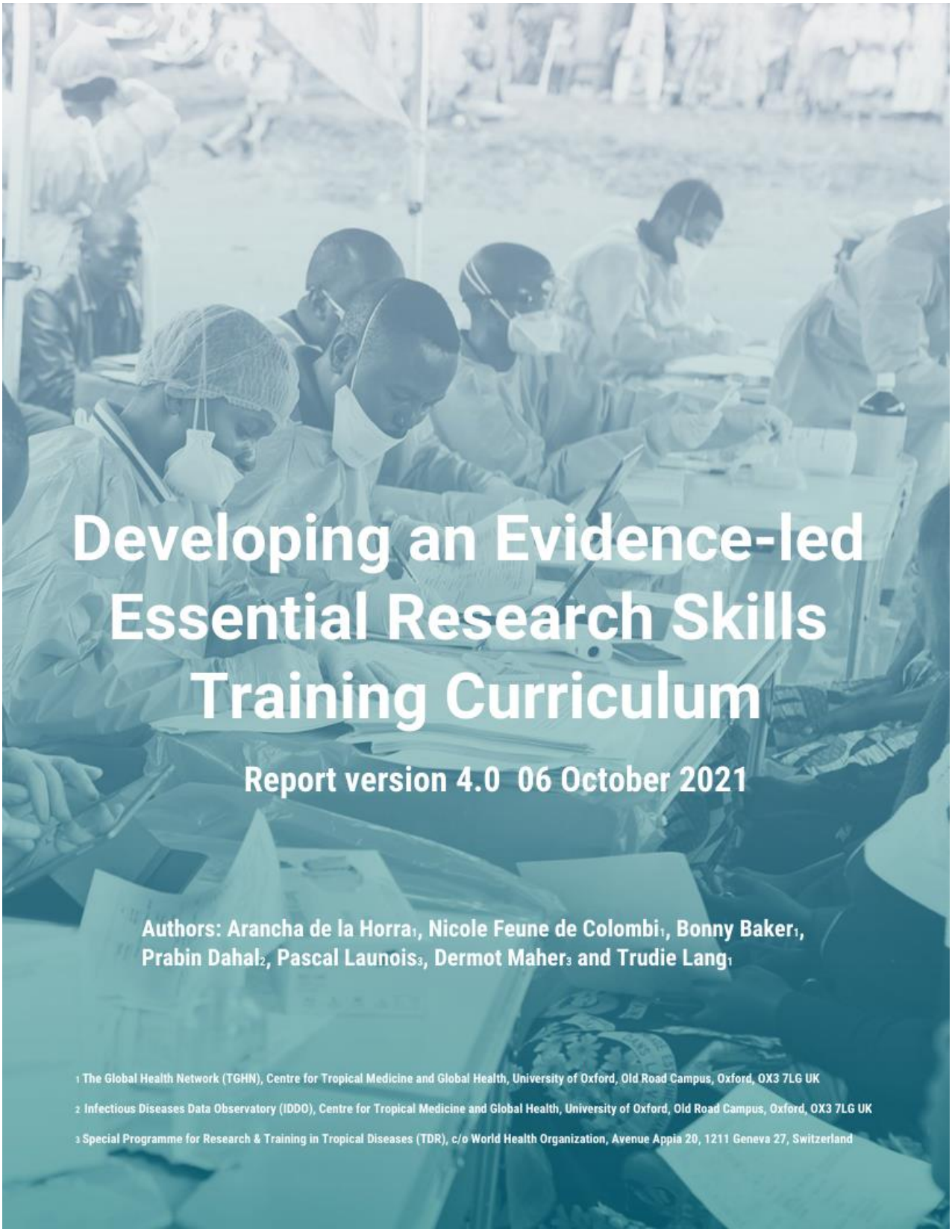

Developing an Evidence-led Essential Research Skills Training Curriculum

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Executive Summary

This study was developed as a collaboration between the Special Programme for Research and Training in Tropical Diseases (TDR) and The Global Health Network (TGHN). The aim of the Essential Research Skills Training Curriculum study is to identify the minimum set of skills, knowledge and key principles that would enable those with limited or no previous experience to undertake high-quality research for health. The study design was underpinned by a three-stage mixed methods consensus methodology to ensure an evidence-led approach for establishing this curriculum.

The Research Methodology and Findings

Stage 1: Gap Analysis

As developed through a mixed-methods consensus protocol, we conducted a comprehensive review of the responses from a series of research training needs surveys, session evaluations from research training workshops and feedback submitted on completion of e-learning, collected by TGHN from 2017 to 2019. We analysed the responses of 7176 participants from across 153 countries. This analysis provided us with a range of research skills topics and subject areas that generated a core list of 98 research-training themes.

Stage 2: e-Delphi Study

The second step aimed to find consensus on what constituted the minimum set of skills, knowledge and key principles that would enable those with limited or no previous experience to undertake high-quality health research. We conducted a two-round online Delphi study to prioritize the outcomes of the gap analysis. The Delphi panel for this study comprised both experts and stakeholders in the field of research for health and research for health training, with heterogeneous expertise and from diverse geographical regions. We sought to include views of researchers, research participants, research training facilitators, members of research advisory committees, research funders, authors of peer-reviewed research training papers, authors of research training books/programmes, journal editors, research policy-makers and regulators.

e-Delphi Round 1 - The Delphi Round 1 survey offered an opportunity for panellists to (i) indicate which of the 98 themes derived from the stage 1 gap analysis they considered essential for inclusion in the *Essential Research Skills Training Curriculum*, and (ii) suggest any themes that might have been omitted.

The themes presented were scored by the panel on the basis of two classifications: [a] relevance (should this theme be included?) and [b] clarity of each statement (is it clear what the category or theme reflected?). There were 254 members on the Delphi panel for Round 1. The panel reached consensus on 43 listed themes to be included in the *Essential Research Skills Training Curriculum*. No consensus was reached for any theme to be outrightly excluded from the proposed framework. The remaining 55 themes were re-evaluated in Round 2 (including eight themes indicated as unclear in Round 1) and alongside 10 new themes generated by panellists in Round 1.

e-Delphi Round 2 - The Delphi Round 2 survey re-evaluated the remaining 55 themes including eight themes indicated as unclear in the first round and alongside the 10 new themes generated by panellists in Round 1. For the purposes of Round 2, themes were scored using a nominal scale [yes/no] for both classifications; relevance and clarity. There were 222 panellists participating in Round 2.

At the end of Stage 2, a final list of 108 themes was generated for inclusion in the curriculum. The research team grouped the themes into 13 'parent modules' which were reviewed by the stakeholders attending the Stakeholder Review Workshop in Stage 3.

Mapping the themes- Following the e-Delphi study, the research team developed a curriculum framework by grouping the 108 themes identified by the panellists. This presented the structure of the curriculum by providing suggested 'parent modules' and the relevant themes generated and included to inform each module. These theme groupings were initially presented and evaluated at a Stakeholder Review Workshop hosted in December 2020.

Stage 3: Review and Validation Workshops

Stakeholder Review Workshop- In December 2020 we conducted a *Stakeholder Review Workshop*. This session brought together a diverse group of stakeholders from across the globe to consider the implications and applicability of the proposed Essential Research Skills Training Curriculum. The aim of this workshop was to consider the results of the study, to review the suitability of the theme groupings as an accurate reflection of the content and to evaluate the applicability of the proposed *Essential Research Skills Training Curriculum* findings to the global research community. The workshop polling exercise undertaken during the session showed substantial agreement between the Delphi panel's ratings and the opinions of the workshop stakeholders. This provided support for the acceptability of the proposed curriculum as a global standard for health research training.

Implementation Workshop- In February 2021 we organized an Implementation Workshop to seek input from global health community researchers on how best to implement this curriculum and convert it into training and teaching resources relevant for the global research community. This workshop generated broader considerations on implementation to ensure that faculty and institutions wanting to design their training around this curriculum could also benefit from evidence-led recommendations such as:

- Participants indicated a preference for learning to be delivered as interactive educational sessions, problem-based learning and discussions with facilitator or mentor alongside downloadable resources.
- Provision of certificates of completion and course endorsement by leading global health institutions are the strongest motivators for trainees.
- Providing multiple options for training delivery such as "training the trainer" resources, hands-on experience, networking opportunities, mentorship and access to experts as well as having materials available in multiple languages.
- Providing curriculum materials for trainers in module format would help the integration of this framework within existing local research training programmes. Linking the training with career development schemes and academic institutions would support the uptake of health research training.
- Embedding this curriculum in global, national and institutional outbreak response plans would guide the development of research training in such emergencies.

Conclusion and Recommendations

This project has concluded an *Essential Research Skills Training Curriculum* that is appropriate for all types of health research study and can be implemented in health care settings with little or no previous research experience. This robust and comprehensive research and consensus process has determined that if these modules are delivered to a research team then these would cover the fundamental and essential elements required to assure a well-designed, safe, ethical and high-quality study.

This process has resulted in a clear curriculum framework in the form of a set of modules that any research group, team or organization can actively use to implement and guide their training programmes. This comprehensive research study has also generated guidance on implementation so that any organization wanting to design or strengthen training programmes or courses around this curriculum can also benefit from evidence-led recommendations on what approaches will work best in their specific context.

In summary, The *Essential Research Skills Training Curriculum* is an evidence-led set of modules that has been determined through the participation of over 7000 researchers and health workers across the globe. This three-stage process concluded the development of a definitive list of modules that would serve as a curriculum that could assure delivery of the full set of steps and skills needed to undertake health research in places and settings inexperienced or new to research. This set of 13 modules covers all aspects of the research cycle including study design, conduct, analysis and reporting the findings as recommendations for policy and practice. Delivering training aligned with this curriculum framework will help promote and ensure that research should be safe, ethical and robust, and that local teams are equipped with lasting research skills, community engagement and management practices that will advance and support their careers.

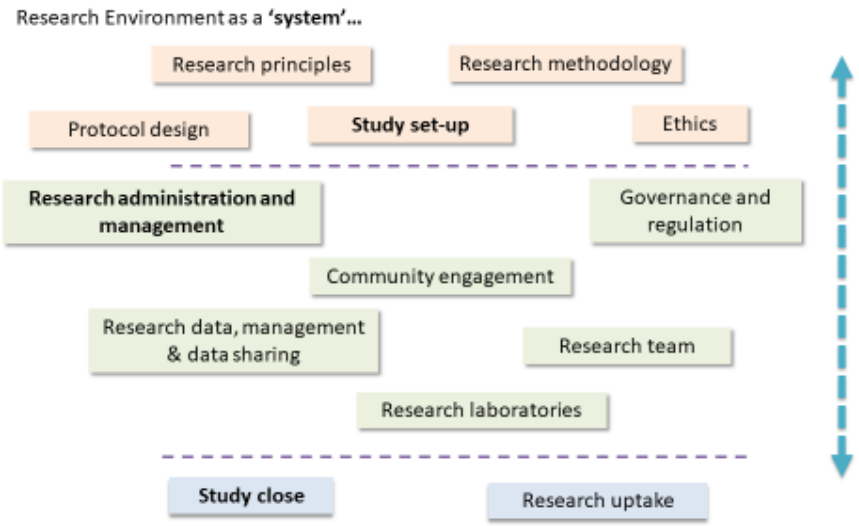

Figure 1. ***Essential Research Skills Training Curriculum*** **parent modules.**

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Introduction

This study was developed as a collaboration between the (TDR) and (TGHN). The aim of the *Essential Research Skills Training Curriculum* study is to identify what constitutes the minimum set of skills, knowledge and key principles that would enable those with limited or no previous experience to undertake high-quality research for health. The study design was underpinned by a three-stage methodology to ensure an evidence-led approach for establishing this curriculum.

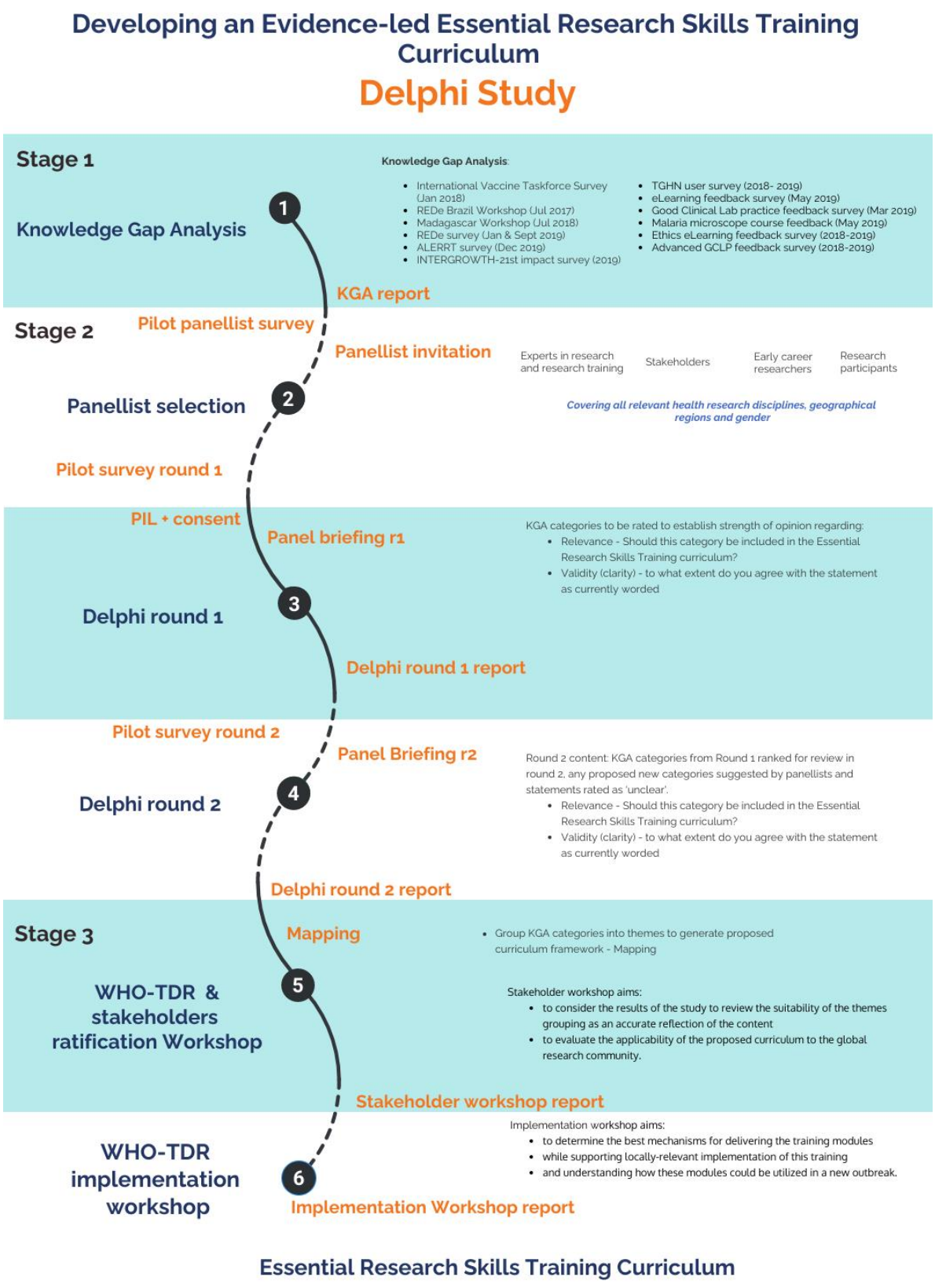

Figure 2. Developing an evidence-led *Essential Research Skills Training Curriculum* study stages

Study Stage 1: Research Training Gap Analysis

Introduction

A gap analysis was developed to identify the key perceived 'gaps' in health and laboratory research capacity across low- and middle-income countries. This step therefore sought to determine the capacity that currently exists across these settings, as well as detect and understand the pressing training needs and skills gaps. This analysis would further inform a series of recommendations for how such issues could be best addressed. It would also guide the development of the Essential Research Skills Training Curriculum and materials to enable day-to-day research. As Stage 1 of this study, the gap analysis sought to gather a broad range of data to accurately and meaningfully inform the subsequent stages.

Guided by a mixed-methods consensus protocol, we conducted a comprehensive review of the responses from (i) a series of research training needs surveys; (ii) session evaluations from research training workshops; and (iii) feedback submitted on completion of e-learning, collected by TGHN from 2017 to 2019. We analysed the responses of 7,167 participants from across 153 countries. This analysis provided us with a range of research skills topics and subject areas that generated a core list of 98 research-training themes.

Methods

To meet the aims of the gap analysis, it was important to identify and assess the barriers and enablers that exist in relation to training, as perceived by individuals and organizations that use and partner with TGHN. Essentially, this explores the drivers or factors that facilitate or prevent health care professionals and academic communities from participating in high-quality health research studies. From this step, a formative list of research-training themes was generated that will be examined, assessed and honed in subsequent stages of the study (2-round e-Delphi and review and validation workshops) to determine the framework for the *Essential Research Skills Training Curriculum*.

For the gap analysis, an exploratory approach was used, combining and analysing diverse data from multiple source points across TGHN. This included data collected from visitors and users of the online platform, as well as researchers attending in-person training, skills-sharing and capacity-strengthening workshops. Collectively, these data sources would assemble a picture of the existing research capacity, the established skills gaps, and what determinants are needed to enable high quality health-related research studies.

Data collection:

Multiple sources were used to collect data from global research communities that would inform (i) the levels of capacity and experience in research competencies; (ii) previous training undertaken; (iii) perceived knowledge and skills gaps in research; and (iv) delivery modes for capacity strengthening initiatives. This stage in the study employed a mix of online surveys and questionnaires, featuring self-assessment ranking questions coupled with open-ended questions that asked users and partner organizations of the Network about their research experience (including current roles, types of research, previous training, experiences and perceptions).

Data was collated at different times and from different geographical regions as shown in Table 1.

Table 1: Source surveys and questionnaires used to collate data.

Survey	Questions	Data collection timeline	Target audience
Research Capacity Network (REDe) Network *online survey*	Self-assessment ranking questions & open-ended questions	1–30 January & 1–30 September 2019	REDe consortia members (Latin America & Caribbean)
African Coalition for Epidemic Research, Response and Training (ALERRT) Network *online survey*	Self-assessment ranking questions & open-ended questions	1 September 2019–30 January 2020	ALERRT consortia members (Africa)
International Vaccine Task Force survey	Self-assessment ranking questions & open-ended questions	1–30 January 2018	Research communities and members from across TGHN. Designed by TGHN and the Task Force.
Developing Clinical Trial Capacity in Madagascar Workshop *(questionnaire)*	Open-ended questions	1–30 July 2018	Participants to a workshop organized and hosted by Institute Pasteur Madagascar & TGHN in Madagascar.
Capacity Assessment for Research Development Workshop *(questionnaire)*	Open-ended questions	1–30 July 2017	Participants to a workshop organized and hosted by ZIKAction study sites and TGHN in Brazil.
The Global Health Network user feedback survey *(online survey)*	Open-ended questions	Jan 2014–Sept 2019	TGHN platform users. The survey algorithm samples every ninth person who visits the platform.

The Global Health Network online courses feedback surveys *e-learning general survey* *Good Clinical Laboratory Practice (GCLP) survey* *Malaria Microscope survey* *Additional advanced Good Clinical Laboratory Practice (GCLP)* *Ethics survey*	Open-ended questions	 1–30 May 2019 1–30 March 2019 1–30 May 2019 1 January 2018–30 December 2019 1 January 2018–30 December 2019	TGHN users upon completion of a set of e-learning short courses. Data was collected at different time points according to each survey.
Intergrowth-21st Impact Assessment survey	Open-ended questions	27 February–31 March 2019	TGHN users and members of the Intergrowth-21st Hub.

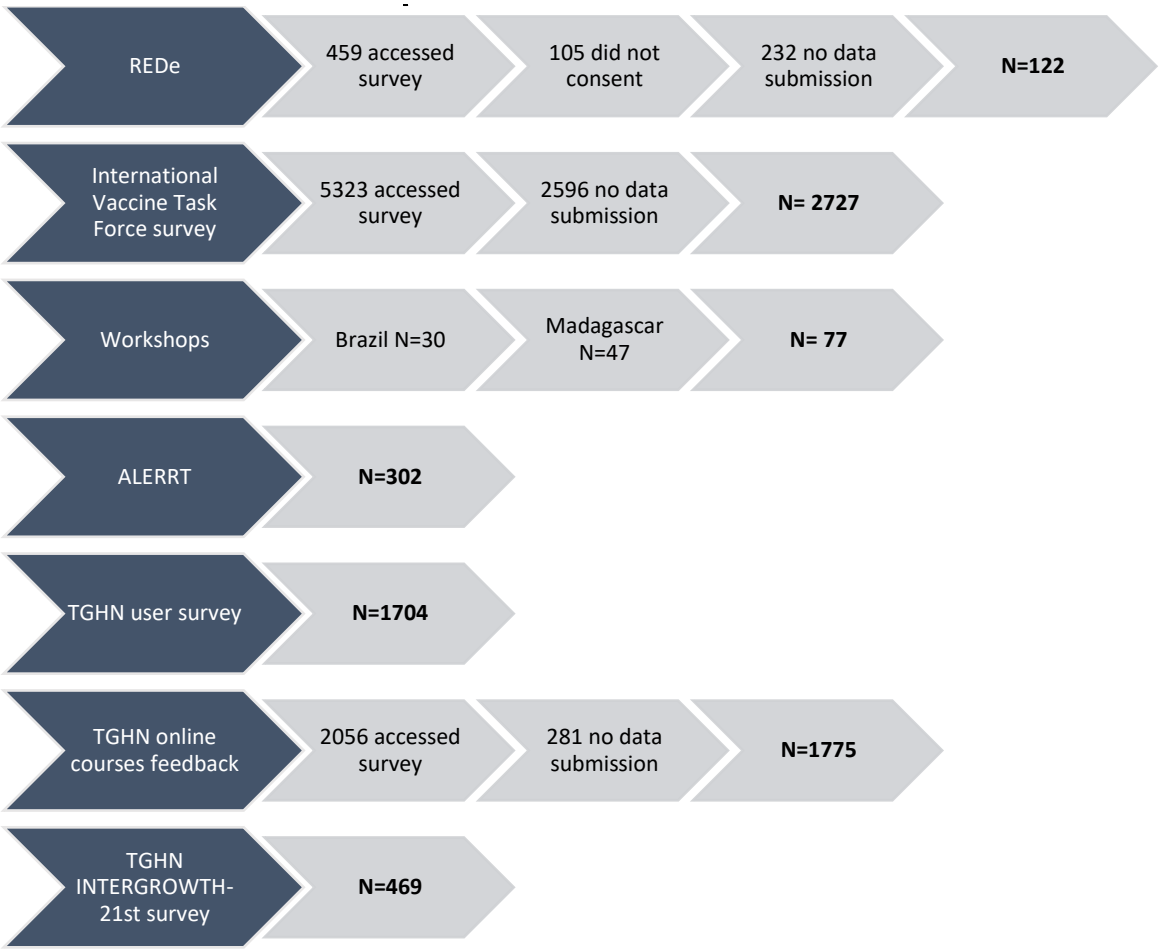

Figure 3. Surveys' response numbers included in research training gap analysis.

Survey tools for data collection included Lime Survey and Jisc (Joint Information Systems Committee), both of which were (at the time) open source and University of Oxford-approved instruments. These two tools were used to collect data to inform the survey exercises described in Table 1. The two questionnaires were designed and developed using Lime Survey, and then issued as paper-based versions during the corresponding workshop sessions.

Before disseminating to target audiences, the surveys were both piloted and validated. In response to feedback necessary adjustments were made and links to the electronic surveys (Lime Survey and JISC) were emailed and promoted through the platform to members of TGHN. Each survey had an introductory page providing information on the aim of the exercise and how the data collected through the survey would be used, and for what purpose. Participation was clarified as voluntary, with the right to withdraw at any time. All participants involved in the study provided informed consent. Ethical approval for the study was obtained from the University of Oxford, UK (OxTREC Reference: 543-17 & 541-18).

Where necessary, paper-based questionnaires used in workshops were transcribed into electronic format by a member of TGHN. Responses to all surveys and questionnaires were subsequently downloaded into an Excel worksheet for analysis. For both the purposes of data collection and analysis, all data was anonymized, password-protected and access was restricted only to the study team. The electronic

databases and backups are all held within the Medical Sciences Division (MSD) of the University/University-owned, Oxford servers. The full list of survey questions is available in Appendices 1 -7.

Data Analysis:

Quantitative data from the multiple survey sources were analysed using Microsoft Excel. As the surveys were developed with different purposes and across different time frames, the data was not standardized and not all variables could be comprehensively merged for direct comparison. Therefore, basic descriptive analysis was employed including percentage and summary statistics to identify trends.

Open-ended questions from across the suite of surveys were compiled, combined and analysed collectively. Thematic data analysis was guided by the method described by Creswell (2018) and followed iterative frameworks proposed by Braun and Clarke (2006). The initial analysis highlighted 'significant statements'. Inductive coding allowed for a data-driven thematic process to help remain true to the purpose of the surveys. The codes used emerged from the data and were refined in an iterative process of coding, comparing and refining. Themes were defined and named according to the overall 'essence' with recognition of subthemes and final categories. This analysis was facilitated using the NVivo qualitative data analysis package (QSR International Pty Ltd, V.9, 2011).

Results

Demographics:

A total of 7176 individuals, from at least 153 countries, completed these surveys and contributed to the data collection as detailed above. Participants from the Global South accounted for over 80% of the responses, as illustrated in Figure 4. Survey participants represented broad research demographics, covering a wide range of job roles (including junior and senior posts) and multiple research disciplines. Various types of establishments and affiliations were reported, demonstrating that the views, skills and concerns of researchers from different sectors and industries were represented.

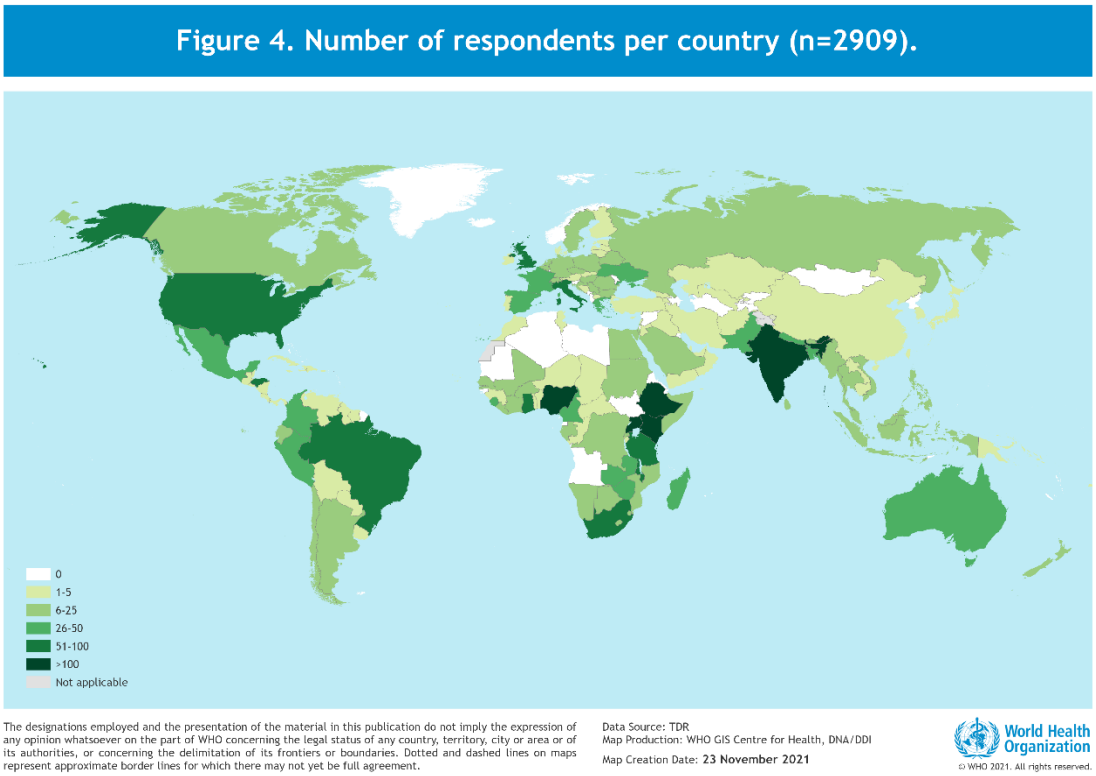

Figure 4. Number of respondents per country (n=2909). Global South strongly represented with 54% of respondents from Africa, 12% from Latin America and the Caribbean, 2% from Oceania and 13% from Asia. From the remaining respondents, only 3% were from North America and 16% from Europe.

This map includes data from the International Vaccine Task Force survey, REDe, ALERRT and from the workshops as detailed in Figure 3. Not all participants provided country data. No country of origin/work data was available from TGHN user feedback survey and TGHN online courses feedback surveys.

Job roles:

The results as illustrated in Figure 5, indicate the diverse range of research positions reported worldwide. The participating respondents span multidisciplinary roles within a research project, as well as hold varying levels of seniority. A number of respondents also selected more than one option, indicating that they hold more than one role at that current time.

When overlaid with geographical region, it was interesting to note that participants across Africa and Asia strongly indicated roles related to the field of public health and public health professionals. Whereas, in North America there was a dominance among participants from industry-led positions. Alternatively, in Europe and across Latin America and the Caribbean, the roles of investigators were significantly reported. Across all continents, there is a notable lack of respondents from backgrounds including health care workers, data managers and laboratory staff.

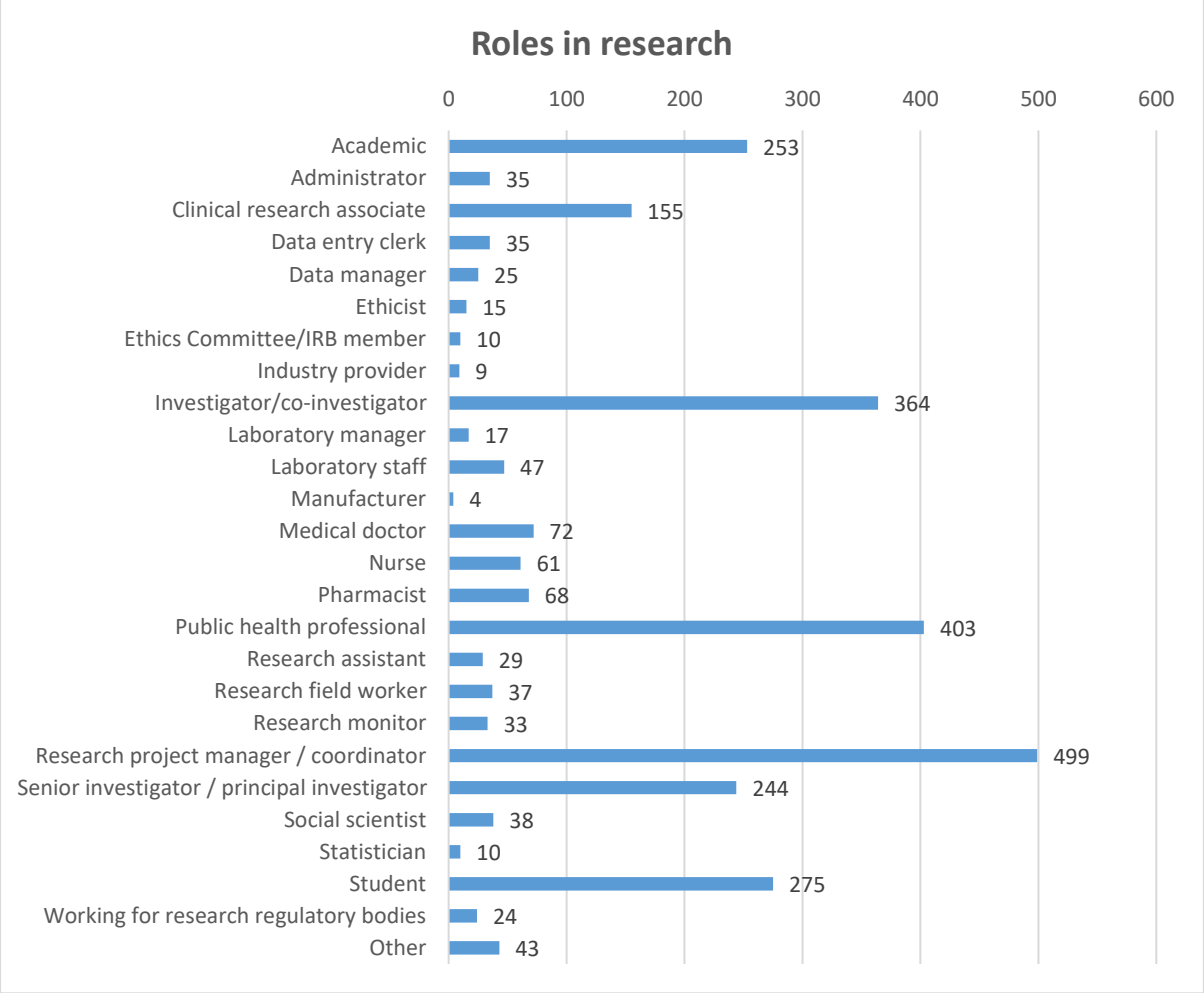

Figure 5. Roles in research as reported by participants (n=2805)

No data on roles in research was available from TGHN user feedback survey and TGHN online courses feedback surveys.

Type of establishment:

The participants reported working across different sectors and industries involved in research, with significant representation from respondents based in public hospitals, as can be seen from Figure 6.

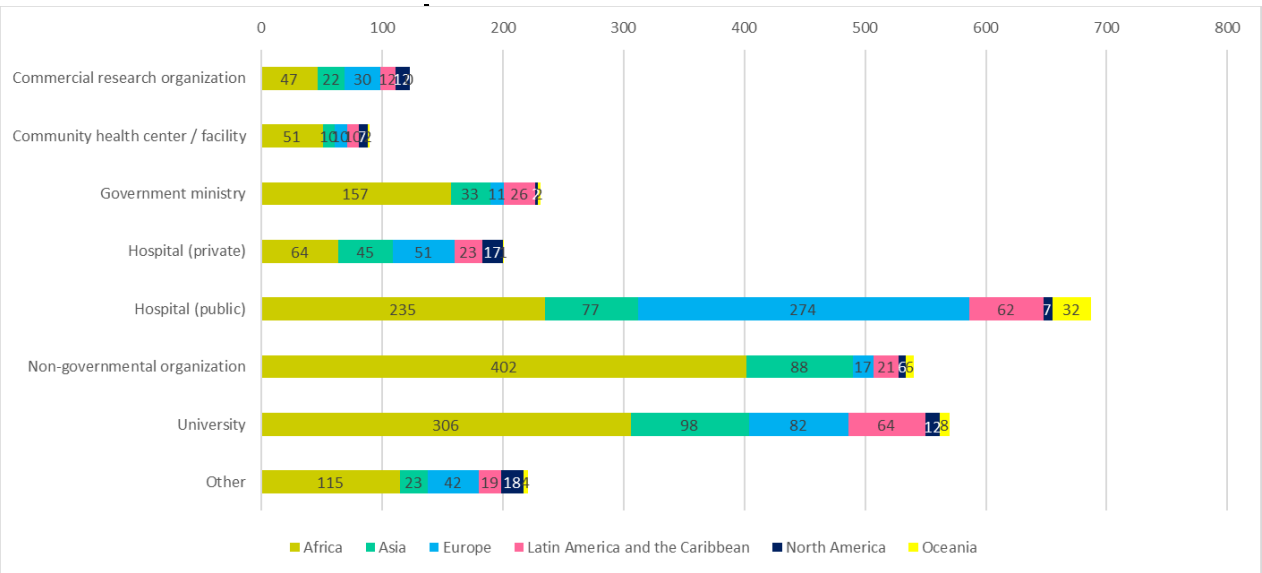

Figure 6. Type of establishment participants are affiliated with (n=2663)

It is important to highlight that non-governmental organizations and private hospitals registered as the most prevalent among respondents from the African and North American regions respectively. Comparatively, community health centers were least represented across all regions. No data on establishment affiliation was available from TGHN user feedback survey and TGHN online courses feedback surveys.

This figure includes data from the International Vaccine Task Force survey, REDe, ALERRT and from the workshops thus conducted. Not all participants provided data on type of work establishment and this question was neither included in TGHN user feedback survey nor on TGHN online courses feedback surveys.

Types of studies:

Across various survey exercises, participants were asked to indicate the type of research studies they were involved with, whereby more than one type of study could be selected (Figure 7).

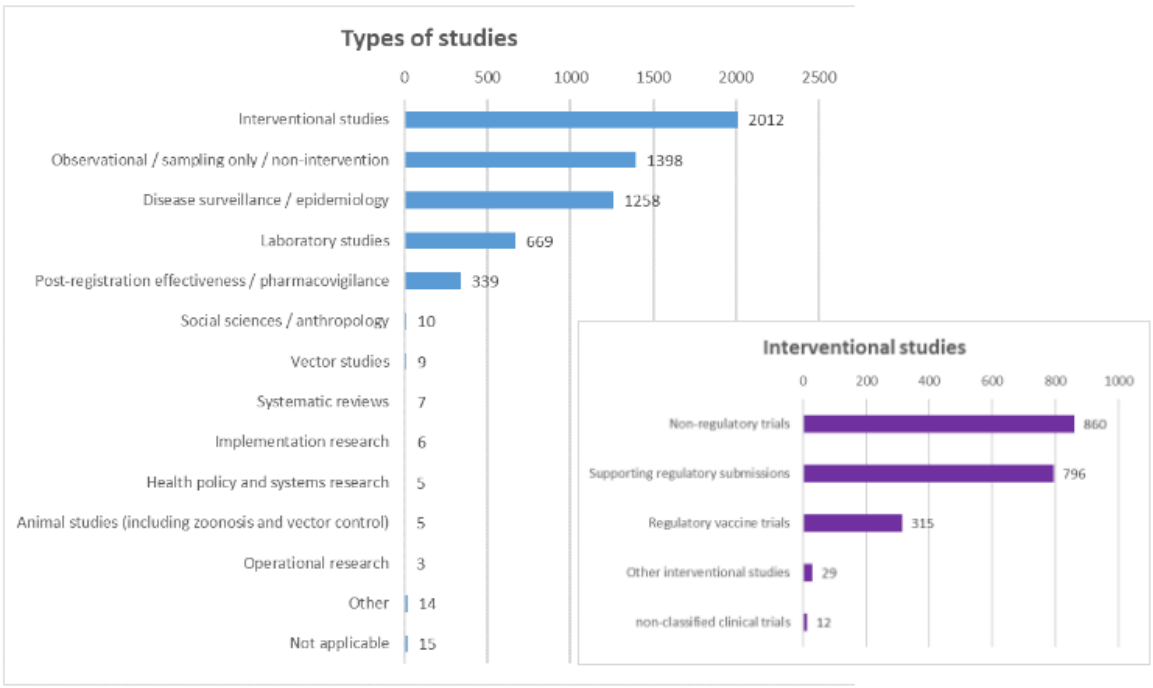

Figure 7. The type of studies and research methods in which participants have experience

It is important to highlight that half of the data that informs this question is drawn from the International Vaccine Task Force survey, which specifically addressed the capacity that exists for clinical trials, to the exclusion of other study types. This biases the results, to a degree, as illustrated in Figure 7.

From a geographical perspective, clinical trials prevailed in the African and European regions whereas surveillance and observational studies were more common in Latin America and the Caribbean, Oceania and Asia. Other study types included operational research, implementation research, public health research, monitoring and evaluation studies, economic studies and translational research among others.

Research experience:

Within the survey exercises, we queried research communities about their expertise in conducting research by providing a list of research competencies to be ranked, using a scale ranging from no experience to highly experienced. Overall, a considerable proportion of participants emphasized that they lacked experience regarding Clinical research laboratory set up and operational management (59%), Clinical trial design (57%) and Clinical trial set-up/operational management (54%). As illustrated further in Figure 8, respondents felt equally lacking in competence with both Biostatistics and Regulatory complianc", with 53% of respondents reporting little to no experience across both fields. For these values no experience, minimal experience and little experience were combined.

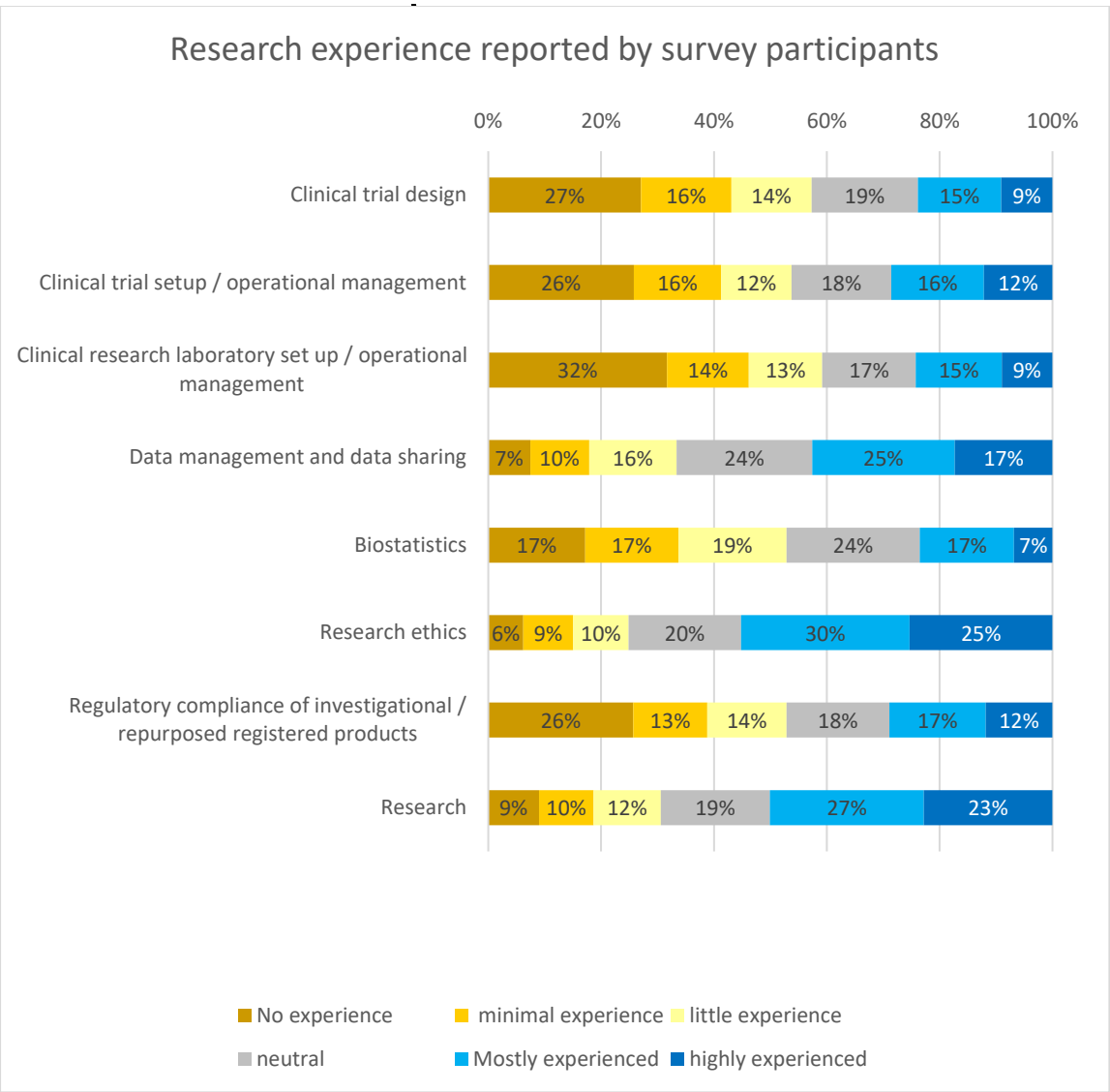

Figure 8. Research experience and competence reported by respondents. Data from the International Vaccine Task Force Survey (n=2727).

In contrast, it is important to note the concepts and skills areas in which participants reported strength and more significant levels of experience. Most notably, this is apparent with 55% of respondents reporting proficiency in "*Research ethics*", with a further 50% and 42% ranking themselves as "mostly experienced to highly experienced" in the fields of "*research*" and "*data management and sharing*", respectively.

Although not directly captured in Figure 8, the ALERRT Network survey (a purpose-designed survey for researchers across the sub-Saharan African region) included and queried researchers across more research domains. As clearly indicated by the results, skills sets and profiles reflecting community engagement, the use of database software, Data management systems and Protocol development emerged as significantly strong fields.

Training needs:

Most respondents honed in on the need to address specific shortfalls in knowledge and skills. Participants explained that in their settings there is an absence of research training centers and no access to materials, tools or platforms, resulting in a situation where they feel unprepared and lacking in opportunities to develop professionally. Furthermore, many participants felt outdated with current practices, techniques and guidelines. This was particularly apparent from respondents across Latin America, where even though 37% of the participants (n=40) acknowledged having received previous training, only two participants and less than 20% of the sample felt "sufficiently trained" and "satisfactorily qualified" respectively in all given research competencies.

In addition to the quantitative data capture, the open free-text answers within the qualitative data from the surveys helped to further clarify what areas training efforts should address and focus on. The elaboration of research problems and the correct use of methodologies was emphasized by students and early career researchers, including identifying scientific gaps and developing the research question. Regarding the "know-how" and selection of suitable methods, training in both quantitative and qualitative research methods were requested. Other research types like implementation research and health system research were also mentioned.

Protocol development was stressed across a wealth of respondents. The need for acquiring "writing techniques" was strongly communicated throughout with a request for, "tutorials on how to make a research proposal" and the provision of "recommended formats" in order to properly plan and formulate successful research protocols.

Laboratory set-up and operational management was significantly stressed by those working in the field of clinical trials. The lack of technical skills for sample handling and appropriate use of reagents and equipment were considered a strong deterrent. Such respondents also mentioned the need to strengthen quality assurance activities in their research laboratories, requesting training directed at ways to enhance Quality Management Systems and impart knowledge on Standard Operational Procedures (SOPs).

The domain of data management also featured, whereby respondents mentioned the need for "Training in survey-management", that emphasizes "relevance" and "quality of data". Resources supporting the creation of data collection tools and active data collection, including qualitative methods such as focus groups were ardently requested. Respondents also appealed for "basic data analysis tools with information on when to use what", instructed in the simplest terms possible. There was a strong emphasis on "identifying appropriate methods of statistical analysis for particular study design" and the need to improve experience with data management software, which would enable day-to-day data analysis.

