i>'</li> </ul>	The competency was re-worded to reflect the need to understand core elements of external validity, and their relevance to IR.	Competency 7.7 (v1), now Competency 8.3 (v2)
<b>4. Re-assigning competencies to a different domain</b>		
<ul style="list-style-type: none"> <li>• Competency '<i>Assess, describe and quantify (where possible) the context for effective IR</i>' re-assigned domain.</li> </ul>	Respondents agreed this competency is better suited under Domain 1 on contextualizing the health system bottlenecks and barriers.	Domain 2 (v1), now in Domain 1 (v2).
<ul style="list-style-type: none"> <li>• Competency on the impact of scaling down and de-implementing ineffective interventions, re-assigned domains.</li> </ul>	Respondents agreed this competency is better suited under Domain 2 on identifying challenges around the implementation of interventions, instead of study design.	Domain 7 (v1), now in Domain 2 (v2).
<ul style="list-style-type: none"> <li>• Competency '<i>Articulate the strengths and weaknesses of participatory research in D&amp;I research</i>' re-assigned domains.</li> </ul>	Respondents agreed this competency is better suited under Domain 3 on identifying stakeholders, instead of building the IR team.	Domain 5 (v1), now in Domain 3 (v2).
<ul style="list-style-type: none"> <li>• Competency '<i>Identify appropriate conceptual models, frameworks, or program logic for D&amp;I change</i>' re-assigned domains.</li> </ul>	Respondents agreed this competency is better suited under Domain 5 on formulating IR questions, as questions formulated should be theoretically grounded to the extent possible.	Domain 7 (v1), now Domain 5 (v2).
<ul style="list-style-type: none"> <li>• Competency '<i>Determine when engagement in participatory research in appropriate within D&amp;I research</i>' re-assigned as a sub-competency.</li> </ul>	Respondents agreed this competency is better suited as a sub-competency in the same Domain on identifying stakeholders.	Competency 5.3 (v1), merged with Competency 3.1 (v2).
<b>5. Change in sequencing and other recommendations</b>		
<ul style="list-style-type: none"> <li>• Dissemination and Implementation research (D&amp;I), replaced entirely by Implementation Research (IR).</li> </ul>	This change was suggested for the framework to be consistent with the prevalent usage of IR as encompassing both D&I in LMICs.	Reflected through the framework (v2).
<ul style="list-style-type: none"> <li>• Sub-competencies developed for competencies</li> </ul>	Respondents and the study team agreed a number of competencies should be broken down into further actionable competencies, to	Domains 1, 2, 3, 4, 5, 7, 8, 9, 10 (v2)

	prevent from it being a complex competency, and instead have a stepwise approach.	
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Supplementary Table 3: Framework of core competencies in IR (version 2.0)

IR Domain & Competencies	Standardized mean proficiency score	Proficiency level*
<p><b>1. Apply a structured process to identify existing bottlenecks and barriers in the health system</b></p> <p><i>Health system barriers and bottlenecks often result in a limited proportion of a population benefitting from highly efficacious interventions/tools. A first critical step is to identify the problems impeding effective implementation or uptake of an intervention. To do so, one might take a systematic approach including, consulting local researchers, healthcare personnel, program managers, and other stakeholders to critically evaluate the physical, sociopolitical, economic and cultural contexts, identify existing gaps (e.g. poor attitudes of health workers toward efficacious interventions), quantify and qualify the problem as much as possible (e.g. how widespread is the problem and what are its consequences), and identify factors that may have contributed to the problem (e.g. poorly trained staff due to inadequate knowledge and resources). A systematic approach to address bottlenecks, as well as identifying optimal implementation options for the given context may avoid a reduced impact of the intervention, losses to the health system, as well as loss of confidence in the intervention among the population and other stakeholders.</i></p>		
<p>1.1. Develop comprehensive understanding of the local healthcare system and health policies to ensure feasibility and appropriateness of interventions.</p> <p>    1.1.1. Be aware of the local healthcare system, i.e. structure, policies, key actors and stakeholders.</p> <p>    1.1.2. Understand the intervention, its purpose and required resources.</p> <p>    1.1.3. Understand what levels of the healthcare system the intervention will interact with and have an effect on.</p> <p>1.2. Assess organizational readiness before implementation.</p> <p>    1.2.1. Be aware of the constructs for organizational readiness.</p> <p>    1.2.2. Be able to identify and implement a readiness tool, pertaining to the needs of the intervention.</p> <p>1.3. Assess, describe, and quantify (where possible) the context for effective IR.</p> <p>    1.3.1. Understand the local setting, culture, perception and understanding, and community readiness.</p> <p>    1.3.2. Understand and apply relevant contextual models to IR.</p> <p>1.4. Identify and articulate the interplay between policy and organizational processes in IR.</p>	<p>-1.627</p> <p>0.031</p> <p>-0.660</p> <p>-2.712</p> <p>-1.303</p> <p>-0.660</p> <p>-0.660</p> <p>-1.074</p>	<p>1</p> <p>3</p> <p>2</p> <p>1</p> <p>1</p> <p>2</p> <p>2</p> <p>1</p>

