

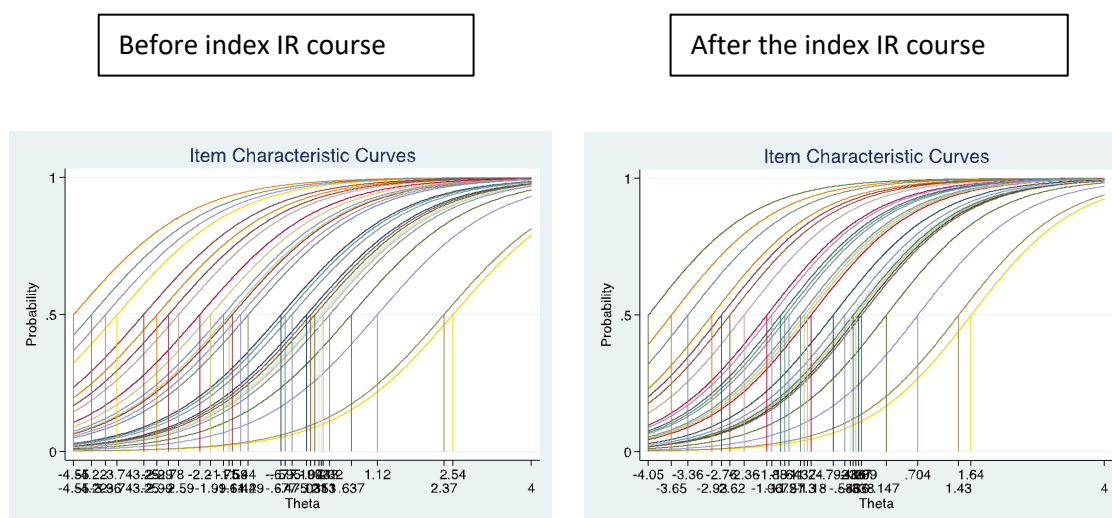
## Supplementary Tables and Figures

**Supplementary Table 1: Index IR courses and other relevant courses students have undertaken prior to the study.**

Country	University	Index Course	Other Relevant Courses
Colombia	Universidad de Antioquia (UdeA) – Héctor Abad Gómez National School of Public Health (Medellín, Colombia)	Implementation Research	Public health I, II, III, IV; Descriptive and inferential statistics; Epidemiology I, II; Demography; Multivariate statistics; Research Methods I, II, III; Epidemiological surveillance; Health economics; Biostatistics I, II.
Ghana	University of Ghana - The School of Public Health	Implementation Research	Statistics for social science; Behavioral sciences; Research methods in public health; Community mobilization for health and development; Social theories and public health practice; Theories and models of health promotion; Social epidemiology; Epidemiology; Health systems; Essentials of environment and occupation on human health; Gender and health; Health psychology; Data management and report writing; Applied medical anthropology; Population studies and reproductive health; Biostatistics; Bio-chemistry; Pathophysiology; Pharmaceutical chemistry; Clinical pharmacy;
Indonesia	Universitas Gadjah Mada, Yogyakarta - The Faculty of Medicine, Public Health and Nursing	Implementation Research	Biostatistics, Epidemiology, Social Science and Health Behaviors, Theory and Practice of Public Health, Health Policy and Management, Epidemiology, Control and Management of Tropical Diseases, Public Health Programme Management, Research Method, Infection Control, Drugs and Vaccines for Tropical Diseases, Public Health Advocacy, Environmental Health, Public Health Informatics; Zoonosis and Vector Control; and Global Health
South Africa	University of the Witwatersrand - School of Public Health	Implementation Science	Computing; Biostatistics for health researchers; Epidemiology for health researchers; Reproductive and family health; Child health; Strategic leadership; Environmental health; Health promotion and education; Health policy and management; Adapting, implementing, and evaluating evidence-based interventions;
Zambia	University of Zambia - School of Public Health	Implementation Science	Fundamentals of public health; Biostatics; Epidemiology; Health promotion; Research methods; Bioethics; Qualitative research methods; Health policy and systems management; Health economics and econometrics; Global public health; Research development and management; Survey analysis; Maternal, child health and nutrition; Social and economic

			dimensions of nutrition; Sexual and reproductive health & gender; Social and behavioral perspectives on health
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**Supplementary Figure 1: Item difficulty characteristics for the objective assessment.**