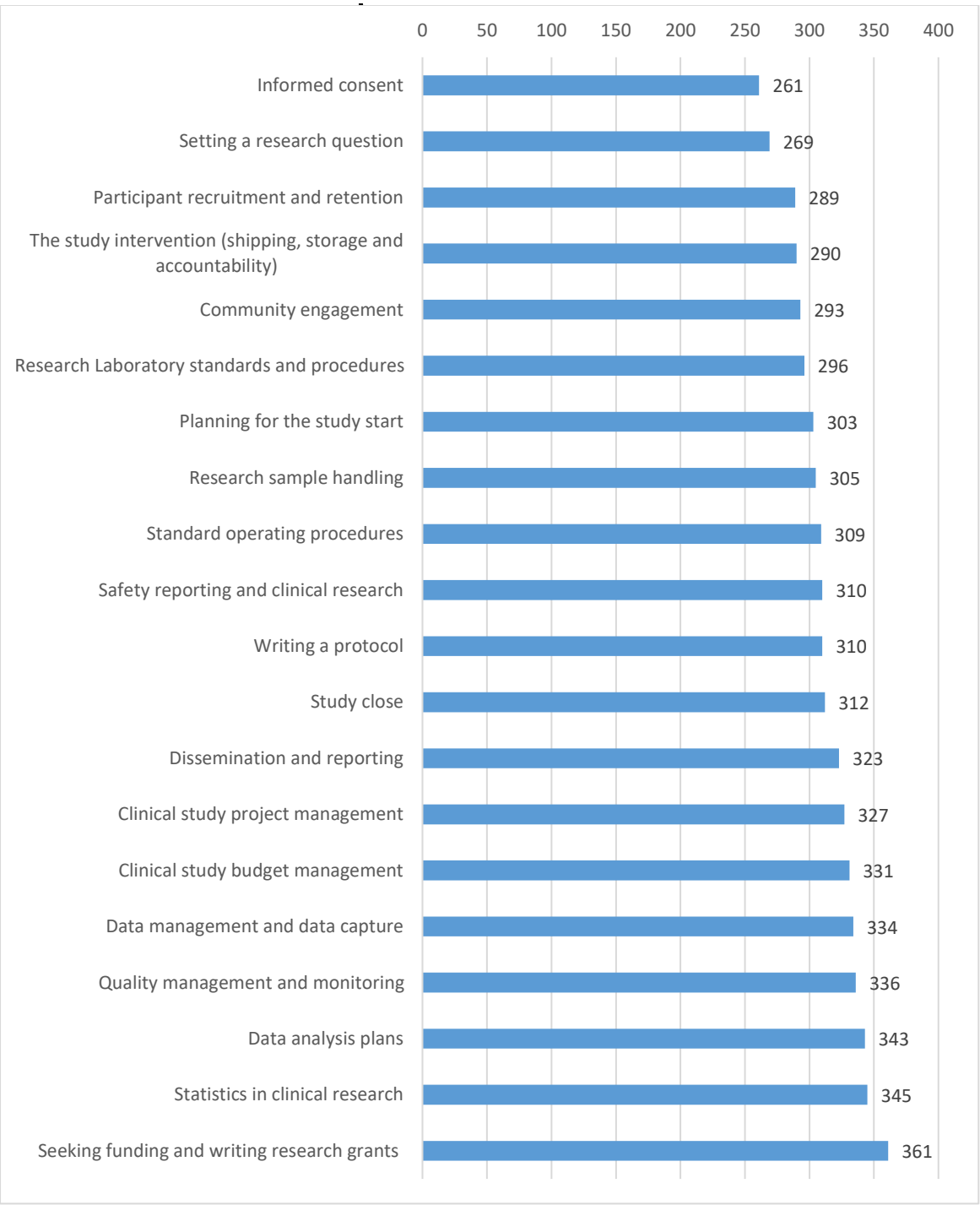

Figure 9. The areas of the research cycle in which respondents indicated a need for further training. Seeking funding and writing grants registered particularly highly, followed by data analysis plans, data management and aspects of data capture. Data obtained from REDe survey priority scores on research areas (n=122).

In addition to data handling, respondents expressed concerns with data exchange and asked for training around "regulation of database usage". They also honed the need for capacity building on other regulatory frameworks and existing guidelines, both national and international. Participants

explained that the main challenge is that "developing countries do not respond to required international norms" and that these varied from country to country.

Participants also recognized that most of the time "people are often taking this [ethics] for granted" and requested tailored training regarding biological sampling and working with vulnerable populations. Community engagement was also emphasized as pertinent in helping to effectively translate research results into practice.

Broader research skills:

Amongst responses, there was also a strong demand for training and support in broader research skills and domains, which spanned broader than the conventional and technical components widely recognized. The lack of available funding was considered a strong deterrent. Budget management skills such as how to write a study budget, development of sustainable and low-cost projects and better business sense to attract more research emerged substantially in relation to good management of fiscal resources in order to show accountability, and therefore attract future funding. Respondents also requested mentorship on how to draft grant proposals and highlighted the need to acquire writing skills.

A range of areas where respondents felt they would improve the clinical trial setup/operational management of the studies were discussed. Project management skills were considered critical: "*Better developed leaders and better communication skills so that resources, projects and research are managed well and that staff are kept motivated and treated with respect"*. According to participants, to date there is a lack of trial coordination because "*there are no courses on trial management and this is self-learnt*". To become a successful project manager, respondents specifically mentioned the need of people management skills and to know how to develop effective research teams. Communication, critical thinking, networking and leadership were also mentioned as a must to enable research by influencing at institutional level and developing effective research teams.

Respondents also emphasized the need for help in publishing the already researched work, with support in scientific writing writing abstracts and impactful conclusions and recommendations as well as referencing and the use of citation tools. Finally, researchers also refer to the importance of translating research results into practice with regard to policy-makers and within healthcare settings. For this they have suggested courses on how to write policy formulations and reviews.

Themes

This list of themes has been derived directly from the quantitative and qualitative data reported above, and covers a wide range of research skills topics and subject areas.

Table 2. Themes identified in the research training gap analysis.

Ability to communicate and meet with funders.
Attrition bias and prevention methods.
Audit.
Best practices regarding referencing and plagiarism.
Budget management.
Building trust within a team.

Building your career in research.
Calculation of participant sample size and sample power.
Clinical trials.
Communicating research to different populations—general public, scientific community (public speaking).
Community engagement principles and activities, starting from the beginning of the research cycle through to feeding back research results to communities.
Concept of research for health.
Critical thinking in research.
Data analysis software (qualitative and quantitative).
Data collection tools (for example, designing surveys and CRF's), advantages and disadvantages.
Data management systems.
Data presentation.
Data sharing best practices and governance (including security confidentiality and privacy of R data/legal precedents for DS/intellectual property rights).
Definition of quality data.
Definition of randomization and methods.
Definition of vulnerable populations and ethics of working with these populations.
Developing effective research teams with named roles and responsibilities for team.
Development of a research objective and a research question/formulating a hypothesis.
Development of Standard Operating Procedures (SOPs).
Epidemiological studies.
Ethical issues related to biological samples.
Ethical issues related to genetic procedures.
Ethical practices around data handling/management.
Experimental research.
Good Clinical Practice (GCP).
Good Clinical Laboratory Practice (GCLP).
Good Participatory Practice (GPP).
Governance and regulation.
Handling and negotiating with a range of stakeholders.
Health economics and economic evaluations.
Health policy and systems research.
How to form a research agenda.
How to manage expectations of study communities.
How to search for secondary datasets in different databases.
How to translate research results into policy (policy formulation and reviews)
How to translate research results into practice within healthcare settings.
Identifying a research gap.
Identifying research participants and selection criteria.
Identifying various funding agencies/sources.
Implementation research.

Influencing at institutional level to enable research.
Informed consent and assent (definitions, how to write/formulate consent forms and various tools to communicate with participants).
Laboratory biosafety and how to manage hazards.
Laboratory management.
Laboratory quality best practices.
Laboratory safety practices.
Laboratory sample handling and storage.
Laboratory standards and regulations.
Leadership in research.
Leading and managing complex research groups.
Mathematical modelling.
Meta-analysis.
Methodology research (research on research).
Mixed methods research.
Monitoring and evaluation.
Networking and how to create collaborations.
Operational research.
Participant 'loss to follow-up'.
Participant's confidentiality and privacy.
Participants' retention strategies.
Pharmacovigilance principles and reporting adverse effects.
Professional guidelines and codes of ethics which apply to the conduct of clinical research (including principles of benevolence, non-maleficence etc).
Qualitative analysis (including, for example, thematic content analysis).
Qualitative data collection methods (including the concept of triangulation).
Qualitative methodologies (including epistemology and ontology).
Qualitative sampling methodologies.
Quality assurance systems.
Quality management systems.
Quantitative data collection methods.
Quantitative methodologies.
Quantitative sampling methodologies.
Research designs for outbreaks.
Research project management and planning.
Research time management.
Scientific writing for journal publications (including how to write abstracts).
Security issues during data collection and how to manage risk.
Selection of control groups for comparison purposes.
Setting up a research laboratory.
Setting up an ethical review board or committee.
Social sciences and anthropological studies.

Specific laboratory techniques and equipment handling.
Statistics.
Steps to conduct a literature review (including bibliographic search).
Storage of research materials.
Study close (archiving data, sample storing, notification of closure processes).
Study reporting procedures skills and best practices.
Study set-up.
Teamwork.
Understanding the difference between health research and standard of care, audit, evaluation.
Use of citation tools (that is, Mendeley).
Writing a grant application and/or grant proposal.
Writing a research protocol — the why and the how (deviations, amendments, how to prepare and then defend protocol).
Writing a study budget.

Summary and next steps

Through data collection and analysis afforded by this first stage of the study, a comprehensive list of 98 research-training themes has been generated. This list of themes is critical to the subsequent stages in the study, and will now be processed through a two-round e-Delphi. The Delphi panel will determine which of these 98 themes are considered essential for inclusion in the *Essential Research Skills Training Curriculum*.

Study Stage 2 – e-Delphi study

The second step of this study aimed to find consensus on what constituted the minimum set of skills, knowledge and key principles required to enable those with limited or no previous experience in research to undertake high-quality health research. We conducted a two-round online Delphi study to prioritize the outcomes generated from the gap analysis in Stage 1.

The study followed the Delphi method, which is a way of combining the views of multiple experts to reach agreement on a subject. The Delphi technique is a consensus building method that gathers experts to discuss issues. The process goes through a series of cycles. In each cycle, a panel of experts is presented with a set of statements to rate followed by feedback, which is then given that shows how each individual's ratings compare with the whole group. One of the main advantages of the Delphi technique is that a large number of individuals across diverse locations and areas of expertise can be included anonymously, thus avoiding domination of the consensus process by one or few experts (de Villiers et al, 2005).

As well as quantitative ratings, open-ended comments can be included at the rating stage and reported to all panel members. The process is anonymized. This means everyone gets a chance to have his/her views considered, without senior individuals or forceful personalities dominating (Hsu and Sandford, 2007). The Delphi can be run online. This facilitates international collaboration and gives people time to respond as per convenience.

Taking part as a panellist involved completing two online surveys over a period of 12 weeks, beginning in February 2020. Participation in the study was voluntary and panellists could withdraw at any point. The surveys were distributed through Jisc online surveys. In the first round, panellists were asked to rate their level of agreement for including the listed themes in the Essential Research Skills Training Curriculum. In the second round, panellists were provided with a summary of how the rest of the study participants had rated each item in Round 1 and given an opportunity to change their answers if they so wished. Each of the two surveys took approximately 30 minutes to complete.

e-Delphi panel

The Delphi panel for this study was constituted by both experts and stakeholders in the field of research for health and research for health training, with heterogeneous expertise and from diverse geographical regions. We sought to include views of researchers, research participants, research training facilitators, members of research advisory committees, research funders, authors of peer-reviewed research training papers, authors of research training books/programmes, journal editors, research policy-makers and regulators.

We identified potential panellists using two methods: crowd sourcing and targeted invitation. A survey to register interest in participating in the Delphi study was launched between February and March 2020. The full survey is listed in Appendix 8. We received 594 expressions of interest from the crowd sourcing survey and, additionally, we invited 63 research experts from within collaborating partners and networks with TGHN.

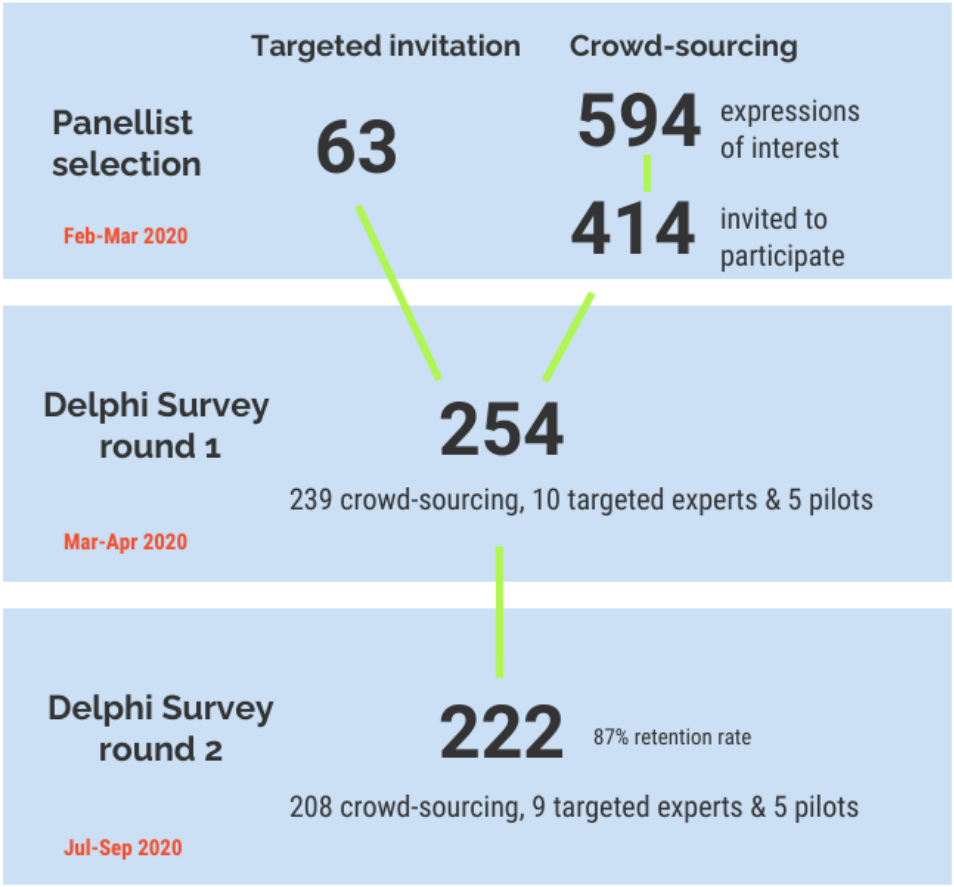

Figure 10. Delphi panellists' participation flow.

Based on their research expertise we invited 414 respondents and we had 254 (61%) responses completing Delphi Round 1 survey. Given that the first Delphi survey was completed by 254 panellists and the second by 222, this provided an 87% retention rate, which we especially appreciated considering the surveys' timing and the difficulties that the COVID-19 pandemic had been causing around the world. We conducted pilots for both Delphi rounds.

The panellists and members of the pilot group who completed both Delphi surveys formed the Process for Developing an Evidence-led Essential Research Skills Training Curriculum Consortium. Membership of the Process for Developing an Evidence-led Essential Research Skills Training Curriculum Consortium is provided in Appendix 11.

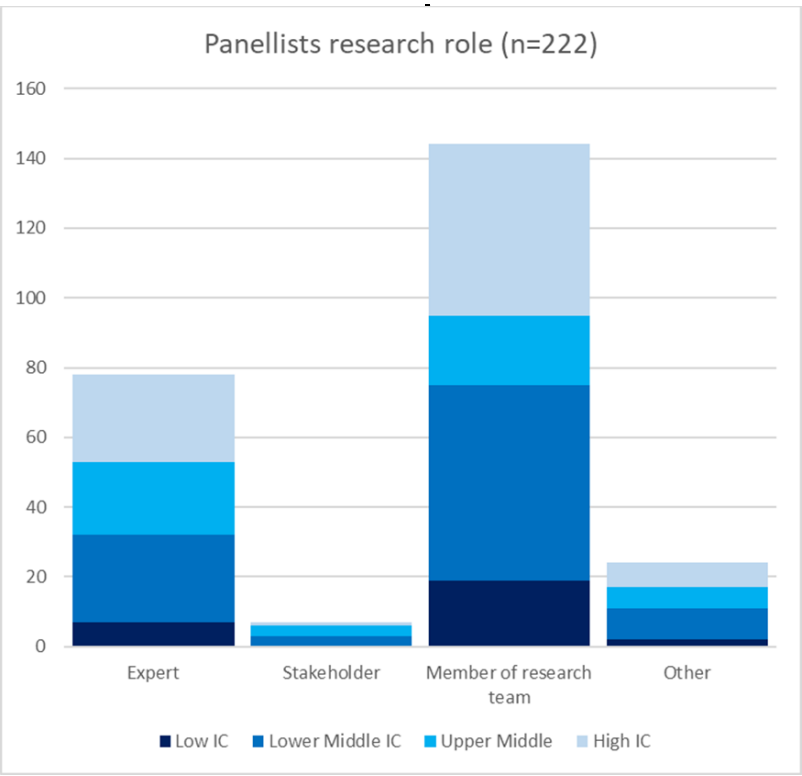

Figure 11. Distribution of the different panellists' research roles against their country of work classification by World Bank Income groups.

This figure illustrates the distribution of the different panellists' research roles correlated with their country of work classification established by World Bank Income groups (2019). To facilitate interpretation, we grouped the panellists' current roles into four categories: expert, stakeholder, member of research team and other.

- *Experts'* category included clinical research associate, investigator/co-investigator, provider of research training, academic, senior investigator/principal investigator and research writer (about research training).
- *Stakeholder* category included ethicists, ethics committee/IRB member, working in research policy, working for research regulatory bodies, working for research funding organization, industry provider, manufacturer and journal/publishing staff.
- *Member of a research team* category included consultant, researcher, data entry clerk, data manager, nurse, midwife, medical doctor, administrator, research monitor, pharmacist, public health professional, laboratory manager, laboratory staff, research project manager/coordinator, research assistant, research field worker, statistician and health care assistant/or other hospital support staff.
- *Other* category included research participant, student and self-described as 'Other'.

e-Delphi Study Round 1

This section reports the findings following the first round of the *Process for Developing an Evidence-led Essential Research Skills Training Curriculum Delphi study*.

The Delphi Round 1 survey was launched between March and April 2020. This first Delphi survey offered an opportunity for panellists to indicate which of these themes they considered essential and should be included in the *Essential Research Skills Training Curriculum*.

Themes were scored on Likert scales on two dimensions:

[a] relevance (*should we include this category/skill at all*?) scored in a 7-point Likert scale (completely disagree, mostly disagree, slightly disagree, undecided, slightly agree, mostly agree and completely agree)

[b] clarity of each statement scored on a 2-point Likert scale (yes/no)

The level of consensus required to include themes in the *Essential Research Skills Training Curriculum* was defined as more or equal to 85% of responses that could be classified as 'mostly agree' and 'completely agree'. The level of consensus required to exclude themes in the *Essential Research Skills Training Curriculum* was defined as more or equal to 85% of responses 'mostly disagree' and 'completely disagree'. Acceptable statement clarity was set to ≥ 80%. Any statement's clarity below 80% was set to be re-defined and re-evaluated in Round 2.

Panellist

A multidisciplinary group of 254 panellists was enrolled in the Delphi, with an average age of 39 years, with 44% of the sample male and 56% of the sample female. The average length of research experience reported is 12 years. Panellists' experience in research and research training was self-reported as shown in Figure 12.

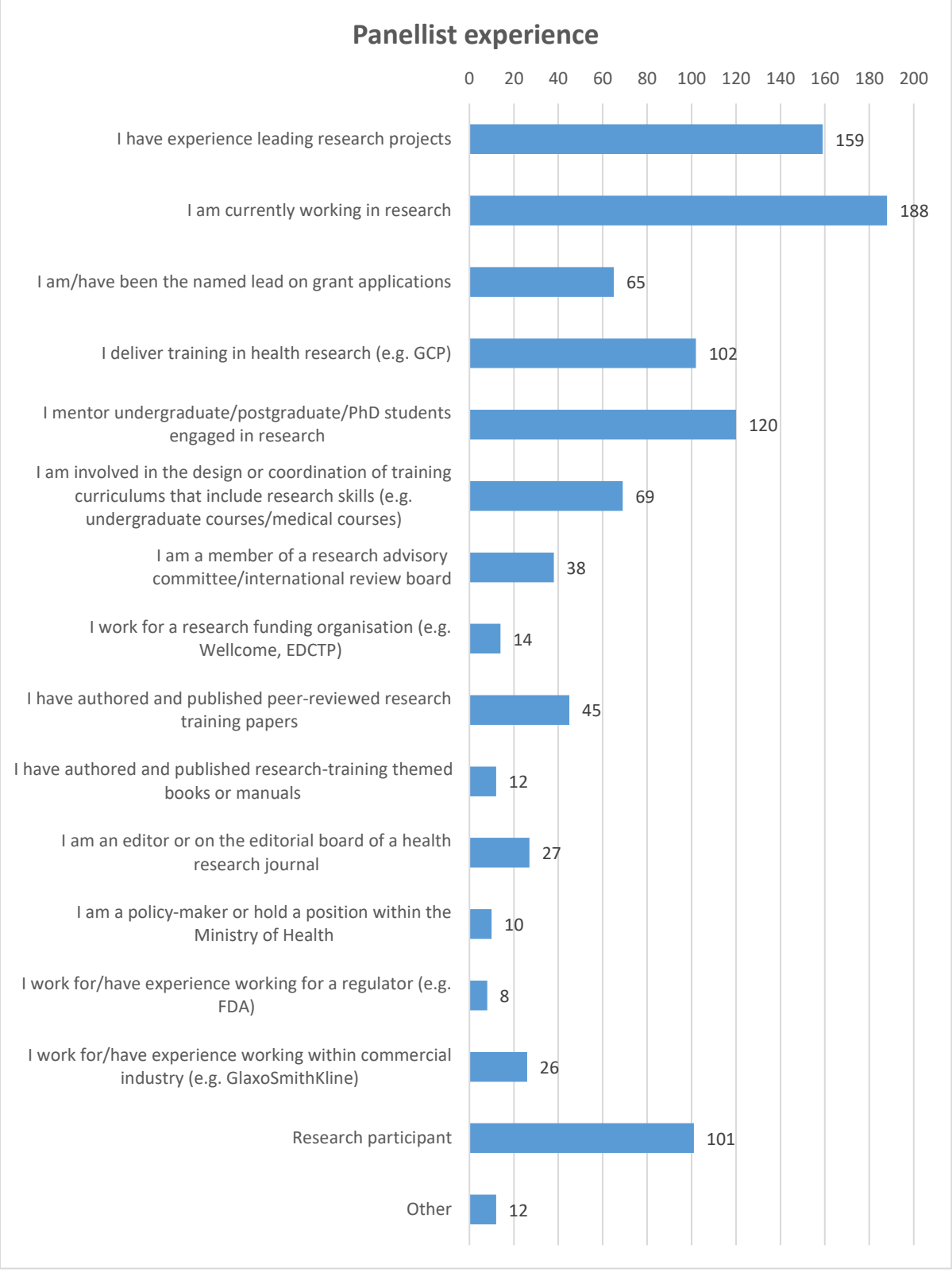

Figure 12. Panellist experience (* multiple options could be selected)

Panellists joined the Delphi from all across the globe:

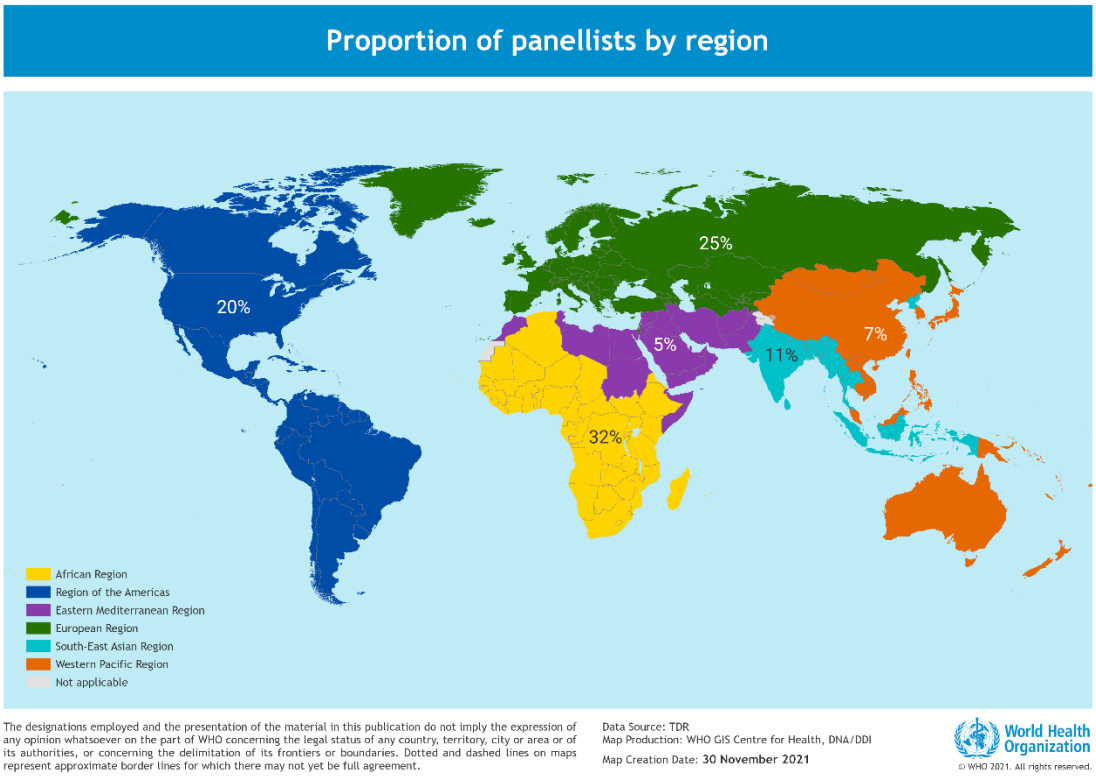

Figure 13. Proportion of panellists by region.

Panellists represented broad clinical research demographics, covering a wide range of job roles, including junior positions (for example, data entry clerk) and senior positions (such as project manager, senior investigators and directors), with input from multiple disciplines including social and medical sciences.

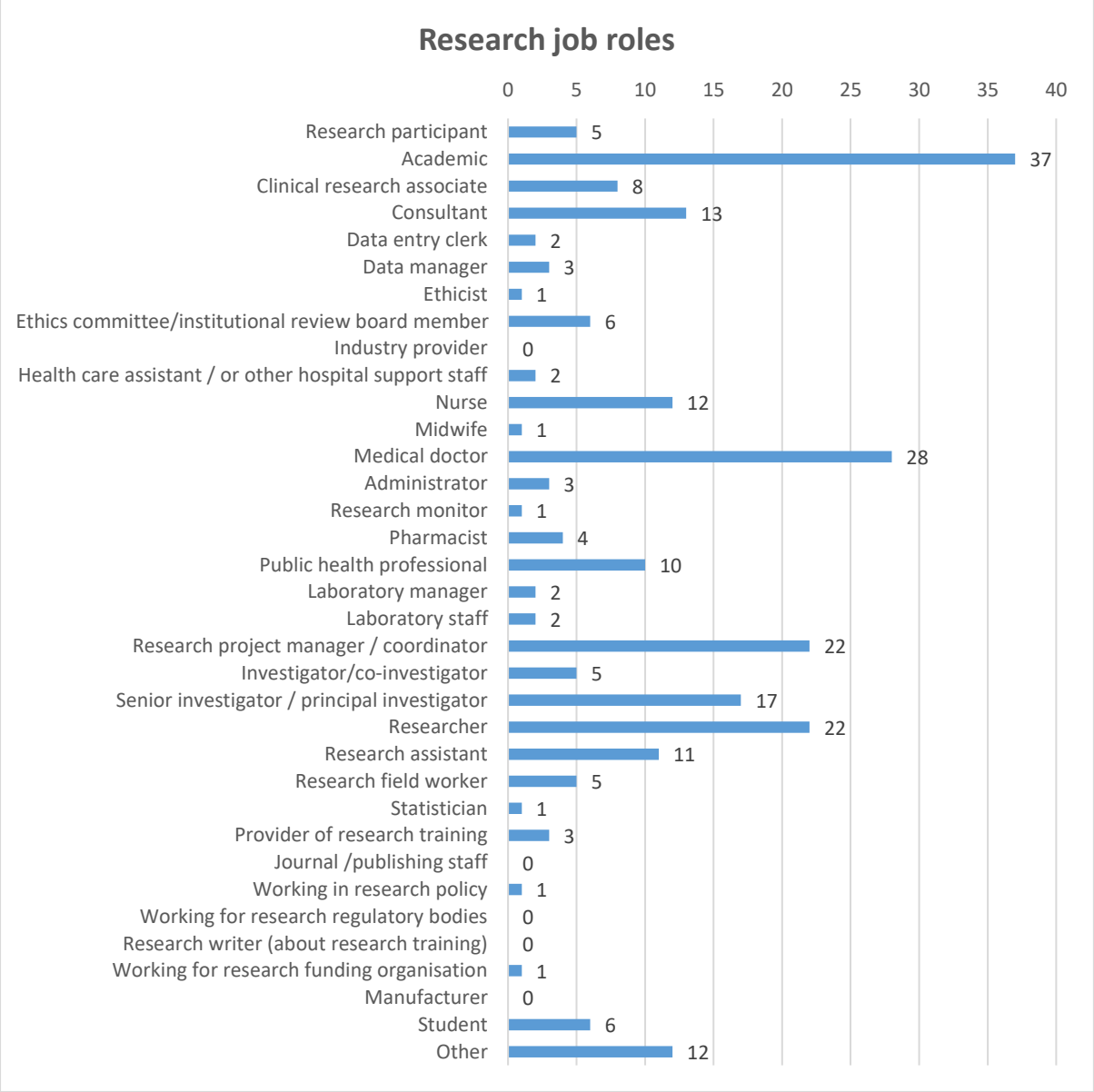

Figure 14. Research job roles held by panellists enrolled in the Delphi

Panellists were mainly employed in academia, public hospitals and non-governmental institutions. However, various types of establishments featured throughout the sample of panellists, illustrating that the views, skills and concerns of researchers from different sectors and industries were represented.

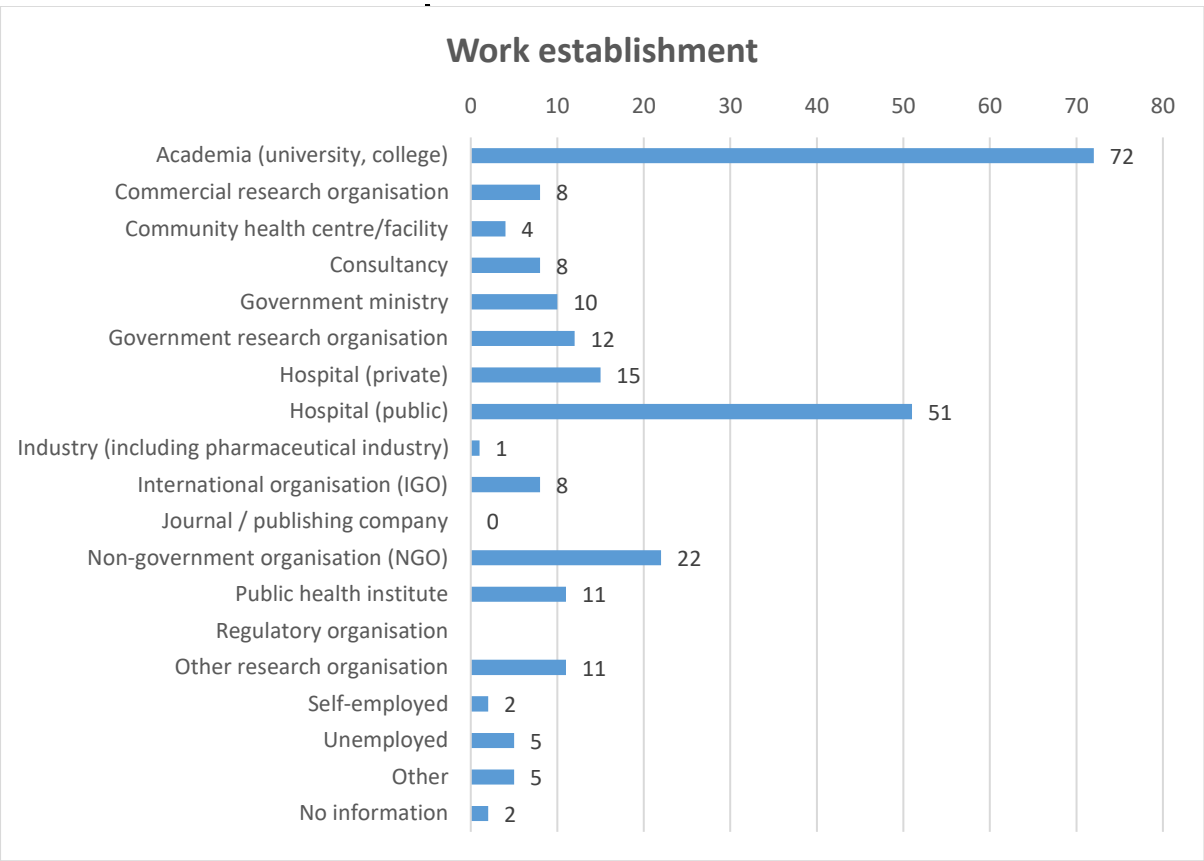

Figure 15. The type of establishments that panellists enrolled in the Delphi survey are affiliated with.

Panellists indicated the diversity of research methods they were engaged with, illustrating significant involvement in "observational" and "clinical trials".

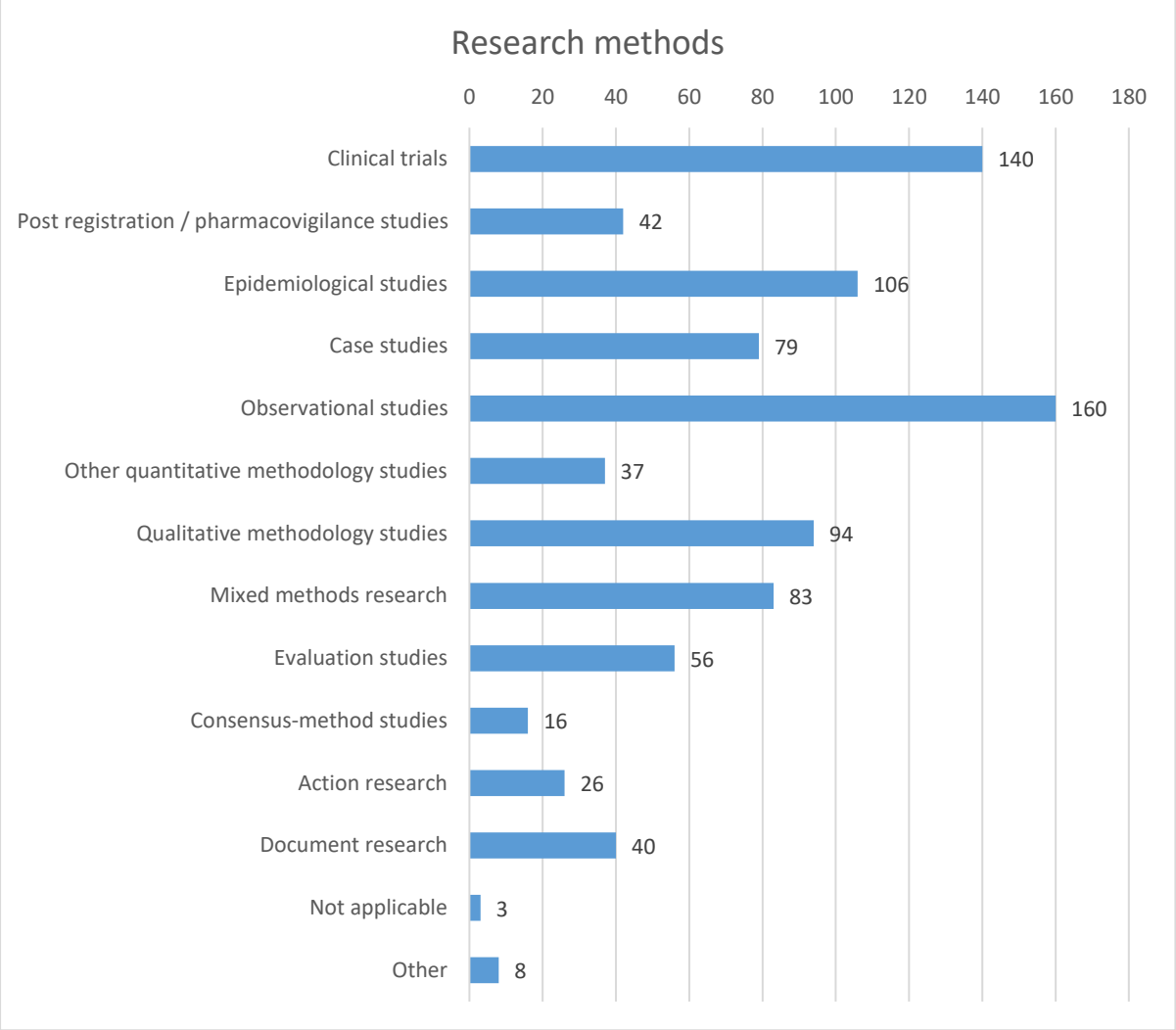

Figure 16. Panellists' research methods experience (* multiple types of studies could be selected).

Panellists also indicated the diversity of research topics (adapted from the WHO research priority list) they were engaged in, with a significant proportion involved in researching non-communicable diseases and reproductive maternal, neonatal and child health (RMNCH).

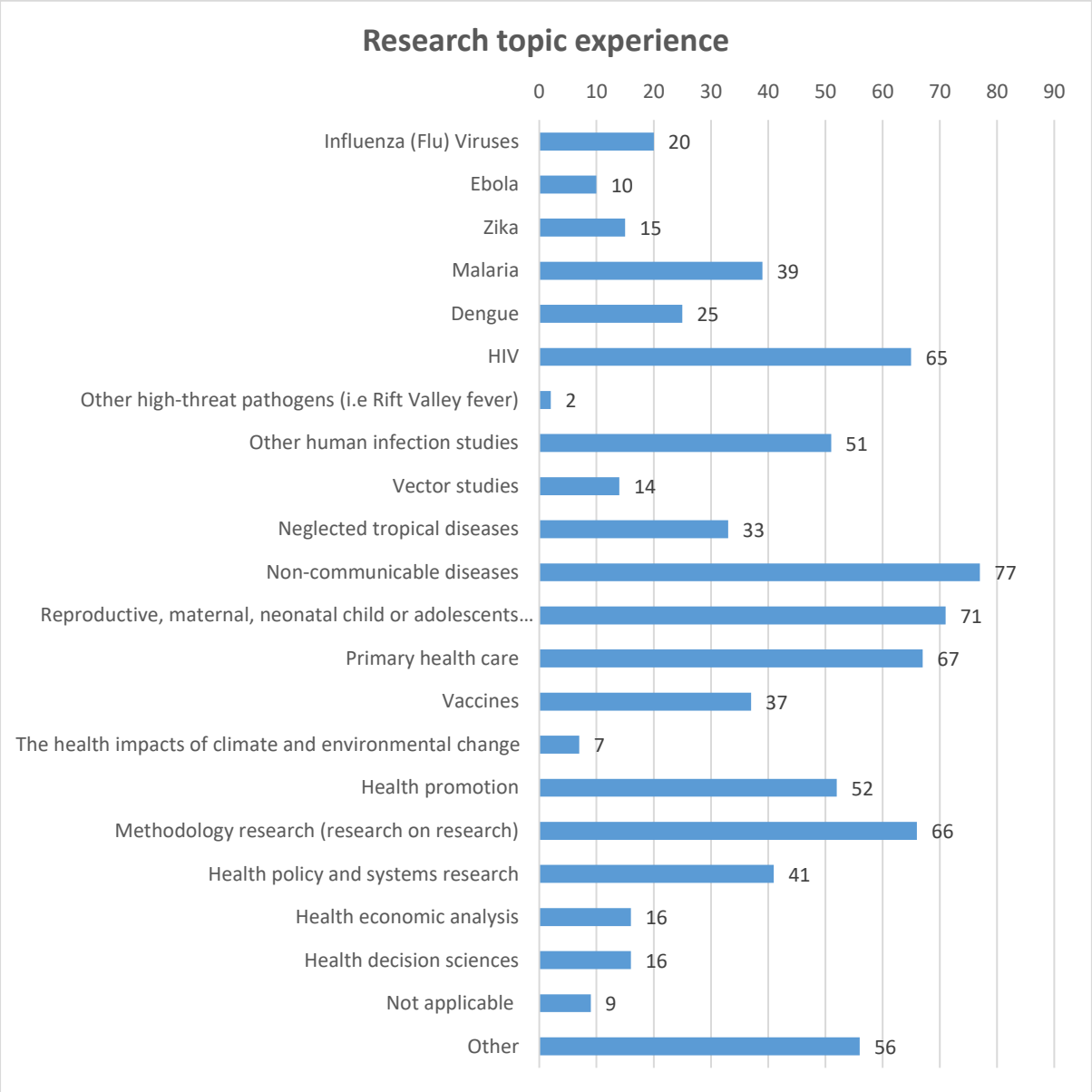

Figure 17. Panellists' research topic experience (* multiple types of studies could be selected)

e-Delphi study Round 1 results

From a total of 98 themes presented in Delphi Round 1 survey:

- The panel team reached consensus for 43 themes to be included in the *Essential Research Skills Training Curriculum*.
- No consensus was reached for any theme to be excluded from the *Essential Research Skills Training Curriculum.*
- The remaining 55 themes were re-evaluated in the Delphi Round 2 survey alongside those that were identified as unclear and all new ones identified by panellists.

The following section provides the individual results for each theme following Round 1.

Themes

1. Concept of health research.

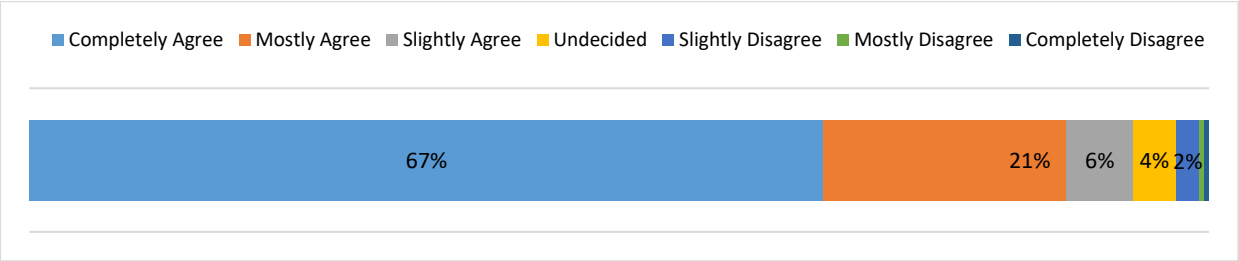

Figure 18. Percentage of panel members in each response category to statement 1.

Delphi Round 1 survey outcome: Consensus achieved (88%). Item included in *Essential Research Skills Training Curriculum.*

2. Understanding the difference between health research and standard of care, audit, evaluation.

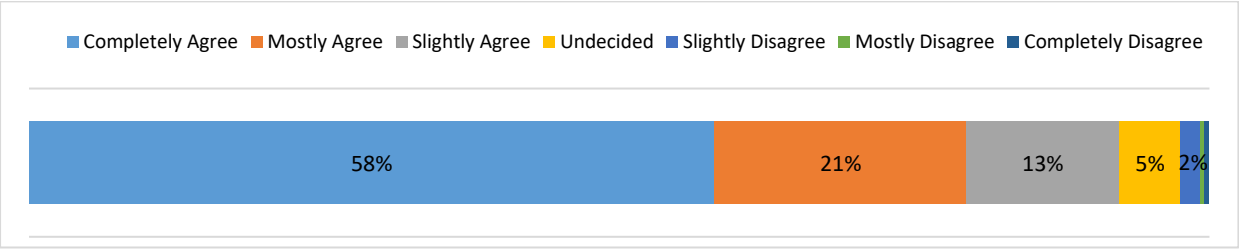

Figure 19. Percentage of panel members in each response category to statement 2.

Delphi Round 1 survey outcome: Consensus not achieved (79%). Item to be reviewed in Delphi Round 2 survey.

3. Identifying a research gap.

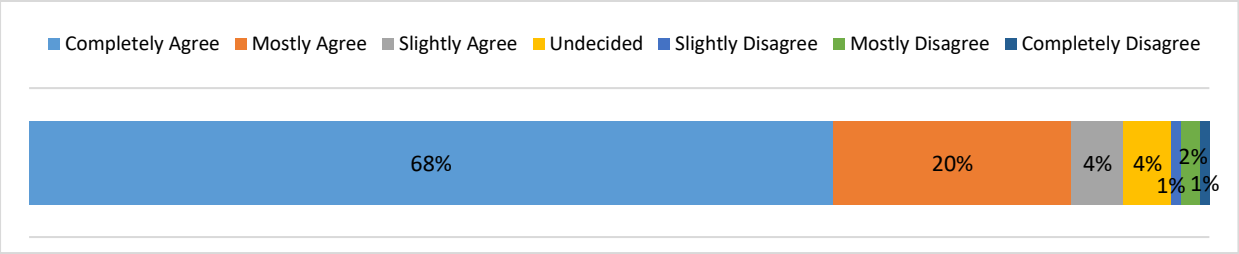

Figure 20. Percentage of panel members in each response category to statement 3.

Delphi Round 1 survey outcome: Consensus achieved (88%). Item included in *Essential Research Skills Training Curriculum.*

4. Development of a research question.

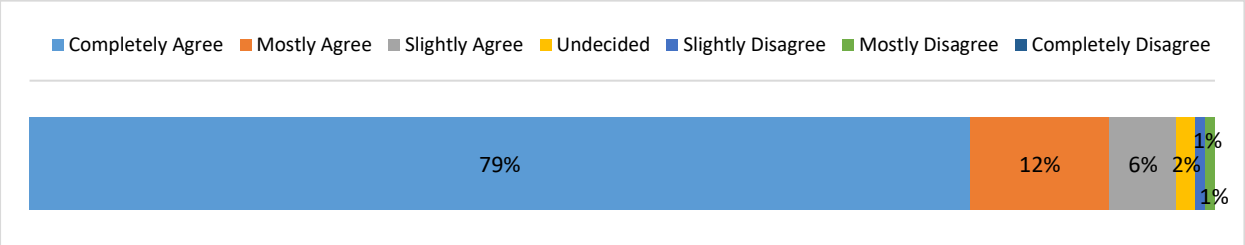

Figure 21. Percentage of panel members in each response category to statement 4.