1.5. Contextualize health system bottlenecks and barriers relevant for addressing implementation of evidence-supported interventions for IDoPs.		
1.5.1. Be able to frame and analyze the context of IR as a complex system with interacting parts; understanding how the local system and stakeholders interact in key processes.	-1.213	1
1.5.2. Understand systems thinking, and how to apply it in identifying and resolving health system challenges.	-1.627	1
1.5.3. Use evidence to evaluate and adapt IR strategies for optimal implementation of interventions for specific populations, settings, contexts, resources and/or capacities.	-0.522	2
<b>2. Identify emerging challenges related to implementation of evidence-supported IDoP interventions</b>		
<i>Optimum introduction of evidence-based interventions is critical to good health outcomes and the well-being of populations. However, interventions that prove efficacious in controlled trial settings or high-income settings, may not always be effective in a resource-limited setting, such as the use of bed-nets and artemisinin-based combination therapy for malaria control in some LMICs. It is critical to assess the need for implementing new strategies or de-implementing existing ones to achieve good health outcomes. It is important to also consider whether the intervention is relevant, new or innovative, urgent, acceptable, ethical, and practical.</i>		
2.1. Identify existing gaps in IR for a specific health outcome.	0.563	4
2.2. Identify relevant, innovative, and practical interventions to address emerging challenges related to a health outcome.		
2.2.1. Be able to identify emerging challenges.	-0.760	1
2.2.2. Based on the given context and issue, be able to draw from model programs and best practices.	-0.172	3
2.3. Identify the potential impact of scaling down (aka de-implementing) an ineffective but often used intervention for addressing that outcome.	-1.936	1
2.4. Identify how inequities affect IR.		
2.4.1. Be aware of potential inequities such as gender, race, social class, education etc., which might impact successful implementation of efficacious interventions for a specific health outcome.	-1.495	1
2.4.2. Be able to strategize to address inequities specific to the implementation of a given set of efficacious interventions, and thereby achieving the desired health outcome.	-0.760	1
<b>3. Identify and engage relevant stakeholders</b>		
<i>IR is a collaborative process, from identifying the problem through dissemination of the results; involving a variety of stakeholders and health personnel is key. Stakeholders play a crucial role in identifying pertinent contextual factors, developing appropriate strategies for the deployment of</i>		

<p><i>interventions, and in disseminating IR findings through their own networks, supporting any recommended tools or changes in the delivery of an interventions and promoting uptake and sustainability.</i></p>		
<p>3.1. Articulate the strengths and weaknesses of participatory research, and determine when engaging in it is appropriate in IR.</p> <p>3.1.1. Understand key constructs of participatory research, i.e. collaborative, equitable, community-based, co-learning and capacity building etc.</p> <p>3.2. Describe the importance of incorporating the perspectives of different stakeholder groups (e.g., patient/family; employers, payers, healthcare settings, public organizations, community and policy makers).</p> <p>3.2.1. Understand the importance of stakeholder engagement in IR.</p> <p>3.2.2. Be able to identify relevant stakeholder groups.</p> <p>3.3. Identify and apply techniques for stakeholder analysis and engagement when implementing evidence-based practices.</p> <p>3.3.1. Be aware of models and methods for facilitating stakeholders' engagement and participation in IR process.</p> <p>3.3.2. Be able to engage stakeholder groups appropriately to gather perspectives and opinions.</p> <p>3.3.3. Be able to incorporate stakeholder input into IR practice.</p> <p>3.4. Describe how to measure successful partnerships for IR.</p> <p>3.4.1. Discuss the role of each stakeholder and partnership.</p> <p>3.4.2. Identify relevant measurable outcomes for each partnership.</p> <p>3.5. Describe the appropriate process for eliciting input from community-based practitioners for adapting an intervention and develop strategies to support the intervention.</p> <p>3.6. Identify and develop sustainable partnerships for IR.</p>	<p>0.355</p> <p>1.707</p> <p>2.441</p> <p>0.055</p> <p>1.060</p> <p>1.010</p> <p>0.355</p> <p>-0.095</p> <p>0.445</p> <p>0.055</p>	<p>4</p> <p>5</p> <p>5</p> <p>3</p> <p>5</p> <p>5</p> <p>4</p> <p>3</p> <p>4</p> <p>3</p>
<p><b>4. Constitute an IR team to lead the research enterprise</b></p> <p><i>A diverse composition of an IR team helps encourage and facilitate collaboration by bringing together people who represent different disciplines, sectors, strengths, and knowledge bases. IR's multidisciplinary approach is essential at every step, from identifying bottlenecks to the choice of study design and research methods, conducting the research, and communicating the findings.</i></p>		
<p>4.1. Describe the range of expertise needed to conduct IR.</p> <p>4.1.1. Identify and develop expertise in relevant domains, such as mixed methods research, economic evaluation, organizational structures, policy, clinical understanding etc.</p>	<p>1.406</p>	<p>5</p>

4.2. Train members of the team in IR methodology.		
4.2.1. Identify important methodologies for IR, such as epidemiology, biostatistics, evaluation etc.	1.256	5
4.2.2. Be able to assess base knowledge and proficiency in all methods.	1.707	5
4.3. Identify key facilitators for developing strategies to support the implementation of efficacious interventions and overcome health system barriers.		
4.3.1. Be able to identify members/researchers/practitioners who can champion strategy development.	1.406	5
4.4. Manage complex situations and different people when conducting IR.		
4.4.1. Be aware of the various partners involved in the research, i.e. individuals conducting field work, practice partners, advisors etc.	0.806	4
4.5. Be aware of all moving pieces in conducting IR.	0.505	4
<b>5. Formulate appropriate IR questions</b>		
<i>IR questions should be of interest to the program managers, policy-makers, healthcare providers, community, researchers, decision-makers, funding agencies, and others that the research will affect. Research questions should aim to describe the health situation and intervention, provide information required to evaluate ongoing interventions, introduce new ones or make adjustments, and analyze possible causes for missed targets in order to find solutions. It is equally important to prioritize IR questions, ensuring efficiency and responsible practice.</i>		
5.1. Differentiate between IR and other related areas, such as efficacy research and effectiveness research.		
5.1.1. Have a strong understanding of each type of research and when they are appropriate.	-0.246	2
5.2. Identify appropriate conceptual models, frameworks, or program logic for IR change.	0.205	3
5.3. Identify common IR measures, outcomes, and analytic strategies relevant for your research question(s).	0.205	3
5.4. Apply common IR measures, outcomes, and analytic strategies relevant for your research question(s) within your model/framework.	0.806	4
5.5. Identify and measure outputs and outcomes that matter to stakeholders, adopters and implementers.	1.106	5
<b>6. Determine the applicable study design</b>		
<i>The research design is a blueprint describing research methods, the steps you will take to collect and analyze data, determine sample size and participants, ensure quality management, and how ethical considerations will be addressed. The study design should be determined based on the team's knowledge regarding the problem – knowing a problem exists, suspecting</i>		