**Supplementary Table 2: Competencies gaps by country, based on students' self-assessment of IR knowledge.**

Countries	IR theme/items	Competencies (refer to appendix 1)
Ghana	<p><b>Theme 2: Scientific inquiry</b></p> <ul style="list-style-type: none"> <li>Determining applicable study designs and methods for conducting IR.</li> <li>Conducting IR in a robust and rigorous manner.</li> </ul> <p><b>Theme 3: Implementation strategies</b></p> <ul style="list-style-type: none"> <li>Synthesizing evidence to support implementation of a given intervention(s).</li> <li>Developing implementation strategies to address barriers to implementation of evidence-supported interventions and IR.</li> <li>Developing implementation strategies to address barriers to implementation of evidence-supported interventions and IR.</li> </ul> <p><b>Theme 4: Resources</b></p> <ul style="list-style-type: none"> <li>Building an IR team.</li> <li>Leveraging required resources for conducting IR.</li> </ul> <p><b>Theme 5: Communication and advocacy</b></p> <ul style="list-style-type: none"> <li>How to use information from IR</li> </ul>	<p><i>Competencies 7.1 – 7.5</i></p> <p><i>Competencies 8.1 – 8.5</i></p> <p><i>Competencies 2.1 – 2.3</i></p> <p><i>Competencies 2.1 – 2.3</i></p> <p><i>Competencies 2.1 – 2.3</i></p> <p><i>Competencies 4.1 – 4.4</i></p> <p><i>Competencies 9.1 – 9.4</i></p> <p><i>Competencies 10.1 – 10.7</i></p>
Indonesia	<p><b>Theme 2: Scientific inquiry</b></p> <ul style="list-style-type: none"> <li>Conducting IR in a robust and rigorous manner.</li> </ul>	<p><i>Competencies 8.1 – 8.5</i></p>
Zambia	<p><b>Theme 2: Scientific inquiry</b></p>	

	<ul style="list-style-type: none"> <li>Conducting IR in a robust and rigorous manner.</li> </ul> <p><b>Theme 3:</b> Implementation strategies</p> <ul style="list-style-type: none"> <li>Analysing implementation strategies.</li> </ul> <p><b>Theme 4:</b> Resources</p> <ul style="list-style-type: none"> <li>Building an IR team.</li> <li>Leveraging required resources for conducting IR.</li> </ul> <p><b>Theme 6:</b> Context and ethics</p> <ul style="list-style-type: none"> <li>Analysing contexts (health systems, implementation organization and community) affecting the implementation of evidence-supported interventions.</li> </ul>	<p><i>Competencies 8.1 – 8.5</i></p> <p><i>Competencies 2.1 – 2.3</i></p> <p><i>Competencies 4.1 – 4.4</i> <i>Competencies 9.1 – 9.4</i></p> <p><i>Competencies 1.1 – 1.5</i></p>
South Africa	<p><b>Theme 2:</b> Scientific inquiry</p> <ul style="list-style-type: none"> <li>Determining applicable study designs and methods for conducting IR.</li> <li>Conducting IR in a robust and rigorous manner.</li> </ul> <p><b>Theme 3:</b> Implementation strategies</p> <ul style="list-style-type: none"> <li>Synthesizing evidence to support implementation of a given intervention(s).</li> <li>Developing implementation strategies to address barriers to implementation of evidence-supported interventions and IR.</li> <li>Developing implementation strategies to address barriers to implementation of evidence-supported interventions and IR.</li> </ul> <p><b>Theme 4:</b> Resources</p> <ul style="list-style-type: none"> <li>Building an IR team.</li> <li>Leveraging required resources for conducting IR.</li> </ul> <p><b>Theme 5:</b> Communication and advocacy</p> <ul style="list-style-type: none"> <li>Communicating and advocating effectively throughout the IR process.</li> </ul>	<p><i>Competencies 7.1 – 7.5</i></p> <p><i>Competencies 8.1 – 8.5</i></p> <p><i>Competencies 2.1 – 2.3</i></p> <p><i>Competencies 2.1 – 2.3</i></p> <p><i>Competencies 2.1 – 2.3</i></p> <p><i>Competencies 4.1 – 4.4</i> <i>Competencies 9.1 – 9.4</i></p> <p><i>Competencies 11.1 – 11.5</i></p>
Colombia	None	None