Delphi Round 1 survey outcome: Consensus achieved (91%). Item included in *Essential Research Skills Training Curriculum.*

5. How to form a research agenda.

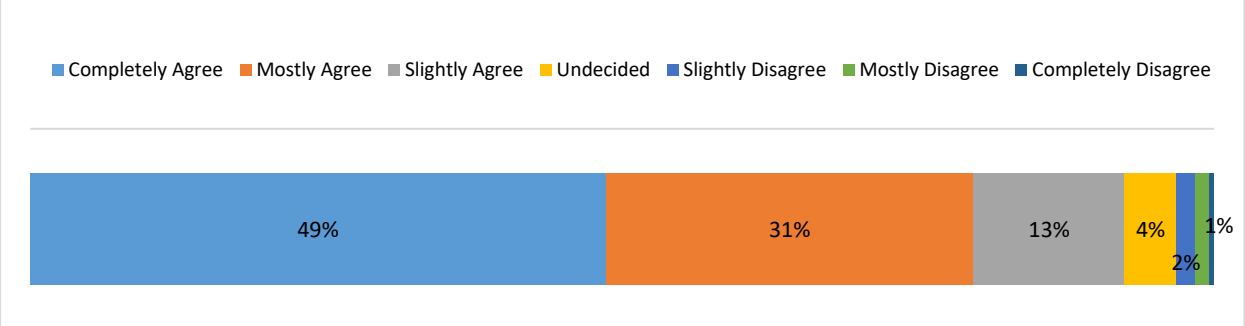

Figure 22. Percentage of panel members in each response category to statement 5.

This statement was rated as 'unclear' and will be reviewed in Delphi Round 2 survey.

6. Qualitative methodologies.

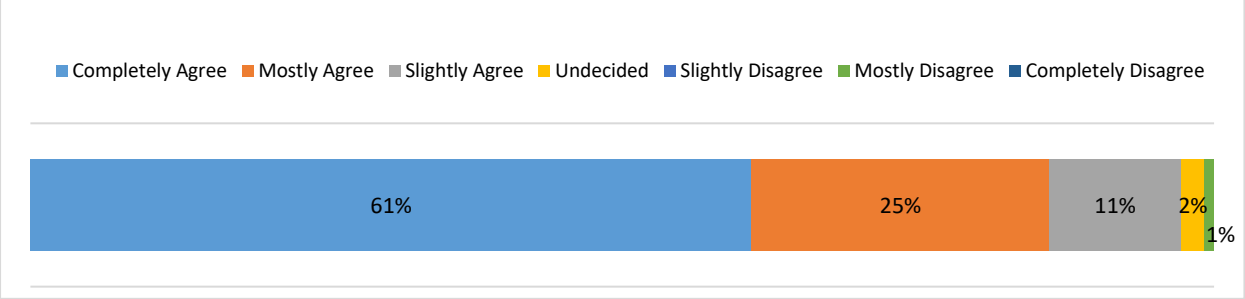

Figure 23. Percentage of panel members in each response category to statement 6.

Delphi Round 1 survey outcome: Consensus achieved (86%). Item included in *Essential Research Skills Training Curriculum.*

7. Quantitative methodologies.

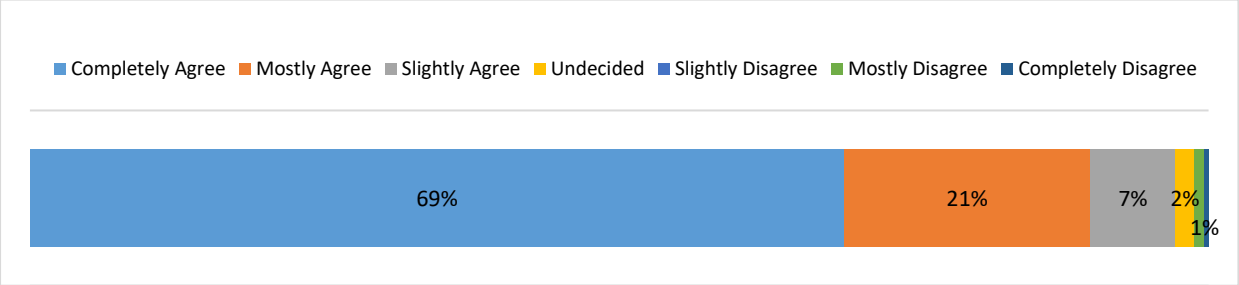

Figure 24. Percentage of panel members in each response category to statement 7.

Delphi Round 1 survey outcome: Consensus achieved (90%). Item included in *Essential Research Skills Training Curriculum.*

8. Mixed methods research.

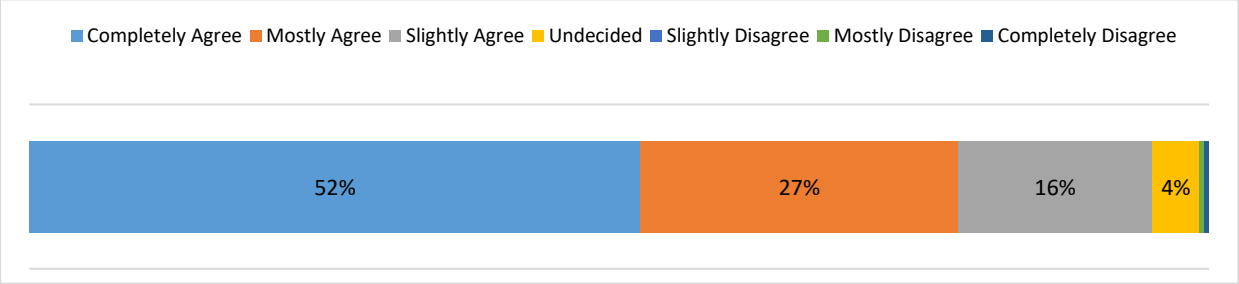

Figure 25. Percentage of panel members in each response category to statement 8.

Delphi Round 1 survey outcome: Consensus not achieved (79%). Item to be reviewed in Delphi Round 2 survey.

9. Epidemiological studies.

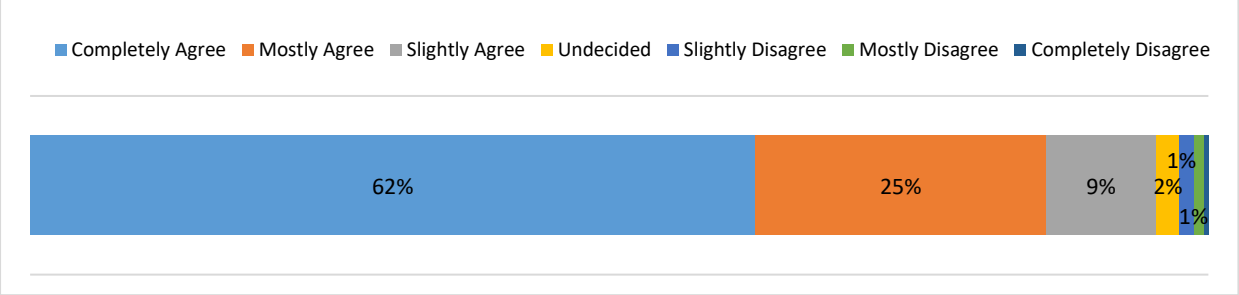

Figure 26. Percentage of panel members in each response category to statement 9.

Delphi Round 1 survey outcome: Consensus achieved (87%). Item included in *Essential Research Skills Training Curriculum.*

10. Meta-analysis.

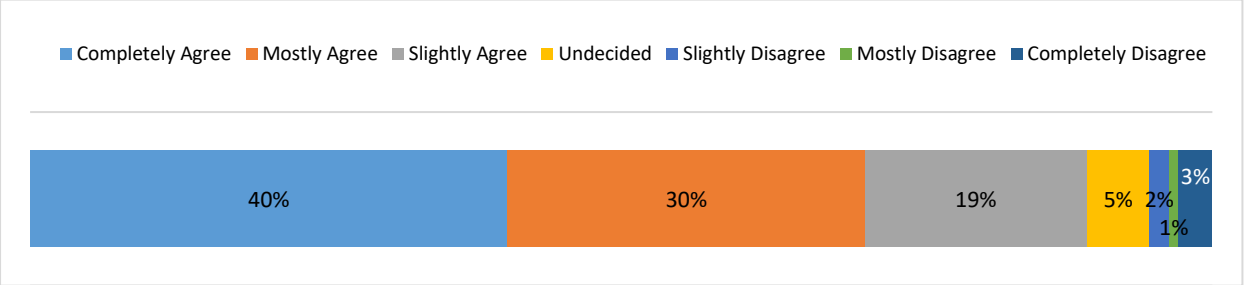

Figure 27. Percentage of panel members in each response category to statement 10.

Delphi Round 1 survey outcome: Consensus not achieved (70%). Item to be reviewed in Delphi round 2 survey.

11. Health policy and systems research.

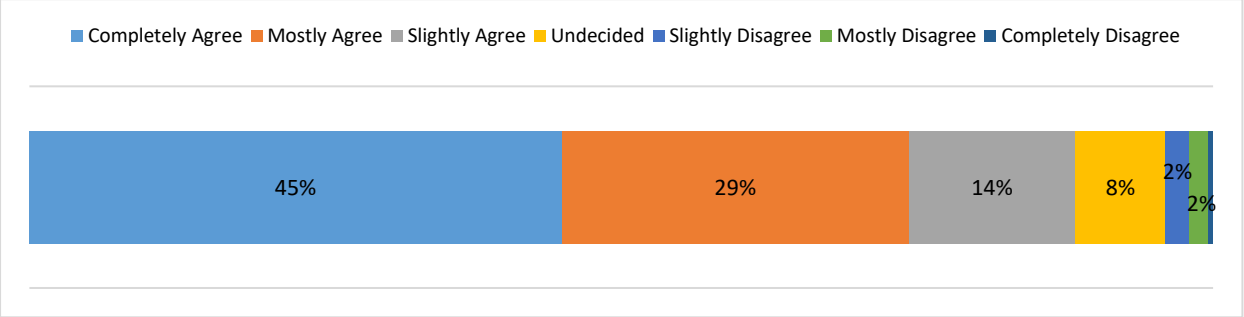

Figure 28. Percentage of panel members in each response category to statement 11.

Delphi Round 1 survey outcome: Consensus not achieved (74%). Item to be reviewed in Delphi Round 2 survey.

12. Social sciences and anthropological studies.

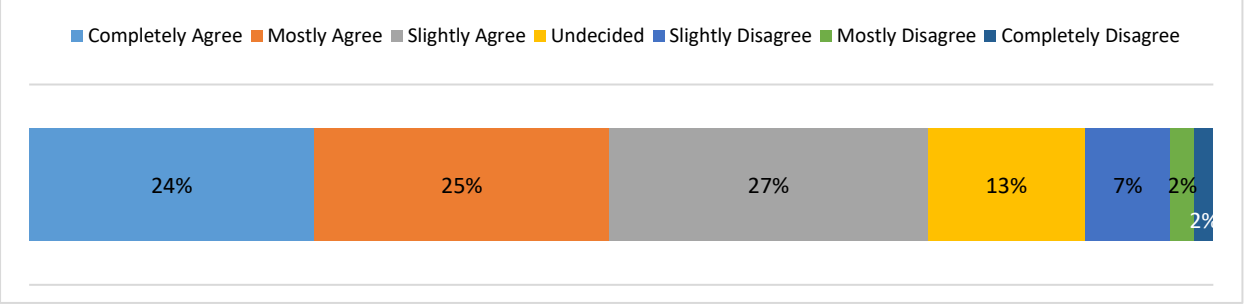

Figure 29. Percentage of panel members in each response category to statement 12.

This statement was rated as 'unclear' and will be reviewed in Delphi Round 2 survey.

13. Health economics and economic evaluations.

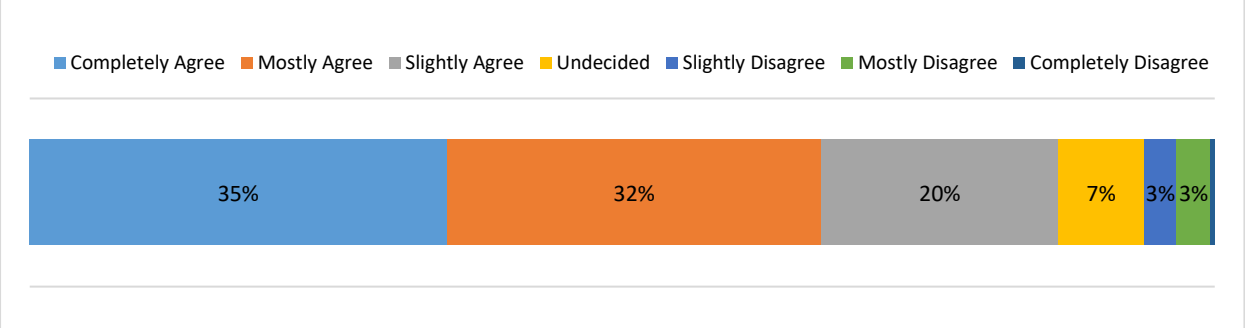

Figure 30. Percentage of panel members in each response category to statement 13.

Delphi Round 1 survey outcome: Consensus not achieved (67%). Item to be reviewed in Delphi Round 2 survey.

14. Mathematical modelling.

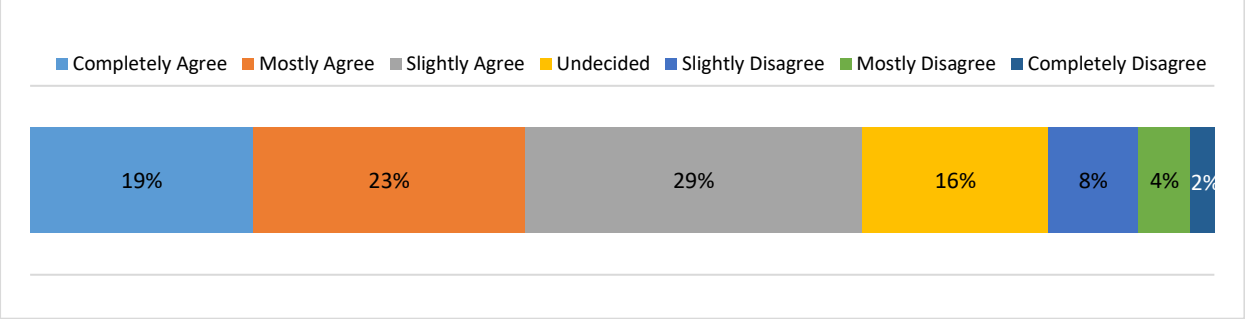

Figure 31. Percentage of panel members in each response category to statement 14.

This statement was rated as 'unclear' and will be reviewed in Delphi Round 2 survey.

15. Research designs for outbreaks.

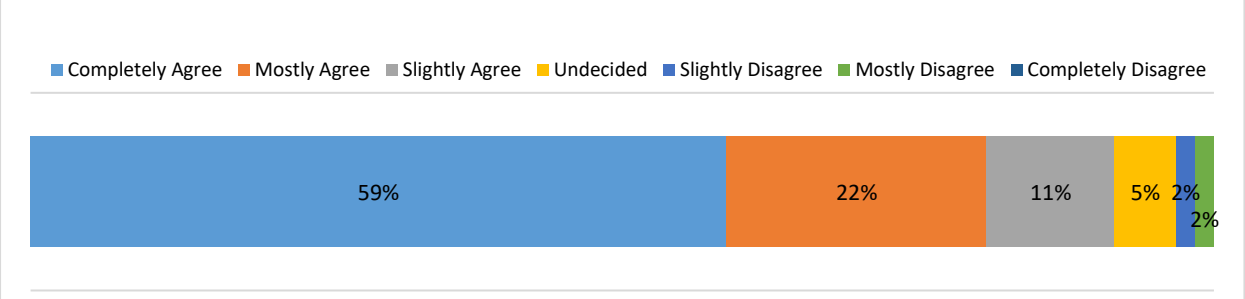

Figure 32. Percentage of panel members in each response category to statement 15.

Delphi Round 1 survey outcome: Consensus not achieved (81%). Item to be reviewed in Delphi Round 2 survey.

16. Clinical trials.

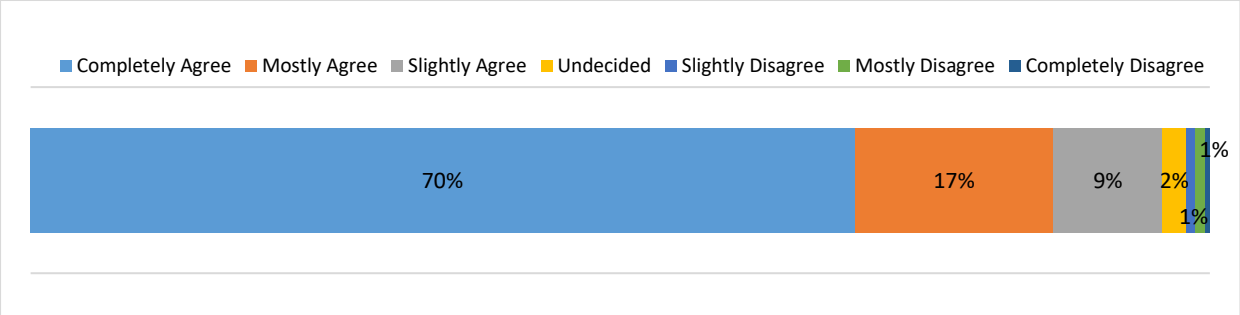

Figure 33. Percentage of panel members in each response category to statement 16.

Delphi Round 1 survey outcome: Consensus achieved (87%). Item included in *Essential Research Skills Training Curriculum.*

17. Methodology research (research on research).

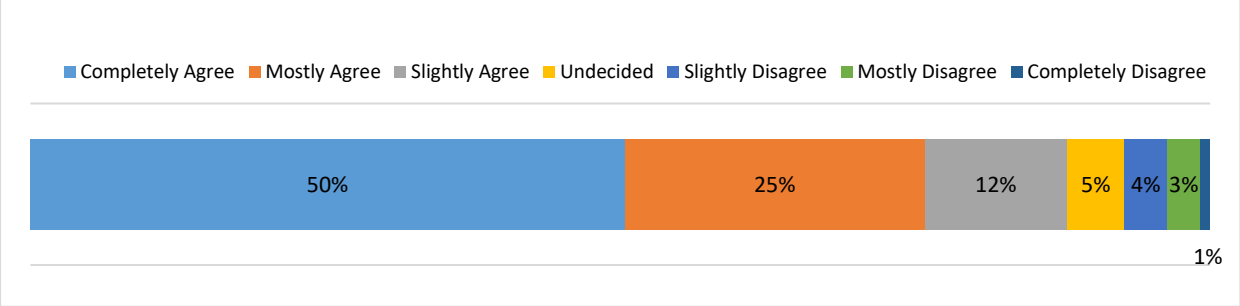

Figure 34. Percentage of panel members in each response category to statement 17.

Delphi Round 1 survey outcome: Consensus not achieved (75%). Item to be reviewed in Delphi Round 2 survey.

18. Implementation research.

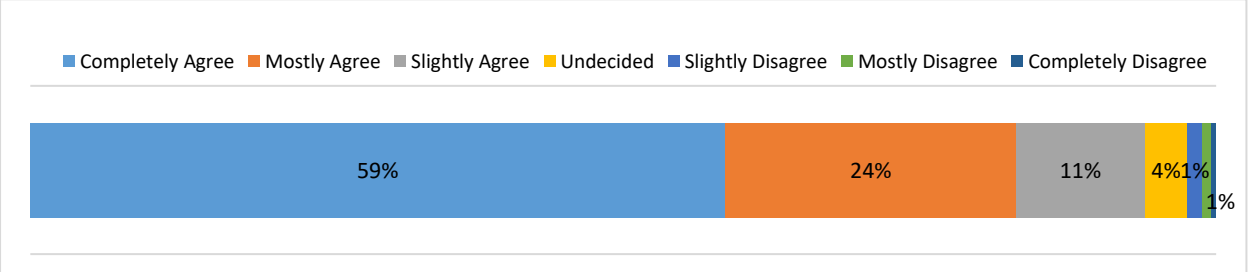

Figure 35. Percentage of panel members in each response category to statement 18.

Delphi Round 1 survey outcome: Consensus not achieved (73%). Item to be reviewed in Delphi Round 2 survey.

19. Experimental research.

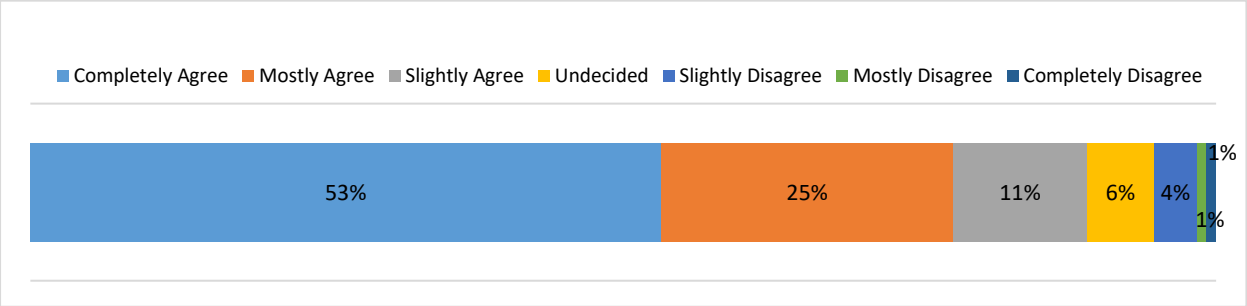

Figure 36. Percentage of panel members in each response category to statement 19.

Delphi Round 1 survey outcome: Consensus not achieved (78%). Item to be reviewed in Delphi Round 2 survey.

20. Operational research.

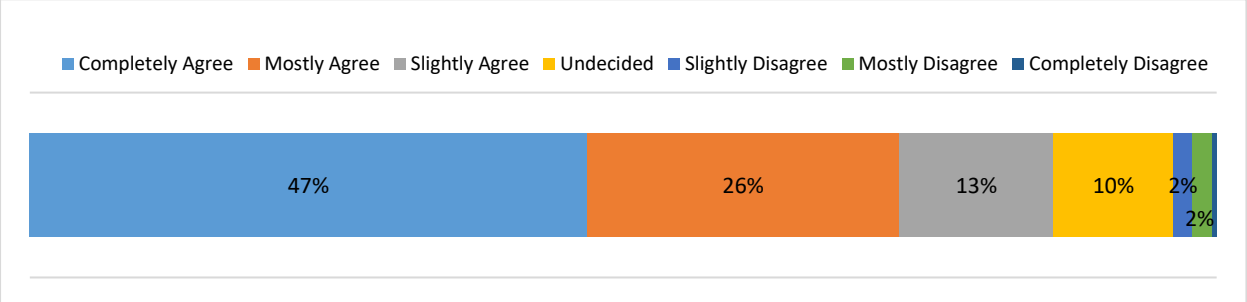

Figure 37. Percentage of panel members in each response category to statement 20.

This statement was rated as 'unclear' and will be reviewed in Delphi Round 2 survey.

21. Identifying various funding agencies/sources.

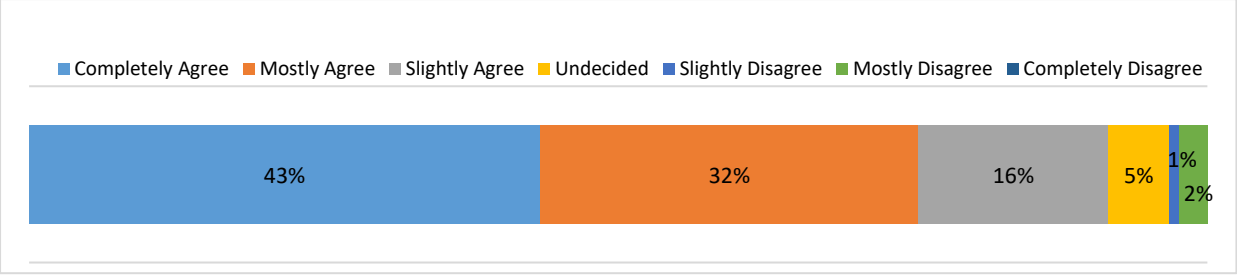

Figure 38. Percentage of panel members in each response category to statement 21.

Delphi Round 1 survey outcome: Consensus not achieved (75%). Item to be reviewed in Delphi Round 2 survey.

22. Ability to communicate and meet with funders.

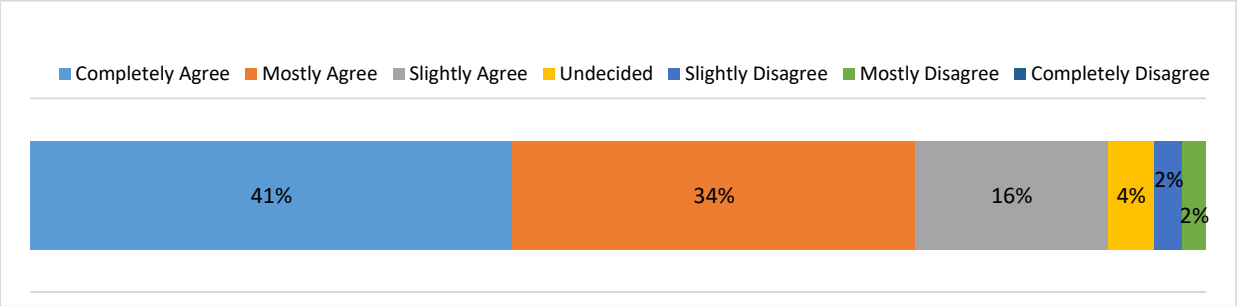

Figure 39. Percentage of panel members in each response category to statement 22.

Delphi Round 1 survey outcome: Consensus not achieved (75%). Item to be reviewed in Delphi Round 2 survey.

23. Writing a grant application and/or grant proposal.

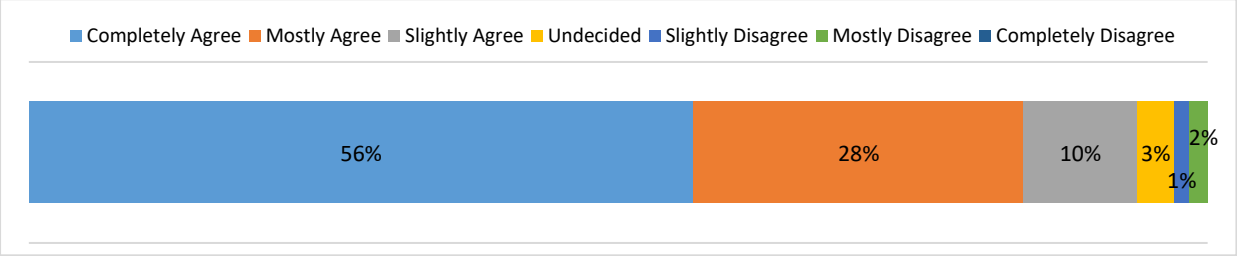

Figure 40. Percentage of panel members in each response category to statement 23.

Delphi Round 1 survey outcome: Consensus not achieved (84%). Item to be reviewed in Delphi Round 2 survey.

24. Writing a research protocol.

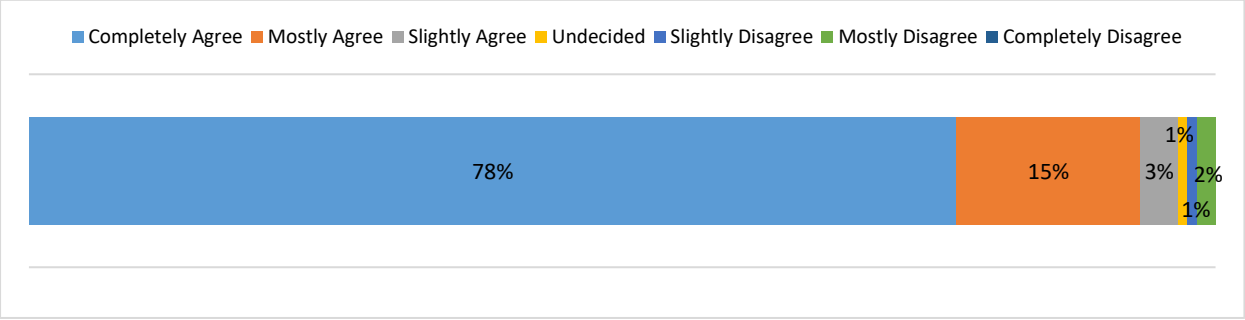

Figure 41. Percentage of panel members in each response category to statement 24.

Delphi Round 1 survey outcome: Consensus achieved (93%). Item included in *Essential Research Skills Training Curriculum.*

25. Identifying research participants and selection criteria.

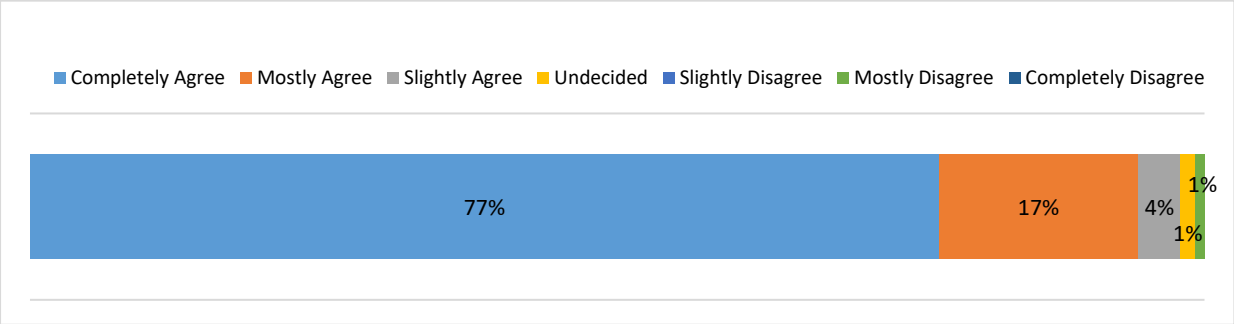

Figure 42. Percentage of panel members in each response category to statement 25.

Delphi Round 1 survey outcome: Consensus achieved (94%). Item included in *Essential Research Skills Training Curriculum.*

26. Qualitative sampling methods.

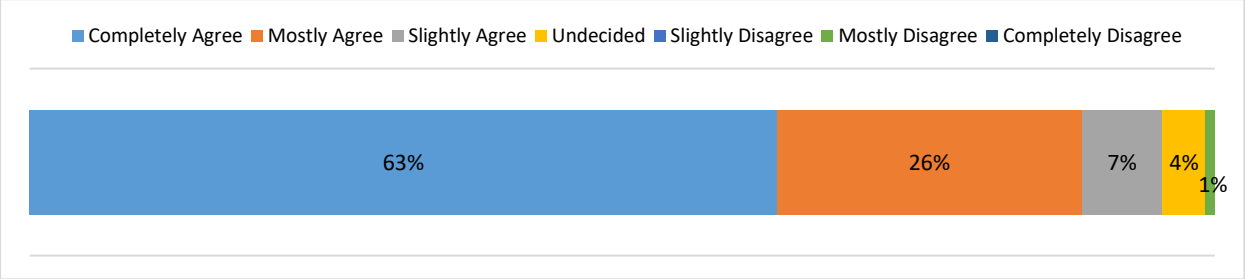

Figure 43. Percentage of panel members in each response category to statement 26.

Delphi Round 1 survey outcome: Consensus achieved (89%). Item included in *Essential Research Skills Training Curriculum.*

27. Quantitative sampling methods.

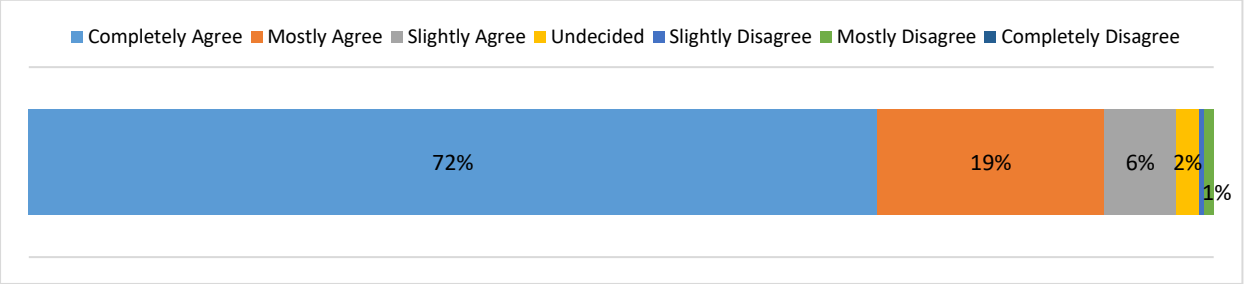

Figure 44. Percentage of panel members in each response category to statement 27.

Delphi Round 1 survey outcome: Consensus achieved (91%). Item included in *Essential Research Skills Training Curriculum.*

28. Definition and methods of randomization.

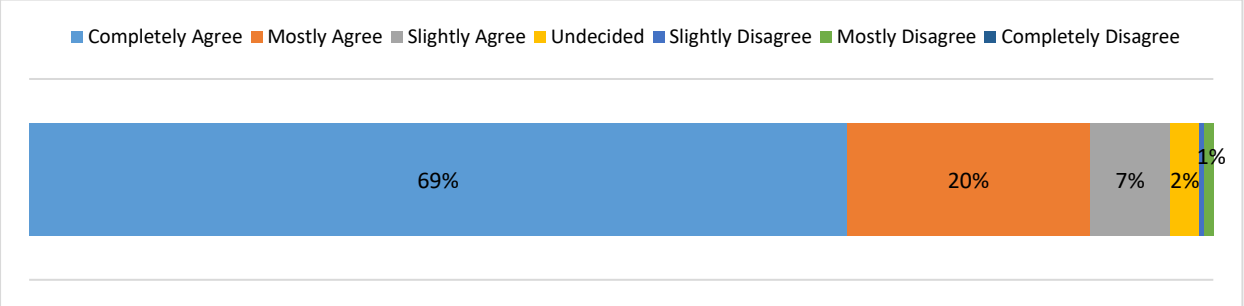

Figure 45. Percentage of panel members in each response category to statement 28.

Delphi Round 1 survey outcome: Consensus achieved (89%). Item included in *Essential Research Skills Training Curriculum.*

29. Calculation of participant sample size and sample power.

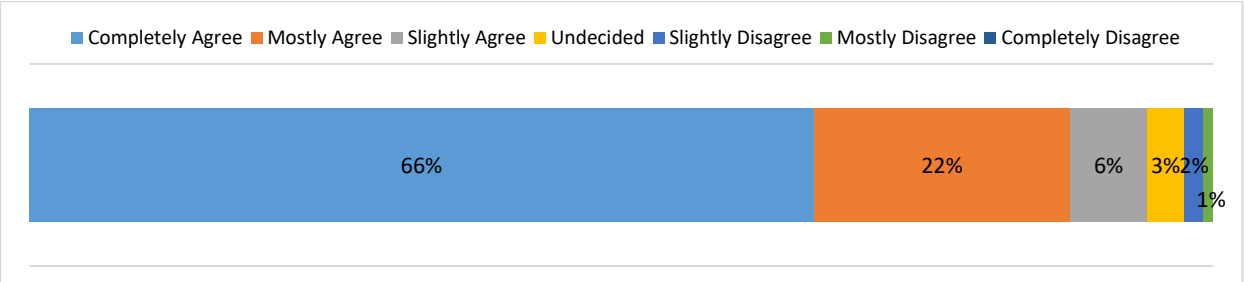

Figure 46. Percentage of panel members in each response category to statement 29.

Delphi Round 1 survey outcome: Consensus achieved (88%). Item included in *Essential Research Skills Training Curriculum.*

30. Selection of control groups for comparison purposes.

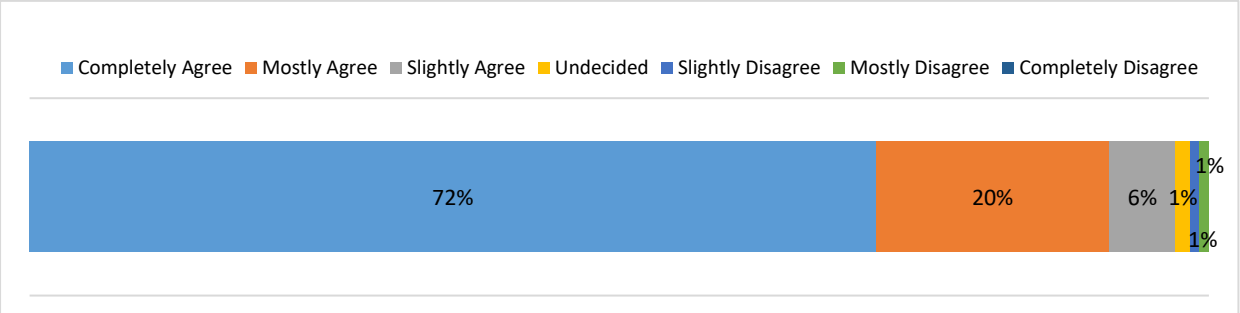

Figure 47. Percentage of panel members in each response category to statement 30.

Delphi Round 1 survey outcome: Consensus achieved (92%). Item included in *Essential Research Skills Training Curriculum.*

31. Setting up a research laboratory.

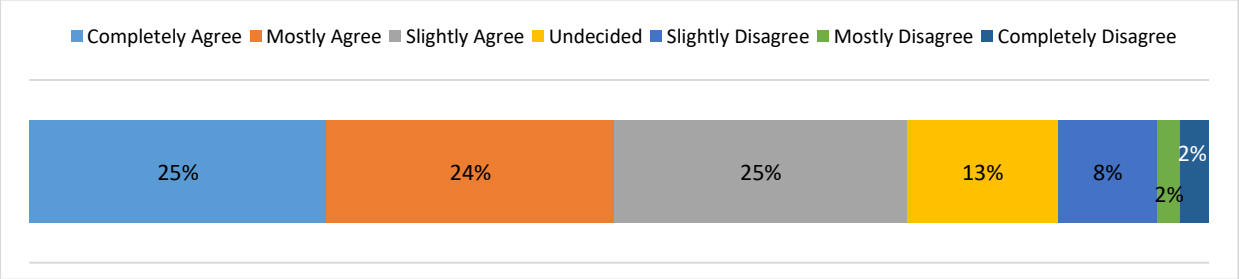

Figure 48. Percentage of panel members in each response category to statement 31.

Delphi Round 1 survey outcome: Consensus not achieved (49%). Item to be reviewed in Delphi Round 2 survey.

32. Specific laboratory techniques and equipment handling.

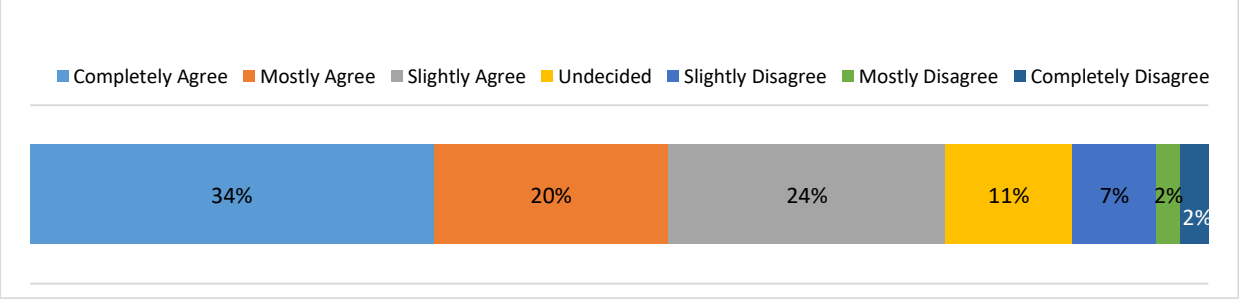

Figure 49. Percentage of panel members in each response category to statement 32.

Delphi Round 1 survey outcome: Consensus not achieved (54%). Item to be reviewed in Delphi Round 2 survey.

33. Laboratory sample handling and storage.

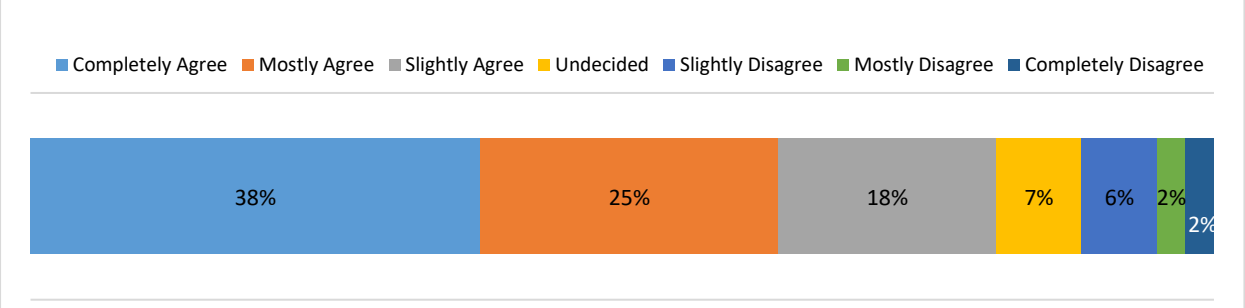

Figure 50. Percentage of panel members in each response category to statement 33.

Delphi Round 1 survey outcome: Consensus not achieved (63%). Item to be reviewed in Delphi Round 2 survey.

34. Laboratory management.

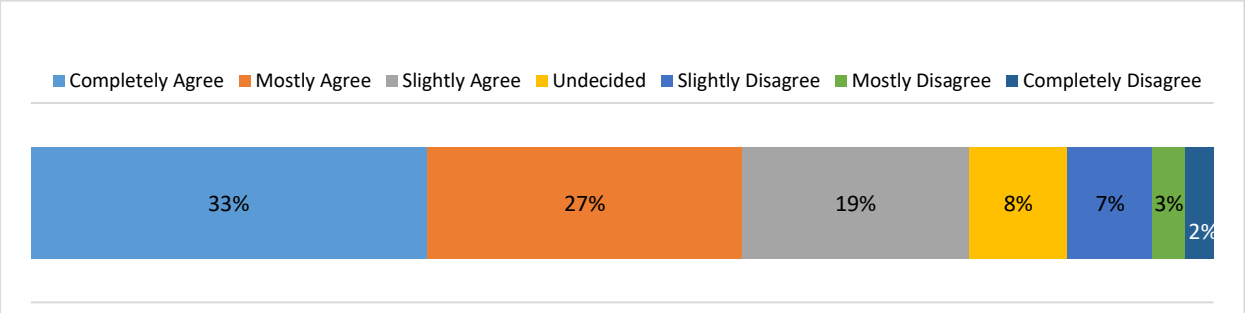

Figure 51. Percentage of panel members in each response category to statement 34.

Delphi Round 1 survey outcome: Consensus not achieved (60%). Item to be reviewed in Delphi Round 2 survey.

35. Laboratory standards and regulations.

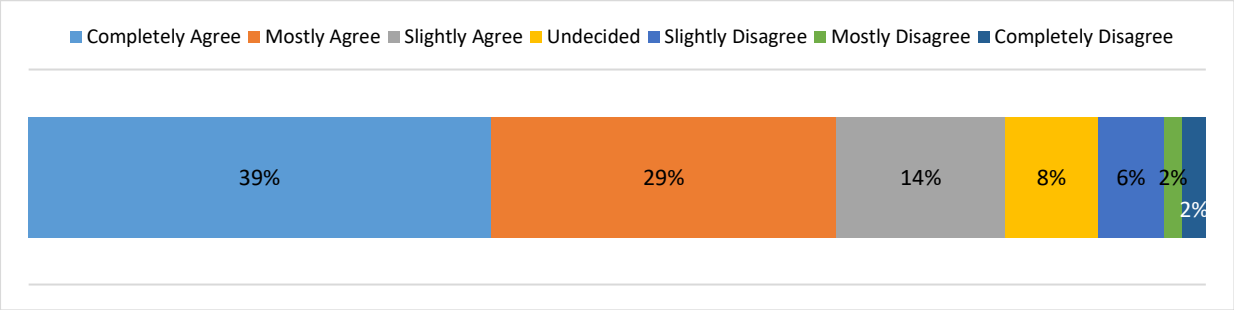

Figure 52. Percentage of panel members in each response category to statement 35.

Delphi Round 1 survey outcome: Consensus not achieved (68%). Item to be reviewed in Delphi Round 2 survey.

36. Laboratory quality best practices.

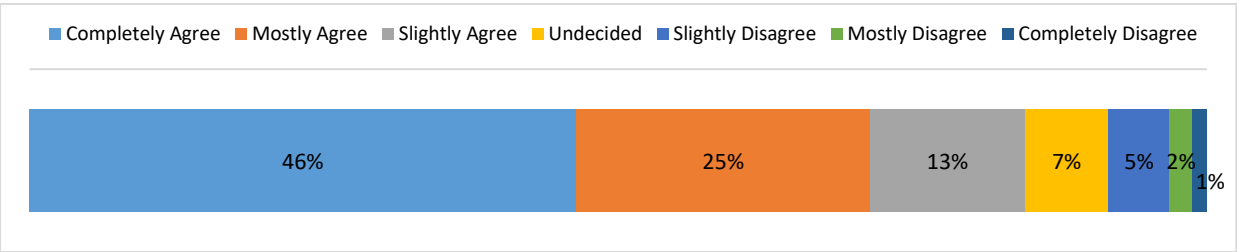

Figure 53. Percentage of panel members in each response category to statement 36.

Delphi Round 1 survey outcome: Consensus not achieved (71%). Item to be reviewed in Delphi Round 2 survey.

37. Laboratory safety practices.

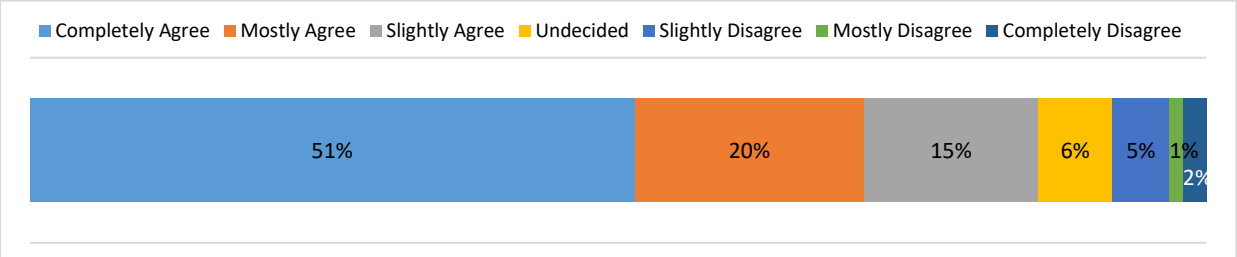

Figure 54. Percentage of panel members in each response category to statement 37.

Delphi Round 1 survey outcome: Consensus not achieved (71%). Item to be reviewed in Delphi Round 2 survey.

38. Good clinical laboratory practice (GCLP).

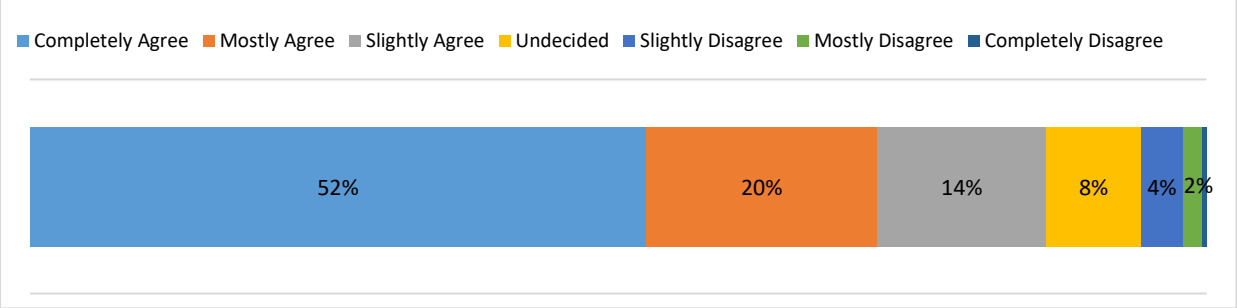

Figure 55. Percentage of panel members in each response category to statement 38.