<i>factors contributing to the problem, establishing the extent to which a particular factor contributes to the problem, and having sufficient knowledge to develop and assess an intervention to prevent, control, or solve the problem.</i>		
6.1. Describe a range of IR strategies, models and frameworks, including models for systematically adapting interventions.	-0.246	2
6.2. Describe a range of study inferences in IR, and their relevant study designs including the mixed-method design.	-0.396	2
6.3. Describe the application and integration of mixed-methods (quantitative and qualitative) approaches in IR.	0.655	4
6.4. Identify and articulate the trade-offs between a variety of different study designs for IR research.	-0.322	2
6.5. Identify appropriate methods and tools for measuring implementation outcomes.	0.548	3
6.6. Effectively integrate the concepts of sustainability/sustainment and the rationale behind them in IR study design.	-0.846	1
<b>7. Articulate a proposal to help leverage required resources</b>		
<i>Successful IR requires adequate and well managed human, logistic, technical, and financial resources. At the outset a detailed assessment of all resources required to accomplish a project should be carried out. This should include an evaluation of the number and experience in human resources required, equipment and material required, and estimated costs. All existing resources should be identified with the help and knowledge of local experts, while additional resources required should be leveraged prior to beginning IR.</i>		
7.1. Identify core elements (effective ingredients) of effective interventions and recognize risks of making modifications to these.	-0.396	2
7.2. Describe the resources for implementing the core elements of the interventions, and any relevant strategies.	-0.246	2
7.3. Identify and develop successful opportunities for obtaining resources from different sources.		
7.3.1. Be able to conduct a detailed assessment of existing resources in the system, and their purpose.	-0.095	3
7.4. Identify sites to participate in IR studies and negotiate or provide incentives to secure their involvement.	0.806	4
<b>8. Conduct and evaluate IR in a robust, rigorous and ethical manner</b>		
<i>As interventions are adapted to specific contexts, it becomes challenging to generalize findings to other populations and settings. It is important to apply scientific rigor, such that implementation, monitoring and evaluation of outcomes is well-documented. As any scientific investigation, IR must comply with good research practices, including clear presentation of data collection and analysis methods, clearly defined and logically consistent concepts, and well-evaluated findings. Additionally, ethical integrity in IR is of special concern, as the autonomy and understanding of participants are likely to be</i>		

<p><i>limited in high-burden and vulnerable populations. Ethical integrity should be maintained by taking special note to address issues such as safety of participants, power relationships, literacy, disruption of routine health services, inequitable selection of participants, over-burdening staff in the health system.</i></p>		
<p>8.1. Describe the concept and measurement of fidelity.</p> <p>8.2. Explain how to maintain fidelity of original interventions during systematic adaption of processes.</p> <p>8.3. Describe the core components of external validity and their relevance to IR.</p> <p>8.4. Describe gaps in IR measurement and critically evaluate how to fill them.</p> <p>8.5. Apply ethical principles in conducting IR.</p> <p>8.5.1. Identify potential ethical issues in IR such as safety of participants, power relationships, literacy, disruption of services.</p>	<p>-0.246</p> <p>-0.396</p> <p>-0.546</p> <p>-0.996</p> <p>1.857</p>	<p>2</p> <p>2</p> <p>2</p> <p>1</p> <p>5</p>
<p><b>9. Integrate the solutions/adaptations back into the health system</b></p> <p><i>At its core, IR is dynamic and adaptive. It is an ongoing process that requires continuous feedback of results back to the team, the study design, and ultimately into the health system, allowing for adaptations to the intervention as required.</i></p>		
<p>9.1. Identify a process for integrating best practices derived from IR, to health systems.</p> <p>9.1.1. Be able to identify best practices from IR conducted around specific interventions and outcomes.</p> <p>9.1.2. Understand integration models and how to build it into the study design.</p> <p>9.2. Identify the potential impact of implementing, disseminating and sustaining effective interventions.</p> <p>9.2.1. Understand processes involved in implementation, i.e. what levels of the health system and/or community will be involved, which stakeholders will be involved, who's buy-in is required, at what levels of the facility / community / household will the intervention effect.</p>	<p>0.055</p> <p>-0.846</p> <p>0.055</p>	<p>3</p> <p>1</p> <p>3</p>
<p><b>10. Communicate and advocate effectively throughout the IR process</b></p> <p><i>Engaging the target audience and relevant stakeholders via consultation, education, communication, participation, and partnerships throughout the IR process is critical. Engagement allows the IR team to draw on the collective contextual knowledge of the community, as well as their understanding of existing strengths and resources in the area. Engagement should therefore be facilitated throughout the IR cycle—from pre-intervention, to intervention and continuous monitoring to the final evaluation. Through effective communication and advocacy, it is important to promote ownership of the</i></p>		

<i>research among key stakeholders, and ultimately help promote and facilitate uptake of research results into related policies and programs.</i>		
10.1. Define and communicate IR terminology.	1.406	5
10.2. Define what is and what is not IR.	0.355	4
10.3. Evaluate and refine innovative scale-up and spread methods.		
10.3.1. Identify opportunities for scaling up interventions.	-0.396	2
10.3.2. Understand methods of scaling up and what is required for each, such as technical assistance, interactive systems, novel incentives, and 'pull' strategies.	-0.696	2
10.4. Articulate dissemination strategies (planning for adoption, implementation and sustainability during the intervention development stage), adapted to the audience.		
10.4.1. Be aware of different channels of dissemination.	0.355	4
10.4.2. Be aware of different audiences, i.e. stakeholders, healthcare providers, end users etc.	1.106	5

\*Proficiency level defined based on quintiles of standardized mean proficiency scores. Cut-off points for quintiles are -0.759926, -0.2455198, 0.2049855, 0.805658, and 2.440821, respectively.