**Supplementary Table 3: Objectively assessed IR knowledge score – Before index course.**

Country	Mean score (%)	Min score (%)	Max score (%)	Median score (%)
All (n = 166)	65.3 (63.6, 66.7)	37.5	87.5	65.0
Colombia (n = 22)	72.3 (69.3, 75.3)	62.5	87.5	72.5
Ghana (n = 37)	63.2 (59.7, 66.6)	47.5	87.5	62.5
Indonesia (n = 34)	64.5 (61.3, 67.8)	50.0	82.5	65.0
South Africa (n = 14)	68.8 (64.0, 73.5)	50.0	80.0	71.3
Zambia (n = 49)	61.8 (58.2, 65.5)	37.5	82.5	62.5

**Supplementary Table 4: Relevance of the IR core competencies framework and index IR course**

	Indonesia	Zambia	Ghana	South Africa
<b>The IR competency Framework</b>	Comprehensive and valid, represents the system; one respondent viewed other frameworks as easier to understand and more	Important and inclusive, particularly working with stakeholders.	Competencies viewed as important and	Yes, highly relevant. Communication, strategies, systems, and overall make sense – one student

	applicable (but didn't indicate which one(s)).		covered in the course.	felt they could not speak to 'scientific inquiry'
<b>Operationalization of IR competency framework</b>	IR still not very popular; Difficult to carry out and dependent on country/institution/context.	Viewed operationalization as possible. One respondent highlighted the interface between animal and human health as an area that the framework should explore.	Unclear on how operationalization applied to the framework of competencies.	Will be easy to implement the content individually but difficult to create a team knowledgeable in IR.
<b>Knowledge of IR after index IR course</b>	Overall increase in knowledge particularly in developing IR questions, planning/conducting IR, analyzing stakeholders, finding barriers and bottlenecks. Desire for more knowledge, particularly in stakeholder engagement and IR more broadly.	Increased and felt it related to current work streams.	Yes, knowledge increased and will serve to enhance other research skills as well.	Yes, improved among each student particularly in terms of process for data collection, analysis, and dissemination. Remarkated that IR is systematic and there are comprehensive frameworks for planning, implementing, and evaluating.
<b>Confidence to do IR after index IR course</b>	Most more confident post-course but desire to work with a mentor/supervisor. Some mixed reports of confidence – increased in some areas but not others.	Enthusiastically yes, and working on proposals.	Not discussed in terms of IR specifically; respondents felt more confident in intervention development and adding IR to their CVs as a skill.	Yes, has increased and this is connected to understanding processes and systems. Felt they still need to refer to course materials for theories and are in process of 'hardwiring' IR into their routine thinking.
<b>Plans to apply IR competency</b>	Felt able to apply, have plans to apply, need to identify opportunities in their workplaces. Most plans to apply IR competency for now are limited to thesis work in home countries	Yes, plan to apply IR competency via work on proposals in current workplaces and future research.	Intend to apply largely through thesis work	Limited opportunities for application yet outside of academic program. So, most plans for now are limited to dissertation studies. One respondent had initiated conversations with a project team at home country.

<b>Recommended changes to index IR course</b>	Need more time; arrange for course to be offered earlier in the postgraduate program (more time to apply)	Should be offered earlier; more time needed; more exercises and activities needed to conceptualize material.	Need to build in opportunities to learn in the field, apply knowledge; Open course to others.	More time with the material (earlier access) to facilitate absorbing material over time; suggested a network/resources to help find IR jobs.
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