Delphi Round 1 survey outcome: Consensus not achieved (72%). Item to be reviewed in Delphi Round 2 survey.

39. Good participatory practice (GPP).

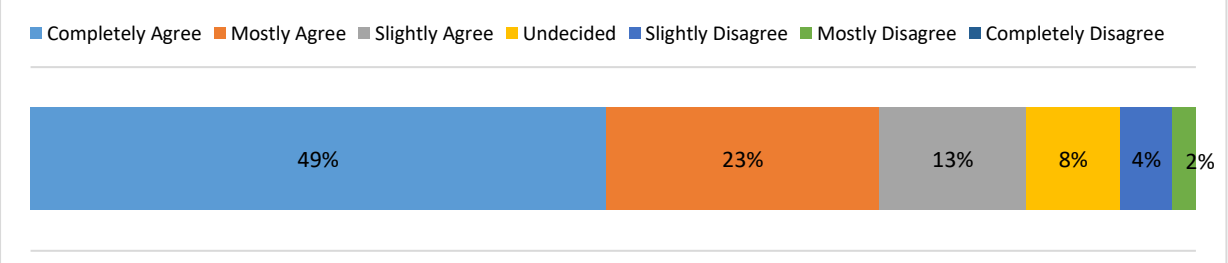

Figure 56. Percentage of panel members in each response category to statement 39.

This statement was rated as 'unclear' and will be reviewed in Delphi Round 2 survey.

40. Community engagement principles and activities.

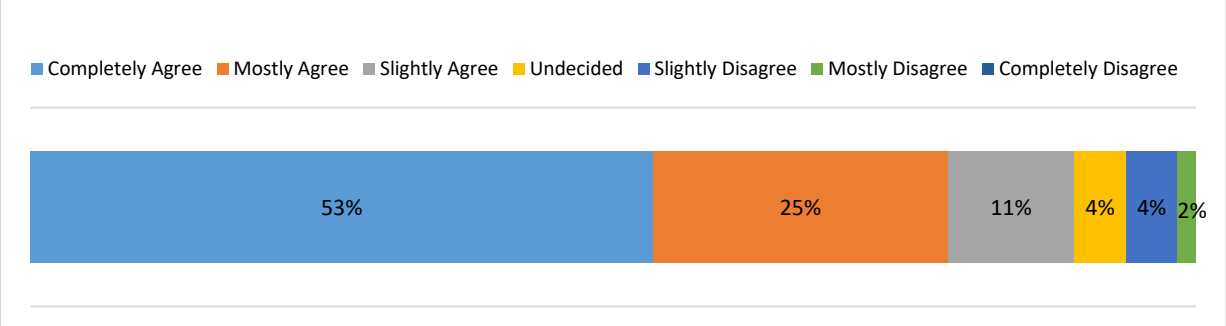

Figure 57. Percentage of panel members in each response category to statement 40.

This statement was rated as 'unclear' and will be reviewed in Delphi Round 2 survey.

41. How to manage expectations of study communities.

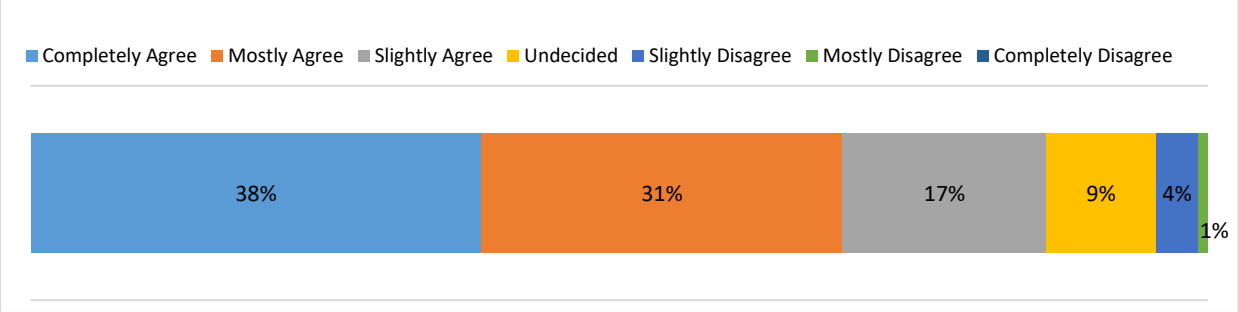

Figure 58. Percentage of panel members in each response category to statement 41.

This statement was rated as 'unclear' and will be reviewed in Delphi Round 2 survey.

42. Participants' retention strategies.

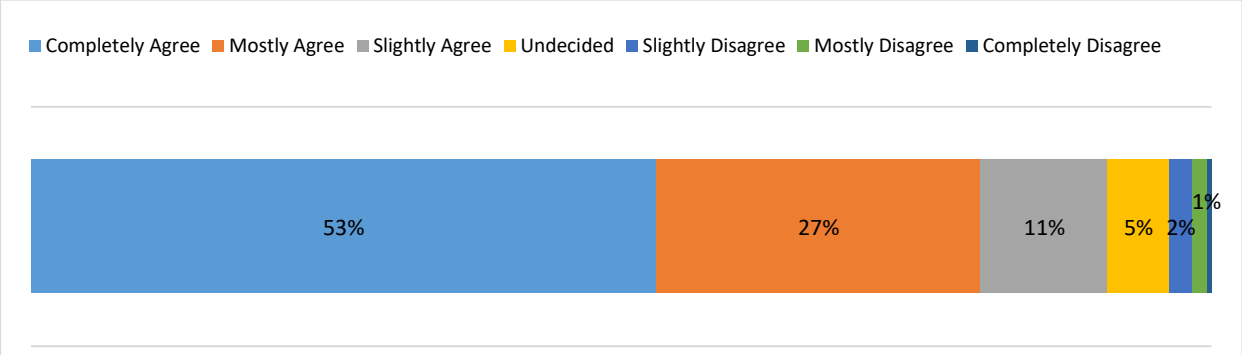

Figure 59. Percentage of panel members in each response category to statement 42.

Delphi Round 1 survey outcome: Consensus not achieved (80%). Item to be reviewed in Delphi Round 2 survey.

43. Participants' "loss to follow-up".

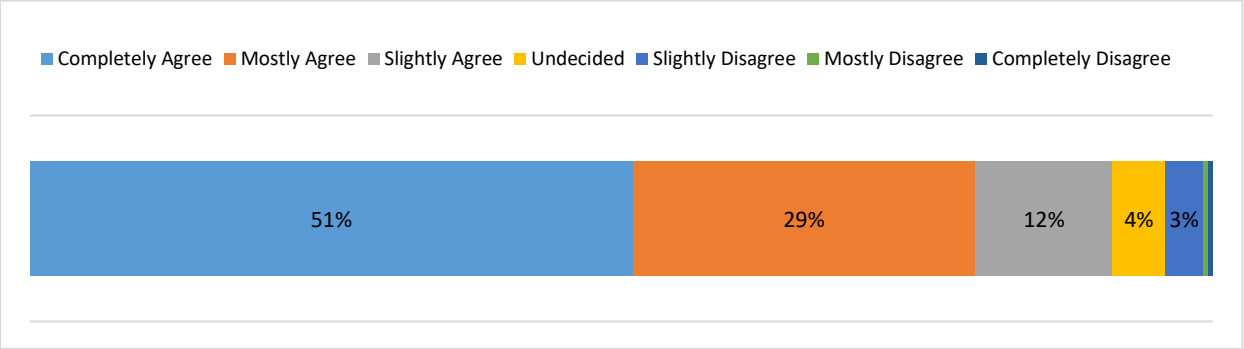

Figure 60. Percentage of panel members in each response category to statement 43.

Delphi Round 1 survey outcome: Consensus not achieved (80%). Item to be reviewed in Delphi Round 2 survey.

44. Attrition bias and prevention methods.

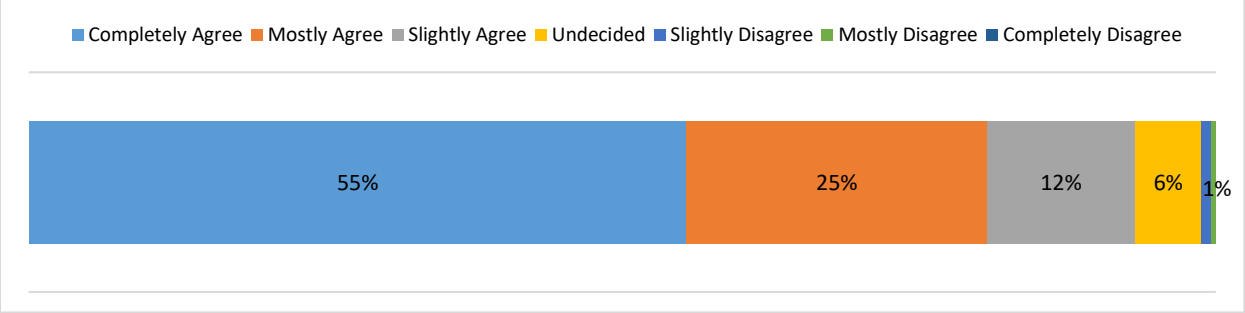

Figure 61. Percentage of panel members in each response category to statement 44.

Delphi Round 1 survey outcome: Consensus not achieved (80%). Item to be reviewed in Delphi Round 2 survey.

45. Definition of quality data.

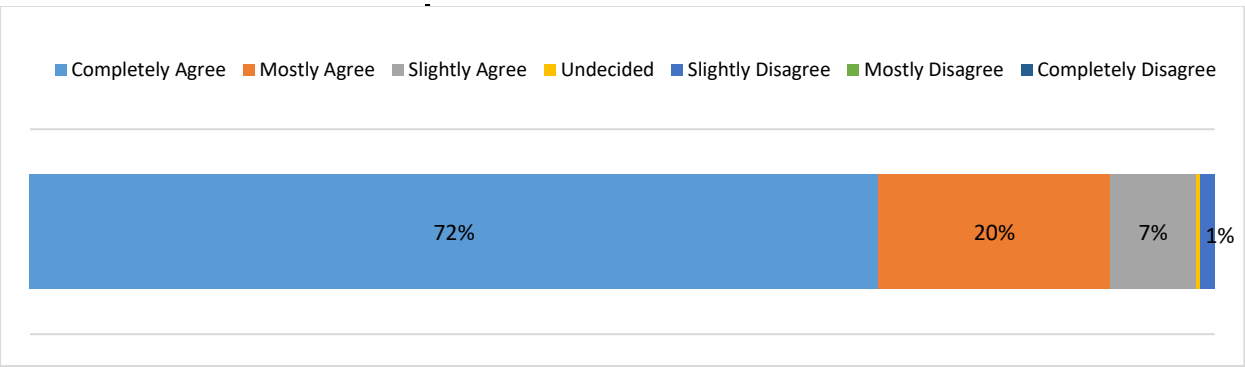

Figure 62. Percentage of panel members in each response category to statement 45.

Delphi Round 1 survey outcome: Consensus achieved (92%). Item included in *Essential Research Skills Training Curriculum.*

46. Qualitative data collection methods.

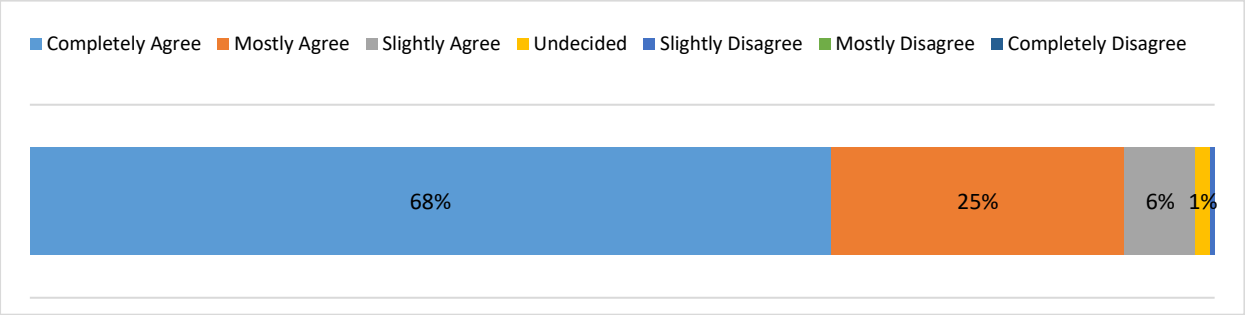

Figure 63. Percentage of panel members in each response category to statement 46.

Delphi Round 1 survey outcome: Consensus achieved (93%). Item included in *Essential Research Skills Training Curriculum.*

47. Quantitative data collection methods.

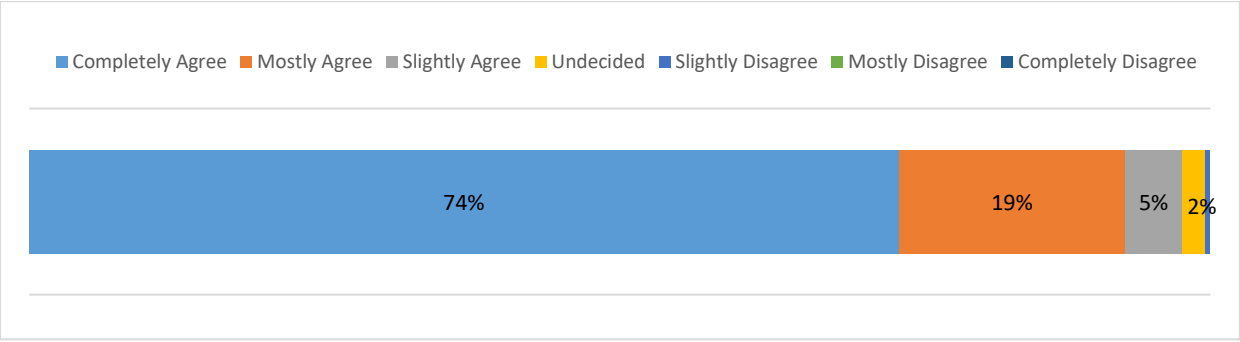

Figure 64. Percentage of panel members in each response category to statement 47.

Delphi Round 1 survey outcome: Consensus achieved (93%). Item included in *Essential Research Skills Training Curriculum.*

48. Data collection tools (for example, designing surveys and CRF's).

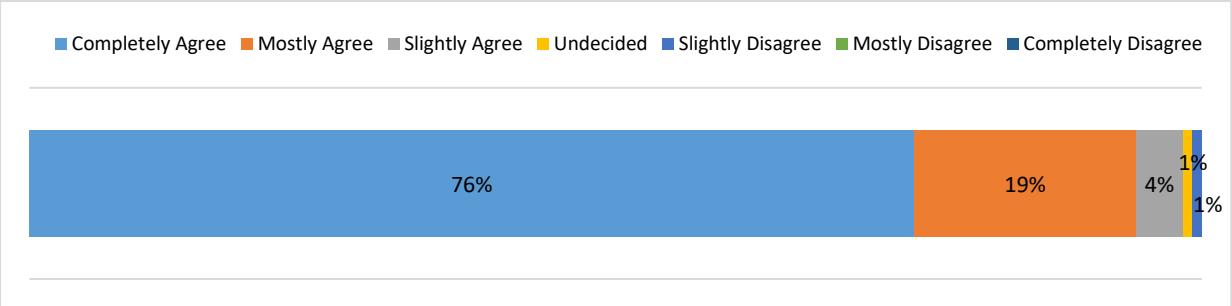

Figure 65. Percentage of panel members in each response category to statement 48.

Delphi Round 1 survey outcome: Consensus achieved (95%). Item included in *Essential Research Skills Training Curriculum.*

49. Data management systems.

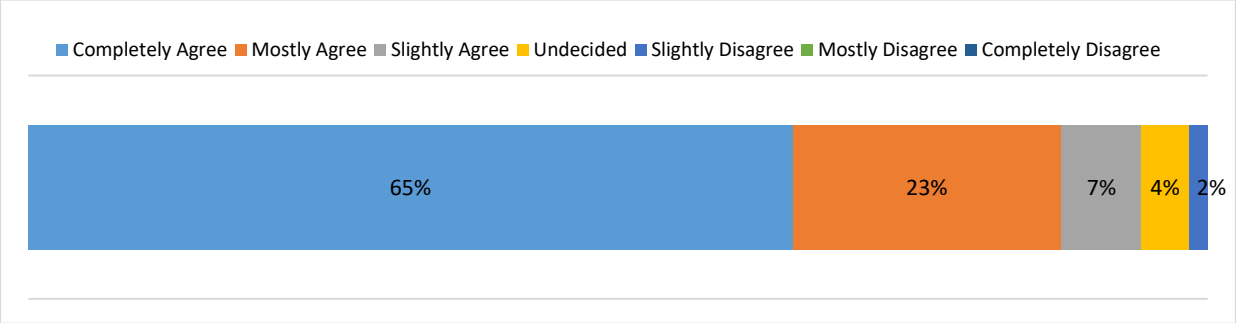

Figure 66. Percentage of panel members in each response category to statement 49.

Delphi Round 1 survey outcome: Consensus achieved (88%). Item included in *Essential Research Skills Training Curriculum.*

50. Qualitative analysis.

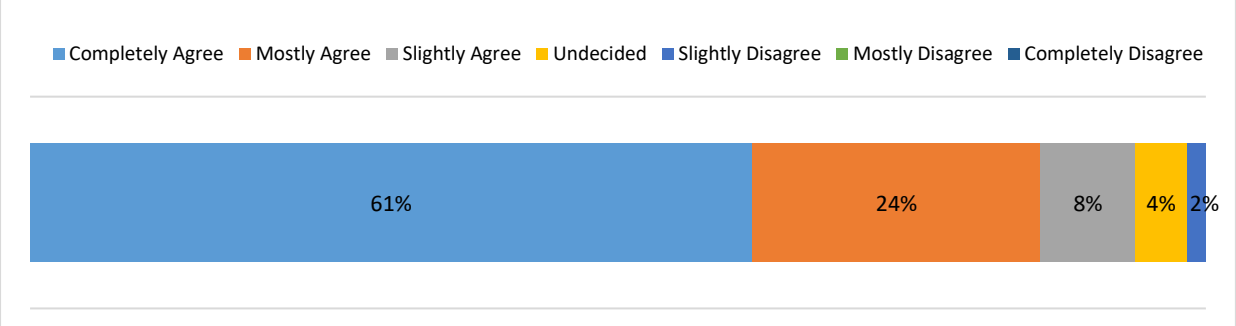

Figure 67. Percentage of panel members in each response category to statement 50.

Delphi Round 1 survey outcome: Consensus achieved (85%). Item included in *Essential Research Skills Training Curriculum.*

51. Statistics.

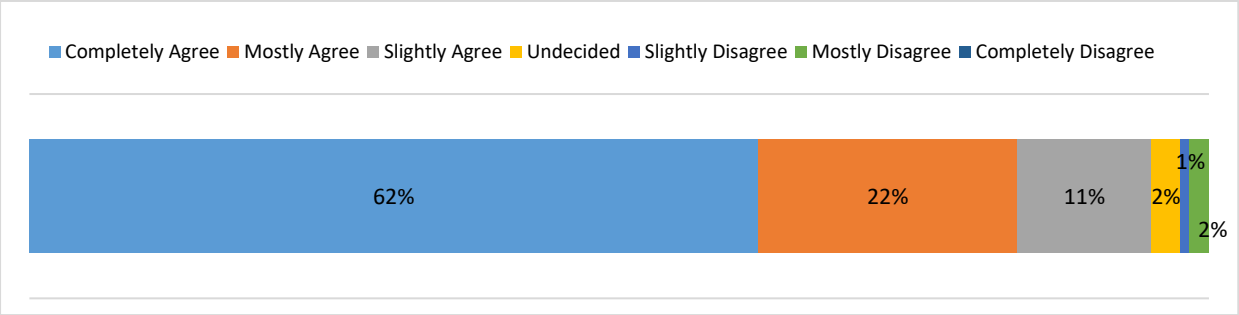

Figure 68. Percentage of panel members in each response category to statement 51.

Delphi Round 1 survey outcome: Consensus not achieved (84%). Item to be reviewed in Delphi Round 2 survey.

52. Data analysis software (qualitative and quantitative).

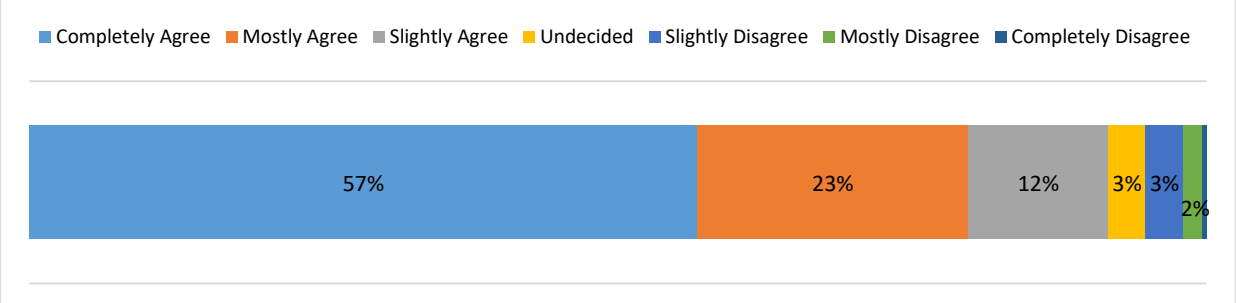

Figure 69. Percentage of panel members in each response category to statement 52.

Delphi Round 1 survey outcome: Consensus not achieved (80%). Item to be reviewed in Delphi Round 2 survey.

53. Data presentation.

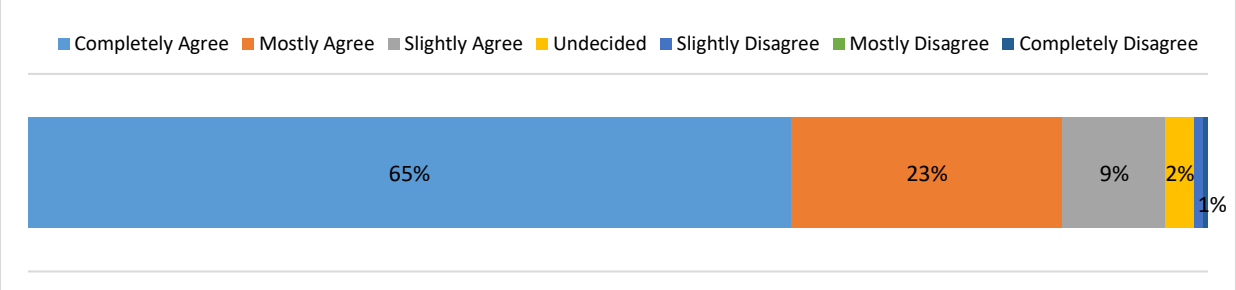

Figure 70. Percentage of panel members in each response category to statement 53.

Delphi Round 1 survey outcome: Consensus achieved (88%). Item included in *Essential Research Skills Training Curriculum.*

54. Data sharing best practices and governance.

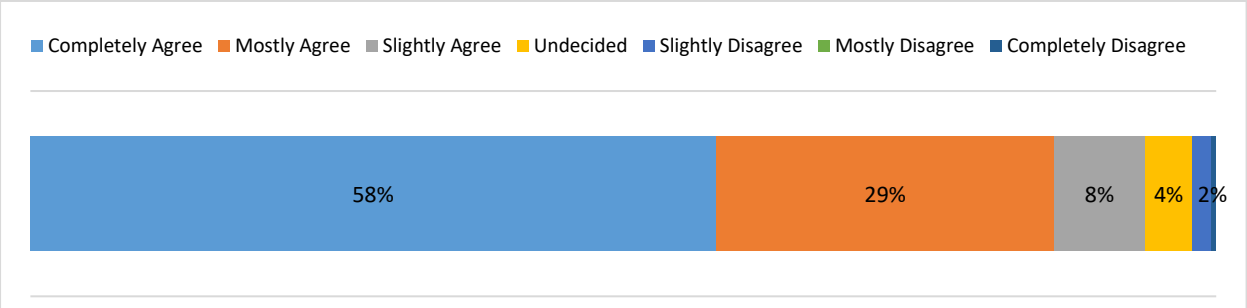

Figure 71. Percentage of panel members in each response category to statement 54.

Delphi Round 1 survey outcome: Consensus achieved (87%). Item included in *Essential Research Skills Training Curriculum.*

55. Quality assurance systems.

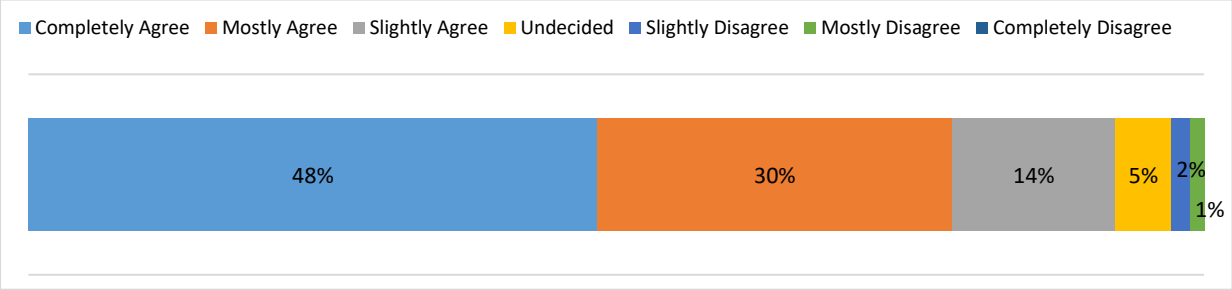

Figure 72. Percentage of panel members in each response category to statement 55.

Delphi Round 1 survey outcome: Consensus not achieved (78%). Item to be reviewed in Delphi Round 2 survey.

56. Quality management systems.

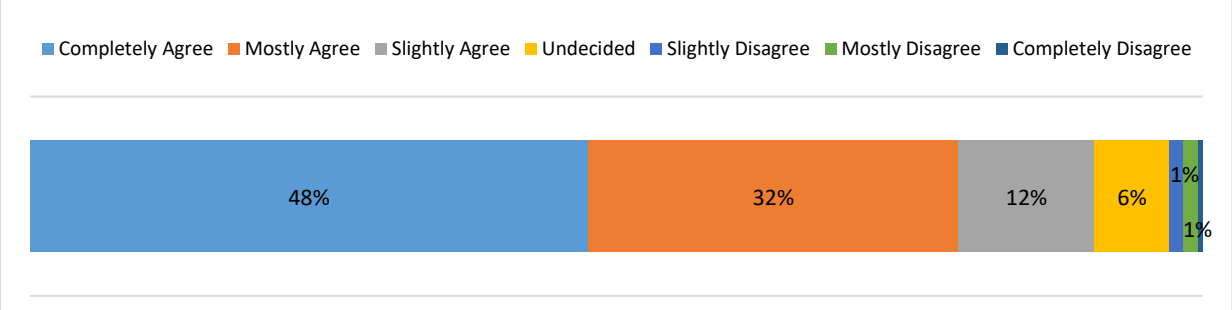

Figure 73. Percentage of panel members in each response category to statement 56.

Delphi Round 1 survey outcome: Consensus not achieved (80%). Item to be reviewed in Delphi Round 2 survey.

57. Monitoring and evaluation.

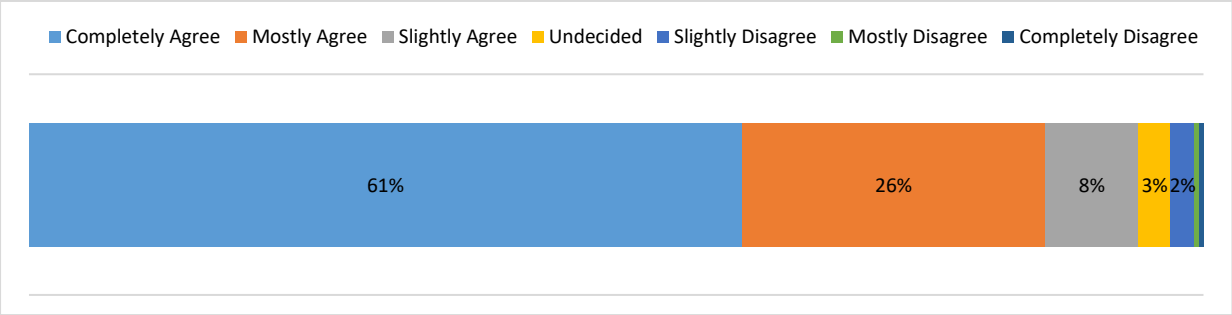

Figure 74. Percentage of panel members in each response category to statement 57.

Delphi Round 1 survey outcome: Consensus achieved (87%). Item included in *Essential Research Skills Training Curriculum.*

58. Audit.

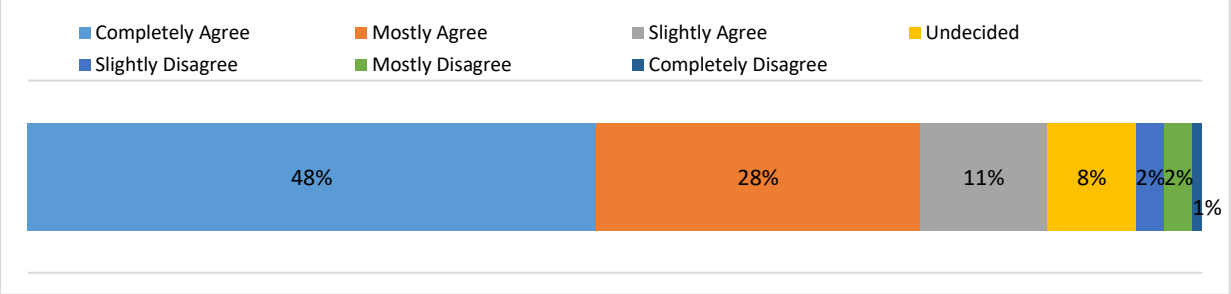

Figure 75. Percentage of panel members in each response category to statement 58.

Delphi Round 1 survey outcome: Consensus not achieved (76%). Item to be reviewed in Delphi Round 2 survey.

59. Development of standard operating procedures (SOPs).

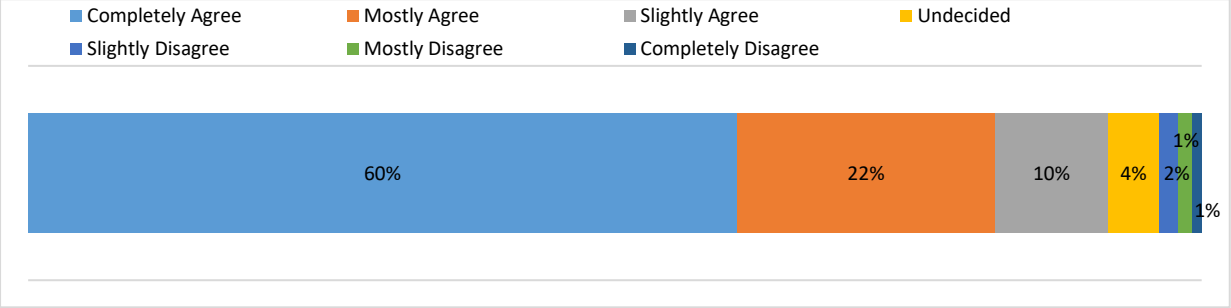

Figure 76. Percentage of panel members in each response category to statement 59.

Delphi Round 1 survey outcome: Consensus not achieved (82%). Item to be reviewed in Delphi Round 2 survey.

60. Governance and regulation.

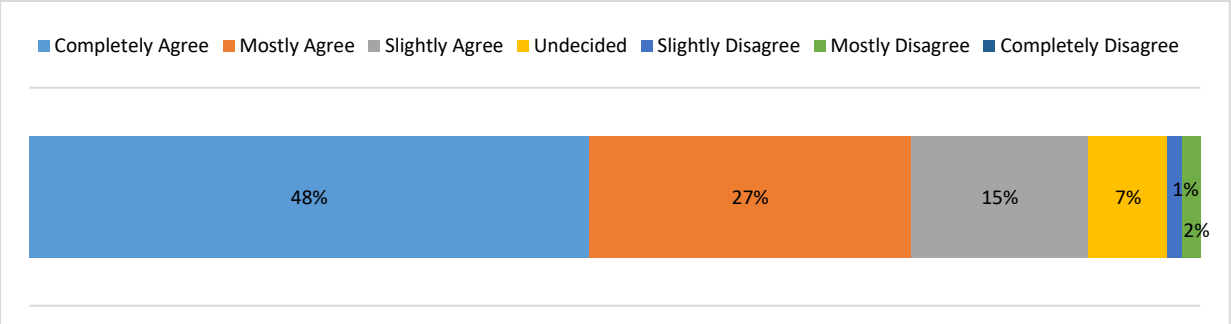

Figure 77. Percentage of panel members in each response category to statement 60.

This statement was rated as 'unclear' and will be reviewed in Delphi Round 2 survey.

61. Good clinical practice (GCP).

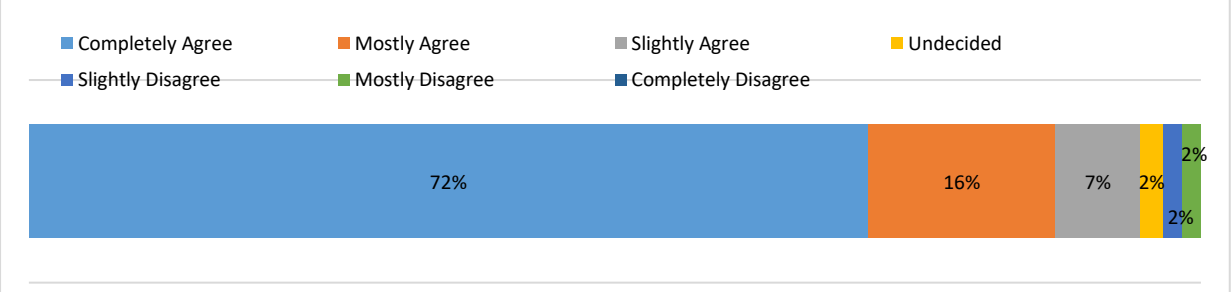

Figure 78. Percentage of panel members in each response category to statement 61.

Delphi Round 1 survey outcome: Consensus achieved (88%). Item included in *Essential Research Skills Training Curriculum.*

62. Research project management and planning.

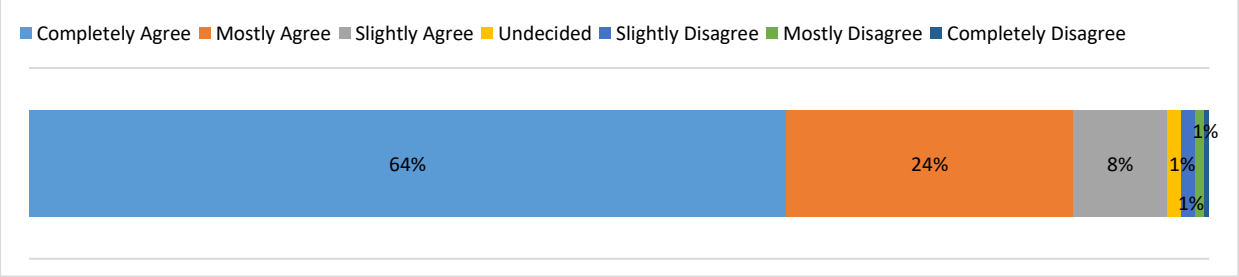

Figure 79. Percentage of panel members in each response category to statement 62.

Delphi Round 1 survey outcome: Consensus achieved (88%). Item included in *Essential Research Skills Training Curriculum.*

63. Research time management.

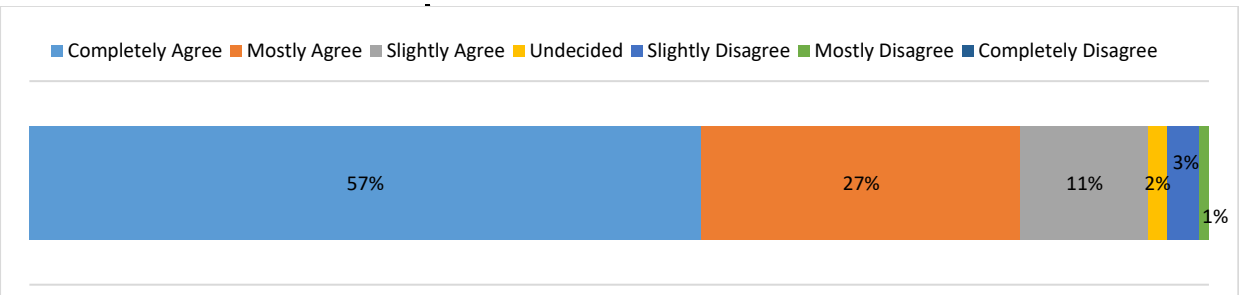

Figure 80. Percentage of panel members in each response category to statement 63.

Delphi Round 1 survey outcome: Consensus not achieved (84%). Item to be reviewed in Delphi Round 2 survey.

64. Study set-up.

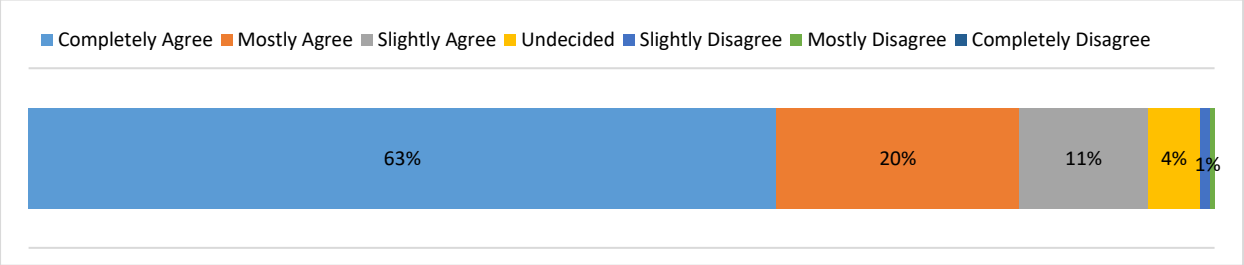

Figure 81. Percentage of panel members in each response category to statement 64.

Delphi Round 1 survey outcome: Consensus not achieved (83%). Item to be reviewed in Delphi Round 2 survey.

65. Storage of research materials.

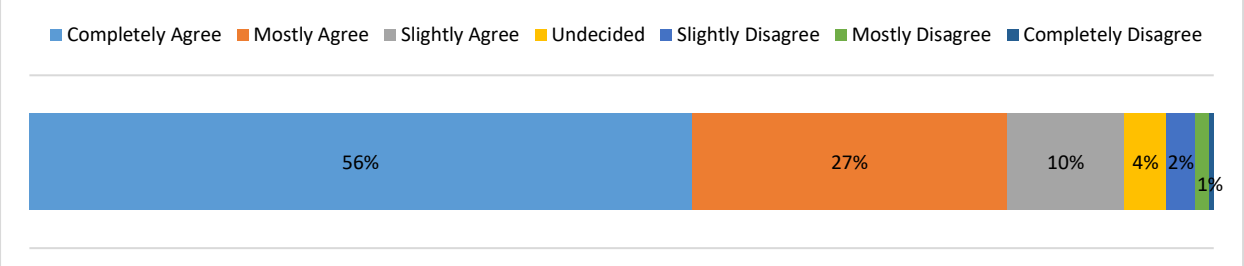

Figure 82. Percentage of panel members in each response category to statement 65.

Delphi Round 1 survey outcome: Consensus not achieved (83%). Item to be reviewed in Delphi Round 2 survey.

66. Writing a study budget.

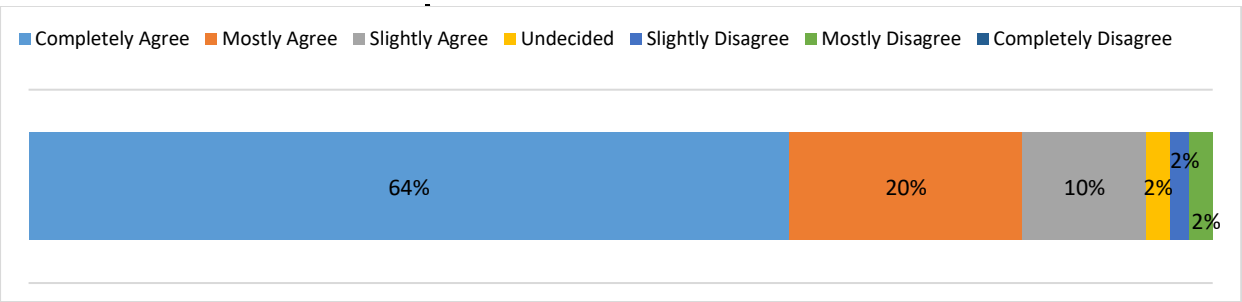

Figure 83. Percentage of panel members in each response category to statement 66.

Delphi Round 1 survey outcome: Consensus not achieved (84%). Item to be reviewed in Delphi Round 2 survey.

67. Budget management.

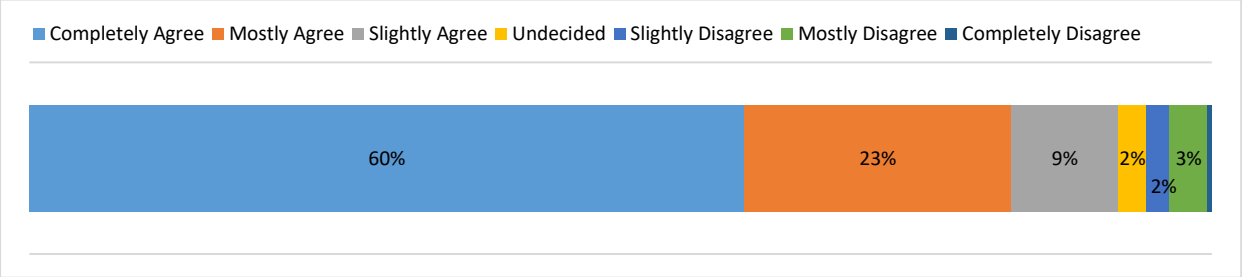

Figure 84. Percentage of panel members in each response category to statement 67.

Delphi Round 1 survey outcome: Consensus not achieved (83%). Item to be reviewed in Delphi Round 2 survey.

68. Security issues during data collection and how to manage risk.

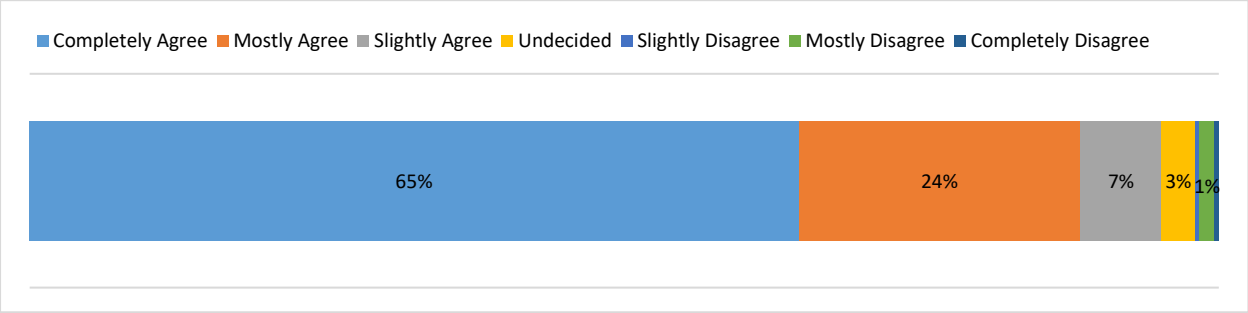

Figure 85. Percentage of panel members in each response category to statement 68.

Delphi Round 1 survey outcome: Consensus achieved (89%). Item included in *Essential Research Skills Training Curriculum.*

69. Laboratory biosafety and how to manage hazards.

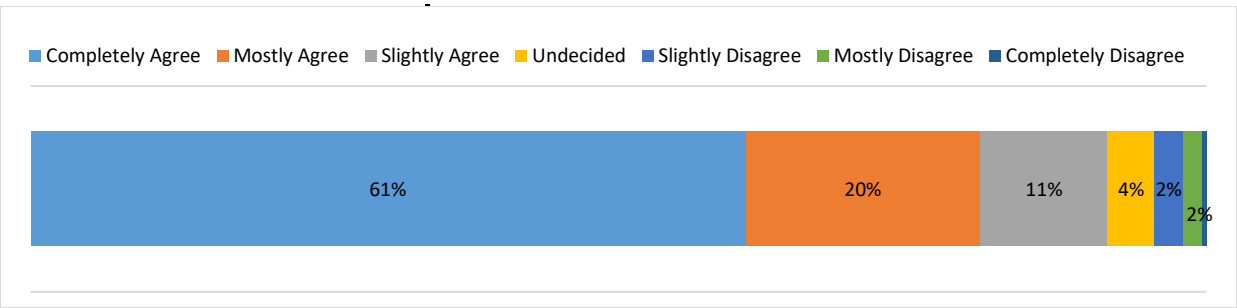

Figure 86. Percentage of panel members in each response category to statement 69.

Delphi Round 1 survey outcome: Consensus not achieved (81%). Item to be reviewed in Delphi Round 2 survey.

70. Pharmacovigilance principles and reporting adverse effects.

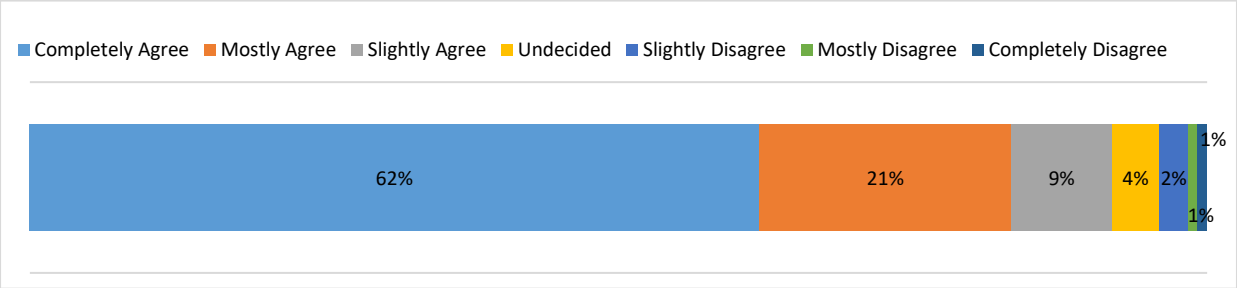

Figure 87. Percentage of panel members in each response category to statement 70.

Delphi Round 1 survey outcome: Consensus not achieved (83%). Item to be reviewed in Delphi Round 2 survey.