Supplementary Table 4: Changes made to the framework between version 2.0 and version 3.0

Category of changes	Reason	Relevant domain/competency
<b>1. Addition/Deletion of domains and/or competencies</b>		
<ul style="list-style-type: none"> <li>Domain added '<i>Applying ethical principles in conducting IR.</i>'</li> </ul>	Participants agreed ethical principles in IR should have a separate domain outlining ethical practices throughout the IR process.	Domain 5 (v3)
<ul style="list-style-type: none"> <li>Competency added '<i>Differentiate relevant contextual factors and constructs as facilitators and barriers of implementation</i>'</li> </ul>	In understanding the context for implementation, the need to equally understand barriers and facilitators, and factors giving rise to both was put forth.	Competency 1.4 (v3)
<ul style="list-style-type: none"> <li>Competency added '<i>Identify and adapt implementation strategies to address facilitators and barriers.</i>'</li> </ul>	Participants emphasized the need to include competencies around implementation strategies throughout the IR process, as a key focus.	Competency 1.5 (v3)
<ul style="list-style-type: none"> <li>Competency added '<i>Define stakeholders, i.e. who constitute as relevant stakeholders.</i>'</li> </ul>	Before engaging with, and managing stakeholders, participants emphasized the first critical step of defining relevant stakeholders.	Competency 3.1 (v3)
<ul style="list-style-type: none"> <li>Competency added '<i>Identify potential ethical issues when planning, conducting, and evaluating IR.</i>'</li> </ul>	This competency was developed under the newly formed domain on ethical principles in IR.	Competency 5.1 (v3)
<ul style="list-style-type: none"> <li>Competency added '<i>Distinguish ethical considerations that are peculiar to IR, and how broad ethical principles for biomedical and clinical research apply differently to IR.</i>'</li> </ul>	This competency was developed under the newly formed domain on ethical principles in IR.	Competency 5.2 (v3)
<ul style="list-style-type: none"> <li>Competency added '<i>Conduct meaningful engagement with all stakeholders throughout the IR process, to identify local health priorities, key participants, communicate research goals, study design, risks and benefits, identify potential barriers etc.</i>'</li> </ul>	This competency was developed under the newly formed domain on ethical principles in IR.	Competency 5.3 (v3)
<ul style="list-style-type: none"> <li>Competency added '<i>Identify and apply implementation and research strategies for preserving participant's autonomy, privacy, and confidentiality.</i>'</li> </ul>	This competency was developed under the newly formed domain on ethical principles in IR.	Competency 5.4 (v3)
<ul style="list-style-type: none"> <li>Competency added '<i>Define ethical issues in the post-research phase of IR (e.g. issues around how to use IR results, data ownership).</i>'</li> </ul>	This competency was developed under the newly formed domain on ethical principles in IR.	Competency 5.5 (v3)

<ul style="list-style-type: none"> <li>Competency added <i>'Identify and apply implementation strategies for ensuring transparency and accountability with key stakeholders.'</i></li> </ul>	This competency was developed under the newly formed domain on ethical principles in IR.	Competency 5.6 (v3)
<ul style="list-style-type: none"> <li>Competency added <i>'Identify existing gaps in knowledge and practice with regards to implementation of specific health interventions or for achieving a health outcome.'</i></li> </ul>	Participants noted, competencies around identifying existing gaps before formulating research questions are critical to the exercise, and were missing from the framework.	Competency 6.2 (v3)
<ul style="list-style-type: none"> <li>Competency added <i>'Conduct a literature review on the context, healthcare challenges, and interventions to frame the IR question'</i></li> </ul>		Competency 6.4 (v3)
<ul style="list-style-type: none"> <li>Competency added <i>'Demonstrate how to phrase/formulate IR questions.'</i></li> </ul>	IR questions should be relevant, of interest, and fit-for-purpose. Irrelevant questions often lead to a lack of interest, mistrust, and a waste of resources. Therefore, is it essential to include a competency on formulating appropriate IR questions to begin with.	Competency 6.3 (v3)
<ul style="list-style-type: none"> <li>Competency added <i>'Prioritize IR questions, based on need, existing resources, stage of implementation, time etc.'</i></li> </ul>	Participants noted, often researchers, implementers, funders and other stakeholders are unable to tackle every issue and need to prioritize time and resources.	Competency 6.5 (v3)
<ul style="list-style-type: none"> <li>Competency added <i>'Differentiate between scale-up research and large-scale implementation research.'</i></li> </ul>	Participants agreed to include a competency on differentiating between scale-up and large-scale research, when conducting IR.	Competency 7.5 (v3)
<ul style="list-style-type: none"> <li>Competency added <i>'Understand and apply the concept of internal validity to IR.'</i></li> </ul>	In addition to external validity, participants agreed it is equally important to understand and evaluate internal validity in IR.	Competency 8.4 (v3)
<ul style="list-style-type: none"> <li>Competency added <i>'Develop a complete IR proposal to acquire resources for intervention and implementation.'</i></li> </ul>	A critical part of acquiring required resources is identifying what is required, budgeting for it, and articulating the rationale via proposals.	Competency 9.2 (v3)
<ul style="list-style-type: none"> <li>Competency added <i>'Develop a plan to ensure sustainability of resources.'</i></li> </ul>	Participants suggested, it is not sufficient to acquire resources during the implementation of an intervention, but equally important to ensure its sustainability.	Competency 9.4 (v3)
<ul style="list-style-type: none"> <li>Competency added <i>'Develop iterative and learning cycles within the conduct of IR, and apply implementation strategies that facilitates feedback to key</i></li> </ul>		Competency 10.1 (v3)

<i>stakeholders and continuous improvement of IR.'</i>		
• Competency added ' <i>Prioritize effective interventions and adaptations to scale-up, integrate or routinize within the health system.'</i>		Competency 10.2 (v3)
• Competency added ' <i>Identify and apply implementation strategies and models for scale-up, routinizing and/or integrating effective interventions into the health system.'</i>		Competency 10.5 (v3)
• Competency added ' <i>Conduct monitoring and evaluation of the scale-up, routinization and/or integration process.'</i>		Competency 10.6 (v3)
• Competency added ' <i>Identify and apply implementation strategies and other opportunities for translating IR results into policy and action.'</i>		Competency 10.7 (v3)
• Competency added ' <i>Frame IR results appropriately and accurately for various target audiences.'</i>		Competency 11.1 (v3)
• Competency added ' <i>Train members of the team in appropriate skills to communicate, advocate and disseminate IR results effectively.'</i>		Competency 11.5 (v3)
• Competency deleted ' <i>Contextualize health system bottlenecks and barriers relevant for addressing implementation of evidence-supported interventions for IDoPs'</i>	Participants agreed this competency was too broad. Instead more specific competencies to carry out contextualizing was suggested to be included.	Competency 1.5 (v2)
• Competency deleted ' <i>Identify existing gaps in IR for a specific health outcome.'</i>		Competency 2.1 (v2)
• Competency deleted ' <i>Train members of the team in IR methodology.'</i>	Participants agreed it is more pertinent to identify expertise for different phases of IR, depending on the research question, study design, findings etc. And that is was improbable and inefficient to train members in all IR methodologies.	Competency 4.2 (v2)