71. Professional guidelines and codes of ethics which apply to the conduct of clinical research.

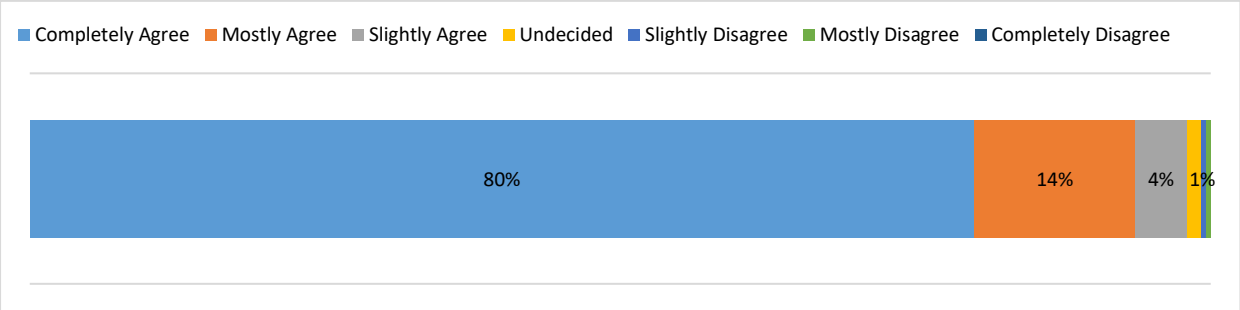

Figure 88. Percentage of panel members in each response category to statement 71.

Delphi Round 1 survey outcome: Consensus achieved (94%). Item included in *Essential Research Skills Training Curriculum.*

72. Informed consent and assent.

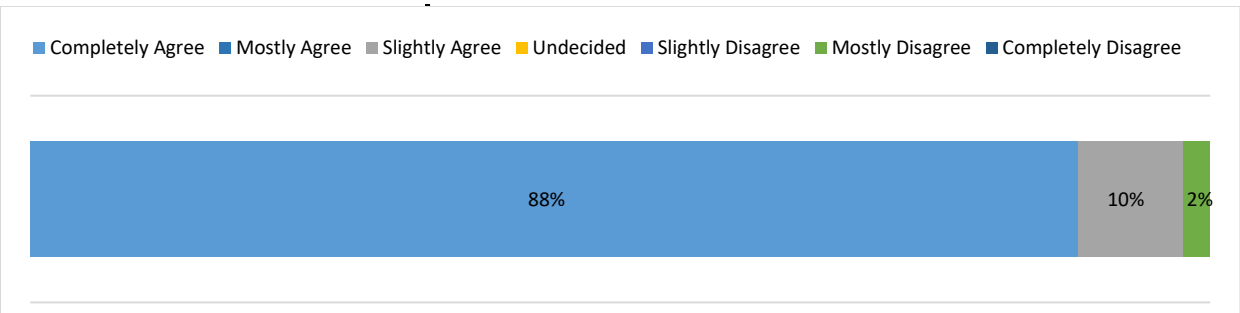

Figure 89. Percentage of panel members in each response category to statement 72.

Delphi Round 1 survey outcome: Consensus achieved (98%). Item included in *Essential Research Skills Training Curriculum.*

73. Participants' confidentiality and privacy.

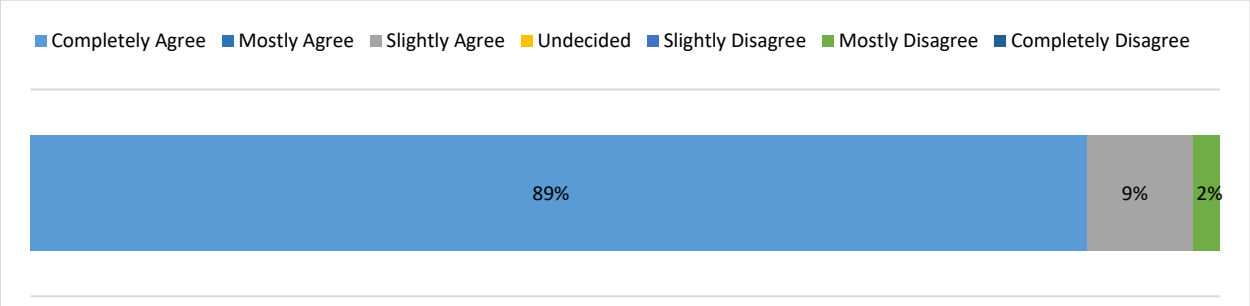

Figure 90. Percentage of panel members in each response category to statement 73.

Delphi Round 1 survey outcome: Consensus achieved (98%). Item included in *Essential Research Skills Training Curriculum.*

74. Definition of vulnerable populations and ethics of working with these populations.

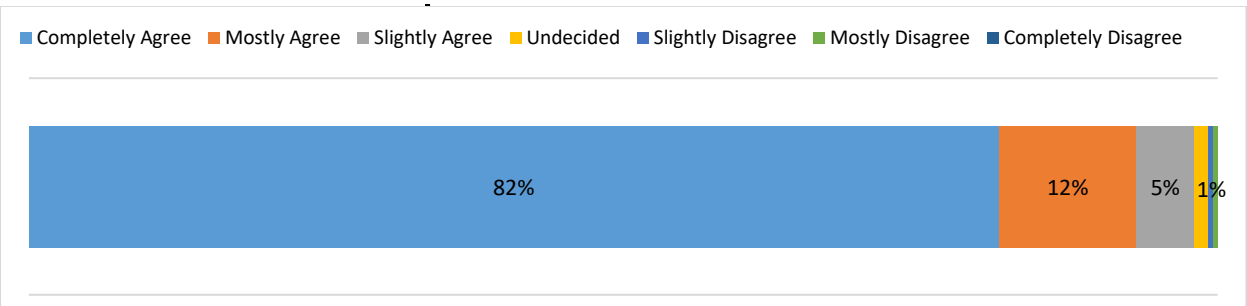

Figure 91. Percentage of panel members in each response category to statement 74.

Delphi Round 1 survey outcome: Consensus achieved (94%). Item included in *Essential Research Skills Training Curriculum.*

75. Ethical practices around data handling/management.

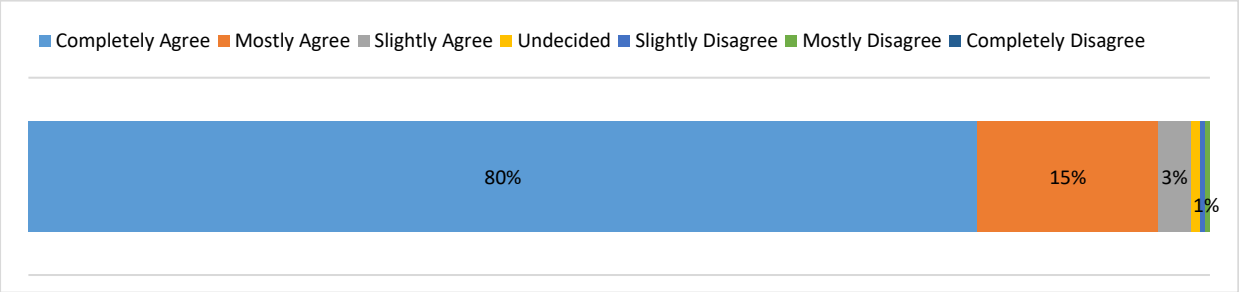

Figure 92. Percentage of panel members in each response category to statement 75.

Delphi Round 1 survey outcome: Consensus achieved (95%). Item included in *Essential Research Skills Training Curriculum.*

76. Ethical issues related to biological samples.

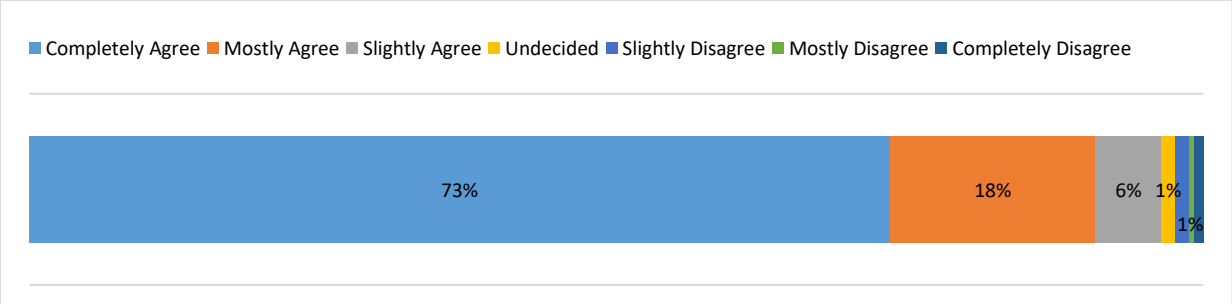

Figure 93. Percentage of panel members in each response category to statement 76.

Delphi Round 1 survey outcome: Consensus achieved (91%). Item included in *Essential Research Skills Training Curriculum.*

77. Ethical issues related to genetic procedures.

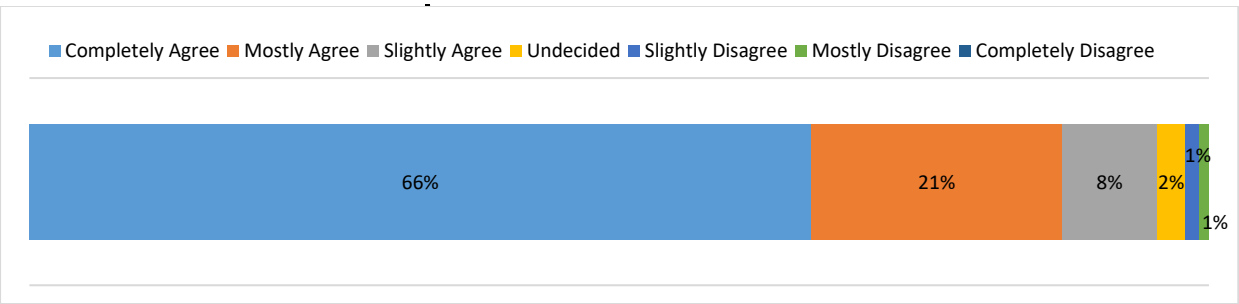

Figure 94. Percentage of panel members in each response category to statement 77.

Delphi Round 1 survey outcome: Consensus achieved (87%). Item included in *Essential Research Skills Training Curriculum.*

78. Setting up an ethical review board or committee.

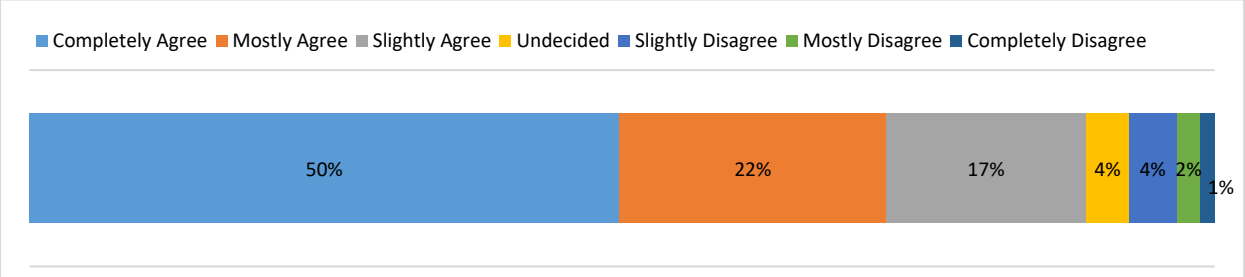

Figure 95. Percentage of panel members in each response category to statement 78.

Delphi Round 1 survey outcome: Consensus not achieved (72%). Item to be reviewed in Delphi Round 2 survey.

79. Study reporting procedures and practices.

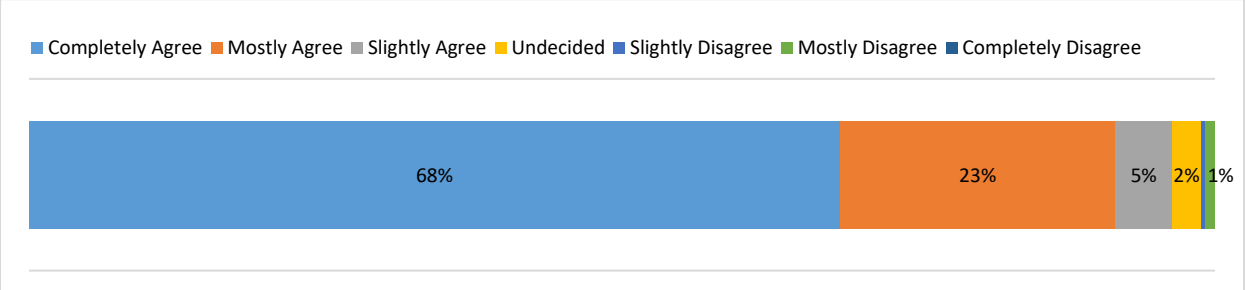

Figure 96. Percentage of panel members in each response category to statement 79.

Delphi Round 1 survey outcome: Consensus achieved (91%). Item included in *Essential Research Skills Training Curriculum.*

80. Study close (archiving data, sample storing, notification of closure processes).

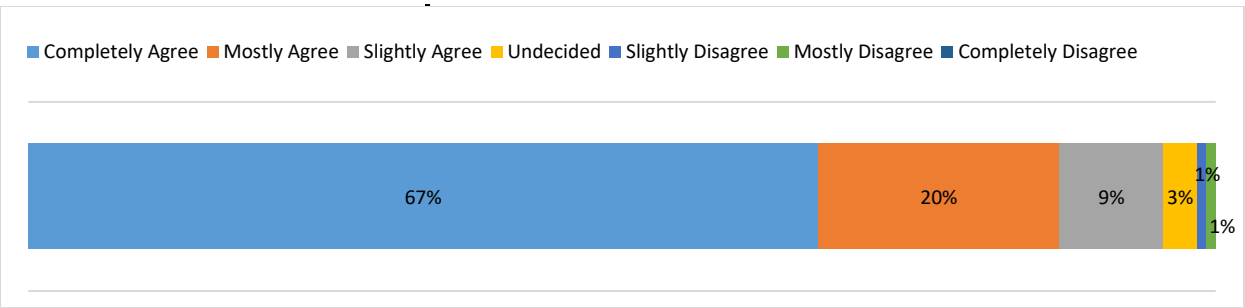

Figure 97. Percentage of panel members in each response category to statement 80.

Delphi Round 1 survey outcome: Consensus achieved (87%). Item included in *Essential Research Skills Training Curriculum.*

81. Scientific writing for journal publications.

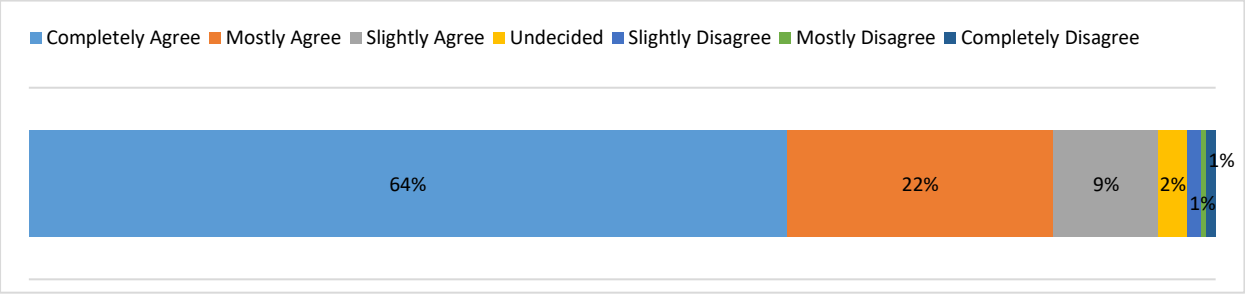

Figure 98. Percentage of panel members in each response category to statement 81.

Delphi Round 1 survey outcome: Consensus achieved (86%). Item included in *Essential Research Skills Training Curriculum.*

82. How to search for secondary datasets in different databases.

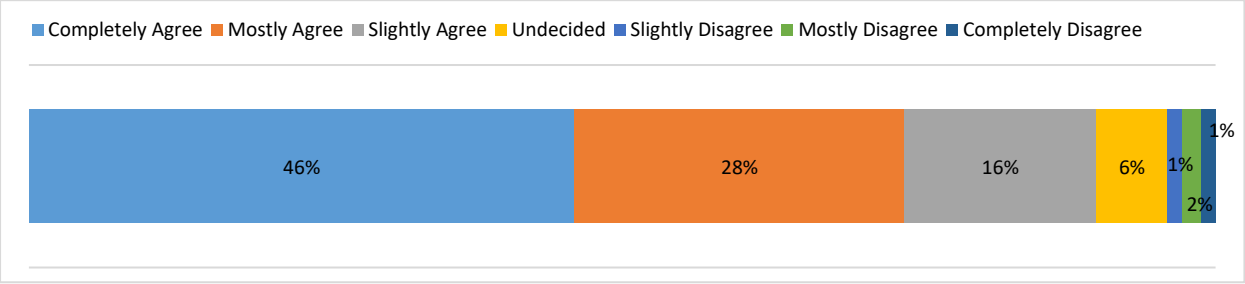

Figure 99. Percentage of panel members in each response category to statement 82.

Delphi Round 1 survey outcome: Consensus not achieved (74%). Item to be reviewed in Delphi Round 2 survey.

83. Steps to conduct a literature review.

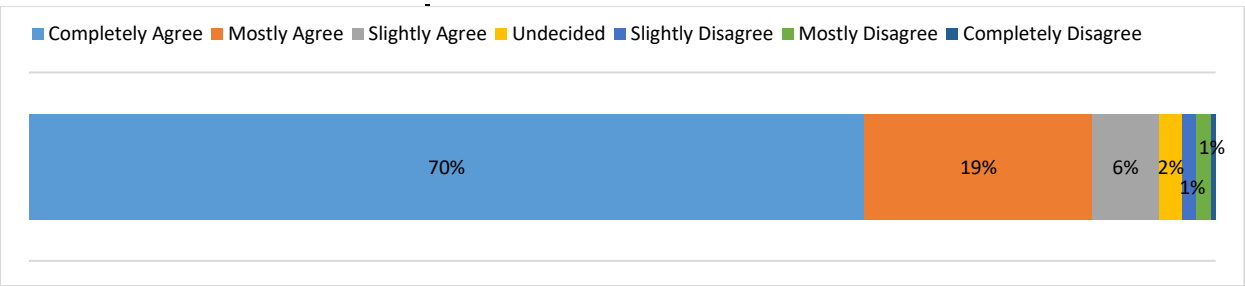

Figure 100. Percentage of panel members in each response category to statement 83.

Delphi Round 1 survey outcome: Consensus achieved (89%). Item included in *Essential Research Skills Training Curriculum.*

84. Best practices regarding referencing and plagiarism.

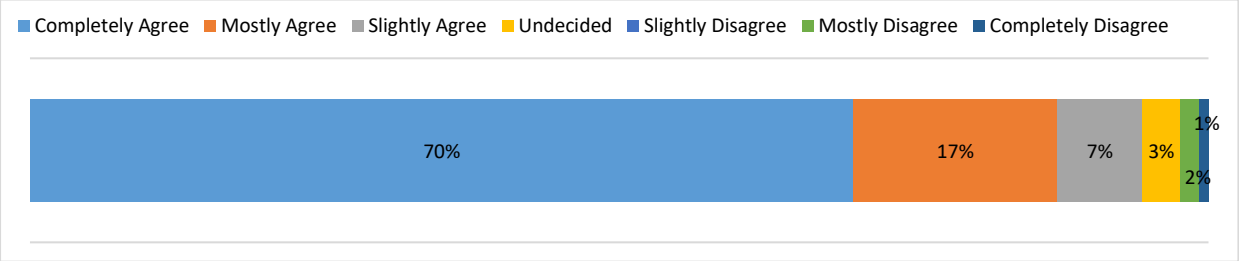

Figure 101. Percentage of panel members in each response category to statement 84.

Delphi Round 1 survey outcome: Consensus achieved (87%). Item included in *Essential Research Skills Training Curriculum.*

85. Use of citation tools (that is, Mendeley).

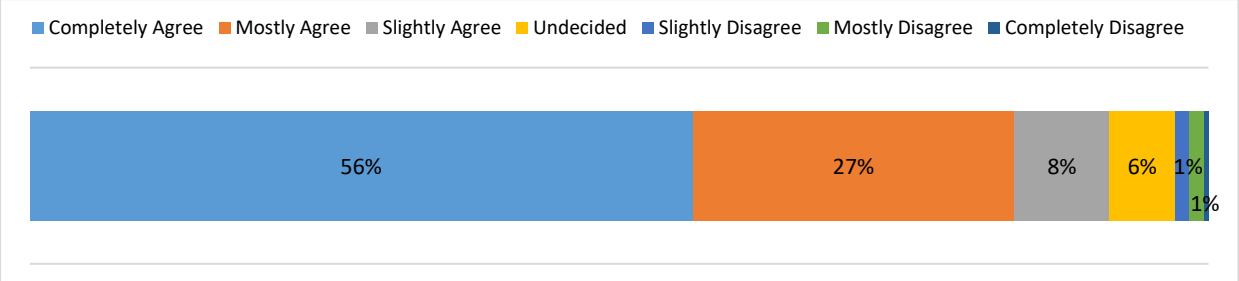

Figure 102. Percentage of panel members in each response category to statement 85.

Delphi Round 1 survey outcome: Consensus not achieved (83%). Item to be reviewed in Delphi Round 2 survey.

86. How to translate research results into policy (policy formulation and reviews).

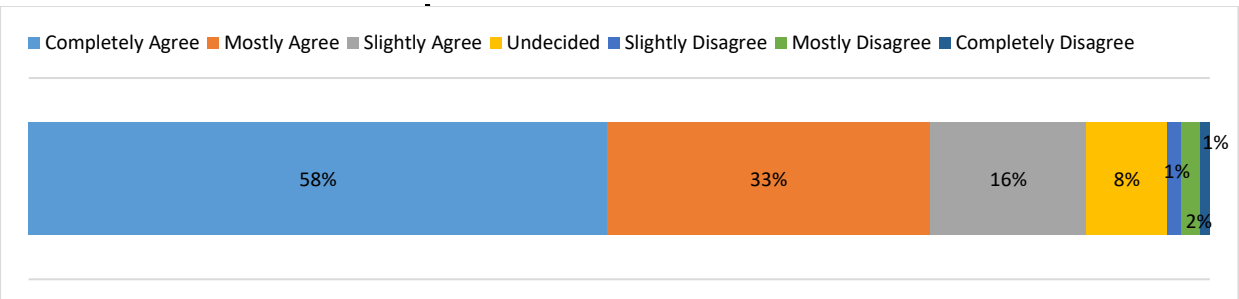

Figure 103. Percentage of panel members in each response category to statement 86.

Delphi Round 1 survey outcome: Consensus achieved (91%). Item included in *Essential Research Skills Training Curriculum.*

87. How to translate research results into practice within health care settings.

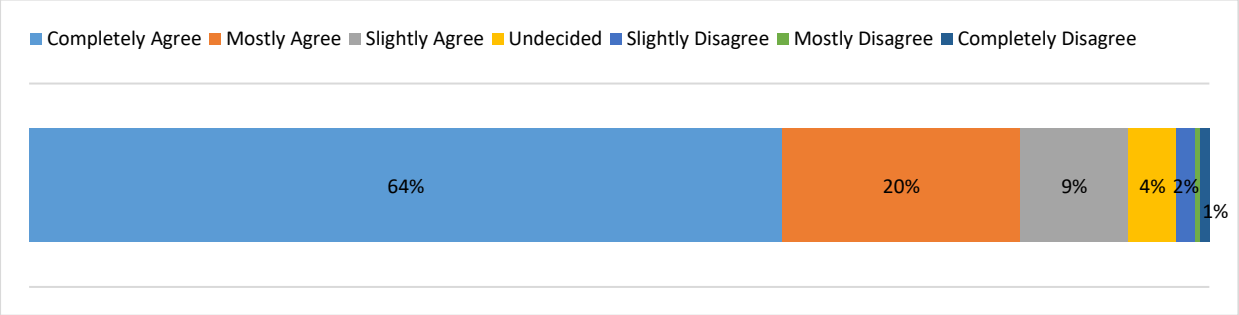

Figure 104. Percentage of panel members in each response category to statement 87.

Delphi Round 1 survey outcome: Consensus not achieved (84%). Item to be reviewed in Delphi Round 2 survey.

88. Leadership in research.

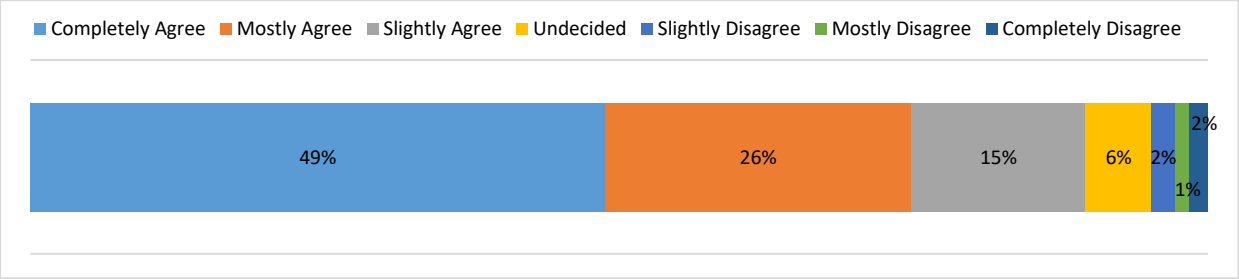

Figure 105. Percentage of panel members in each response category to statement 88.

Delphi Round 1 survey outcome: Consensus not achieved (75%). Item to be reviewed in Delphi Round 2 survey.

89. Leading and managing complex research groups.

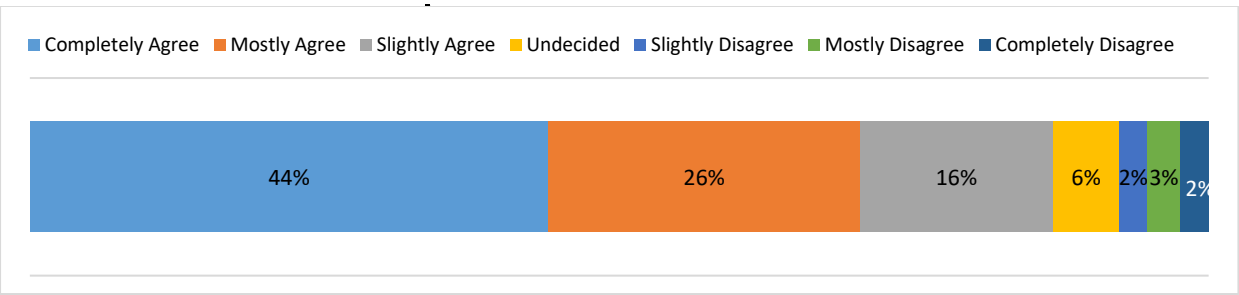

Figure 106. Percentage of panel members in each response category to statement 89.

Delphi Round 1 survey outcome: Consensus not achieved (70%). Item to be reviewed in Delphi Round 2 survey.

90. Influencing at institutional level to enable research.

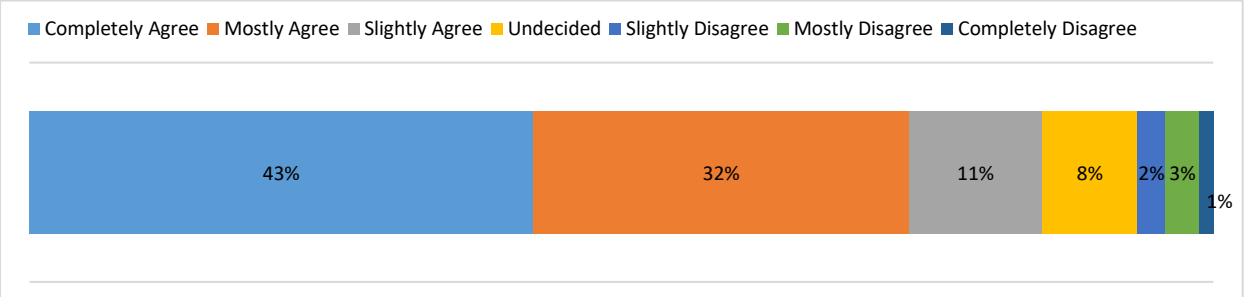

Figure 107. Percentage of panel members in each response category to statement 90.

Delphi Round 1 survey outcome: Consensus not achieved (75%). Item to be reviewed in Delphi Round 2 survey.

91. Teamwork.

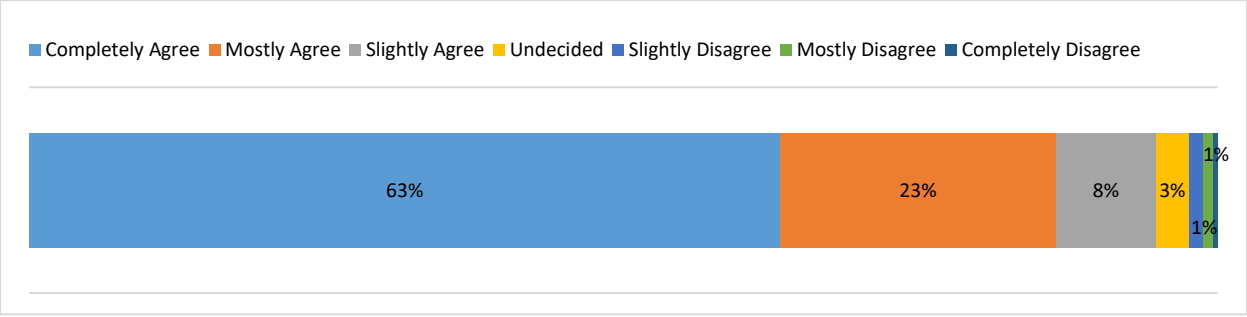

Figure 108. Percentage of panel members in each response category to statement 91.

Delphi Round 1 survey outcome: Consensus achieved (86%). Item included in *Essential Research Skills Training Curriculum.*

92. Handling and negotiating with a range of stakeholders.

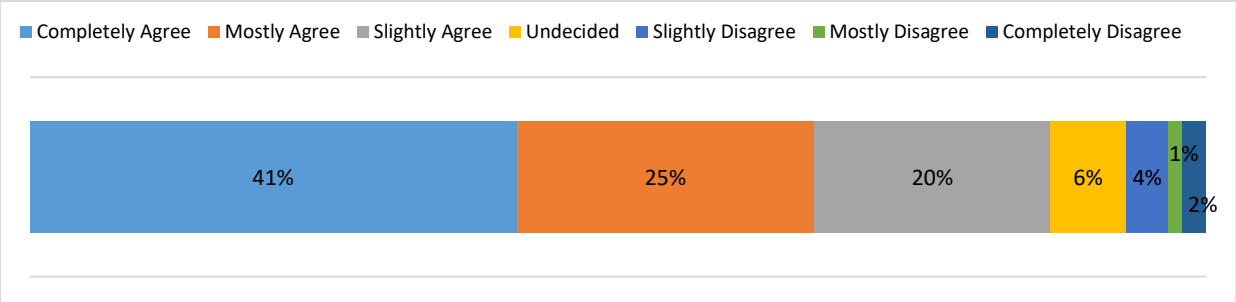

Figure 109. Percentage of panel members in each response category to statement 92.

Delphi Round 1 survey outcome: Consensus not achieved (66%). Item to be reviewed in Delphi Round 2 survey.

93. Critical thinking in research.

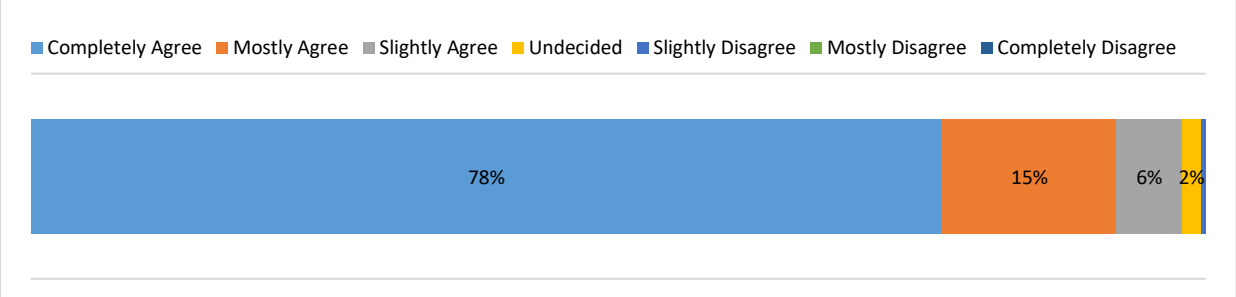

Figure 110. Percentage of panel members in each response category to statement 93.

Delphi Round 1 survey outcome: Consensus achieved (93%). Item included in *Essential Research Skills Training Curriculum.*

94. Building trust within a team.

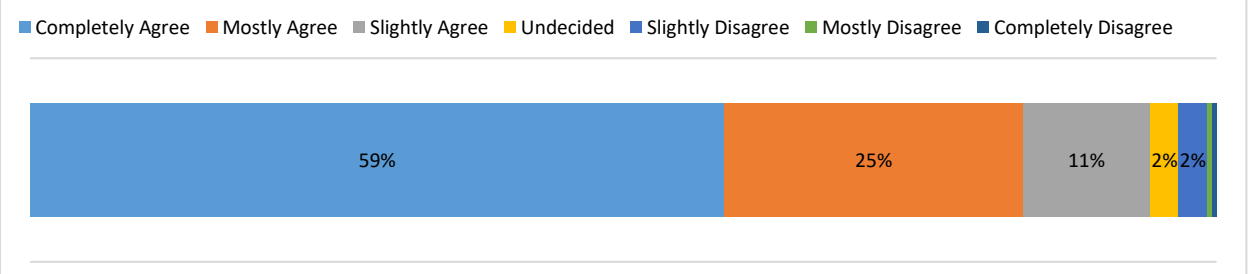

Figure 111. Percentage of panel members in each response category to statement 94.

Delphi Round 1 survey outcome: Consensus not achieved (84%). Item to be reviewed in Delphi Round 2 survey.

95. Communicating research.

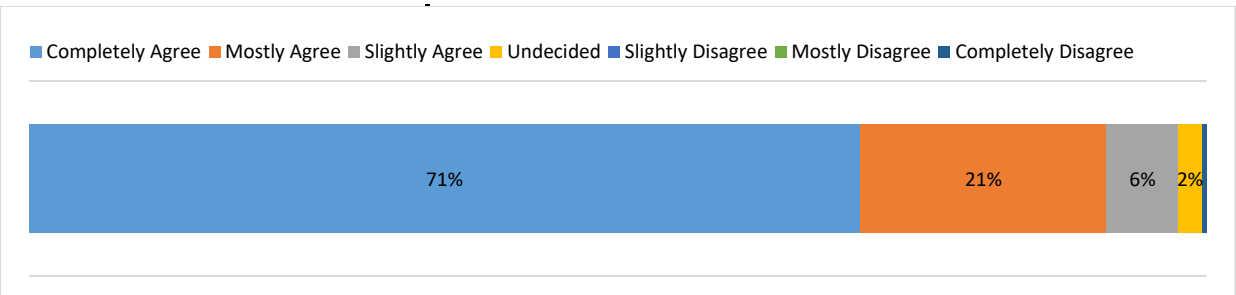

Figure 112: Percentage of panel members in each response category to statement 95.

Delphi Round 1 survey outcome: Consensus achieved (92%). Item included in *Essential Research Skills Training Curriculum.*

96. Developing effective research teams with named roles and responsibilities for team.

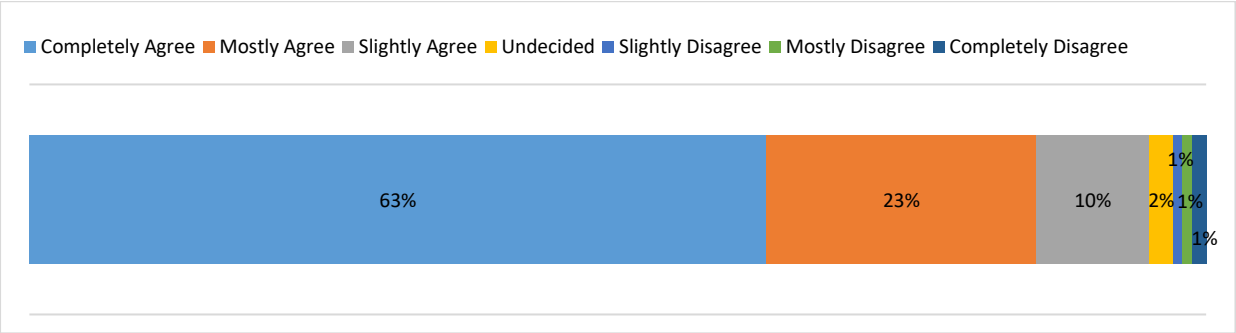

Figure 113. Percentage of panel members in each response category to statement 96.

Delphi Round 1 survey outcome: Consensus achieved (86%). Item included in *Essential Research Skills Training Curriculum.*

97. Networking and how to create collaborations.

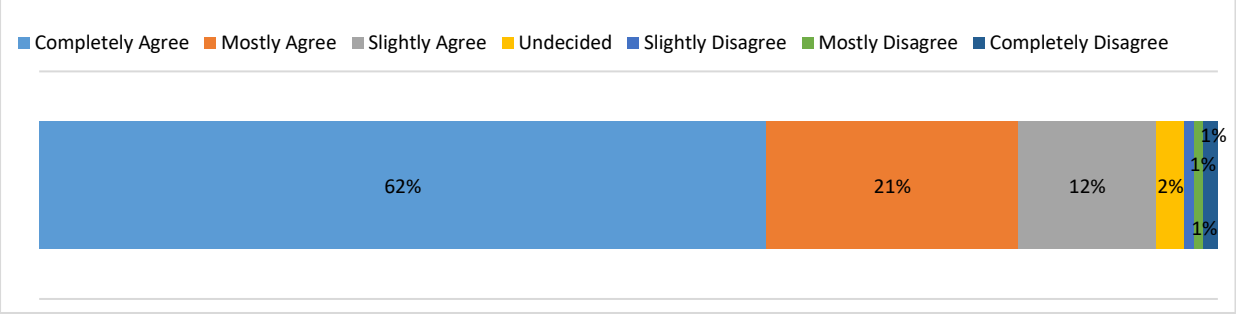

Figure 114. Percentage of panel members in each response category to statement 97.

Delphi Round 1 survey outcome: Consensus not achieved (83%). Item to be reviewed in Delphi Round 2 survey.

98. Building your career in research.

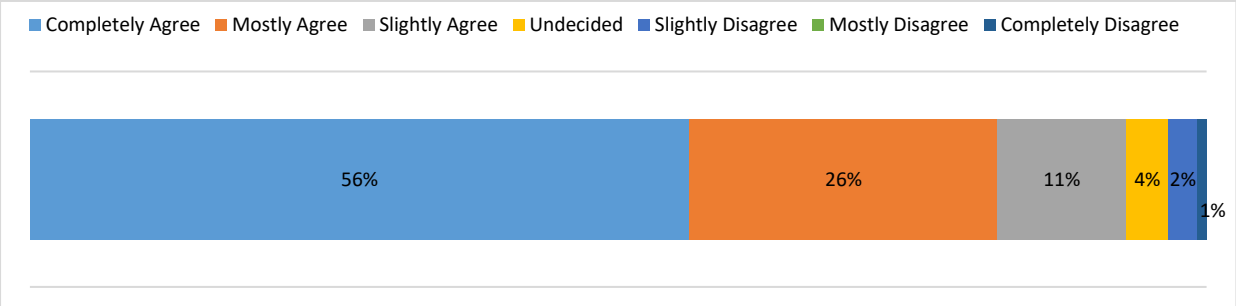

Figure 115. Percentage of panel members in each response category to statement 98.

Delphi Round 1 survey outcome: Consensus not achieved (82%). Item to be reviewed in Delphi Round 2 survey.

In addition, we conducted hierarchical cluster analysis with round 1 scores to determine whether there were obvious patterns in the responses correlated to country income classification, years of experience in research, current role and gender. No obvious clusters were identified which would support the generalizability of the findings.

Further multivariable logistic regression models were carried out separately for each of the 98 themes to identify if any of the following characteristics were associated with responses. For these analyses, a composite binary outcome was created using the following rule: if a respondent marked either "completely agree" or agree", the outcome was “in agreement” and all other responses were “otherwise” (those with missing outcomes were excluded from the analyses). The following variables were included in the multivariable logistic regression: length of research, gender, income group (high, low, middle) and expertise level of the respondent. Variable screening was not performed and all the variables were included in the multivariable analyses. No obvious predictors were identified.

New themes identified from panellists’ comments

We received 152 comments that included 124 suggestions for new curriculum themes. See Appendix 9 for the full list of comments. These 124 suggestions generated 19 new potential themes that were re-evaluated excluding:

- Those considered to be already part of the list or subthemes within the original list
- Topics outside the scope of this project such as “English language skills” or “IT skills”
- Suggestions for the focus of research studies or projects
- Suggestions about how to deliver the curriculum. This feedback will be passed onto those devising the curriculum.

The remaining suggestions were grouped into 10 new themes.

- Contingency plans for research studies (in situations like pandemics etc.)
- How to set up study training
- Critical appraisal of a research paper

- Authorship in research
- Research registries
- Medicines supply and regulations
- Research indexing
- Legal issues in research
- Intellectual property rights
- Principles of big data analysis

Summary of e-Delphi study Round 1 themes

Table 3. *Essential Research Skills Training Curriculum* themes status following e-Delphi Round 1

Consensus achieved **Themes included in the *Essential Research Skills Training Curriculum***
Concept of research for health
Identifying a research gap
Development of a research objective and a research question/formulating a hypothesis
Qualitative methodologies (including epistemology and ontology)
Quantitative methodologies
Epidemiological studies
Clinical trials
Writing a research protocol—the why and how (deviations, amendments, how to prepare and then defend protocol)
Identifying research participants and selection criteria
Qualitative sampling methodologies
Quantitative sampling methodologies
Definition of Randomization and methods
Calculation of participant sample size and sample power
Selection of control groups for comparison purposes
Definition of quality data
Qualitative data collection methods (including the concept of triangulation)
Quantitative data collection methods
Data collection tools (for example, designing surveys and CRF's), advantages and disadvantages
Data management systems
Qualitative analysis (including, for example, thematic content analysis)
Data presentation
Data sharing best practices and governance (including security confidentiality and privacy of R data/legal precedents for DS/intellectual property rights)
Monitoring and evaluation
GCP
Research project management and planning
Security issues during data collection and how to manage risk

Professional guidelines and codes of ethics which apply to the conduct of clinical research (including principles of benevolence, non-maleficence, etc)
Informed consent and assent (definitions, how to write/formulate consent forms and various tools to communicate with participants)
Participants' confidentiality and privacy
Definition of vulnerable populations and ethics of working with these populations
Ethical practices around data handling/management
Ethical issues related to biological samples
Ethical issues related to genetic procedures
Study reporting procedures skills and best practices
Study close (archiving data, sample storing, notification of closure processes)
Scientific writing for journal publications (including how to write abstracts)
Steps to conduct a literature review (including bibliographic search)
Best practices regarding referencing and plagiarism
How to translate research results into policy (policy formulation and reviews)
Teamwork
Critical thinking in research
Communicating research to different populations—general public, scientific community (public speaking)
Developing effective research teams with named roles and responsibilities for team
Consensus not achieved **Themes for inclusion in Delphi Round 2 survey**
Understanding the difference between health research and standard of care, audit, evaluation
Mixed methods research
Meta-analysis
Health policy and systems research
Health economics and economic evaluations
Research designs for outbreaks
Methodology research (research on research)
Implementation research
Experimental research
Identifying various funding agencies/sources
Ability to communicate and meet with funders

Writing a grant application and/or grant proposal
Setting up a research laboratory
Specific laboratory techniques and equipment handling
Laboratory sample handling and storage
Laboratory management
Laboratory standards and regulations
Laboratory quality best practices
Laboratory safety practices
Good clinical laboratory practice (GCLP)
Participants' retention strategies
Participant 'loss to follow-up'
Attrition bias and prevention methods
Statistics
Data analysis software (qualitative and quantitative)
Quality assurance systems
Quality management systems
Audit
Development of standard operating procedures (SOPs)
Research time management
Study set-up
Storage of research materials
Writing a study budget
Budget management
Laboratory biosafety and how to manage hazards
Pharmacovigilance principles and reporting adverse effects
Setting up an ethical review board or committee
How to search for secondary datasets in different databases
Use of citation tools (that is, Mendeley)
How to translate research results into practice within healthcare settings
Leadership in research
Leading and managing complex research groups
Influencing at institutional level to enable research

Handling and negotiating with a range of stakeholders
Building trust within a team
Networking and how to create collaborations
Building your career in research
Unclear themes **Themes for inclusion in Delphi Round 2 survey**
How to form a research agenda
Social sciences and anthropological studies
Mathematical modelling
Operational research
Good participatory Practice (GPP)
Community engagement principles and activities, from the beginning of the research cycle through to feeding back research results to communities
How to manage expectations of study communities
Governance and regulation
New themes
Contingency plans for research studies (in situations like pandemics, etc)
How to set up study training
Critical appraisal of a research paper
Authorship in research
Research registries
Medicines supply and regulations
Research indexing
Legal issues in research
Intellectual property rights
Principles of big data analysis

e-Delphi study Round 2

e- Delphi study Round 2 re-evaluated the remaining 55 themes alongside eight themes indicated as unclear in the first round and 10 new themes generated by panellists in Round 1.
For the purposes of Round 2, themes were scored on a yes/no nominal scale for both relevance and clarity.

Panellists

Characteristics of panellists

The following analysis will include data from the pilot participants who completed both Round 1 and Round 2. Pilot participants n=5.

A total of 254 panellists, including experts and stakeholders, completed the Delphi Round 1.
Round 2 of the Delphi was completed by 222 panellists, giving a panellist retention rate of 87%.

Table 4. Characteristics of panellists (self-reported)

	Delphi Survey Round 1 (N=254)			Delphi Survey Round 2 (N=222)		
Gender	Male	Female	No information	Male	Female	No information
	105	137	12	93	118	11
Age (mean)	50 (range 24–72)		10	52 (range 24–72)		10
Years of research practice: self-reported (average)	10 years		10	11 years		10

Geographical Distribution of panellists

Geographical distribution of panellists according to WHO regions.

Table 5. Geographical distribution of panellist by WHO regions. Percentages in parenthesis are based on column percentages

WHO Regions	Round 1 (n= 254)	Round 2 (n=222)
African region	81 (32%)	67 (30%)
Americas	51 (20%)	44 (20%)

Eastern Mediterranean	13 (5%)	13 (6%)
European	63 (25%)	57 (26%)
South East Asia	27 (11%)	25 (11%)
Western Pacific	19 (7%)	16 (7%)

Panellists' country of work classified by World Bank Income Groups

World Bank Income Groups published in June 2020.

Table 6. Panellists' country of work classified by World Bank list of economies (June 2019). Percentages in parenthesis are column percentages

Country classification by income	Round 1 (n= 254)	Round 2 (n=222)
High Income	83 (32%)	75 (33%)
Upper middle income	50 (20%)	44 (20%)
Lower middle income	93 (37%)	83 (38%)
Low income	28 (11%)	20 (9%)

Panellists research experience

Our panellist group included experts in research and research training, and stakeholders such as researchers with experience working for research funding organizations, editorial boards of health research journals, research advisory committee/international review board members, policy-makers, research commercial industry, research regulators and research participants.

This data was available from all panellists with the exception of 10 in Round 1, and 9 in Round 2.

Table 7. Panellists' research experience (* multiple options could be selected). Percentages in parenthesis are column percentages

Research experience	Round 1 Information available from (n= 244)		Round 2 Information available from (n= 213)	
I have experience leading research projects	146	60%	129	60%

I am currently working in research	170	70%	162	75%
I am/have been the named lead on grant applications	60	24%	56	26%
I deliver training in health research (for example, GCP)	94	38%	84	39%
I mentor undergraduate/postgraduate/PhD students engaged in research	107	43%	106	49%
I am involved in the design or coordination of training curriculums that include research skills (for example, undergraduate courses/medical courses)	68	27%	60	28%
I am a member of a research advisory committee/international review board	35	14%	35	16%
I work for a research funding organisation (for example, Wellcome, EDCTP)	14	6%	10	4%
I have authored and published peer-reviewed research training papers	41	16%	41	19%
I have authored and published research-training themed books or manuals	14	6%	13	6%
I am an editor or on the editorial board of a health research journal	28	11%	27	13%
I am a policy-maker or hold a position within the ministry of health	10	4%	9	4%
I work for/have experience working for a regulator (for example, FDA)	8	3%	7	3%
I work for/have experience working within commercial industry (for example, GlaxoSmithKline)	25	10%	23	11%
Research participant	105	42%	92	43%
None of the above	2	1%	4	2%
Other	13	5%	13	6%

Panellists' were asked to indicate in which field of health research they had experience. The options for this list were adapted from the WHO priorities for research for Health.

Table 8. Panellists' research health area experience (* multiple options could be selected). Percentages in parenthesis are column percentages

Health area	Round 1 Information available from (n= 244)		Round 2 Information available from (n= 213)	
Influenza (Flu) viruses	20	8%	17	7%
Ebola	10	4%	9	4%
Zika	13	5%	9	4%
Malaria	36	14%	30	14%
Dengue	23	9%	16	7%
HIV	55	22%	52	24%
Other high-threat pathogens (that is, Rift Valley fever)	2	0%	2	0%
Other human infection studies	49	20%	43	20%
Vector studies	11	4%	11	5%
Neglected tropical diseases	26	10%	26	12%
Non-communicable diseases	69	28%	67	31%
Reproductive, maternal, neonatal child or adolescents health research	65	26%	58	27%
Primary health care	60	24%	60	28%
Vaccines	37	15%	31	14%
The health impacts of climate and environmental change	6	2%	6	2%
Health promotion	46	19%	47	21%

Methodology research (research on research)	64	26%	54	25%
Health policy and systems research	26	10%	36	16%
Health economic analysis	15	6%	12	6%
Health decision sciences	15	6%	11	5%
Not applicable (that is, for research participants)	10	4%	9	4%

Table 9. Panellists' research topic experience (* multiple types of studies could be selected). Percentages in parenthesis are column percentages

Research methodology	Round 1 Information available from (n= 244)		Round 2 Information available from (n= 213)	
Clinical trials	139	57%	122	57%
Epidemiological studies	97	39%	93	44%
Case studies	81	33%	75	36%
Observational studies	146	59%	139	66%
Other Quantitative methodology studies	43	17%	39	18%
Qualitative methodology studies	90	36%	76	36%
Mixed methods research	76	31%	74	34%
Evaluation studies	54	22%	47	22%
Consensus-method studies	15	6%	15	7%
Action research	22	9%	22	10%
Document research	35	14%	35	16%
Not applicable (that is, for research participants)	6	2%	6	3%
Other	9	3%	9	4%

e-Delphi Round 2 results

The following section provides a more detailed impression of the themes.

Themes re-evaluated in Delphi Round 2 (n=222)

The panellists reached consensus in Delphi Round 1 for 43 listed themes. These themes were ranked as strongly recommended for inclusion in the *Essential Research Skills Training Curriculum*. No consensus was reached to exclude any theme from the *Essential Research Skills Training Curriculum*. The remaining 55 themes have been re-evaluated in Delphi Round 2 alongside those that were identified as unclear, and new themes suggested by panellists in Round 1.

Percentages were calculated in relation to the responses obtained and excluding "*no response*". The table below presents the relevance of themes. All themes scored as clear have been highlighted in green. The cut-off for the themes' selection is more than 80% of responses.

Table 10. e-Delphi Round 2 themes review

Round 2		Relevance					Clarity				
		Essential training		Not essential training		No response	Clear		unclear		No Response
		n	%	n	%	No response	n	%	n	%	Blank
1	Understanding the difference between research for health and standard of care, audit, evaluation	186	86%	31	14%	5	174	87%	25	13%	23
2	Mixed Methods research	164	76%	52	24%	6	167	84%	32	16%	23
3	Meta-analysis	146	67%	71	33%	5	177	92%	15	8%	30
4	Health policy and systems research	156	73%	59	27%	7	178	92%	15	8%	29
5	Health economics and economic evaluations	114	54%	99	46%	9	178	91%	17	9%	27
6	Research designs for outbreaks	164	75%	54	25%	4	178	90%	19	10%	25
7	Methodology research (research on research)	161	74%	58	26%	3	171	88%	24	12%	27
8	Implementation research	178	82%	38	18%	6	175	89%	21	11%	26

9	Experimental research	186	85%	32	15%	4	**178**	**91%**	**18**	9%	26
10	Identifying various funding agencies/sources	147	68%	70	32%	5	**190**	**95%**	**9**	5%	23
11	Ability to communicate and meet with funders	140	65%	76	35%	6	**186**	**94%**	**12**	6%	24
12	Writing a grant application and/or grant proposal	169	87%	26	13%	27	**193**	**97%**	**5**	3%	24
13	Setting up a research laboratory	119	55%	99	45%	4	**178**	**89%**	**21**	11%	23
14	Specific laboratory techniques and equipment handling	132	60%	87	40%	3	**188**	**94%**	**12**	6%	22
15	Laboratory sample handling and storage	144	66%	75	34%	3	**187**	**94%**	**11**	6%	24
16	Laboratory management	114	53%	103	47%	5	**172**	**87%**	**26**	13%	24
17	Laboratory standards and regulations	144	66%	74	34%	4	**181**	**92%**	**15**	8%	26
18	Laboratory quality best practices	153	70%	67	30%	2	**178**	**92%**	**15**	8%	29
19	Laboratory safety practices	156	71%	64	29%	2	**181**	**95%**	**10**	5%	31
20	Good clinical laboratory practice (GCLP)	173	79%	46	21%	3	**183**	**95%**	**10**	5%	29
21	Laboratory biosafety and how to manage hazards	156	71%	63	29%	3	**180**	**94%**	**12**	6%	30
22	Participant retention strategies	173	79%	45	21%	4	**169**	**87%**	**26**	13%	27
23	Participant 'loss to follow-up'	172	80%	44	20%	6	**167**	**86%**	**28**	14%	27

24	Attrition bias and prevention methods	170	79%	46	21%	6	**164**	**84%**	**31**	16%	27
25	Statistics	197	90%	22	10%	3	**184**	**94%**	**12**	6%	26
26	Data analysis software (qualitative and quantitative)	188	86%	31	14%	3	**184**	**96%**	**8**	4%	30
27	Quality assurance systems	140	65%	77	35%	5	**171**	**86%**	**27**	14%	24
28	Quality management systems	131	60%	86	40%	5	**173**	**88%**	**24**	12%	25
29	Audit	127	59%	90	41%	5	**172**	**88%**	**24**	12%	26
30	Development of standard operating procedures (SOPs)	174	81%	40	19%	8	**193**	**97%**	**6**	3%	23
31	Research time management	171	79%	45	21%	6	**185**	**93%**	**13**	7%	24
32	Study set-up	199	92%	17	8%	6	**190**	**95%**	**10**	5%	22
33	Storage of research materials	174	81%	42	19%	6	**191**	**96%**	**8**	4%	23
34	Writing a study budget	185	85%	32	15%	5	**191**	**98%**	**4**	2%	27
35	Budget management	173	79%	45	21%	4	**192**	**97%**	**5**	3%	25
36	Pharmacovigilance principles and reporting adverse effects	179	82%	40	18%	3	**187**	**96%**	**8**	4%	27
37	Setting up an ethical review board or committee	131	60%	87	40%	4	**187**	**95%**	**10**	5%	25

38	How to search for secondary datasets in different databases	151	70%	66	30%	5	**178**	**89%**	**21**	11%	23
39	Use of citation tools (that is, Mendeley)	175	81%	42	19%	5	**185**	**94%**	**11**	6%	26
40	How to translate research results into practice within health care settings	185	85%	33	15%	4	**194**	**98%**	**4**	2%	24
41	Leadership in research	147	67%	71	33%	4	**177**	**90%**	**19**	10%	26
42	Leading and managing complex research groups	123	57%	94	43%	5	**181**	**91%**	**17**	9%	24
43	Influencing at institutional level to enable research	123	58%	90	42%	9	**176**	**88%**	**25**	12%	21
44	Handling and negotiating with a range of stakeholders	135	63%	79	37%	8	**184**	**92%**	**17**	8%	21
45	Building trust within a team	176	81%	40	19%	6	**190**	**95%**	**10**	5%	22
46	Networking and how to create collaborations	172	80%	43	20%	7	**189**	**96%**	**8**	4%	25
47	Building your career in research	168	78%	48	22%	6	**183**	**92%**	**16**	8%	23

Redefined themes from Delphi Round 1 (n=222)

These themes were indicated by panellists as "unclear" in Delphi Round 1. The criterion for themes to be considered unclear was a score of <80% on the clarity classification.

Table 11. e-Delphi Round 2 review of redefined unclear themes from Round 1

		Relevance					Clarity				
	Round 2	Essential training		Not essential training		No response	Clear		unclear		No Response
		n	%	n	%	No response	n	%	n	%	Blank
48	**How to form a research agenda** - NEW: Identifying a list of research areas to focus on and the order of priority in which they should be addressed	175	81%	41	19%	6	184	92%	15	8%	23
49	**Social sciences and anthropological studies** - NEW: The role and contribution of qualitative social science approaches and social science research to understanding the context, influences and problems concerning health	148	69%	67	31%	7	177	89%	23	12%	22

50	**Mathematical modeling** - NEW: Computerized mathematical models used as research tools to simulate medical outcomes	108	50%	107	50%	7	178	89%	22	11%	22
51	**Operations research** - NEW: A discipline that uses advanced analytical methods (for example, simulation, optimization, decision analysis) to better understand complex systems and aid in decision-making	110	52%	103	48%	9	172	86%	28	14%	22
52	**Good Participatory Practice (GPP**) - NEW: Guidelines for how to effectively engage with stakeholders throughout the research cycle of health research	175	80%	43	20%	4	187	95%	10	5%	25
53	**Community engagement principles and activities, from the beginning of the research cycle through to feeding back research results to communities** - NEW: Community engagement principles and approaches used throughout the research cycle to identify partners, consult in protocol development, draft consent process, conduct research and disseminate results	179	84%	35	16%	8	183	91%	18	9%	21

54	**How to manage expectations of study communities -** NEW: Consider the expectations of all of those involved in the research process; the overall aim of the research and what it hopes to achieve, and therefore who seeks to gain (and what) from participating in such a research study	166	76%	51	24%	5	178	91%	18	9%	26
55	**Governance and regulation** - NEW: Governance is the system of administration, regulations and supervision through which research is managed, participants and staff are protected, and accountability is assured	180	83%	37	17%	5	183	93%	14	7%	25

New themes identified from panellist comments in Delphi Round 1 (n=222)

Table 12. e-Delphi Round 2 review of new themes identified in Round 1

		Relevance					Clarity				
	Round 2	Essential training		Not essential training		No response	Clear		unclear		No Response
		n	%	n	%	No response	n	%	n	%	Blank
56	Contingency plans for research studies (in situations like pandemics, etc)	165	75%	54	25%	3	183	94%	11	6%	28

57	How to set up study training	162	75%	53	25%	7	174	89%	21	11%	27
58	Critical appraisal of a research paper	186	85%	32	15%	4	184	94%	11	6%	27
59	Authorship in research	175	80%	43	20%	4	185	94%	11	6%	26
60	Research registries (database that allows researchers to provide specific details about their project to serve as a record for the scientific community)	160	74%	55	26%	7	164	84%	32	16%	26
61	Medicines supply and regulations	116	54%	100	46%	6	167	85%	30	15%	25
62	Research indexing (indexing is the process of creating indexes for record collections. Indexing journals/research allows for discoverability)	121	56%	95	44%	6	141	73%	53	27%	28
63	Legal issues in research	183	84%	34	16%	5	181	92%	15	8%	26
64	Intellectual property rights	163	74%	56	26%	3	177	91%	17	9%	28
65	Principles of big data analysis	154	70%	65	30%	3	170	87%	25	13%	27

The full list of Delphi Round 2 panellists' comments can be found in Appendix 10.

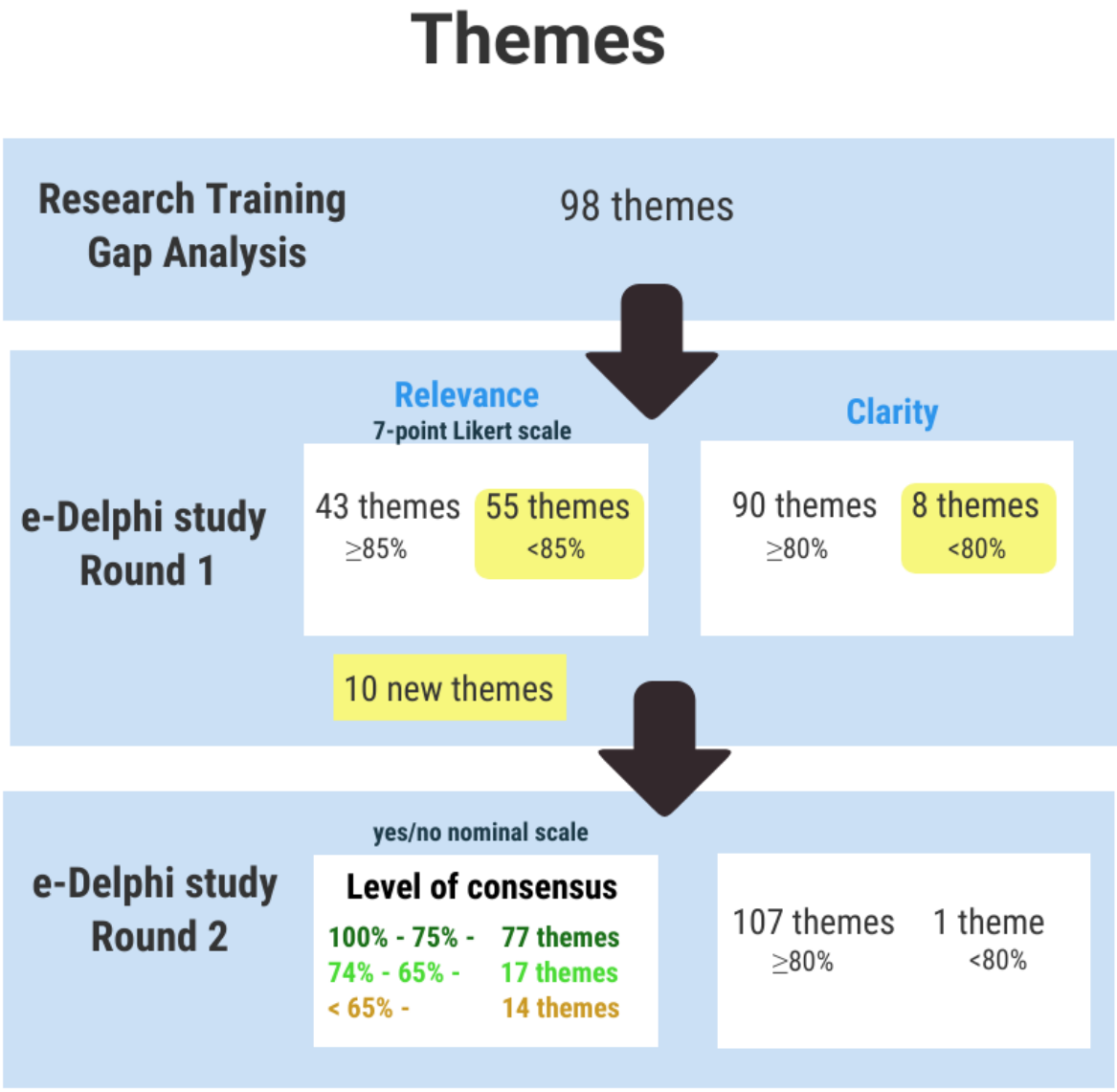

Figure 116. Evolution of themes through the study process.

Summary: Themes in order of level of consensus following Round 2

The level of agreement between experts and stakeholders was translated into levels of recommendations for inclusion in the *Essential Research Skills Training Curriculum*. The levels are classified as follows:

- Level of consensus achieved 100%–75% = Strong recommendation
- Level of consensus achieved 74%–65% = Medium recommendation
- Level of consensus achieved <65%–Weak recommendation

Table key

Level of consensus 100% - 75%
Level of consensus 74% - 65%
Level of consensus <65%
Items added by panellists

Table 13. Themes in order of level of consensus following e-Delphi Round 2

Essential Research Skills Training themes	Round 1 level of consensus	Round 2 level of consensus
Informed Consent and assent	98%	98%
Participants' confidentiality and privacy	98%	98%
Data collection tools (for example, designing surveys and CRF's)	95%	95%
Ethical practices around data handling/management	95%	95%
Identifying research participants and selection criteria	94%	94%
Professional guidelines and codes of ethics which apply to the conduct of clinical research	94%	94%
Definition of vulnerable populations and ethics of working with these populations	94%	94%
Qualitative data collection methods	93%	93%
Quantitative data collection methods	93%	93%
Critical thinking in research	93%	93%
Writing a research protocol	93%	93%
Selection of control groups for comparison purposes	92%	92%
Definition of quality data	92%	92%
Study set-up	83%	92%
Communicating research	92%	92%
Development of a research question	91%	91%
Quantitative sampling methods	91%	91%
Ethical issues related to biological samples	91%	91%
Study reporting procedures and practices	91%	91%
How to translate research results into policy (policy formulation and reviews)	91%	91%
Quantitative methodologies	90%	90%
Statistics	84%	90%
Qualitative sampling methods	89%	89%
Definition and methods of randomization	89%	89%
Security issues during data collection and how to manage risk	89%	89%
Steps to conduct a literature review	89%	89%
Concept of health research	88%	88%
Identifying a research gap	88%	88%
Calculation of participant sample size and sample power	88%	88%
Data management systems	88%	88%

Data presentation	88%	88%
Good clinical practice (GCP)	88%	88%
Research project management and planning	88%	88%
Epidemiological studies	87%	87%
Clinical trials	87%	87%
Writing a grant application and/or grant proposal	84%	87%
Data sharing best practices and governance	87%	87%
Monitoring and Evaluation	87%	87%
Ethical issues related to genetic procedures	87%	87%
Study close (archiving data, sample storing, notification of closure processes)	87%	87%
Best practices regarding referencing and plagiarism	87%	87%
Understanding the difference between health research and standard of care, audit, evaluation	79%	86%
Qualitative methodologies	86%	86%
Scientific writing for journal publications	86%	86%
Teamwork	86%	86%
Developing effective research teams with named roles and responsibilities for team	86%	86%
Experimental research	78%	85%
Qualitative analysis	85%	85%
Data analysis software (qualitative and quantitative)	80%	85%
Writing a study budget	84%	85%
How to translate research results into practice within health care settings	84%	85%
Critical appraisal of a research paper		85%
Community engagement principles and activities	**unclear**	84%
Legal issues in research		84%
Governance and regulation	**unclear**	83%
Implementation research	73%	82%
Pharmacovigilance principles and reporting adverse effects	83%	82%
How to form a research agenda	**unclear**	81%
Development of standard operating procedures (SOPs)	82%	81%
Storage of research materials	83%	81%
Use of citation tools (that is, Mendeley)	83%	81%
Building trust within a team	84%	81%
Good participatory practice (GPP)	**unclear**	80%
Participant 'loss to follow-up'	80%	80%
Networking and how to create collaborations	83%	80%
Authorship in research		80%
Good clinical laboratory practice (GCLP)	72%	79%
Participants' retention strategies	80%	79%
Attrition bias and prevention methods	80%	79%

Research time management	84%	79%
Budget management	83%	79%
Building your career in research	82%	78%
Mixed methods research	79%	76%
How to manage expectations of study communities	unclear	76%
Research designs for outbreaks	81%	75%
Contingency plans for research studies (in situations like pandemics, etc)		75%
How to set up study training		75%
Methodology research (research on research)	75%	74%
Research registries		74%
Intellectual property rights		74%
Health policy and systems research	74%	73%
Laboratory safety practices	71%	71%
Laboratory biosafety and how to manage hazards	81%	71%
Laboratory quality best practices	71%	70%
How to search for secondary datasets in different databases	74%	70%
Principles of big data analysis		70%
Social sciences and anthropological studies	unclear	69%
Identifying various funding agencies/sources	75%	68%
Meta-analysis	70%	67%
Leadership in research	75%	67%
Laboratory sample handling and storage	63%	66%
Laboratory standards and regulations	68%	66%
Ability to communicate and meet with funders	75%	65%
Quality assurance systems	78%	65%
Handling and negotiating with a range of stakeholders	66%	63%
Specific laboratory techniques and equipment handling	54%	60%
Quality management systems	80%	60%
Setting up an ethical review board or committee	72%	60%
Audit	76%	59%
Influencing at institutional level to enable research	75%	58%
Leading and managing complex research groups	70%	57%
Research indexing		56%
Setting up a research laboratory	49%	55%
Health economics and economic evaluations	67%	54%
Medicines supply and regulations		54%
Laboratory management	60%	53%
Operational research	unclear	52%
Mathematical modeling	unclear	50%

Mapping

Following the 2-round e-Delphi study, the research team developed a curriculum framework by grouping the 108 themes identified by the panellists. This presented an initial structure of the *Essential Research Skills Training Curriculum* themes by providing suggested "parent modules" and the relevant themes generated and included to inform each module. These theme groupings were initially presented and evaluated at a Stakeholder Review Workshop hosted in December 2020.

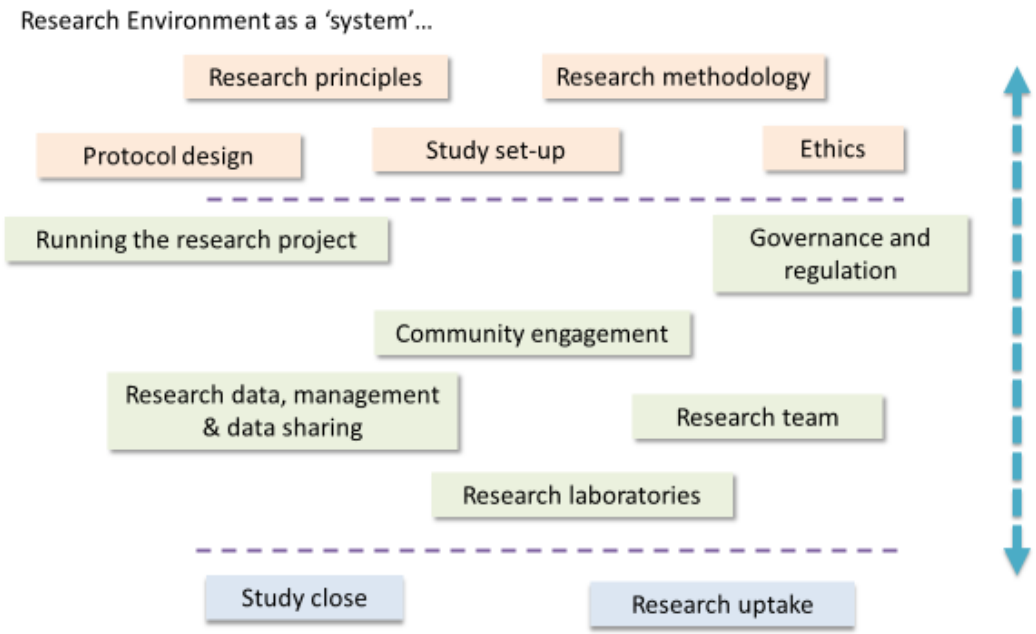

Figure 117. Overview of initial grouping of themes into parent modules.

Essential Research Skills Training Curriculum: Delphi themes' initial mapping

Table 14. *Essential Research Skills Training Curriculum*: Delphi themes' initial mapping.
The themes listed within the modules do not represent individual lessons to be delivered; they are an indication of concepts to be included in the module.

Research Principles	
Critical thinking in research	93%
Development of a research question.	91%
Concept of health research.	88%
Good clinical practice (GCP).	88%
Identifying a research gap.	88%
Understanding the difference between health research and standard of care, audit, evaluation.	86%
Critical appraisal of a research paper	85%
Legal issues in research	84%
How to form a research agenda.	81%
Governance and regulation	
Governance and regulation	83%
Quality assurance systems	65%
Quality management systems	60%
Medicines Supply and Regulations	54%

Research Methodology	
Qualitative data collection methods.	93%
Quantitative data collection methods.	93%
Selection of control groups for comparison purposes.	92%
Qualitative sampling methods	91%
Quantitative sampling methods.	91%
Quantitative methodologies.	90%
Qualitative sampling methods.	89%
Steps to conduct a literature review.	89%
Epidemiological studies.	87%
Clinical trials.	87%
Qualitative methodologies.	86%
Experimental research.	85%
Qualitative analysis.	85%
Implementation research.	82%
Mixed Methods research.	76%
Research designs for outbreaks	75%
Methodology Research (research on research).	74%
Health Policy and Systems Research.	73%
How to search for secondary datasets in different databases.	70%
Social sciences and anthropological studies.	69%

Meta-analysis.	67%
Health economics and economic evaluations.	54%
Operational research.	52%

Protocol design	
Identifying research participants and selection criteria	94%
Writing a research protocol	93%
Definition and methods of randomization	89%
Calculation of participant sample size and sample power	88%
Writing a study budget	85%

Study set up	
Data collection tools (e.g. designing surveys and CRF's).	95%
Study set-up	92%
Writing a grant application and/or grant proposal	87%
Storage of research materials	81%
Development of Standard Operating Procedures (SOPs)	81%
How to set up study training	75%

Running the research project	
Study reporting procedures and practices	91%
Research Project management and planning.	88%
Monitoring and Evaluation.	87%
Pharmacovigilance principles and reporting adverse effects.	82%
Participant 'loss to follow-up'.	80%
Budget management.	79%
Research Time management.	79%
Contingency plans for research studies (in situations like pandemics, etc)	75%
Audit.	59%

Study close	
Study close (archiving data, sample storing, notification of closure processes).	87%
Best practices regarding referencing and plagiarism.	87%
Scientific writing for journal publications.	86%
Use of citation tools (i.e. Mendeley).	81%
Authorship in research	80%
Research registries	74%
Intellectual property rights	74%

Identifying various funding agencies/sources	68%

Ethics	
Informed Consent and assent.	98%
Participant's confidentiality and privacy.	98%
Ethical practices around data handling/management.	95%
Professional guidelines and codes of ethics which apply to the conduct of clinical research.	94%
Definition of vulnerable populations and ethics of working with these populations.	94%
Ethical issues related to biological samples.	91%
Ethical issues related to genetic procedures.	87%
Setting up an ethical review board or committee.	60%

Research data, management & data sharing	
Definition of data quality	92%
Statistics.	90%
Security issues during data collection and how to manage risk.	89%
Data management systems.	88%
Data presentation.	88%
Data sharing best practices and governance.	87%
Data analysis software (qualitative and quantitative).	85%
Principles of Big data analysis	70%
Mathematical Modelling.	50%

Community engagement	
Community engagement principles and activities.	84%
How to manage expectations of study communities.	76%
Good Participatory Practice (GPP).	80%
Participants' retention strategies.	79%
Attrition bias and prevention methods.	79%

Research laboratories	
Good Clinical Laboratory Practice (GCLP).	79%
Laboratory safety practices.	71%
Laboratory biosafety and how to manage hazards.	71%
Laboratory quality best practices.	70%
Laboratory sample handling and storage.	66%
Laboratory standards and regulations.	66%
Specific laboratory techniques and equipment handling.	60%
Setting up a research laboratory.	55%
Laboratory management.	53%

Research Team	
Teamwork	86%
Developing effective research teams with named roles and responsibilities for team	86%
Building trust within a team	81%
Networking and how to create collaborations	80%
Building your career in research	78%
Leadership in research.	67%
Ability to communicate and meet with funders.	65%
Handling and negotiating with a range of stakeholders	63%
Influencing at institutional level to enable research.	58%
Leading and managing complex research groups.	57%

Research uptake - How to make a difference with your findings	
Communicating research	92%
How to translate research results into policy (policy formulation and reviews).	91%
How to translate research results into practice within healthcare settings.	85%
Research Indexing	56%

Study Stage 3 - Workshops

Stakeholder Review Workshop

On the 17 December 2020, The Global Health Network (TGHN) and the Special Programme for Research and Training in Tropical Diseases (TDR) hosted a virtual "Stakeholder Review Workshop" to validate the proposed curriculum framework. This workshop contributed to the third and final stage of the study process for *Developing an Evidence-led Essential Research Skills Training Curriculum*. In response to the COVID-19 pandemic, the workshop was hosted virtually, using the zoom video conferencing system. Here we report the results of the workshop.

Date of Workshop: 17 December 2020, 13.00-14.30 GMT

Workshop chairing panel

- *Trudie Lang,* Professor of Global Health Research at the University of Oxford and Director of TGHN
- *Dermot Maher,* Unit Head, Research Capacity Strengthening at TDR
- *Pascal Launois,* Research Capacity Strengthening Scientist at TDR and Manager of the Career Development Fellowship programme.
- *Arancha de la Horra,* Clinical Research Specialist at TGHN
- *Bonny Baker,* Regional Programme Lead, TGHN
- *Nicole Feune de Colombi,* Scientific Coordinator, TGHN
- *Prabin Dahal,* Statistician, Infectious Diseases Data Observatory

At the end of Stage 2, a final list of 108 themes was generated for inclusion in the curriculum. The research team grouped the themes into 13 "parent modules", which were reviewed by the stakeholders attending the workshop.

Stakeholder Review Workshop objectives

This workshop was a joint collaboration between TDR and TGHN. The aim of the workshop was to consider the results of the study, to:

i) review the suitability of the theme groupings as an accurate reflection of the content; *and*

ii) to evaluate the applicability of the proposed *Essential Research Skills Training Curriculum* findings to the global research community

The research team gave a presentation offering an overview of the methodology undertaken and the findings of the study. Full workshop agenda is listed in Appendix 11. Stakeholders engaged in an interactive polling exercise to add to these findings. This workshop focused on capturing stakeholders' feedback to address a limitation identified during Stage 1 as the Delphi study panel had only 3% stakeholder representation.

Stakeholder Review Workshop participants' characteristics

From the 70 global health research stakeholders that were invited, 42 (60%) participated in the workshop. The following figures describe their roles as stakeholders in the field of health research.

a. What type of establishment do you primarily work for?

Figure 118. Stakeholders' primary work establishment.

b. Which of the following categories best describes your experience or role in research?

Table 15. Stakeholder experience (* multiple options could be selected).

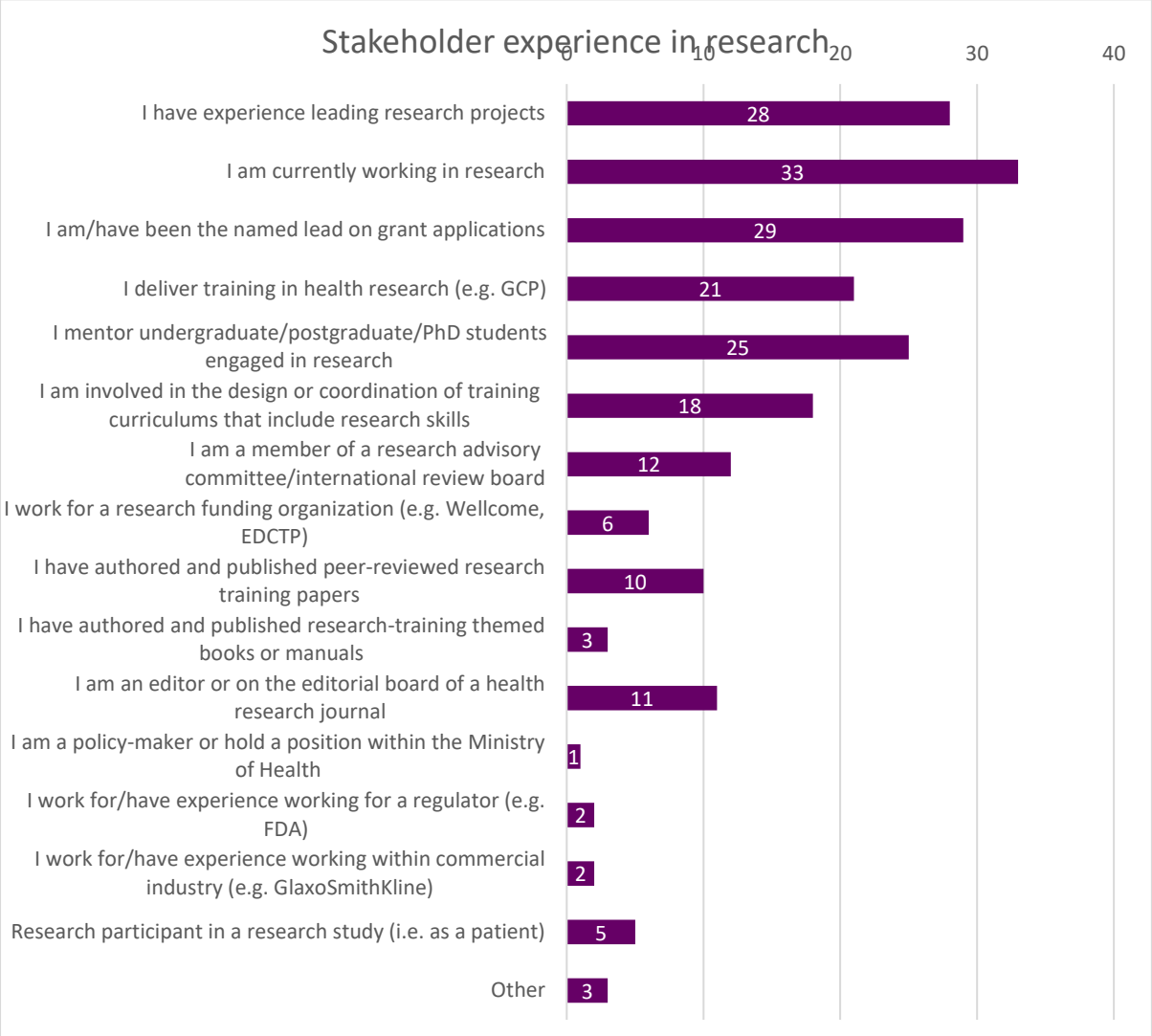

Figure 119. Stakeholders' experience (* multiple options could be selected).

c. What types of research methodology do you have experience in?

Table 16. Stakeholders' research methods experience (* multiple options of studies could be selected)

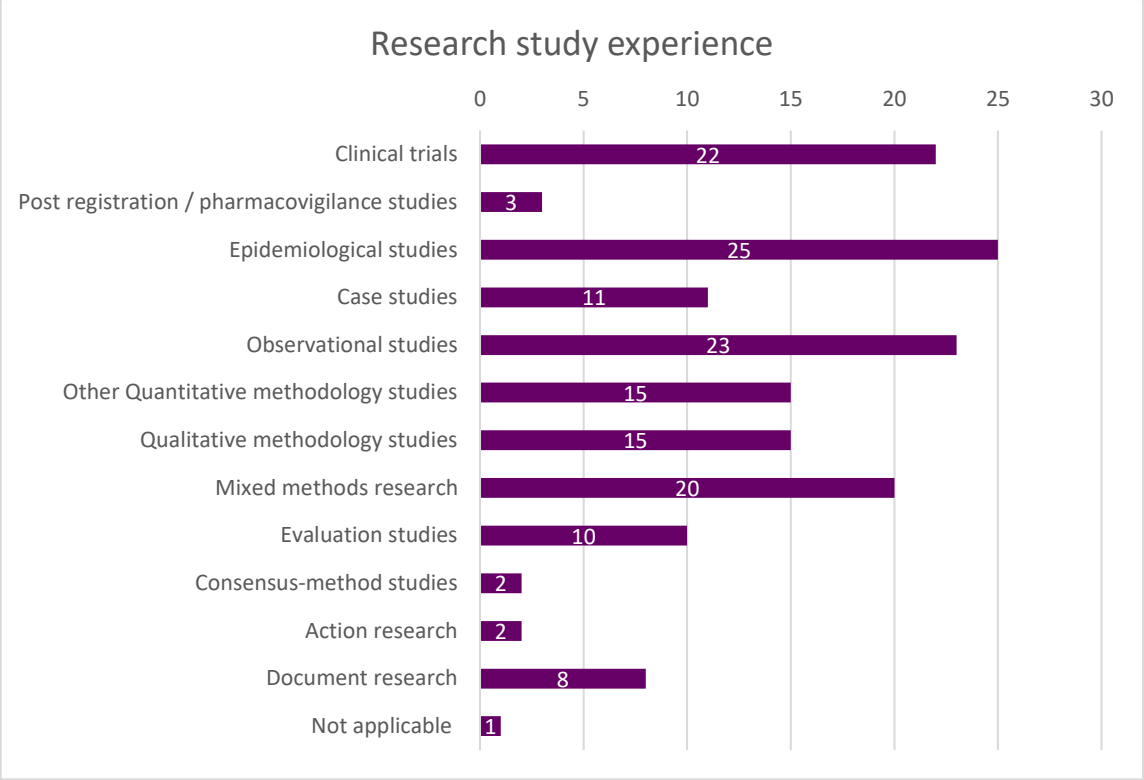

Figure 120. Stakeholders' research methods experience (* multiple options of studies could be selected).

d. Which country/countries is your work primarily based in?

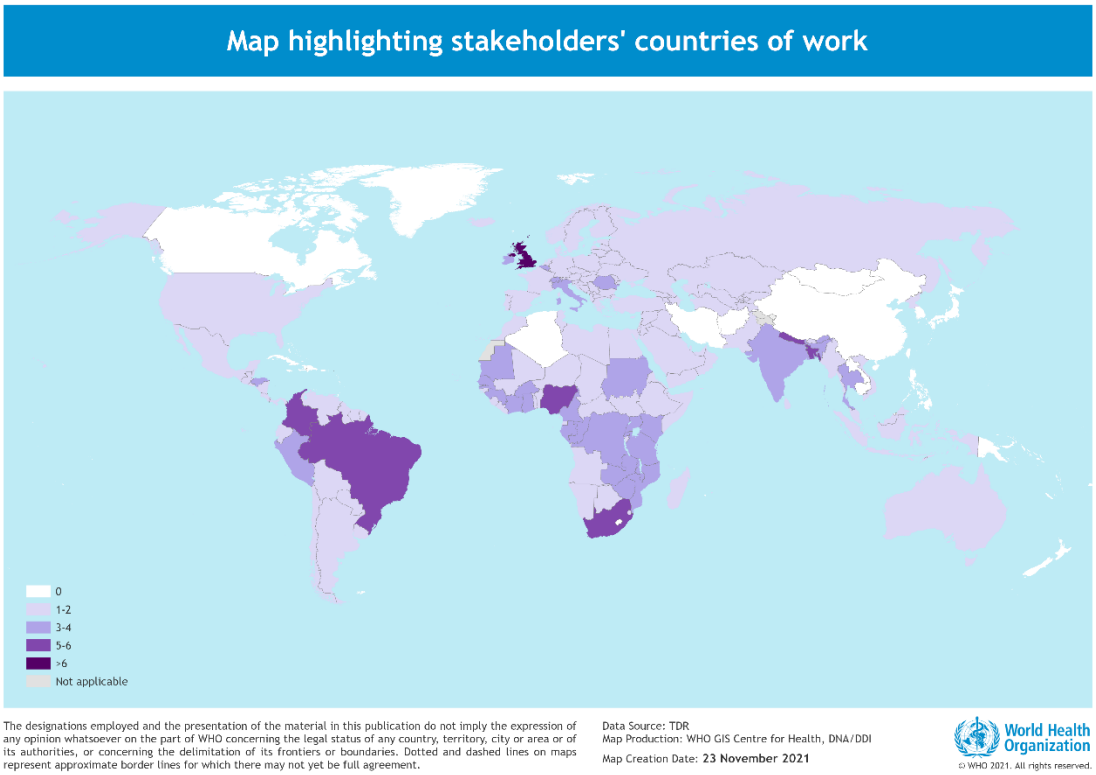

Figure 121. Map highlighting stakeholders' countries of work.

Stakeholder Review Workshop polling

As part of the workshop, an interactive session sought to capture direct feedback and input from the stakeholders. Each polling question was presented to the audience in turn (with a yes/no answer option), and attendees were asked to answer live by selecting their responses on their screens or devices. Attendees were also invited to provide any further details or free-text answers to support their choice in the Q&A feature of Zoom.

Table 17. Stakeholders' review workshop polling questions

	Yes	No	No response
Objective 1: Validate the grouping of the themes (potential module titles)			
a. Are these titles an accurate reflection of the content of the themes? (n=32)	31 (97%)	1 (3%)	10
b. Does this address the key essential principles of the research process? (n=31)	31 (100%)	0	11
Objective 2: Global applicability of the findings			
c. Is this proposed curriculum globally applicable? (n=30)	26 (87%)	4 (13%)	12
d. Would this proposed curriculum be relevant to different types of research? (n=31)	23 (75%)	8 (25%)	11

After each poll, the results were calculated and shared live before moving on to the next question. Attendees had the opportunity to see the collective responses and views from across those actively participating. Not all attendees to the workshop contributed to the interactive polling review. Eight attendees, who had predominantly research funding roles, did not complete any polling questions.

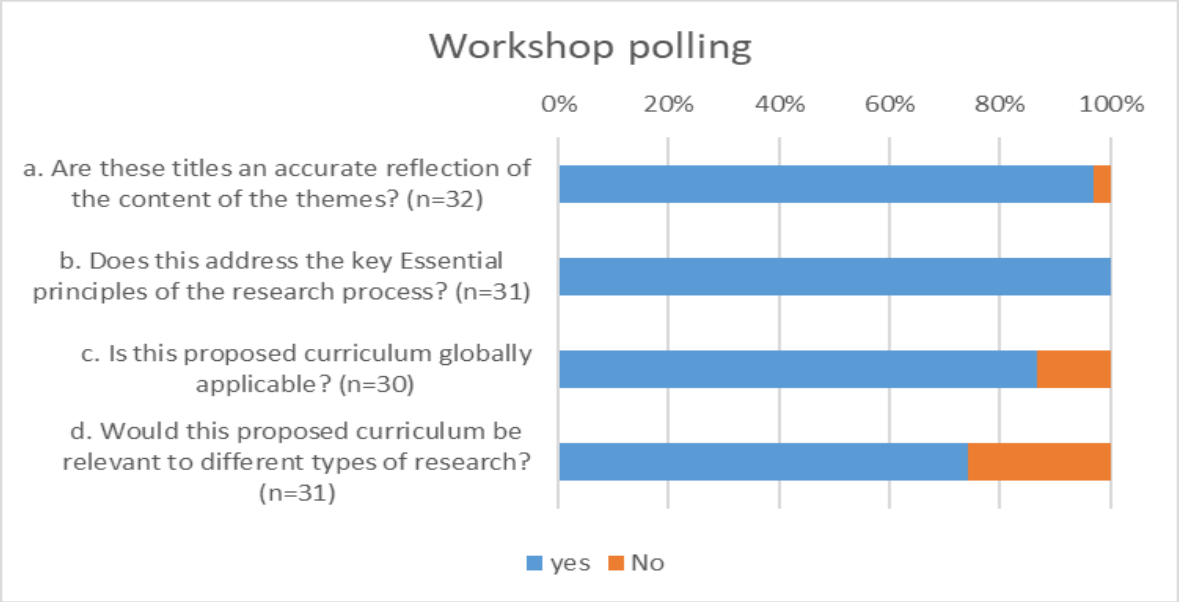

Figure 122. Stakeholders' workshop polling results

Summary of comments from attendees

Attendees were strongly encouraged to submit their comments in support of their voting options, especially if they had selected answer option "no" in the polling to offer a rationale and justification for their disagreement with the proposed statement. The attendees' comments, suggestions and recommendations were collated and are summarized as follows:

- Suggestions regarding theme classification: Attendees suggested a change in terminology from "Good Clinical Practice" to "Good Research Practice" to encompass all research standards. This term has been incorporated into the themes' grouping.
- "Monitoring and evaluation" and "audit" themes were re-allocated from "Running the research project" module to "Research governance and regulations" module as suggested by stakeholders.
- The module "Running the research project" was renamed as "Research administration and management" as suggested by the stakeholders. There were no suggestions for new modules. It is worth clarifying that the themes listed within the modules *do not* represent individual lessons to be delivered; they are an indication of concepts to be included in the module.
- Mentorship was suggested as a positive way of supporting the delivery of the curriculum.
- Regarding the global applicability of the curriculum, participants who selected "no", indicating they disagreed with the proposed statements in the polling, raising concerns over how to adapt the curriculum to different settings, particularly in low resource settings. This has been taken into consideration by the research team and was explored in the *Implementation Workshop* in February 2021.
- Those concerned with the applicability of the curriculum to all types of research stated reasons including: "some sections are relevant to all areas of health research; other sections or themes are more specific … so perhaps a general basic view and knowledge is desirable, but in what regards methods, different 'sub-branches' could be necessary".

Stakeholders' Review Workshop follow-up action plan to contribute further to research study objectives

While the *Evidence-led Essential Research Skills Training Curriculum* framework had been validated at the workshop, the key final step would be to ensure that these findings could be implemented within the highly varied settings where this curriculum is intended to bring impact. The final step in this research study was to ask a wider group how they would like to use this curriculum and suggest various mechanisms by which it could be implemented.

The research team conducted a follow-up, open Implementation Workshop, inviting the Delphi study panellists and a wide range of experts. The aim of the workshop was to critically assess and understand the various ways this *Essential Research Skills Training Curriculum* could be implemented in order to guide easy, faster and better research in any given health care setting, with any or no previous research experience.

Stakeholders' Review Workshop conclusion

The workshop polling showed substantial agreement between the Delphi panel's ratings and the opinions of the workshop stakeholders. This provides support for the acceptability of the proposed curriculum as a global standard for health research training.