<ul style="list-style-type: none"> <li>Competency deleted <i>'Apply common IR measures, outcomes, and analytic strategies relevant for your research question(s) within your model/framework.'</i></li> </ul>	This competency was found to be redundant, as a competency on identifying and applying appropriate IR measures, outcomes, and analytic strategies relevant for constructing research question(s) already exists (6.7).	Competency 5.4 (v2)
<ul style="list-style-type: none"> <li>Competency deleted <i>'Identify sites to participate in IR studies and negotiate or provide incentives to secure their involvement.'</i></li> </ul>		Competency 7.4 (v2)
<ul style="list-style-type: none"> <li>Competency deleted <i>'Apply ethical principles in conducting IR.'</i></li> </ul>	This competency was deleted as a new domain on ethical principles was suggested, with competencies covering principles across IR phases.	Competency 8.5 (v2)
<ul style="list-style-type: none"> <li>Competency deleted <i>'Define and communicate IR terminology.'</i></li> </ul>		Competency 10.1 (v2)
<b>2. Merging/combining domains and/or competencies</b>		
-	-	-
<b>3. Re-wording/re-describing domains and/or competencies</b>		
<ul style="list-style-type: none"> <li>Re-worded domain <i>'Apply a structures process to identify bottlenecks and barriers in the health system'</i> to <i>'Understanding contexts (health systems, implementing organizations, and community)'</i></li> </ul>	The domain was re-worded to place emphasis on understanding the context as a whole, which includes the health system, implementing organizations, and the community), as well as to remove focus from just barriers and bottlenecks, but to also include facilitators and successes.	Domain 1 (v2, v3)
<ul style="list-style-type: none"> <li>Re-worded domain <i>'Identify emerging challenges related to implementation of evidence-supported IDoP interventions'</i> to <i>'Understanding the interventions for addressing IDoPs, their mechanisms, and emerging implementation challenges'</i></li> </ul>	The domain was re-worded to place emphasis on the interventions itself, as well as to understand the interventions as a whole, instead of just its implementation challenges.	Domain 2 (v2, v3)
<ul style="list-style-type: none"> <li>Re-worded domain <i>'Constitute an IR team to lead the research enterprise'</i> to <i>'Building an IR team'</i></li> </ul>	This domain was re-worded as respondents agreed IR teams are required for more than just leading the research enterprise, but also so implement and execute interventions, carry out monitoring and evaluation, and post-research dissemination.	Domain 4 (v2, v3)
<ul style="list-style-type: none"> <li>Re-worded domain <i>'Determine the applicable study design'</i> to <i>'Determining applicable study designs and methodology.'</i></li> </ul>	This domain was re-worded to include methodology.	Domain 6 (v2), now Domain 7 (v3)

<ul style="list-style-type: none"> <li>• Re-worded domain '<i>Articulate a proposal to help leverage required resources</i>' to '<i>Leveraging required resources for conducting IR.</i>'</li> </ul>	This domain was re-worded as respondents agreed it was misleading and incorrect as it implied writing up a proposal for acquiring resources, which in fact only one facet of the domain.	Domain 7 (v2), now Domain 9 (v3)
<ul style="list-style-type: none"> <li>• Re-worded domain '<i>Conduct and evaluate IR in a robust, rigorous, and ethical manner</i>' to '<i>Conducting IR in a robust and rigorous manner</i>'</li> </ul>	This domain was re-worded to exclude ethics, as consensus was reached to create a new domain entirely dedicated to ethical principles in IR.	Domain 8 (v2, v3)
<ul style="list-style-type: none"> <li>• Re-worded domain '<i>Integrate the solutions/adaptations back into the health system</i>' to '<i>How to use information from IR</i>'</li> </ul>	This domain was re-worded to make it clearer and easier to understand.	Domain 9 (v2), now Domain 10 (v3)
<ul style="list-style-type: none"> <li>• Re-worded competency '<i>Assess organizational readiness before implementation</i>' to '<i>Assess health systems, organizational, and community readiness before implementation of interventions</i>'</li> </ul>	This competency was re-worded to include health systems and community readiness, in addition to organizational.	Competency 1.2 (v2), now Competency 1.3 (v3)
<ul style="list-style-type: none"> <li>• Re-worded competency '<i>Identify relevant, innovative, and practical interventions to address emerging challenges related to a health outcome</i>' to '<i>Apply research strategies to identify relevant, innovative, and practical interventions to achieve a specific health outcome or address health services delivery challenges related to IDoPs</i>'</li> </ul>	This competency was re-worded to focus on implementation strategies in identifying interventions, as well as to include service delivery challenges in addition to health outcomes.	Competency 2.2 (v2), now Competency 2.1 (v3)
<ul style="list-style-type: none"> <li>• Domains and competencies throughout the framework were edited to reflect more active and actionable phraseology.</li> </ul>		
<b>4. Re-assigning competencies to a different domain</b>		
<ul style="list-style-type: none"> <li>• Competency '<i>Describe the core elements (effective ingredients) of evidence-informed interventions</i>' re-assigned domains.</li> </ul>	Respondents agreed this competency is better suited under Domain 8 on conducting IR in a robust and rigorous manner, which requires sufficient knowledge on essential/core/effective ingredients of interventions being implemented.	Domain 7 (v2), now in Domain 8 (v3)
<ul style="list-style-type: none"> <li>• Competency '<i>Understand and articulate what is and what is not IR.</i>' re-assigned domains.</li> </ul>	Respondents agreed this competency is better suited under Domain 6 on formulating appropriate IR questions, as it is critical to recognize and differentiate between IR and other types of research.	Domain 10 (v2), now in Domain 6 (v3)
<b>5. Change in sequencing and other recommendations</b>		

<ul style="list-style-type: none"><li>• Domains '<i>Conducting IR in a robust and rigorous manner</i>' and '<i>Leveraging required resources for conducting IR</i>' were swapped in sequence.</li></ul>		Domains 7 and 8 (v2), Domains 8 and 9 (v3)
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**Supplementary Table 5: Final framework of core competencies in IR (version 3.0)**