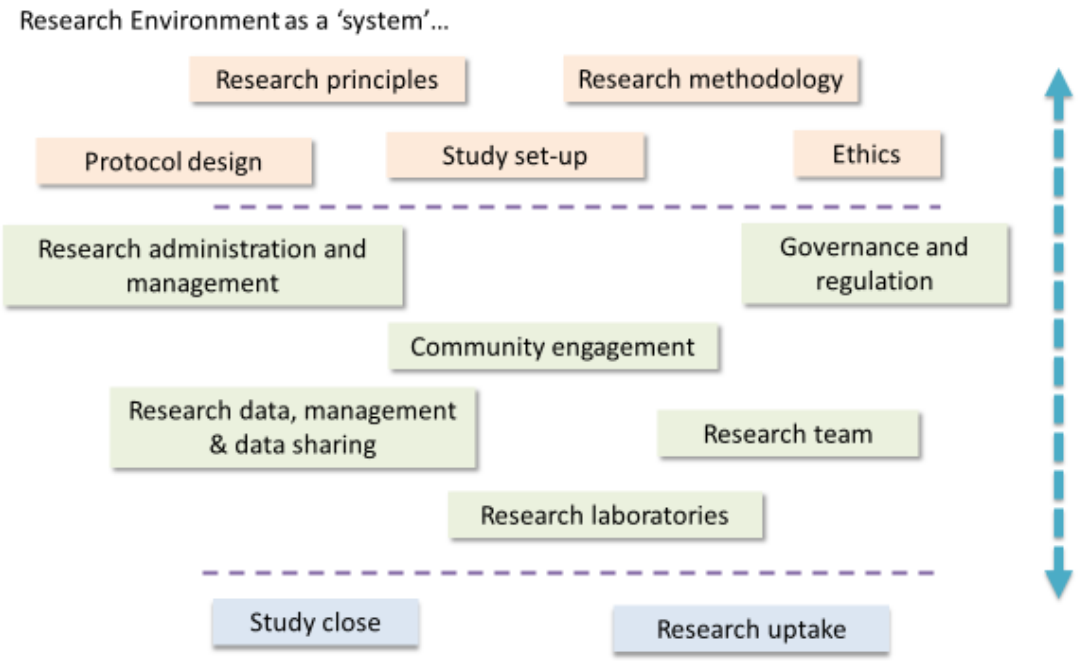

Figure 123. *Essential Research Skills Training Curriculum* parent modules.

Implementation Workshop

On 10 February 2021, TGHN and TDR hosted a virtual Implementation Workshop to determine optimal approaches for implementing the *Essential Research Skills Training Curriculum*. This workshop was the final stage of the study process for *Developing an Evidence-led Essential Research Skills Training Curriculum*. In response to the COVID-19 pandemic, the workshop was hosted virtually, using Zoom video conferencing system.

Date of Workshop: 10 February 2021, 13.00-14.30 GMT

Workshop chairing panel

- *Trudie Lang,* Professor of Global Health Research at the University of Oxford and Director of TGHN
- *Pascal Launois,* Research Capacity Strengthening Scientist at TDR and Manager of the Career Development Fellowship programme
- *Arancha de la Horra,* Clinical Research Specialist at TGHN
- *Bonny Baker,* Regional Programme Lead, TGHN
- *Nicole Feune de Colombi,* Scientific coordinator, TGHN
- *Sinéad Whitty*, Head of Training, Teaching and Career Development, TGHN

Implementation Workshop objectives

This workshop was a joint collaboration between TDR and TGHN. The aim of this workshop was to understand how best to implement the *Essential Research Skills Training Curriculum* by:

i) Determining the best mechanisms for delivering the training modules

ii) Supporting locally relevant implementation of this training

iii) Understanding how these modules could be utilized in the context of a new outbreak

The research team gave a presentation offering an overview of the methodology undertaken and the findings of the study. The full workshop agenda is listed in Appendix 14. Participants engaged in an interactive polling exercise to add to these findings. This workshop focused on capturing experts' feedback to facilitate the implementation of the *Essential Research Skills Training Curriculum*.

Implementation Workshop participants' characteristics

The workshop was attended by 122 participants with a maximum concurrent view of 105 participants. The following figures describe their role as stakeholders in the field of health research.

a. What type of establishment do you primarily work for?

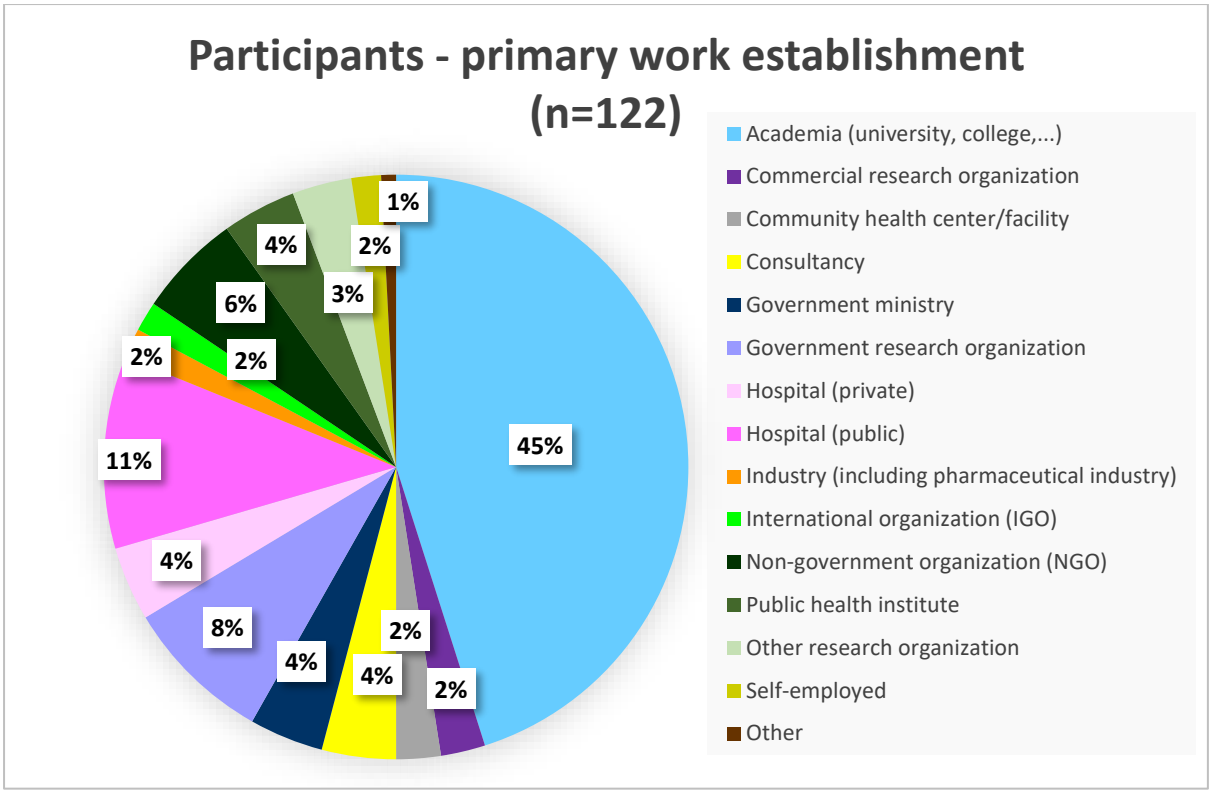

Figure 124. Participants' primary work establishment in percentages

b. Which of the following categories best describes your experience or role in research?

Table 18. Participants' experience in research (* multiple options could be selected)

Experience in Research	Total Numbers (n=)	%
I have experience leading research projects	74	61%
I am currently working in research	98	80%
I am/have been the named lead on grant applications	41	34%
I deliver training in health research (for example, GCP)	61	50%
I mentor undergraduate/postgraduate/PhD students engaged in research	67	55%
I am involved in the design or coordination of training curriculums that include research skills (such as undergraduate courses/medical courses)	47	39%
I am a member of a research advisory committee/international review board	28	23%
I work for a research funding organisation (for example, Wellcome, EDCTP)	7	6%
I have authored and published peer-reviewed research training papers	30	25%

I have authored and published research-training themed books or manuals	9	7%
I am an editor or on the editorial board of a health research journal	20	16%
I am a policy-maker or hold a position within the ministry of health	7	6%
I work for/have experience working for a regulator (such as FDA)	2	2%
I work for/have experience working within commercial industry (for example, GlaxoSmithKline)	19	16%
Research participant in a research study (that is, as a patient)	23	19%
Other	5	4

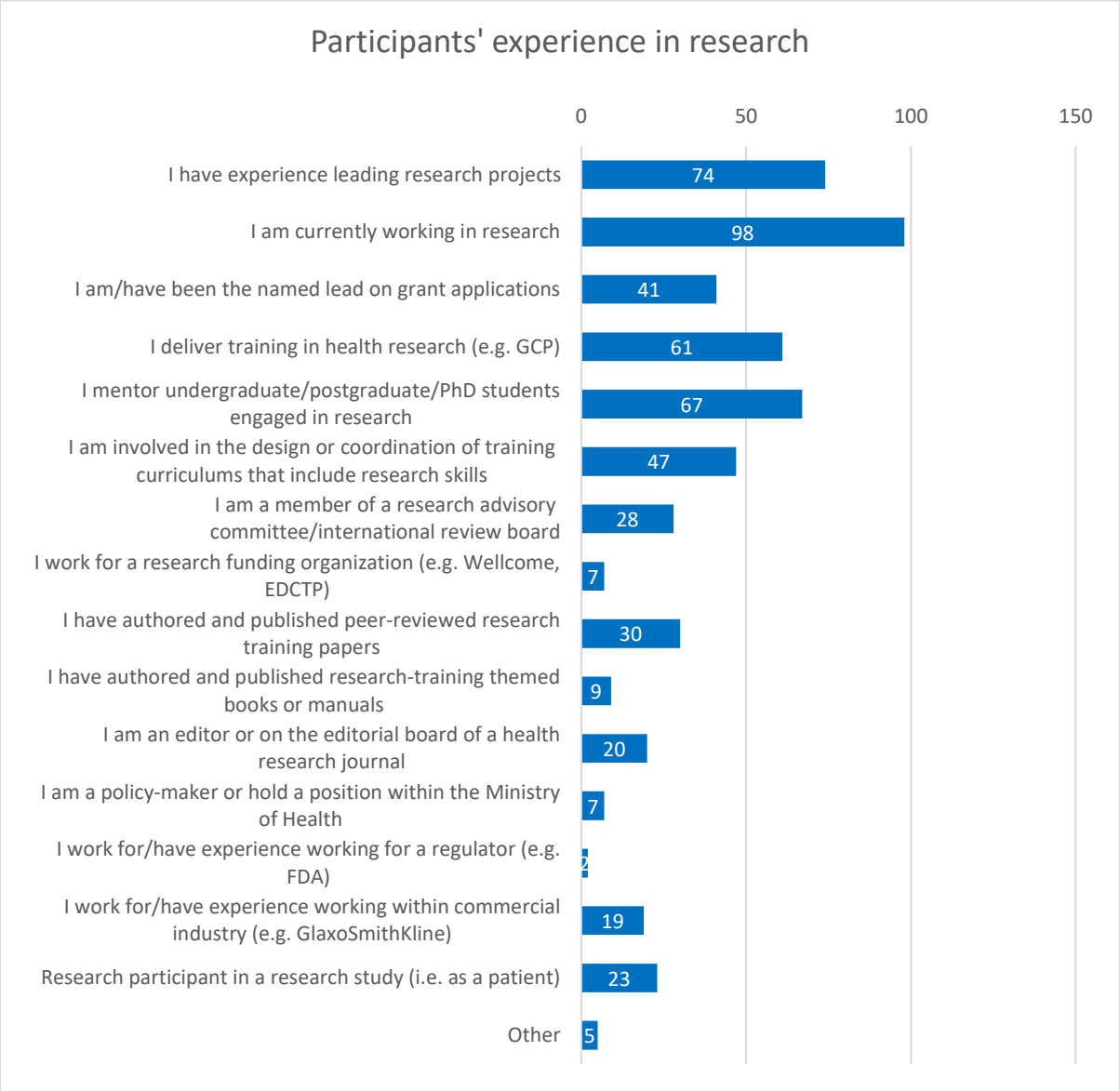

Figure 124. Participants' experience in research (* multiple options could be selected) (total numbers)

c. What types of research methodology do you have experience in?

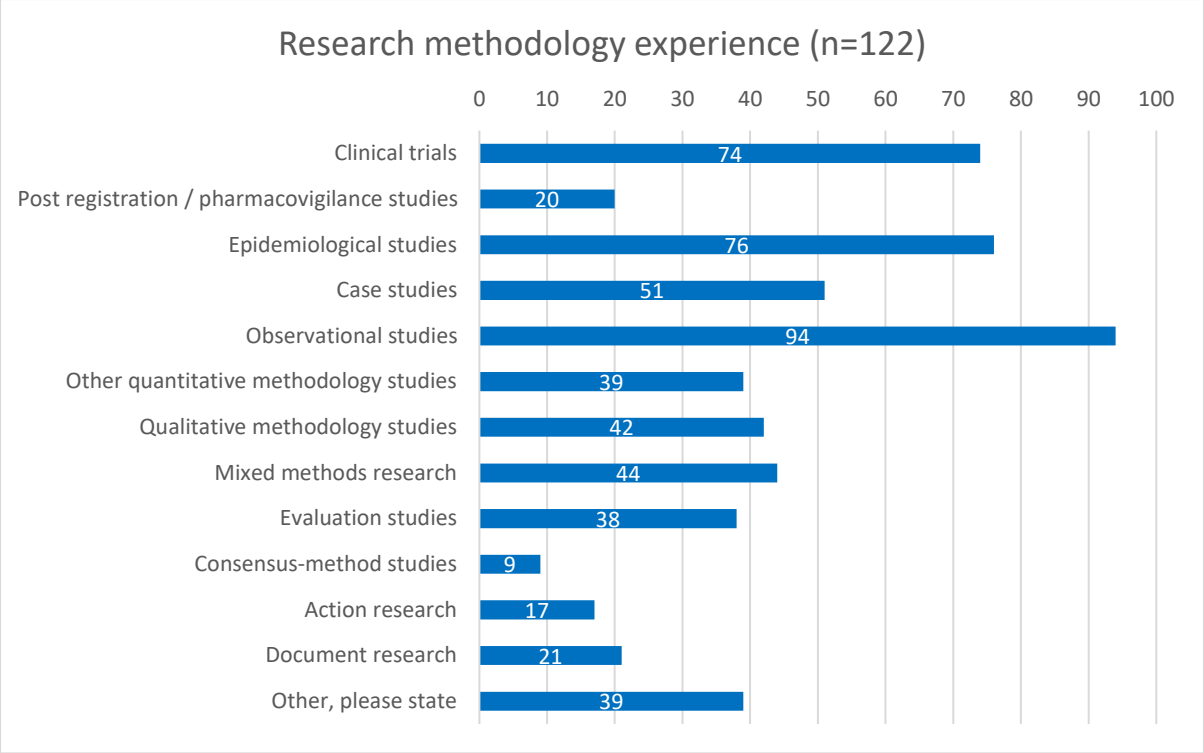

Figure 125. Participants' research methods experience (* multiple options could be selected) (Total numbers).

d. Which country/countries is your work primarily based in? Please list as many as applicable

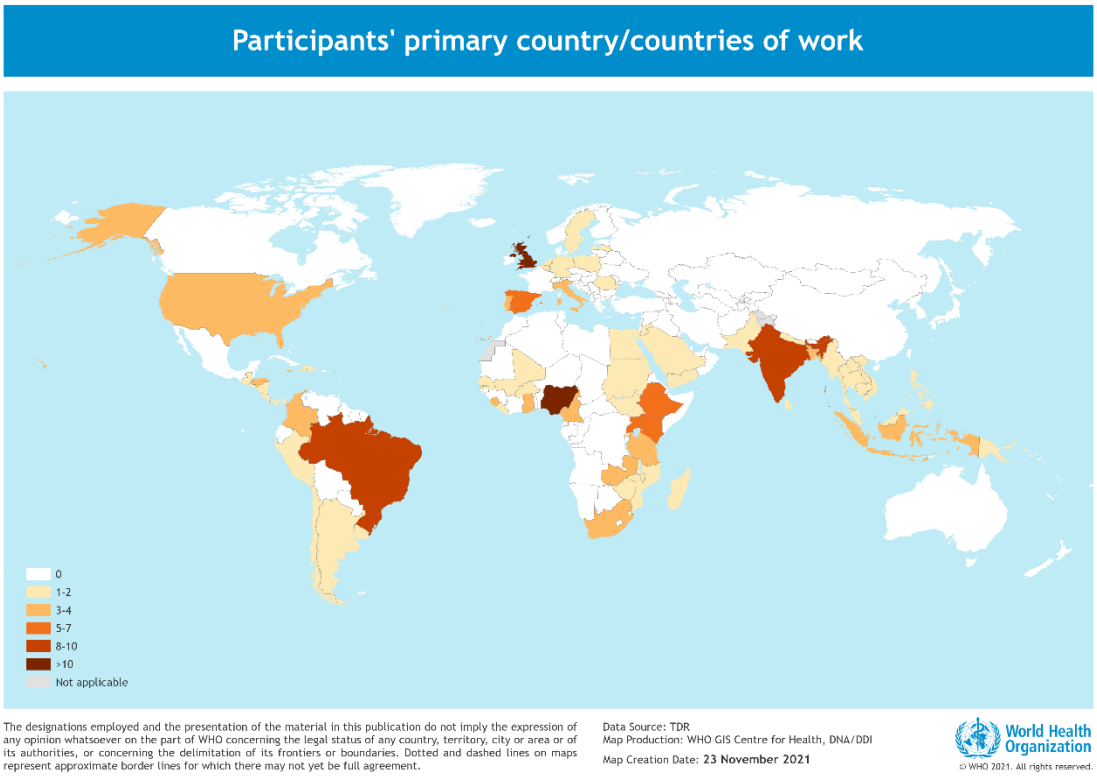

Figure 126. Participants' primary country/countries of work.

Implementation Workshop polling

As part of the workshop, an interactive session sought to capture direct feedback and input from the participants. Each question was presented to the audience in turn, and attendees were asked to answer live by selecting their responses on their screens or devices. Attendees were also instructed to provide any further details or free-text answers to support their choices, in the Q&A feature of Zoom.

After each poll, the results were calculated and shared live, before moving on to the next question. Attendees had the opportunity to see the collective responses and views from across all participants.

Table 19. Implementation Workshop polling questions.

Objective	Live questions
i) Determining the best mechanisms for delivering the training modules	**Question 1** - Which of the following online methods would work best for you in your setting? **Question 2** - What different forms of recognition would be valuable?
ii) Supporting locally relevant implementation of this training	**Question 3** - What would help you in delivering this training? **Question 4** - How could these modules be presented and adapted to integrate with, or complement, existing research training in your setting?
iii) Understanding how these modules could be utilized in the context of a new outbreak	**Question 5** - How could these modules be utilized in the context of a new outbreak

Question 1: Which of the following online methods would work best for you in your setting? Multiple options' question.

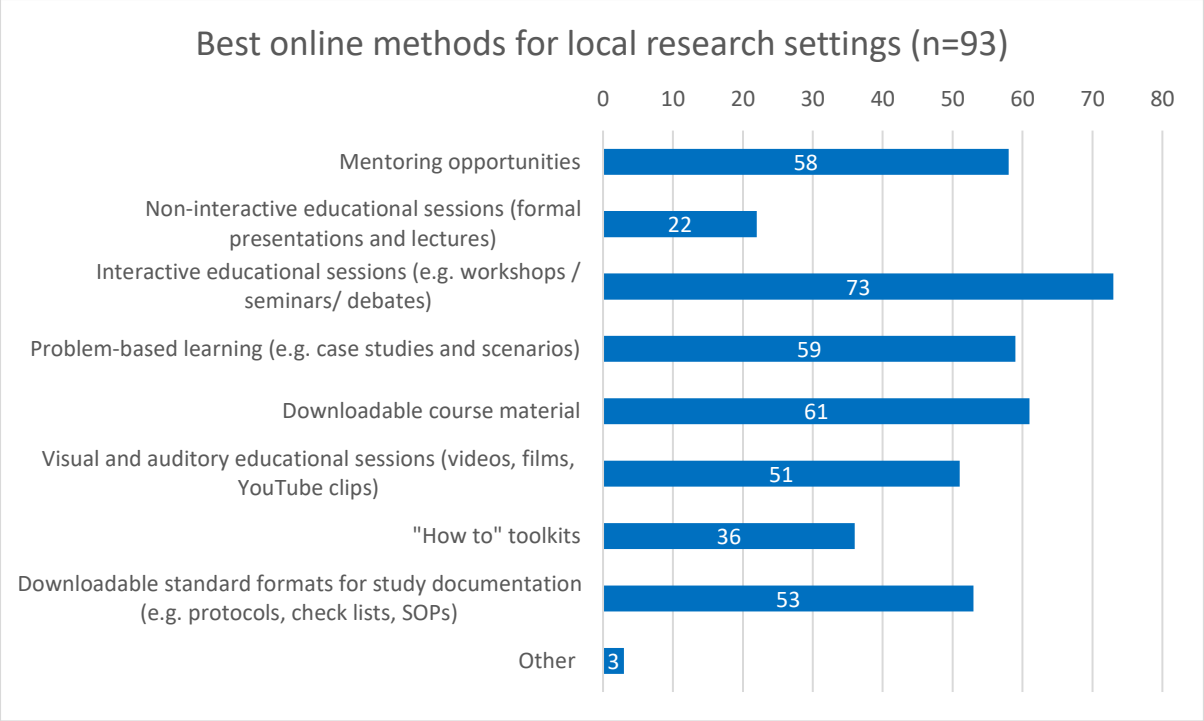

Figure 127. Best online methods for participants' research settings (total numbers).

Participants' comments and quotes

Workshop participants proposed varied mechanisms for implementation. Some preferred module training based on short courses, with a mix of online and offline options, given unstable local internet connections, and with the addition of face-to-face sessions after COVID-19. New suggestions comprised Q&A forums, interactive sessions and a combination of self-learning followed by discussions with facilitator or mentor.

"Blended learning (synchronous and asynchronous sessions), a combination of self-learning and then discussion with facilitator or mentor" (Medical Sciences Faculty Professor, Honduras)

"The ability to 'stop/start' and continuation is important. An example is the EPAP training programme" (Patient Research Ambassador, UK)

There was high support for mentoring early career researchers by their local health institutions and for the creation of internships.

Participants also recommended to adapt the way the modules are delivered based on their content:
"For instance, critical thinking might be best conveyed with active learning methods with case studies while GCPs are best delivered with online courses" (Scientific Director, Mali)

"For me, an online set of modules (basic) with examples, videos, content, possibly even quick tests etc., with possibility of doing 'advanced' modules that link to local established learning (for example, GCP in the UK). Would also like to have an option to visit others learning as well—international summer school would be great for people to mingle, learn and share experiences" (Public and Patient Involvement Facilitator, UK)

Question 2: What different forms of recognition would be valuable?

Multiple options' question.

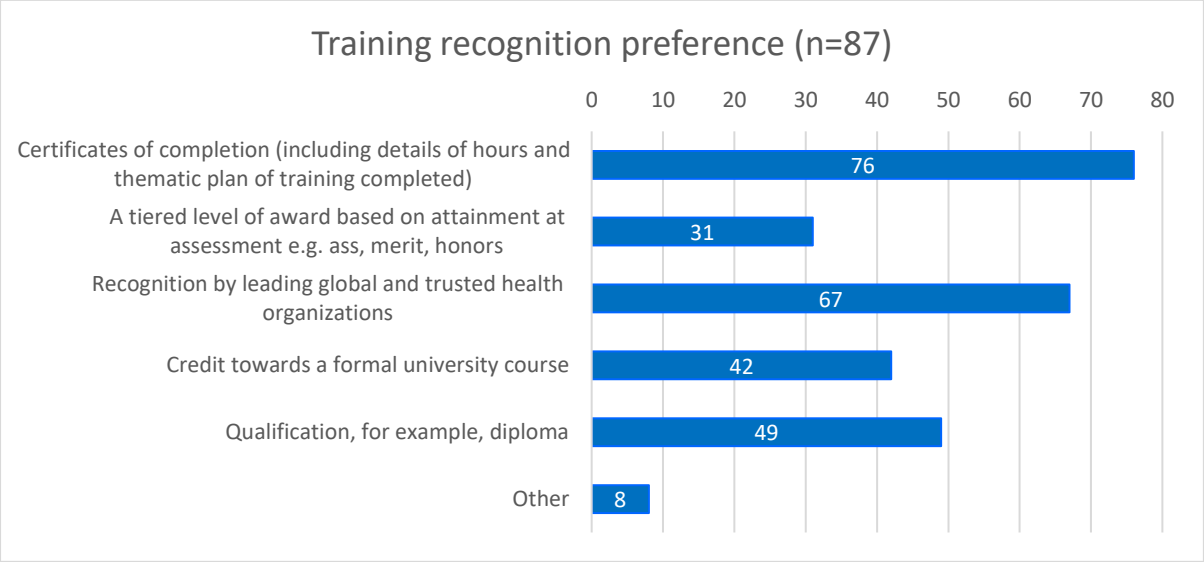

Figure 128. Most valuable forms of recognition (* multiple options could be selected) (total numbers).

Participants' comments and quotes

Evaluations and certifications were identified as incentives for high rates of training completion. Some participants suggested that "levels" would be useful so, some modules would be required to be completed before starting next-level modules.

"A compilation of short courses can lead to an overall examination where an individual can achieve a higher award/qualification for the course as a whole" (Senior Lecturer, Jamaica)

Opportunity of progression within the training was also valued.

"Online short courses that would eventually progress to a diploma, will be very enticing" (Health Data Analyst, Nigeria)

New suggestions included offering a graduation project at end of the programme, participating in key meetings or conferences and opportunities to apply for fellowships or specialized training.

"Implementation of the curriculum first online with awarding of certificate and later collaborating with research institutions to adapt the curriculum in their institutions" (Research Student, Nigeria)

"I know it is silly, but possibly being able to have 'letters after your name' to show people that you have this qualification. Most important is making sure the world knows what this qualification is, what it represents, what it means that someone has passed it etc—no point having a certificate if no one knows how important it is or how good the course was" (Public and Patient Involvement Facilitator, UK)

Question 3: What would help you in delivering this training?

Multiple options' question.

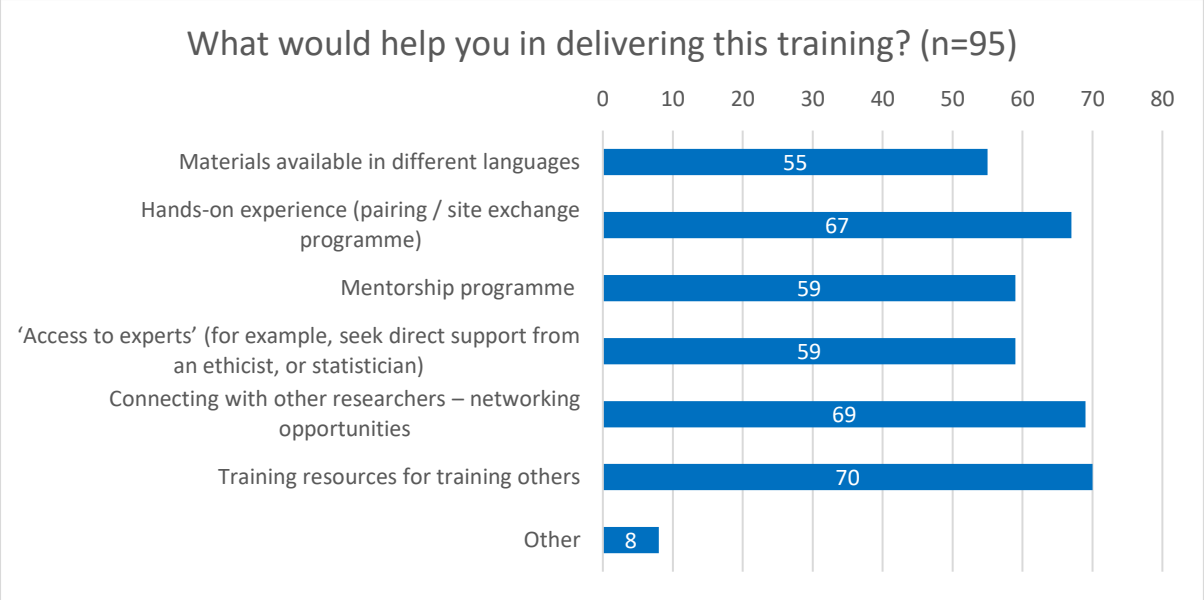

Figure 129. Participants' preferred tools for delivering the curriculum (* multiple options could be selected).

Participants' comments and quotes

Participants stated that they would like special support with education technology, access to an online learning management system, to create professional material where you can also build in exams, create podcasts, etc. Having a referral/core team for trainers to liaise with was also important as well as being able to access mentoring by a senior researcher from an international institution.

New suggestions comprised international summer schools, grouping of course attendees based on their research context similarities and having a global community of trainers. Participants found challenging modes of ascertaining assessments or recognize/certify the "hands-on" experience.

"For other studies we are working on, we see that countries in Latin America are very similar. So, I am not sure how you are grouping the countries, if by income, culture, etc. I would suggest that you analyse if our countries in Latin America do group together and then think of essential skills by region (cultural, language, geographic). I am asking because I saw Central America as part of North America instead of Latin America" (Professor, Costa Rica)

"Being part of a visible global community—to share ideas, ask for help, make suggestions etc. It is vital to know that there are other people out there in the same situation, and who can help you to adapt the training to your local needs. It would also be good to have a 'finish your learning, mentor someone else' scheme, especially locally, to help spread this within communities from more experienced to less. Get 'Big Names' involved as well as headline figures—possibly locally again—to give credibility and provide expert mentoring. Train us to train others!" (Public and Patient Involvement Facilitator, UK)

"It is surprising that about 50% are not including other languages ... this is one of the main barriers for training in research in many countries!" (Director of Education, Argentina)

Question 4: How could these modules be presented and adapted to integrate with, or complement, existing research training in your setting?

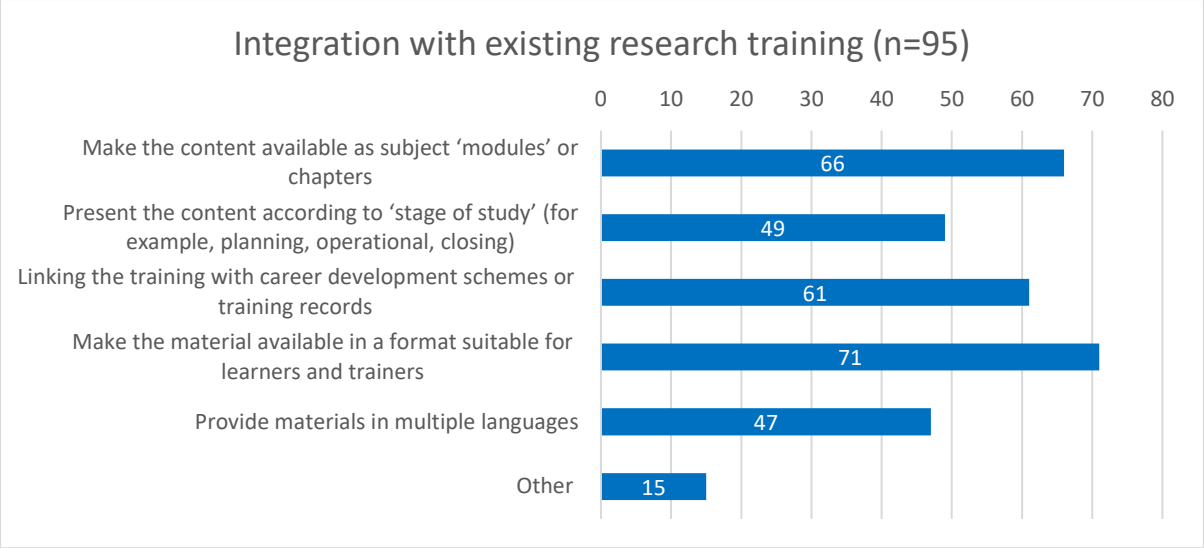

Figure 130. Participants' preferred formats to facilitate integration of framework with existing local research training (* multiple options could be selected).

Workshop participants recommended to:

- Include research training as part of appraisals, ongoing performance reviews and induction to new staff
- Form partnerships with academic institutions and embed this research training in universities as a module in undergraduate studies in health (nursing, pharmacy, medicine, etc.), postgraduate, masters and doctorates
  "Involve TDR Regional Training Centers and the universities involved in the Masters' degrees (public health or epidemiology) as allies to incorporate this training in their courses" (Medical Sciences Faculty Professor, Honduras)
- Modules could be integrated as training requirement *involving politicians (Professor, Costa Rica)*
- To offer a school-friendly version of research training creating local "research clubs"

"Modules can be integrated as regulatory training by curriculum development authorities making it mandatory for graduate training. For example, national medical commission or national council for medical research" (Professor in Community Medicine, India)

"Delivering research course through the research team based on the organization, different sessions organized throughout the year" (Oncology clinical research nurse, Spain)

"Adaptable training modules that can be tailored to specific cadres or scenarios—for example, modifying training on vaccine clinical trials to pregnant women clinical trials, that is same skeleton, different content" (Professor, UK)

"I think here in Brazil what we really need is to identify 'researcher' as a profession and having this core curriculum is a great way to start walking in that direction. This is such a brilliant idea and I think it brings up the need for 'formal' training to do research and also a way to value such individuals" (Regional coordinator, Brazil)

Question 5: How could these modules be utilized in the context of a new outbreak

The preferred type of training suggested within a new outbreak scenario would be intensive, short and fast training; online-based and possibly through phone applications providing videos on course topics.
"During this pandemic, I have been able to do training virtually with researchers in hospitals, using their cell phones. It works when the message is focused, short and clear, no more than one hour per session. A fixed schedule through a month also works" (Head of Research Administration Programme, Peru)

For those areas without internet, a trained-trainer for face-to-face and downloadable offline resources would be needed. To have the capacity of face-to-face training during epidemics, we would need to create a registry of trained-trainers to contact during such times of emergencies.
"Bank emergency trainers that will do expedited training when need arises. Make targeted summaries/instruction manuals that are available and easy to follow when need arises. Liaise with ministries of health and education in different countries and start training as soon as the curriculum is available. The more people are trained, the less the need for emergency training" (Medical Officer, Uganda)

Training during/for epidemics would require a bridge course focusing on skills considered more essential to such a situation, providing all those modules online and for free of cost at once. The participants might benefit from undertaking this training, working at the same time on their own research project.
"In outbreak situations in our African setting, researchers have to be very innovative given that we don't have all that is needed to fight an outbreak. This training needs to be in a realistic form so that peers can make use of the knowledge and devise new ways to manage disease in poor settings" (Researcher, USA)

It was important to facilitate the use of online research platforms*: "Empowering researchers for real-time data capture, training through digital platform about the new disease so that results can be collated from various regions and published faster. TGHN and WHO can lead in setting up platforms" (Professor in Community Medicine, India)*

"Partner with local institutions for mentoring and certifications" (Institute for Clinical Effectiveness and Health Policy Investigator, Argentina)

It would be essential to embed the training in the global/national outbreak response plan. Also work with health ministries to provide this training for health professionals nationally, aligning training with regulatory bodies. It was also recommended to train government officials.
"There should be coordination between organizations so that these kinds of tools are available and are easily handed to countries/organizations so people can access this info ASAP for the management of diseases/outbreaks" (Oncology clinical research nurse, Spain)

"Organize and present a summary of the material highlighting the main points as a toolkit specifically directed to the particular outbreak. Rapid pairing with more experienced sites and learn from case studies and similar context situations in order to be down-to-earth and adapt to the local capacities" (Director of Education at Institute for Clinical Effectiveness and Health Policy, Argentina)

"I will align with some comments that talked about training health ministry staff, in addition to that clinical health care professionals (hospital staff) interested in clinical research should be given the opportunity for training, too. This is essential in my environment in Nigeria. […] Concentrating on academia isn't enough" (*Molecular scientist, Nigeria)*

"Make a strong emphasis of listening to people in other disciplines, different from medicine, such as economists and social workers" (Researcher, Argentina)

"Research needs to [be] seen as an everyday activity for those working in human health and, of course, other areas. Structures, systems, governance and incentives need to become part of this process for uptake and delivery. In the event of an outbreak, it is rather 'quick fix' to get things done. We need credible and strong institutions to start discussing difficult questions around implementation and help countries and contexts to shape the requirements and be able to own them! This curriculum is a good start to grasp the research skills and probably have them broken down into modules… Everyone shall not [do] everything. Collaboration and supporting each other is the key… Once we have this evidence in hand, it will be great to present to research and grant offices of our institutions" (*Research coordinator, Sweden)*

Other comments from attendees

Attendees were strongly encouraged to submit their comments in support of their voting options. The attendees' comments, suggestions and recommendations were collated and summarized as follows:

Table 20. Implementation Workshop – other comments from attendees

Study methodology comments on limitations
"Could some of these methods that have low consensus be thus because of a lack of understanding of the methods by the respondents?" (Professor, UK).
"To what extent will the level of recommendation influence the inclusion of the topics within each module? For instance, I believe the lab topics are quite essential, although the consensus was low." (Senior lecturer, Nigeria/Canada).
"Would think the inability to conduct in person sessions impacted data quality?" (Director, Jamaica).
"Perhaps one of the limitations of this project is that it was limited to people that have a good command over English. It is assumed that English is the lingua franca for researchers, but I have found this is not true for researchers involved in qualitative research in Colombia—and probably most of South America." (Professor, Colombia).
Curriculum themes and scoring comments
"My comments on the workshop briefing (V1.0) and the proposed changes to the briefing were arranged in four points: (a) Adding two new themes influenced by Covid-19 pandemic, (Delphi Round 1 started prior to the peak of the crisis); (b) proposed changes to the presentation of the parent modules; (c) suggestions for the discussion about writing the curriculum; (d) suggestions for the discussion about practical issues related to the implantation of the curriculum and accreditation" (Medical scientist, UK).
"I am curious. There was low positive response for "Audit" as part of the curriculum. Shouldn't this be of high importance for any health research"? (Senior clinical research associate, Nigeria).
"The Pandemic has highlighted the introduction of technology in data collection in research, that is, wearables (quality of device) in addition to the quality of data that is the data for

"monitoring" purposes or for "clinical" data collection? Should we have included "innovation and technology" in the study?" (Patient research ambassador, UK).

"Communication skills for all new researchers and the importance in public health work needs to be emphasized." (Research coordinator, Sweden)

Other comments

"The results seem very good, despite the limitations. Many excluded topics will be useful when the young researcher gets more experience. We must remember that this is a basic curriculum for young researchers, who will generally be under the supervision of experienced researchers, who will negotiate with stakeholders and observe the progress of the study" (Professor, Brazil).

"The contents are very wide and I believe they are some contents that are applicable to all members of research teams, but others may need to be tailored to the roles of the staff (for example, research methods, laboratories). So, it would be good to have a tool to align the curriculum with the roles and profiles that researchers envision for their careers" (Clinical researcher, Germany).

"I suggest that this should not be the end, the panellists should have a network where they will be discussing important issues in research" (Research student, Nigeria).

Implementation Workshop: Conclusion and Recommendations

This follow-up Implementation Workshop has succeeded in its aim of asking research organizations and research training experts what is the optimal way to convert this curriculum into practical teaching and training resources. We set out to ask how to implement this curriculum by determining the best mechanisms for delivering the training modules, while supporting locally relevant implementation of this training and understanding how these modules could be utilized in the context of a new outbreak. The following are the recommendations from the workshop:

- Interactive educational sessions, problem-based learning and discussion with facilitator or mentor have been identified as some of the most effective online learning tools alongside downloadable resources
- Certificates of completion and course recognition by leading global health institutions are the strongest motivators for trainees. Additional opportunities such as graduation projects, training progression and collaborations with research institutions would strengthen the curriculum
- It was important to provide multiple options for delivering training such as: "training the trainer" resources, hand-on experience, networking opportunities, mentorship and access to experts as well as having materials available in multiple languages. Providing access to online management systems and core teams would build a global community of trainers
- Providing curriculum materials for trainers in module format would help the integration of this framework within existing local research training programmes. Linking the training with career development schemes and academic institutions would support the uptake of health research training
- Embedding this curriculum in global, national and institutional outbreak response plans would guide the development of research training in such emergencies

Conclusion

This study has brought together health researchers from across the world to identify what constitutes the minimum set of skills, knowledge and key principles required to enable those without previous experience in research to undertake high-quality health research.

We conducted a comprehensive review of the responses from research training needs' surveys, session evaluations from research training workshops, and e-learning feedback collected by TGHN between 2017 and 2019 from 7176 participants from across 153 countries. This analysis provided us with a range of research skills topics and subject areas that generated a core list of 98 potential essential research skills training themes. These potential themes were reviewed by health research experts and stakeholders through a Delphi consensus process to assess their relevance as an essential research skill.

Following the Delphi consensus process that provided 108 themes, the research team developed a curriculum framework by grouping the themes identified by panellists. This presented the structure of the curriculum by providing suggested "parent modules" and the relevant themes generated and included to inform each module. These theme groupings were evaluated at a Stakeholder Review Workshop. The workshop results showed agreement between the Delphi panel's ratings and the opinions of the workshop stakeholders that supported our recommendation of this curriculum as a global standard for health research training.

This project has established the *Essential Research Skills Training Curriculum* in the form of a set of topics that any research group, team or organization could take forward to guide their training programme. This workshop has generated guidance on implementation so that anyone wanting to design their training around this curriculum can also benefit from evidence-led recommendations on what approaches will work best in their specific context.

In summary, The Global Health Network Essential Research Skills Training Curriculum is an evidence-led set of modules that has been determined through the participation of over 7000 researchers and health workers across the globe. This three-stage process concluded the development of a definitive list of modules that would serve as a curriculum, which could assure delivery of the full set of steps and skills needed to undertake health research in places and settings inexperienced or new to research. This set of 13 modules covers all aspects of the research cycle including study design, conduct, analysis and reporting the findings as recommendations for policy and practice. Delivering training aligned with this curriculum framework will help promote and ensure that research should be safe, ethical and robust and that local teams are equipped with lasting research skills, community engagement and management practices that will advance and support their career

Essential Research Skills Training Curriculum: Delphi Themes' Final Mapping

Table 21. *Essential Research Skills Training Curriculum:* Delphi Themes' Final Mapping. The themes listed within the modules do not represent individual lessons to be delivered; they are an indication of concepts to be included in the module.

Research Principles	
Critical thinking in research	93%
Development of a research question.	91%
Concept of health research.	88%
Good Research practice.	88%
Identifying a research gap.	88%
Understanding the difference between health research and standard of care, audit, evaluation.	86%
Critical appraisal of a research paper	85%
Legal issues in research	84%
How to form a research agenda.	81%
Research governance and regulations	
Monitoring and evaluation	87%
Governance and regulation	83%
Quality assurance systems	65%
Quality management systems	60%
Audit.	59%
Medicines Supply and Regulations	54%

Research Methodology	
Qualitative data collection methods.	93%
Quantitative data collection methods.	93%
Selection of control groups for comparison purposes.	92%
Quantitative sampling methods.	91%
Quantitative methodologies.	90%
Qualitative sampling methods.	89%
Steps to conduct a literature review.	89%
Epidemiological studies.	87%
Clinical trials.	87%
Qualitative methodologies.	86%
Experimental research.	85%
Qualitative analysis.	85%
Implementation research.	82%
Mixed Methods research.	76%
Research designs for outbreaks	75%
Methodology Research (research on research).	74%
Health Policy and Systems Research.	73%
How to search for secondary datasets in different databases.	70%
Social sciences and anthropological studies.	69%
Meta-analysis.	67%
Health economics and economic evaluations.	54%
Operational research.	52%

Protocol design	
Identifying research participants and selection criteria	94%
Writing a research protocol	93%
Definition and methods of randomization	89%
Calculation of participant sample size and sample power	88%
Writing a study budget	85%

Study set up	
Data collection tools (e.g. designing surveys and CRF's).	95%
Study set-up	92%
Writing a grant application and/or grant proposal	87%
Storage of research materials	81%
Development of Standard Operating Procedures (SOPs)	81%
How to set up study training	75%
Identifying various funding agencies/sources	68%

Research administration and management	
Study reporting procedures and practices	91%
Research Project management and planning.	88%
Pharmacovigilance principles and reporting adverse effects.	82%
Participant 'loss to follow-up'.	80%
Budget management.	79%
Research Time management.	79%
Contingency plans for research studies (in situations like pandemics, etc)	75%

Study close	
Study close (archiving data, sample storing, notification of closure processes).	87%
Best practices regarding referencing and plagiarism.	87%
Scientific writing for journal publications.	86%
Use of citation tools (i.e. Mendeley).	81%
Authorship in research	80%
Research registries	74%
Intellectual property rights	74%

Ethics	
Informed Consent and assent.	98%
Participant's confidentiality and privacy.	98%
Ethical practices around data handling/management.	95%
Professional guidelines and codes of ethics which apply to the conduct of clinical research.	94%
Definition of vulnerable populations and ethics of working with these populations.	94%
Ethical issues related to biological samples.	91%
Ethical issues related to genetic procedures.	87%
Setting up an ethical review board or committee.	60%

Research data, management & data sharing	
Definition of data quality	92%
Statistics.	90%
Security issues during data collection and how to manage risk.	89%
Data management systems.	88%
Data presentation.	88%
Data sharing best practices and governance.	87%
Data analysis software (qualitative and quantitative).	85%
Principles of Big data analysis	70%
Mathematical Modelling.	50%

Community engagement	
Community engagement principles and activities.	84%
Good Participatory Practice (GPP).	80%
Participants' retention strategies.	79%
Attrition bias and prevention methods.	79%
How to manage expectations of study communities.	76%

**The themes listed within the modules do not represent individual lessons to be delivered, they are an indication of concepts to be included in the modules*

Figure 131. Mapping of the Essential Research Skills training Curriculum framework themes into modules following Stakeholder review workshop. Please note that the themes listed within the modules/groups do not represent individual lessons to be delivered. They are an indication of essential concepts to be included within the module.