<p><b>1. Understanding contexts (health systems, implementing organizations, and community)</b></p> <p><i>Different types of barriers and bottlenecks may restrict the benefits of highly efficacious health interventions/tools from reaching their target population. These barriers and bottlenecks, as well as opportunities and facilitators for delivering these interventions, are specific to different contexts (including health systems, implementing organizations, and communities). A critical step in implementation research (IR) is therefore to understand the context in which an intervention will be (is being or has been) delivered or from where an implementation challenge may have occurred (or could occur). Such understanding will help to identify the problems that may impede effective implementation or uptake of an intervention. To understand contexts, one might take a systematic approach including consulting community members, program managers, healthcare personnel, policy-makers, local researchers, and other stakeholders to assess the physical, sociopolitical, economic, and cultural factors (e.g. political stability, prevalent religious beliefs and custom); health systems factors (e.g. how services delivery is organized and governed); the capacity and readiness of the implementing organizations (e.g. attitudes and motivation of program workers); and community factors (e.g. collective efficacy and readiness of community members to address specific problems) relevant for implementing an efficacious intervention or addressing a health problem. Such assessments would quantify and qualify these contextual factors as much as possible, and identify factors that may contribute to implementation challenges as well as any existing solutions and facilitators of the intervention. A systematic approach to assess the context, across the health system-, implementing organization-, and community-level may avoid a reduced impact of interventions, losses to the health system, as well as loss of confidence and trust among the population and other stakeholders.</i></p>
<p>1.1. Develop comprehensive understanding of contextual factors relevant for the implementation of an efficacious intervention</p> <p>1.1.1. Articulate and apply knowledge of relevant physical, socio-political, economic and cultural factors</p> <p>1.1.2. Describe and apply knowledge of relevant health system factors, i.e. levels of the health system, key inputs, processes, outputs, and how policies and stakeholders interact at each level.</p> <p>1.1.3. Identify and appraise relevant implementation organizations, i.e. their organizational structure, policies, processes, and stakeholders.</p> <p>1.1.4. Identify and appraise the relevant community, i.e. structure, beliefs, stakeholders, needs and resources.</p> <p>1.2. Select and apply relevant contextual models and theories to IR, including application of systems thinking to appropriately describe complex relationships among interacting contextual factors</p> <p>1.2.1. Identify and articulate the interaction between policy and organizational processes in IR</p> <p>1.3. Assess health systems, organizational and community readiness before implementation of interventions.</p> <p>1.3.1. Identify and measure relevant constructs and implement a readiness tool pertaining to the needs of the intervention.</p> <p>1.4. Differentiate relevant contextual factors and constructs as facilitators and barriers of implementation</p> <p>1.5. Identify and adapt implementation strategies to address facilitators and barrier.</p> <p>1.5.1. Apply understanding of the contextual factors (including the local setting, culture, and perception with regards to existing barriers and facilitators of health and healthcare).</p>
<p><b>2. Understanding the interventions for addressing IDoPs, their mechanisms, and emerging implementation challenges</b></p> <p><i>Implementation researchers and practitioners focused on IDoP need to be aware of the evidence-informed interventions (including treatment, tools, programs, and policies) for reducing/eliminating morbidity and mortality due to these diseases, and need to know how the interventions work, and for whom. Interventions that prove efficacious in controlled trial settings or high-income settings, may not always be effective in a resource-limited setting. Similarly, not all interventions that are</i></p>

*potentially impactful have an adequate evidence base, especially in resource-limited settings. A critical step in IR is the assessment of the state of evidence regarding interventions for addressing a specific disease or condition, including the mechanisms and conditions under which the interventions are effective, the specific populations that may benefit from the interventions, and the relevance of the interventions for the contexts under consideration. The assessment should further consider whether the intervention is innovative, urgent, acceptable, ethical, and practical. It is also critical to assess the need for implementing and testing new interventions or de-implementing existing ones to address infectious diseases of poverty.*

- 2.1. Apply research strategies to identify relevant, innovative, and practical interventions to achieve a specific health outcome or address health services delivery challenges related to IDoP.
  - 2.1.1. Describe and apply robust and rigorous literature and systematic review methods to identify interventions, their purpose, core components, implementation strategies, and required resources
  - 2.1.2. Identify existing or emerging implementation challenges for identified interventions
  - 2.1.3. Apply models for evaluating evidence and decision-making around implementation of evidence supported interventions
  - 2.1.4. Assess the evidence (or the lack of evidence) for interventions, their mechanisms of action, and for whom those mechanisms apply
  - 2.1.5. Based on the given context and issue, synthesize evidence and draw from model programs and best practices to decide about implementation of a given intervention
- 2.2. Identify the potential impact of scaling down (aka de-implementing) an ineffective but often used intervention.
- 2.3. Analyse how inequities may affect the implementation of an intervention.
  - 2.3.1. Identify and apply implementation strategies to address inequities around gender, race, social class, education etc., which might impact successful implementation of interventions.

### **3. Identifying and engaging relevant stakeholders**

*IR is a collaborative and participatory process involving a variety of stakeholders, from identifying the problem through dissemination of the results. Stakeholders play a crucial role in understanding the context, identifying pertinent implementation gaps, developing appropriate implementation strategies for the deployment of interventions, and in disseminating IR findings through their own networks, supporting any recommended tools or changes in the delivery of an intervention, and promoting uptake and sustainability.*

- 3.1. Define stakeholders, i.e. who constitute as relevant stakeholders.
- 3.2. Identify relevant stakeholder groups.
  - 3.2.1. Describe the importance of incorporating the perspectives of different stakeholder groups (e.g. patient/family; employers, payers, healthcare settings, public organizations, communities, policy makers, frontline workers etc.)
- 3.3. Articulate and apply key constructs of participatory research, i.e. collaborative, equitable, community-based, co-learning, capacity building etc for outlining goals of stakeholder engagement
- 3.4. Identify and apply techniques for stakeholder analysis and engagement.
  - 3.4.1. Apply appropriate models and tools for facilitating stakeholder engagement and participation in IR.
  - 3.4.2. Engage stakeholder groups and incorporate stakeholders' input into IR.
  - 3.4.3. Identify and resolve possible challenges and dynamics around stakeholder engagement.
- 3.5. Describe and apply how to measure successful partnerships for IR.
  - 3.5.1. Discuss the role of each stakeholder and partnership.
  - 3.5.2. Identify relevant measurable outcomes for each partnership.

3.6. Describe and apply the appropriate process for eliciting input from community-based practitioners for adapting an intervention.

3.6.1. Develop strategies to support the intervention.

3.7. Develop sustainable partnerships for IR.

#### **4. Building an IR team**

*A diverse composition of an IR team helps encourage and facilitate collaboration by bringing together people who represent different disciplines, sectors, strengths, and knowledge bases needed to achieve specific IR goals. An interdisciplinary approach is essential at every step of the IR process, from identifying bottlenecks and implementation problems to the choice of study design and research methods, conducting the research, and communicating and using the findings. A diverse IR team facilitates such interdisciplinary approach, and the coordination of expertise, resources and relationships at every step of the IR process.*

4.1. Articulate the range of expertise needed to conduct IR.

4.1.1. Identify expertise for different steps of the IR process, such as expertise needed for identification of existing challenges, development of research questions and study design, conducting mixed-methods research, understanding organizational structures and policies, communication and using IR findings etc.

4.2. Identify and apply appropriate IR methodology for defining IR stakeholders, training and capacity building.

4.3. Identify key individuals/groups for developing strategies to support the implementation of interventions.

4.4. Manage complex situations and different people when conducting IR.

4.4.1. Be aware of the various partners involved in the research, i.e. individuals conducting field work, practice partners, advisors etc.

4.4.2. Be able to manage and resolve complex situations using relevant implementation strategies.

#### **5. Applying ethical principles in conducting IR.**

*A primary focus of IR is implementing and scaling-up evidence from biomedical and clinical research, and ethical principles for conducting biomedical and clinical research may not be directly transportable to IR. For example, while biomedical research may focus on obtaining informed consent from competent individuals, IR may require informed consents from multiple levels, including community gatekeepers and individuals. It is important for IR team and researchers to recognize the ethical considerations that are peculiar to IR, and work with key stakeholders to address these considerations at every phase of IR, including during the planning of the research and translating IR results to action. Ethical issues in IR would vary with the IR question, context, and nature of the proposed interventions. Hence, transparency, accountability and effective communication among all key stakeholders in IR are essential for addressing ethical challenges during the IR process. Ethical integrity should be maintained in IR by taking special note to address issues such as safety of participants, power relationships, disruption of routine health services, inequities around gender, race, education, over-burdening staff in the health system, etc; similar to considerations that would be made in the conduct of biomedical and clinical research.*

5.1. Identify potential ethical issues when planning, conducting, and evaluating IR

5.2. Distinguish ethical considerations that are peculiar to IR, and how broad ethical principles for biomedical and clinical research apply differently to IR

- 5.3. Conduct meaningful engagement with all stakeholders throughout the IR process, to identify local health priorities, key participants, communicate research goals, study design, risks and benefits, identify potential barriers etc.
  - 5.3.1. Identify and apply implementation strategies for facilitating responsiveness to local needs and priorities
  - 5.3.2. Identify and apply implementation strategies for ensuring broad inclusion of research subjects, including vulnerable populations
  - 5.3.3. Identify and apply research strategies for preserving equipoise in IR
  - 5.3.4. Identify and apply study designs wherein effective interventions are not withheld from any group e.g. hybrid- and mixed-methods designs
- 5.4. Identify and apply implementation and research strategies for preserving participants' autonomy, privacy, and confidentiality
- 5.5. Define ethical issues in the post-research phase of IR (e.g. issues around how to use IR results, data ownership)
  - 5.5.1. Identify and apply implementation strategies for addressing ethical considerations in the post-research phase of IR
- 5.6. Identify and apply implementation strategies for ensuring transparency and accountability with key stakeholders

## 6. Formulating appropriate IR questions

*IR questions should be fit-for-purpose, relevant, and of interest to program managers, policy-makers, healthcare providers, community, researchers, decision-makers, funding agencies, and others that the research will affect. IR questions may be stand-alone questions but are often embedded within implementation of evidence-informed interventions. IR questions should aim to analyze the context and intervention, provide information required to evaluate ongoing interventions, introduce new ones or make adjustments, and analyze possible causes for missed targets in order to find solutions. IR questions may also be focused on developing, testing and evaluating implementation strategies and models, and understanding pathways for scale-up and sustaining evidence-informed interventions. Given the multiple aims that IR questions may address, it is important to prioritize IR questions considering practicality, efficiency and responsible practice.*

- 6.1. Understand and articulate what is and what is not IR
  - 6.1.1. Differentiate between IR and other related area, such as efficacy research and effectiveness research. Have an understanding of each type of research and when they are appropriate.
- 6.2. Identify existing gaps in knowledge and practice with regards to implementation of specific health interventions or for achieving a health outcome.
- 6.3. Demonstrate how to phrase/formulate IR questions.
  - 6.3.1. Involve relevant stakeholders when formulating IR questions.
- 6.4. Conduct a literature review on the context, healthcare challenges, and interventions to frame the IR question.
- 6.5. Prioritize IR questions, based on need, existing resources, stage of implementation, time etc.
- 6.6. Identify appropriate conceptual models, frameworks, or logic models for IR change in developing research questions.
- 6.7. Identify and apply appropriate IR measures, outcomes, and analytic strategies relevant for constructing research question(s).

6.8. Identify and measure outputs and outcomes that matter to stakeholders, adopters and implementers.

## **7. Determining applicable study design and methodology**

*The research design is a blueprint describing research methods, the steps you will take to collect and analyze data, determine sample size and participants, ensure quality management, and how ethical considerations will be addressed. The study design should be determined based on the team's knowledge regarding the problem – knowing a problem exists, suspecting factors contributing to the problem, establishing the extent to which a particular factor contributes to the problem, and having sufficient knowledge to develop and assess an intervention to prevent, control, or solve the problem.*

- 7.1. Articulate the range of models and frameworks, methods, and study designs, including primary and secondary data collection for conducting IR.
  - 7.1.1. Identify and articulate the trade-offs between a variety of different study designs for IR.
  - 7.1.2. Identify and apply adaptive and pragmatic research designs for IR
- 7.2. Identify, apply and integrate mixed-methods (quantitative and qualitative) approaches to IR.
- 7.3. Understand and apply approaches to measure and assess implementation outcomes
  - 7.3.1. Distinguish between implementation outcomes, efficacy/effectiveness outcomes, and impact
  - 7.3.2. Articulate the connectedness of the different types of outcome with the implementation process, including the input and outputs
- 7.4. Effectively integrate the concepts of sustainability/sustainment, and the rationale behind them in IR study design.
- 7.5. Differentiate between scale-up research and large-scale implementation research.

## **8. Conducting IR in a robust and rigorous manner**

*As interventions are adapted to specific contexts, it becomes challenging to generalize findings to other populations and settings. It is important to apply scientific rigor, such that implementation, monitoring and evaluation of outcomes is well-documented. As with any scientific inquiry, IR must comply with good research practices, including clear presentation of data collection and analysis methods, clearly defined and logically consistent concepts, and well-evaluated findings.*

- 8.1. Describe the core elements (effective ingredients) of evidence-informed interventions
- 8.2. Understand and apply the concept of fidelity to the conduct of IR
  - 8.2.1. Distinguish between intervention fidelity and implementation fidelity
- 8.3. Describe gaps in IR measurement and critically evaluate how to fill them
- 8.4. Understand and apply the concept of internal validity to IR
  - 8.4.1. Identify threats to internal validity of IR study, and apply appropriate research strategies to minimize threats
- 8.5. Understand and apply the concept of external validity or transferability to IR
  - 8.5.1. Identify threats to external validity of IR study, and apply appropriate research strategies to minimize threats

## **9. Leveraging required resources for conducting IR**

*Successful IR requires adequate and well managed human, logistic, technical, and financial resources. At the outset, a detailed assessment of all resources required to accomplish a project should be carried out. This should include an evaluation of the number and experience in human resources required, equipment and material required, and estimated costs. All existing resources should be identified with the help and knowledge of local experts, while additional resources required should be leveraged prior to beginning IR, and over the course of conducting the IR study.*

- 9.1. Describe the resources required for implementing the core elements of interventions.
- 9.2. Develop a complete IR proposal to acquire resources for intervention and implementation.
  - 9.2.1. Identify core elements of proposal activities for IR
  - 9.2.2. Apply skills to develop budget and implementation plan for IR.
- 9.3. Identify and develop successful opportunities for obtaining resources from different sources.
  - 9.3.1. Be able to conduct a detailed assessment of existing resources in the local context and system, and identify their purpose.
  - 9.3.2. Identify sites to participate in IR studies and negotiate or provide incentives to secure their involvement and resources.
- 9.4. Develop a plan to ensure sustainability of resources.

#### **10. How to use information from IR**

*At its core, IR is dynamic and adaptive. It is an ongoing process that requires continuous feedback of results back to the team and other stakeholders to address immediate implementation problems, and allowing for adaptations to the intervention as required. IR results should also inform broader and long-term learning and actions, including scale-up of effective interventions, integration of effective interventions into existing systems, and routinization/institutionalization of effective implementation processes and best practices, and other actions to translate IR evidence to policy. Implementation strategies are needed to facilitate the use of IR results both in the short and long-term, and the process of translating IR results to both short and long-term actions can be studied as IR with well-defined implementation outcomes linked to impact measures.*

- 10.1. Develop iterative and learning cycles within the conduct of IR, and apply implementation strategies that facilitates feedback to key stakeholders and continuous improvement of IR
- 10.2. Prioritize effective interventions and adaptations to scale-up, integrate or routinize within the health system
- 10.3. Identify the potential impact of implementing, disseminating and sustaining effective interventions at scale.
  - 10.3.1. Articulate the processes involved in large-scale implementation, i.e. what levels of the health system and/or community will be involved, which stakeholders will be involved, who's buy-in is required, at what levels of the facility/community/household will the intervention operate.
- 10.4. Identify opportunities for scaling up interventions.
  - 10.4.1. Understand methods of scaling up interventions, and what is required, such as technical assistance, interactive systems, novel incentives, and 'pull' strategies.
- 10.5. Identify and apply implementation strategies and models for scale-up, routinizing and/or integrating effective interventions into the health system.
  - 10.5.1. Understand and apply concepts of complex adaptive system to scale-up, routinization and integration process

10.5.2. Identify and apply best practices from the conduct of the IR into the scale-up, routinization and/or integration process.

10.5.3. Know how to use Health Information Systems (HIS) to identify and integrate solutions into the health system.

10.6. Conduct monitoring and evaluation of the scale-up, routinization and/or integration process

10.6.1. Identify relevant implementation outcomes

10.6.2. Use the Health Information Systems (HIS) to study scale-up, routinization and/or integration process

10.7. Identify and apply implementation strategies and other opportunities for translating IR results to policy and action

## **11. Communicating and advocating effectively throughout the IR process**

*Engaging the target audience and relevant stakeholders via consultation, education, communication, participation, and partnerships throughout the IR process is critical. Engagement allows the IR team to draw on the collective contextual knowledge of the community, as well as their understanding of existing strengths and resources in the area. Engagement should therefore be facilitated throughout the IR cycle – from pre-intervention, to intervention and continuous monitoring to the final evaluation. Through effective communication and advocacy, it is important to promote ownership of the research among key stakeholders, and ultimately help promote and facilitate uptake of research results into related policies and programs.*

11.1. Frame IR results appropriately and accurately for various target audiences.

11.1.1. Identify key messages for relevant stakeholders.

11.2. Define and identify relevant channels for IR key messages.

11.3. Describe and apply communication and advocacy strategies in IR.

11.4. Articulate dissemination strategies and adapt appropriately to the relevant audience.

11.4.1. Identify appropriate channels of dissemination.

11.4.2. Identify appropriate audiences, i.e. policy-makers, community, healthcare providers, end users etc.

11.4.3. Use the HIS to facilitate dissemination of IR results

11.5. Train members of the team in appropriate skills to communicate, advocate and disseminate IR results effectively