Research Methodology
Qualitative data collection methods 93%
Quantitative data collection methods 93%
Selection of control groups for comparison purposes 92%
Quantitative sampling methods 91%
Quantitative methodologies 90%
Qualitative sampling methods 89%
Steps to conduct a literature review 89%
Epidemiological studies 87%
Clinical trials 87%
Qualitative methodologies 86%
Experimental research 85%
Qualitative analysis 85%
Implementation research 82%
Mixed Methods research 76%
Research designs for outbreaks 75%
Methodology Research (research on research) 74%
Health Policy and Systems Research 73%
How to search for secondary datasets in different databases 70%
Social sciences and anthropological studies 69%
Meta-analysis 67%
Health economics and economic evaluations 54%
Operational research 52%

Research Team
Teamwork 86%
Developing effective research teams with named roles and responsibilities for team 86%
Building trust within a team 81%
Networking and how to create collaborations 80%
Building your career in research 78%
Leadership in research 67%
Ability to communicate and meet with funders 65%
Handling and negotiating with a range of stakeholders 63%
Influencing at institutional level to enable research 58%
Leading and managing complex research groups 57%

Research uptake - How to make a difference with your findings
Communicating research 92%
How to translate research results into policy (policy formulation and reviews) 91%
How to translate research results into practice within healthcare settings 85%
Research Indexing 56%

Study close
Study close (archiving data, sample storing, notification of closure processes) 87%
Best practices regarding referencing and plagiarism 87%
Scientific writing for journal publications 86%
Use of citation tools 81%
Authorship in research 80%
Research registries 74%
Intellectual property rights 74%

Research principles
Critical thinking in research 93%
Development of a research question 91%
Concept of health research 88%
Good Research practice 88%
Identifying a research gap 88%
Understanding the difference between health research and standard of care, audit, evaluation 86%
Critical appraisal of a research paper 85%
Legal issues in research 84%
How to form a research agenda 81%

Ethics
Informed Consent and assent 98%
Participant's confidentiality and privacy 98%
Ethical practices around data handling/management 95%
Professional guidelines and codes of ethics which apply to the conduct of clinical research 94%
Definition of vulnerable populations and ethics of working with these populations 94%
Ethical issues related to biological samples 91%
Ethical issues related to genetic procedures 87%
Setting up an ethical review board or committee 60%

Research laboratories
Good Clinical Laboratory Practice (GCLP) 79%
Laboratory safety practices 71%
Laboratory biosafety and how to manage hazards 71%
Laboratory quality best practices 70%
Laboratory sample handling and storage 66%
Laboratory standards and regulations 66%
Specific laboratory techniques and equipment handling 60%
Setting up a research laboratory 55%
Laboratory management 53%

Community engagement
Community engagement principles and activities 84%
Good Participatory Practice (GPP) 80%
Participants' retention strategies 79%
Attrition bias and prevention methods 79%
How to manage expectations of study communities 76%

Research governance and regulations
Monitoring and evaluation 87%
Governance and regulation 83%
Quality assurance systems 65%
Quality management systems 60%
Audit 59%
Medicines supply and regulations 54%

Protocol design
Identifying research participants and selection criteria 94%
Writing a research protocol 93%
Definition and methods of randomization 89%
Calculation of participant sample size and sample power 88%
Writing a study budge 85%

Study set up
Data collection tools (e.g. designing surveys and CRF's) 95%
Study set-up 92%
Writing a grant application and/or grant proposal 87%
Storage of research materials 81%
Development of Standard Operating Procedures (SOPs) 81%
How to set up study training 75%
Identifying various funding agencies/sources 68%

Research administration and management
Study reporting procedures and practices 91%
Research Project management and planning 88%
Pharmacovigilance principles and reporting adverse effects 82%
Participant 'loss to follow-up' 80%
Budget management 79%
Research Time management 79%
Contingency plans for research studies (in situations like pandemics, etc) 75%

Research data, management & data sharing
Definition of data quality 92%
Statistics 90%
Security issues during data collection and how to manage risk 89%
Data management systems 88%
Data presentation 88%
Data sharing best practices and governance 87%
Data analysis software (qualitative and quantitative) 85%
Principles of big data analysis 70%
Mathematical Modelling 50%

References

Braun, V. and Clarke, V. (2006) Using Thematic Analysis in Psychology, Qualitative Research in Psychology, 3:2, 77-101, DOI: 10.1191/1478088706qp063oa

Creswell, J. (2018) Qualitative Inquiry & Research Design: Choosing Among Five Approaches. 4th ed. Poth CN, editor. Los Angeles: SAGE.

de Villiers MR, de Villiers PJ, Kent AP. (2005) The Delphi Technique in Health Sciences Education Research. Med Teach. 2005 Nov;27(7):639-43. doi: 10.1080/13611260500069947. PMID: 16332558.

Hsu, Chia-Chien and Sandford, Brian A. (2007) The Delphi Technique: Making Sense of Consensus, Practical Assessment, Research, and Evaluation: Vol. 12 , Article 10.
DOI: https://doi.org/10.7275/pdz9-th90

World Bank Group. World Bank Country and Lending Groups [Internet]. Vol. 7, World Bank Group. 2019 [cited 2020 Jun 19]. p. Low-Income Countries; Lower-Middle Income Countries. Available from: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

Appendices

Appendix 1: Research Capacity Network (REDe) Network online survey

Assessing Research Skills Capacity across Latin America and the Caribbean

TGHN leads the capacity development package within the three EU-funded Zika consortia programmes. To inform this work we are conducting a survey to establish the key knowledge and skills gaps in Latin America and the Caribbean, relating to clinical and laboratory research. The aim is to determine key training needs and skills gaps in order to support health facilities and laboratories in running high-quality health research studies.

Should you have any questions or difficulties completing this survey, please contact TGHN at this address: REDe@theglobalhealthnetwork.org

Consent:

- I have read and understood the participant information sheet and consent form (Yes/No)
- I have direct involvement in clinical, laboratory or observational research studies in Central America, South America or the Caribbean (Yes/No).
- I agree to take part in this survey (Yes/No)

Q1. Name

_____

Q2. Email address

_____

Q3. Which of the EU consortia are you working with, if known? (Please check all that apply if more than one)

- ZikAction
- ZikAlliance
- ZikaPLAN
- Member of the REDe Network
- Not sure
- None of the above

Q4. What is the name of the organization that you work for?

_____

Q5. Which country are you based in?

{List provided}

Q6. What is your role in the study or studies that you are involved in? (Please check all that apply)

	Academic
	Administrator
	Clinical Research Associate
	Data Entry Clerk
	Data Manager
	Ethicist
	Ethics Committee/IRB Member
	Field Worker
	Industry Provider
	Investigator (also includes Co-Investigator)
	Laboratory Manager
	Laboratory Staff
	Manufacturer
	Monitor
	Nurse
	Pharmacist
	Physician
	Principal Investigator
	Project Manager
	Public Health Professional
	Regulator
	Research Assistant
	Research Coordinator
	Senior Investigator
	Social Scientist

	Statistician
	Student
	Other, please specify

Q7. Which type of study or studies are you currently working on? (Please check all that apply)

- Animal studies
- Clinical trials
- Disease surveillance
- Epidemiological studies
- Laboratory studies
- Observational/sampling only/non-intervention
- Social science/anthropology
- Vector studies
- Not applicable—no current study/studies
- Other, please specify
-

Q8. Have you received any training to help you carry out your current research activities? (for example, Good Clinical Practice)

- Yes
- No

Q9. If yes, please state the name of the training course(s), or subject(s) covered (for example, consent)

_____

Q10. From the following list, what training do you think would help your work on these studies or future studies?

Please select from the following categories where:

0 = not applicable, 1 = sufficiently trained, 2 = low priority, 3 = medium priority and 4 = high priority

	0	1	2	3	4
Setting a research question					
Writing a protocol					
Planning for study start					
Standard operating procedures					
Community engagement					
Informed consent					
Participant recruitment and retention					
Data management and data capture					
Quality management and monitoring					
Research Laboratory standards and procedures					

Research sample handling					
Safety reporting in clinical research					
The Study Intervention (shipping, storage and accountability)					
Statistics in clinical research					
Data analysis plans					
Dissemination and reporting					
Study close					
Clinical study project management					
Clinical study budget management					
Seeking funding and writing grants for clinical research					
Other, please specify					

Q11. **Is there anything else you would like to tell us?**

_____

Thank you for completing this survey.

Your contribution to this research is greatly appreciated.

Appendix 2: African Coalition for Epidemic Research, Response and Training (ALERRT) Network online survey

Research Capacity and Skills Assessment Questionnaire

In collaboration with The African coalition for Epidemic Research, Response and Training (ALERRT) and its partners, The University of Yaounde I (UNIYAO I) and TGHN, are running a programme to support research capacity development. The aim of this is to determine the health research capacity gaps for ALERRT partner institutions and determine short-, medium- and longer-term mechanisms for addressing these.

To inform this work we are conducting a questionnaire to establish the key research capacity and skills gaps in order to support these. We would be most grateful if you could answer all of the following questions. It will take no more than 10 minutes to complete and your answers will be incredibly helpful for guiding and determining the development of future training and resources.

Should you have any questions or difficulties completing this survey, please contact Dr Sylvie Kwedi Nolna at this address: ALERRT@tghn.org

Thank you for your time and assistance with this.

1. **Responder profile**

1.1. Country of residence:

1.2. Institution:

1.3. Current position:

☐ Professor/ Associate Professor	☐ Student	☐ Research Coordinator
☐ Senior Lecturer /Lecturer	☐ Project Manager	☐ Investigator
☐ Medical Doctor/Nurse	☐ Senior Investigator	☐ Field Worker
☐ Postdoc/Research Fellow	☐ Laboratory Staff	☐ Laboratory Manager
☐ Research staff/Assistant	☐ Statistician	☐ Data Entry Clerk
☐ Data Manager	☐ Pharmacist	☐ Clinical Research Associate
☐ Ethics Committee/IRB Member	☐ Monitor	☐ Administrator
☐ Social Scientist	☐ Ethicist	☐ Public Health Professional
☐ Regulator	☐ Manufacturer	☐ Industry Provider

☐ Other _____

1.4. Your current main field of health research (for example, infectious diseases, pharmacology, biochemistry, parasitology, etc.:

1.5. Years of research experience:

☐ 0 to 2 ☐ 3 to 5 ☐ 6 to 10 ☐10+

1.6. Percentage of your time currently spent on research:

☐ 0% to 20% ☐ 21% to 40% ☐ 41% to 60% ☐ 61% to 80 % ☐ 81% to 100 %

Research environment

1.7. What type of establishment do you currently work for?

☐ Hospital (Public) ☐Hospital (Private) ☐Community Health Center/Facility
☐ Government Ministry ☐University (Public) ☐University (Private)
☐ Non-Governmental Organization (NGO) ☐ Commercial Research Organization
☐ Others (specify) _____

1.8. Reliability of internet access:

☐ not reliable ☐ somewhat reliable ☐ mostly reliable ☐ always reliable

1.9. Access to free bibliographic databases (online or others):

☐ Yes ☐ No

2. Personal research skills

Please rate your level of experience for each of the following skills listed below:

2.1 Scientific concepts in clinical research

2.1.1 Design an appropriate research study (including: selecting a design for the research question, define outcome measures and endpoints, perform power calculations, design a randomization system, etc.)

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.1.2 Ability to write an effective grant application

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.1.3 Ability to write a study protocol and implement it

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others

☐ Not applicable

2.1.4 Ability to analyse and interpret research results with appropriate statistical methods

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.2 General operation and management of clinical research

2.2.1 Process for monitoring a study

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.2.2 Data quality assurance systems and Standard Operating Procedures

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.2.3 Professional guidelines and codes of ethics which apply to the conduct of clinical research

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.3 Community and Public Engagement*

2.3.1 Planning community or public engagement activities around research design that involves communities in early stages of developing research questions

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.3.2 Accessing tools and resources to guide the planning of community or public engagement activities around research

☐ No experience

☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.3.3 Reflecting with others in my institution on the guiding principles of community engagement (that is, the reasons for doing community engagement) and how to design community engagement programmes around them

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.3.4 Adapting research design or other institutional practice based on lessons learned from community engagement

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

*Community engagement different from community mobilization or community health programmes (CHPs). The WHO understands it to mean the following: Community engagement is a process of developing relationships that enable stakeholders to work together to address health-related issues and promote well-being to achieve positive health impact and outcomes.

2.4 Data collection and management

2.4.1 Design a suitable research questionnaire /Case Report Form (CRF)

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.4.2 Create and maintain data in a clinical data management system / database for example, MS Access or other database software

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.4.3 Use of database software to find records, sort, review, edit, print, and other data related functions

☐ No experience

☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.4.4 Set up a document archive system for adequate storage and easy retrieval of research records and documents

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.5 Disseminating research findings

2.5.1 Reporting the results of research, and of the various dissemination formats available for different audiences

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.5.2 Clearly communicate results in speaking to an audience (live or otherwise)

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.5.3 Design and prepare a suitable poster for a conference

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

2.5.4 Writing a scientific article for publication

☐ No experience
☐ Minimal experience
☐ Capable of performing task(s)
☐ Experienced—regularly perform the task(s)
☐ Highly experienced—able to train and guide others
☐ Not applicable

3 Research challenges

3.1 Perception of challenges: Please indicate the impact of the following challenges on your research

3.1.1 Your government's attitude to supporting and investing in research

- ☐ Not significant
- ☐ Somewhat significant
- ☐ Significant
- ☐ Very significant
- ☐ Not sure

3.1.2 Available national research funding

- ☐ Not significant
- ☐ Somewhat significant
- ☐ Significant
- ☐ Very significant
- ☐ Not sure

3.1.3 Available international research funding

- ☐ Not significant
- ☐ Somewhat significant
- ☐ Significant
- ☐ Very significant
- ☐ Not sure

3.1.4 Administrative and management support for research in your institution

- ☐ Not significant
- ☐ Somewhat significant
- ☐ Significant
- ☐ Very significant
- ☐ Not sure

3.1.5 International research collaborations (your own)

- ☐ Not significant
- ☐ Somewhat significant
- ☐ Significant
- ☐ Very significant
- ☐ Not sure

3.1.6 Level of teaching/administrative work load and how it affects your research time

- ☐ Not significant
- ☐ Somewhat significant
- ☐ Significant
- ☐ Very significant
- ☐ Not sure
- ☐ Not applicable

3.1.7 Salary allocated for research activities

- ☐ Not significant
- ☐ Somewhat significant
- ☐ Significant
- ☐ Very significant
- ☐ Not sure

3.1.8 Your institution's interest in practicing and developing community engagement around its work

- ☐ Not significant
- ☐ Somewhat significant
- ☐ Significant
- ☐ Very significant
- ☐ Not sure

Are there any further comments you wish to make in relation to any aspect?

If you are happy to be contacted about this study, please provide your contact details below:
E-mail address (optional):_____

Thank you for completing this questionnaire, your contribution is greatly appreciated.

For more information on ALERRT and associated training and capacity development initiatives, please visit alerrt.tghn.org.

Appendix 3: International Vaccine Task Force survey

Survey Questions

1. Which of the following categories best describes your current role?
Please choose **only one** of the following:

- Student
- Research Coordinator
- Project Manager
- Investigator
- Senior Investigator
- Field Worker
- Laboratory Staff
- Laboratory Manager
- Statistician
- Data Entry Clerk
- Data Manager
- Clinical Research Associate
- Pharmacist
- Administrator
- Monitor
- Ethics Committee/IRB Member
- Social Scientist
- Ethicist
- Academic
- Public Health Professional
- Regulator
- Manufacturer
- Industry Provider
- Other

2. What type of establishment do you primarily work for? Please choose **only one** of the following:

- Hospital (Public)
- Hospital (Private)
- Community Health Center/Facility
- Government Ministry
- Non-government organization
- Commercial Research Organization
- University
- Other

3. Which country do you work in? Please choose **only one** of the following (drop down list)

4. What type of study or studies have you personally worked on over the past five years?
Please choose **all** that apply:

- Disease surveillance/epidemiology
- Observational/sampling only/non-intervention studies
- Laboratory studies
- Clinical trials (non-regulatory)
- Clinical trials to support a regulatory submission
- Regulatory vaccine trials
- Post registration effectiveness or pharmacovigilance studies

- Other:

5. How much experience do you personally have conducting the following activities?
Please choose the appropriate response for each item with 0 being no experience through to 5 being a very high level of experience

5.1 Clinical trial design
5.2 Clinical trial set-up/operational management
5.3 Clinical research laboratory set-up/operational management
5.4 Data management and data sharing
5.5 Biostatistics
5.6 Research ethics
5.7 Regulatory compliance of investigational/repurposed registered products
5.8 Research/project management

6. Please can you suggest some of the key knowledge and skills gaps, or practical barriers, that prevent you from doing more research or developing your own research skills and experience?

7. Please can you describe what your organization or institution would need in terms of resources, training or infrastructure in order to be able to take part in regulatory standard clinical trials?

8. Who has been the Principal Investigator (PI) for most of the studies you have worked on? Please tick which sentence applies most to your studies. Please choose **only one** of the following:

- You or a colleague in your organization or institution as we lead our own studies
- An external PI because we were a collaborating site in a study led from elsewhere
- Both because we have led studies and worked on others that have been externally-led
- Other

9. Please can you suggest what might help make your research activities and capacity sustainable into the future?

10. Would you like to provide us with more information so we know who you are, where you work and your contact details? Please choose **only one** of the following:

- Yes
- No

11. What is your full name? (optional)

12. What is the name of the organization that you work for? (optional)

13. What is your email address? (optional)

14. Would you be happy for us to contact you and maybe ask you further questions?
Please choose **only one** of the following:

- Yes
- No

15. Would you like more information on any of the following areas of TGHN?
Please choose **all** that apply:

- The Global Health Network
- The Global Health Network Member areas

- SiteFinder
- The Process Map
- The Global Health Training Centre
- The Professional Membership Scheme
- The Global Health Regulatory Requirements Database
- Research topic areas on The Global Health Network for example, HIV, TB and Influenza
- Other

Appendix 4: Developing Clinical Trial Capacity in Madagascar Workshop

Research capacity and skills assessment questionnaire

Q1. What is your name and what is your job role?

Q2. Who do you work for and what type of organization is this, for example, public hospital?

Q3. Have you experience of health research, and if so, what types of study or studies have you worked on?

(Please check all that apply)

- No health research experience
- Animal studies
- Clinical trials
- Epidemiological and surveillance studies
- Laboratory studies
- Observational/sampling only/non-intervention
- Social science/anthropology
- Vector studies
- Other, please specify _____

Q4. Have you or your research team received any training or support in how to conduct health research?

- Yes (Go to Q5)
- No (Go to Q6)

Q5. If yes, please explain the type of training or support and the topics covered.

Q6. From your own perspective what are the main barriers to you working in health research; what are your main training or career development needs?

Q7. What would your organization or institution need in terms of resources, training, support or infrastructure in order to take part in more research studies?

Q8. Is there anything else you would like to tell us about how research capacity could be improved in Madagascar?

Thank you for completing this questionnaire, your contribution to this research is greatly appreciated.

Appendix 5: Capacity Assessment for Research Development Workshop in Brazil

QUESTIONNAIRE: CAPACITY ASSESSMENT FOR RESEARCH DEVELOPMENT

SECTION A: PERSONAL INFORMATION

DATE:
PLACE: **(name of the institution)**
RESPONDENT'S NAME: **(full name)**
AGE:
Gender: **0 = Male** **1 = Female**

SECTION B: ORGANIZATION AND RESPONDENT INFORMATION

B1. What kind of organization do you work for?

B2. What's your position?

B3. How long have you been working in this position?

B4. Briefly describe your tasks.

SECTION C: ASSESSMENT OF RESEARCH CAPACITY

C1. Do you work with any aspect, or areas associated to the Zika virus?

0 = NO (Go to question C3)

1 = YES (Go to question C2)

C2. If YES, please briefly describe your work.

C3. Have you been involved in research/studies, both clinical and non-clinical, in your current position?

0 = NO (Go to question C3b)

1 = YES (Go to question C3a).

C3a. Describe briefly the research/studies in which you have been involved, and in which capacity (for example, doctor, nurse, laboratory technician, social worker, etc.).

C3b. If NO, is there any particular reason why you have never been involved in research/studies?

C4. Have you received any training or attended courses on research development in the institution where you currently work?

0 = NO (Go to question C5)

1 = YES (Go to question C4a and then C4b)

C4a. If yes, briefly describe the type of training you received.

C4b. What is/was the training format? Distance learning/online course; face-to-face course; etc.

C5. Would you like to receive training on how to develop clinical research?

0 = NO (Go to question C5b)

1 = YES (Go to question C5a and then C5c and C5d).

C5a. If YES, why would you like to receive this additional training?

C5b. If NO, why would you not like to receive additional training?

C5c. What specific type of training would you like to receive?

C5d. Which training format would be the most appropriate (for example, face-to-face, distance/online learning, etc.)

C6. Please list any other suggestions for training and courses you would like to receive.

Appendix 6: INTERGROWTH-21st Impact Assessment survey

Only questions 9, 10 & 11 were analysed in this gap analysis

INTERGROWTH-21st Impact assessment survey questions

General information	1. Which of the following categories best describes your current role? Nurse Midwife Health care assistant/hospital support staff Obstetrician/gynaecologist Paediatrician Medical doctor (other specialty) Student Research coordinator Project manager Investigator Laboratory staff Other 2. What type of establishment do you primarily work for? Hospital (Public) Hospital (Private) Community Health Center/Facility Government ministry Non-government organization Commercial Research Organization University Other 3. Which country do you work in?
Experience of using INTERGROWTH-21st	4. Does your institution use any of the following INTERGROWTH-21st standards? Please select as many as relevant. Pre-term feeding recommendations Early pregnancy dating Fetal size in early pregnancy Symphysis –fundal height Fetal growth by ultrasound Newborn size Newborn size for very pre-term infants Postnatal growth of pre-term infants Maternal gestational weight gain Neurodevelopment assessment at 2 years Other

	5. Have you accessed any of the following Intergrowth-21st resources? Downloadable tables & graphs Calculators Mobile apps Online apps E-learning training courses Publications 6. Please can you tell us how you used these? Please describe as much as you can and tell us whether they were for research or clinical care (or both). 7. Please tell us how these tools helped make your clinical or research tasks easier or better? 8. Do you have any comments or suggestions on how we can improve any of these resources around child development or what further tools would help you in your role?
Experience of accessing TGHN resources	9. Have you accessed any other information, training or tools on TGHN? Please, can you tell us which ones? 10. Did this help you research or clinical work? Please tell us how. 11. What general research resources, tools or information would help you in your role?
Interview invitation and contact details	12. Thank you for participating in the survey. This information is vital in making sure we provide tools and resources that can truly help you. It would help even further to briefly talk to some of our users and find out a little more so we have a better understanding of the impact. Would you be willing to participate in a short telephone interview? If so, please tell us: Name Email address

Appendix 7: The Global Health Network user feedback and e-learning surveys:

- ***The Global Health Network user feedback survey (online survey)***

- ***The Global Health Network online courses feedback surveys***
    - ***eLearning general survey***
    - ***Good Clinical Laboratory Practice (GCLP) survey***
    - ***Malaria Microscope survey***
    - ***Additional advanced Good Clinical Laboratory Practice (GCLP)***
    - ***Ethics survey***

Survey questions:

1. How did you hear about TGHN?
    - Recommended by a friend, colleague, or organization (please specify)
    - Link from another website
    - Read about it in an article
    - Global Health Trials workshop
    - Search engine (for example, Google)
    - Other (please specify)
2. Which of the following categories best describe your current job role?
    - Student
    - Research Coordinator
    - Project manager
    - Investigator
    - Senior Investigator
    - Research Nurse
    - Field Worker
    - Laboratory Staff
    - Laboratory Manager
    - Statistician
    - Data Entry Clerk
    - Data Manager
    - Clinical Research Associate
    - Pharmacist
    - Administrator
    - Monitor
    - Ethics Committee/IRB Member
    - Social Scientist
    - Ethicist
    - Academic
    - Public Health Professional
    - Regulator
    - Manufacturer
    - Industry Provider
    - Other

3. Have you used information from any of the following areas of the site in your research or other work?

4. Have you used information from any of the following areas of the site in your research or other work?

5. Feel free to comment on the above sources of information.

6. Have any of the following areas of TGHN contributed to your career progression?

7. Feel free to comment on the above tools in relation to your career progression.

8. Do you have any other comments or suggestions on how we can improve any aspects of the website?

Appendix 8: List of questions of panellist survey

Process for developing an Evidence-led E*ssential Research Skills Training Curriculum*

e-Delphi Study: Panellist selection survey

Welcome to the Delphi study panellist invitation survey.

We are carrying out this study to develop an evidence-led Core Research Skills Training Curriculum (core curriculum). This project is led by Professor Trudie Lang at University of Oxford, in collaboration with the Special Programme for Research and Training in Tropical Diseases (TDR).

The aim of this study is to find consensus on what constitutes the **minimum set of** skills, knowledge and key principles that would **enable those without previous experience in research to undertake high-quality health research.**

Delphi panellists must be over the age of 18 years and able to understand and communicate in English. We will include individuals from a range of backgrounds, and therefore you will be asked to provide demographic information including details of your background, current role and any experiences and expertise in research.

Click NEXT to start completing the survey.

Section 1 – General information

1. Which of the following categories best describes your current role?
   Research participant
   Academic
   Clinical research associate
   Consultant
   Data Entry Clerk
   Data Manager
   Ethicist
   Ethics Committee/IRB Member
   Industry provider
   Health care assistant/or other hospital support staff
   Nurse
   Midwife
   Medical doctor
   Administrator
   Research Monitor
   Pharmacist
   Public health professional
   Laboratory Manager
   Laboratory Staff

Research Project manager/coordinator
Investigator/Co-investigator
Senior investigator/Principal Investigator
Researcher
Research assistant
Research Field worker
Statistician
Provider of research training
Journal/publishing staff
Working in research policy
Working for research regulatory bodies
Research writer (about research training)
Working for research funding organization
Manufacturer
Student
Other

2. What type of establishment do you primarily work for?
   Academia (university, college,...)
   Commercial Research Organization
   Community Health Center/Facility
   Consultancy
   Government Ministry
   Government research organization
   Hospital (Private)
   Hospital (Public)
   Industry (including Pharma)
   International organization (IGO)
   Journal/Publishing company
   Non-government organization (NGO)
   Public health institute
   Regulatory organization
   Other research organization
   Self-employed
   Unemployed
   Other
3. Which country do you work in? (drop down list)

4. Please select your gender
   Female
   Male
   Other

5. Please indicate you age:

Section 2 - Your research experience

6. Which of the following categories best describes your experience or role in research? Please select as many as applicable.

Research participant
I have experience leading research projects
I am currently working in research
I am/have been the named lead on grant applications
I deliver training in health research (for example, GCP)
I mentor undergraduate/postgraduate/PhD students engaged in research
I am involved in the design or coordination of training curriculums that include research skills (for example, undergraduate courses/medical courses)
I am a member of a research advisory committee/international review board
I work for a research funding organization (for example, Wellcome, EDCTP)
I have authored and published peer-reviewed research training papers
I have authored and published research-training themed books or manuals
I am an editor or on the editorial board of a health research journal
I am a policy-maker or hold a position within the ministry of health
I work for/have experience working for a regulator (for example, FDA)
I work for/have experience working within commercial industry (for example, GlaxoSmithKline)
None of the above
Other

7. What research topic do you have experience in? (list adapted from WHO priorities for research for health). Please, select as many as relevant:
Influenza (Flu) Viruses
Ebola
Zika
Malaria
Dengue
HIV
Other high-threat pathogens (that is, Rift Valley fever)
Other human infection studies
Vector studies
Neglected tropical diseases
Non-communicable diseases
Reproductive, Maternal, Neonatal Child or Adolescents Health research
Primary health care
Vaccines
The health impacts of climate and environmental change
Health promotion
Methodology research (research on research)
Health policy and systems research
Health economic analysis
Health decision sciences
Not applicable (that is, for research participants)
Other

8. What research methods do you have experience in? Please, select as many as relevant:
   Clinical trials
   Post registration/pharmacovigilance studies
   Epidemiological studies
   Case studies
   Observational studies
   Other Quantitative methodology studies
   Qualitative methodology studies
   Mixed methods research
   Evaluation studies
   Consensus-method studies
   Action research
   Document research
   Not applicable (that is, for research participants)
   Other, please state

9. How long have you been involved in the field of research (in years)?

10. Please indicate your name.

11. Please indicate you email address.

Appendix 9: e-Delphi study Round 1: panellists' comments

Are there any other categories that, in your opinion, should be included in the essential research skills curriculum?
Appropriate knowledge of British and American English *Ability to choose a peer-reviewed journal (and what it means)* *Use of Scopus and other abstract and citation database of peer-reviewed literature*
Development of contingency plans (in light of the current Covid-19 pandemic this has been crucial) *Training procedures (that is, how to organize training (for example, GCP, critical scales, ethics) for researchers participating in a particular study)* *Recruitment procedures*
Validating informed consent in rural African settings
Details of study/trial registry with other agencies *Exploration of funding source*
IT skills, especially MS Word, Excel and Power Point presentation skills *Critical appraisal of a research paper*
Participants' privacy and confidentiality *Establishing a sustainable model for collaboration*
Tackling the United Nations' Sustainable Development Goals through research *Interdisciplinary and multidisciplinary research teams for novel approaches to research*
Advantages and disadvantages of data collection directly using electronic system *Advantages and disadvantages of collecting data using papers*
Assessing clinical trial site *Providing feedback to communities* *Shipping samples*
Understanding meetings and how to run them Appreciating people have different approaches depending on clinical background *Understanding decision-making and how to change peoples' minds*
Action research *How to identify research objectives*
Adverse events/serious adverse events reporting awareness and pharmacovigilance signal detection
Analyse local population knowledge and cultural and faith impact on research success
As of this stage, all the questions raise are OK
Assumptions
Authorship in research; working and contributing in multidisciplinary collaborative research teams; coordination of multicultural international research projects
Basic concepts in epistemology
Basic research for health
Being able to perform a critical review of an article
Bibliographic search: resources and strategies; critical analysis of scientific literature; research methodology: approaches and study designs
Buenas prácticas de investigación en salud (GCP). Translation: Good health research practice.

Build and validate models *Create and validate a collection instrument of data* *Técnicas de estadística: descriptiva e inferencial para datos univariados, bivariados y multivariados, Técnicas de análisis cualitativo y técnicas de simulación.* *Scientific citation techniques—learn the style of scientific writing*
Capacidades de los integrantes de equipo. Translation; Capacities of team members.
Capturing and assessing metrics of performance for research sites
Clinical experience in specific research, not only research experience
Clinical trial management systems
Communicating to the general public; peer review; measures of impact of research;
Community engagement and involvement *Community-based research* *Study tools' development; pretesting of study tools; mock sessions for data collection*
Community engagement strategies. Project management software (that is, smartsheet, Microsoft project)
Conference presentations, and PPI (patient and public involvement)
Consideration and understanding of cultural issues and beliefs. Community entry, for example, presenting the research to county and sub county health management teams, local administrative leaders etc. to seek support authorization processes—IRB and ethics review boards and research permits with government bodies; importance of dissemination of results to study participants and ministry of health and other government authorities; how to write abstracts
Coordinación entre instituciones publicas con investigadores independientes. Translation: Coordination between public institutions with independent researchers.
Critical thinking of researchers to generate new knowledge; researchers must have patience and confidence besides having competency in assessing various factors and variables more judicially
Data management
Design of research study and clear objectives matching the funders' topics and requirements
Developing an appropriate theoretical framework for the research ontology; epistemology; how to align research questions/hypotheses and theoretical frameworks with ontology, epistemology and methodology validity and reliability strategies (although maybe included under data quality); discussing results, implications and recommendations; structuring papers, articles, reports etc.
Development of research tools using XLS forms
Education on research: teaching people how to teach research
Effective patient and public involvement, co-production of research with communities
English proficiency
Enumerator training validity and random reliability tests
Evidence-based medicine skills to share research results in scientific events (posters, presentations, etc)
Evidence-based practice *Evidence-informed practice; critical event reporting; patient involvement*
Experience
Formulating a scientific hypothesis; understanding the difference between experiment and measurement
Globally, the research should also put into consideration measures on lifestyle diseases' preventions since it has remained the greatest global threat. Last but not least, the effect of the research on common man within our locality

Good clinical practice *Data management* *Regulatory file development* *Data security* *Hierarchy of reporting* *Surveillance and research*
Handling and proper storage of the laboratory chemicals and reagents; *Handling of spillage in the laboratory*
Handling of registries: no major guidelines [i think otherwise done exhaustively].
How to consider the variance of each country/region's settings (regulations, languages, cultures and systems like health system) in multi-regional clinical research "sponsor" responsibilities.
How to prepare for grant applications. (This should include sections on the appropriate duration to plan and prepare for target RFPs, and essential documents usually required in grants applications.) How to set-up a research grant application support office or team (this should include sections on the kind of personnel required for this and essential expertise/trainings the team needs.)
How to publish in international journal
How to read a protocol: the how and why behind the protocol deviations in clinical trials (protocol, sop, gcp, temp/samples); *Amendments: when and how do you implement them; how to develop source documents; how to prepare for an audit and respond to audit observations*
How to search online databases, for example, Pubmed; how to identify predatory journals and conferences/ how to identify a suitable journal for publication; principles of ethical research; how to come up with a good research question; how to identify important research topics for your country; performing critical appraisal; how to write a scientific article
Hands-on training with data management and analysis systems such as r or stata
I can't recall if it has been listed already, but it would be great to include research methodologies (that is, RCT, Bayesian, observational) and how to apply ethics requirements/standards to different research methods. Writing a business case, a protocol synopsis and a research proposal would all be very useful. Proficiency in computer programmes may be outside the scope of this project, however, understanding how to proficiently use Microsoft Excel, for example, can assist with budgets, data management, stats, staff management and more. Tools such as Visio can help provide clarity to organizations of workflows and SOPs and Power Bi can assist in providing real-time trends in studies with large sample sizes.
I missed pharmacy management/drug quality and regulations
I think a very important issue is defining the operationalization of the variables in the study. How really are they measured in the study *realidad* *also confounding and effect modifiers in the study and selection bias and others* *one important issue is the historical perspectives of the diseases and how different societies answers to the situation: anthropology la estrategia de atencion primaria en salud y los determianantes sociales de la salud enfermedad el indice ginni and the happy planet index as measure of wellbeing (bienestar). Translation: the primary health care strategy and the social determinants of health disease the ginni index and the happy planet index as measure of wellbeing*
I think all previous categories are the essential required categories to be included in the programme. I see that understanding types of journals & indexing rules are also beneficial
I think all the essential elements have been mentioned

I think if one lesson the current Covid-19 crisis would teach us in this context, it will be about the anthropological role of researchers, their responsibility towards the public concerns, sense of duty toward the well-being of humans regardless of race, colour, geography, backgrounds and so on.
I think it is broad enough, but then research is multifaceted involving various interest groups and many roles; there may arise competition on patents and or litigation; in low- and medium-income countries, issues of equipment, subsidy on laboratory investigations, is so important, budget may be higher as most participants are not insured, they usually pay out of pocket, and some investigations can be very expensive or unavailable in many service delivery points. It may be wise to add a bit of caution in the spirit of carrot and stick, a category dealing with legal consequences of a botched or bungled research project wouldn't be a bad addendum, equally important for those in hard-to-reach locations would be provision of a good teleguidance gadgets for very timely resolution/getting prompt information! The latest statistical softwares should be put on DVD, with enough exercises to benefit even the novice. I think it is broad enough if all the categories are dealt with extensively, it would cease to be essential but becomes a compendium of research skills for all.
I think it should be important to understand the mainstream methodologies in both qualitative and quantitative research, depending on the researcher´s interest and this person should be able to identify in other studies what can be applied in his/hers.
I think that the proposals that you listed are very complete
I think that the use of drade methodology to formulate clinical practice guidelines based on scientific evidence should be included among the skills
I think the curriculum can have more categories on dealing with the hardships of research in different areas as per access to information
I think the list is very comprehensive. A modular format would be useful to stop new researchers feeling overwhelmed. Possibly some assistance/resources for writing skills for those for whom English is not their mother tongue might be helpful. Even ensuring the teaching and learning materials are written in plain English would be helpful. You have covered academic literacy to some extent but this may well need to be scaffolded for participants.
I think you have captured all relevant areas
I would prefer the term biostatistics instead of 'statistics'. This could be purely semantics. Other topics, concept paper, formulation, conducting a pilot study, systematic review
Identification of study areas
Importance of multi-sectoral research
Knowledge of whole process in clinical trials from idea, through bench test, phases of trial and HTA (Health Technology Assessment) into community and pharmacovigilance. Knowledge of global healthcare systems, such as WHO, regulations etc. Give them a context for their own healthcare system. Knowledge of non-clinical trial research such as health care policy, mental health, registries of patients, community healthcare etc.
Legal precedents for data sharing, availability of data sharing platforms, compatibility issues for data sharing; there should be a module on national and local considerations for research, national policy, national ethics review processes; cultural sensitivity and linguistic competence
Maintaining data quality throughout the project and Excel/application practices for data storing
Management of pharmacovigilance
Managing and maintaining the blind when multiple blinding levels are set in a single study.
Managing and reporting human errors among study participants and risk mitigation; writing useful, understandable informed consents and participant tools

Medical device related chapters viz. Iso 14155, additional methods for medical device research, differences between other health research and medical device research; reporting skill related aspects —interpretation of various statistical outputs, graphs, listing. [The International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH)] ICH guidelines, e2, e3, e9 21cfr part 11, iso 27001
Medical writing in clinical research *Protocol writing or CSR* *Health blog writing* *Entrepreneurship in clinical research*
Mentor–mentee research forum in academia: stimulate young minds to discuss their research questions with the right research mentors with experience who will enable them to formulate a right research hypothesis
Mentoring *Investigational medicinal product management* *Data cleaning* *Data monitoring*
Mentorship in research
Minimum skills really should be things like critical thinking, communication, attention to detail, punctuality, ability to multitask, some basic computer skills, abilities to learn new information. Many of the listed skills I would consider to be unimportant for a new hire, but a must for someone a few months into a new job
Myths and misconceptions in clinical and health-related research
Naming places where researches will be done depending on the type of research and specific topic which will relates to the place
No, the categories are sufficient at this stage. But a little modification can be done on the aspects of data ethics
Not a category but an item of negotiation: negotiating with your superiors' time for research. This is because most professionals in low- and middle-income countries have clinical, teaching and/or administrative work as priorities, so it is difficult to get time to do research because it is usually not considered necessary
Participant recruitment methods, tools and strategies. *Interacting with regulatory agencies*
Participatory action research
Personal development
Piloting and testing of research tools. Mobilizing and engaging research participants skills. Crisis management in research. Training of research team
Policy formulation
Presentation in front of ethical board
Pretty much everything has been included in the previous questionnaire
Principal investigator roles and responsibilities, [intellectual property] IP accountability/storage/destruction
Procedures for handling epidemiological disease outbreaks. Data management practices. Quality control methods in research laboratories. Intellectual property rights. Fraud and misconduct.
Project management tools *Risk-based monitoring*
Promotion on international basis *How to get funding from external programmes*
Publication ethics
Publications
Regular training of all health care workers or involved in clinical research *Need of centralized database in the entire world for therapy area*

Requirements for grant writing; standard formats for specific grant organizations
Research designs; statistical tests of significance
Research in different contexts, that is, low-income countries vs high-income countries *Research and politics* *Youth and research*
Research in low resource settings
Research infrastructure development for academic institution, private sector and NGOs- setting for standards
Research methodology
Research methodology as a separate course
Research methods
Research results communication
Researcher–patient communication in clinical settings. Microsoft Excel and/or other programmes for data management. How to properly transfer results into research data?
Resilience as a trait for a career in research
Responsible conduct of research (which is expressed in some categories already, but needs to be covered in the final version); more categories for research ethics are needed, including ones pertaining to participant incentives/compensation, distributive justice and other aspects of benevolence, nonmaleficence and respect for persons; more details about what is meant by epidemiological, quantitative and qualitative study design, data collection and data analysis methods
Ritengo sufficienti le categorie presenti nel questionario. Translation: I consider the categories in the questionnaire to be sufficient.
Security, confidentiality and privacy of research data
Self-reliance, resilience
Skill in managing the increasing volume of academic literature to keep the researcher's knowledge and awareness about research issues updated, not necessary having to perform a systematic review
Strategies for recruitment and retention of participants, especially in vulnerable groups *"Statistics" and "quantitative methods" sound too vague* *In addition to clinical trials the following should be explicitly included:* - *different observational study designs and quasi experiments* - *applied essential statistical methods such as bivariate and most common multivariable analysis (regression models) and perhaps exploratory factor analysis when building evaluation instruments* - *methods to evaluate treatment effects from observational studies and real world data causal inference*
Synchronization of data to relevant officials with proper confidential disclosure agreement
The listed items are comprehensive and if they are incorporated in a training, it should be enough. This is because in most cases junior researchers are usually left at data collection and never go beyond that. Given a training in the listed items, everybody should go along the way in the best practices of research
The principles of big data analysis
The role of patient, public, carers in involvement and engagement in collaborative/co-produced research, that is, participation, involvement and engagement. The inclusion of GRIPP2 tool to measure method/impact of patient, public, carer involvement in research. Methods/resources to promote participation, involvement and engagement with patients, public, carers and traditionally "hard to reach groups"
The topics of risk-based monitoring (RBM) or RBQM and patient centricity in clinical research

These are sufficient
This method of evaluating the research capability is excellent
Time frames of publications and public speaking
Token for research participants when the need arises
Tools and tests selection (validity and reliability) problem-solving skills, basic programming skills
Tools for translating information based on stakeholder categories. *Stakeholder mapping*
Triangulation of research methods/data case study research; participatory action research; narrative research
Understanding the role of critical assumptions *Hypothesis framing and testing*
Use of emotional intelligence
We have a complete set of topics to study
Well, proposal design, formulation of problem, trials design and how to implementation research, I know all mentioned above are so important
Working with industry or third sectors
Yes, I think in the LMICs we need to improve the capacity of professionals to search for scientific evidence at indexing library databases, and collect a reliable body of evidence on a specific subject. Actually, I think the Delphi's essential research skills list should expand the point on meta-analysis to comprise skills on systematic reviews as a whole
Yes, I think something that has to do with understanding context and community entry should be included
Yes, something like organization and priorities during emergency situation (Covid-19 inspired)
Yes. How to formulate research hypotheses and interpret contingency tables and graphs
Yes. The importance between endemic diseases and diseases present in all countries and how this impacts clinical research. The gap 10/90 and the research in rare diseases. The particularity of clinical research in developing countries. I slightly agree that these topics are added to a core topics' curriculum
Your questionnaire is more focused on practical and technical abilities of the researcher and less focused on his personality. For instance, he/she should be able to build trust among a research team, as well as collaboration, the researcher must be sociable, patient, tolerant and got communication skills. Because most of the time we have to work or collaborate with people coming from various and different cultural backgrounds

Appendix 10: e-Delphi study Round 2: panellists' comments

Please use the comments box available below to comment on any aspect including items missed, the wording of the new items or to challenge anything that seems to misrepresent Essential Research Training Skills knowledge.
There should be mention of an evaluation system to gauge research competence—new and old.
I suggest that use of software and statistical applets need to be emphasized especially for estimation of sample size and sampling techniques. Use of proposal, thesis, scientific writing guidelines. Scientific writing skills are necessary
Overall, I am satisfied with the items as appropriate. Although some items are more suitable than others, which is usually expected in every situation
In essential research skills, it is critical to involve individual participants at the planning of research and training process as part of community engagement process. This aspect has been neglected in the part but the most essential parts of research. Once this is done, having access to community members to be engaged in research will be eased at any time
The report from the first round seemed to show that many participants did not focus on identifying the most relevant skills for new investigators. There also seems to be some lack of clarity about whether the training would be for population-based research, laboratory-based research or other types of investigations. If many types of research areas are included in the curriculum (mathematical modelling, econometrics, anthropological approaches, epidemiology, clinical trials and so on), each can be covered only very superficially. If a narrower definition of health research is provided, the participants in the Delphi process will be better able to comment on which skills are essential, which are supportive but not critical for new investigators, and which are not important to include in a basic curriculum
Preparation and content of research protocol and dissemination strategies
The intent of this survey is to cultivate the interest of persons without prior experience in health research. Many of the themes should have been tailored to direct their zeal into health systems research. I think this aspect and similar features were missing. It should be considered in the next round.
It would be good to raise question on qualitative and quantitative research because there is wrangling among researchers on the use of qualitative or quantitative research as both methods have their flaws. However, many researchers concluded that quantitative research is much better than qualitative research because it deals with a larger population, which can produce a more reliable result than qualitative research
Research in limited resource settings
Several of the items would be useful, but not essential for everyone undertaking research. It is important that the outcomes of the study do not result in an overly large and cumbersome set of modules which are not relevant to everyone. Extra content areas can be included as electives
In my answers I considered the curriculum essential for the training of a new researcher, someone who comes from an undergraduate course and wants to start research. All the topics presented are of interest to a researcher, but I assume that the junior researcher will always be under the supervision of someone more experienced and that the training will be continuous. I believe that the question "Setting up an ethical review board or committee" could be replaced by understanding the role of, and how, a review board or committee works
Translational data used in research
The statements in some new items are lengthy and convoluted. They could benefit from revision

On medicines supply and regulations: individual countries have different regulations and for this one to be included, it needs to be tabled to see how regulations are in different countries
I am not sure if "Clinical Data Management Practices" was listed as one of the options because I don't recall seeing it. This is a very important topic to include as part of an Essential Research Skills Training Programme. The quality of data collected and analysed is of paramount importance to any health research. Also "Fraud and Misconduct" should be included as part of the curriculum because it is very important in understanding the codes of research ethics
Many of the essentials that were mentioned seem to have some significance in new researchers trying to conduct their own research. I think basic knowledge of finance shouldn't be a priority unless absolutely required. Being able to form research ideas should be more of a priority in basic levels of studies. A special understanding of what might go wrong in research should also be included. Like not getting a positive result to the one you were hoping to get. Also, a chapter on how to apply to a paper should also be added
Some of the topics need to be covered in-depth, while others could be touched on briefly to ensure awareness. Perhaps this could be a further refinement as part of this Delphi project. For example, a researcher needs to understand how to write a research protocol in an in-depth way. However, things like "big data analysis" and meta-analysis should be understood from an awareness but not in-depth. Similarly, I don't think one would need to know how to set up an ethics committee but should understand the role of ethics committees and researchers' responsibilities with regard to ethics committees
Communicating with editors and reviewers writing progress reports
The skills training should be grouped into broad categories. For example, laboratory vs clinical vs public health; for instance, laboratory topics such as lab management will not be relevant to non-lab research
Implementing the same research in areas of different socioeconomic demographics, that is contextualizing research. Myths and misconceptions surrounding research. History of medical research
Privacy also requires essential research training, however, as researchers we also need good clinical practice for safety of research participants
The health workers who meet the research ethics criteria and engaged in conducting research need to be registered and approved in a systematic way as health research officers to avoid engagement of other non-health workers conducting health researches. This is one of the big challenges in the outcome of data especially in qualitative research
It is not clear how a research topic is to be selected for achieving academic prerequisites and evaluation of already ongoing projects and its monitoring at every step, so that it can achieve its stated goals
1) Dissemination of study findings apart from publication ethics, could elaborate on avoiding publishing in non-predatory journals/ availability of a checklist or guide to identify predatory publishers or journals in the organization/work place *2) Section 10 sub point 2: How to set up study training: Could not understand the term, if I understood the concept right, it can be reframed/elaborated for simpler understanding into "Organization/institutes to have periodical research re-orientation training/workshops on research methodology, grant writing and statistical analysis"* *3) Section 8: Subpoint 15 on leadership in research: Context is not understood. Is it with respect to mentorship or role models being available for researcher or to ensure participant is trained to be a leader?* *4) Personally felt that big data analysis, mathematical modeling, health policy, economic evaluation, health technology assessment is not necessary for essential research training skills, but could be incorporated into advanced research learning*

This is turning into a huge agenda for training, with many areas covered including qualitative research, stakeholder management etc. But there seems to be more of a focus on laboratory-based medicinal research and a slant towards research that may become commercialized. If this is an agenda to train health care staff in how to conduct "research" then I feel that the focus needs to shift back towards the basics—what types of research are conducted (not all interventions include drugs but may be service improvements, trial of online resources etc) and from there move into more of a standard "research methods" training. For someone working in social care, for example, the laboratory skills suggested are irrelevant, but all potential new researchers do need to understand how to search for existing literature, how to write a protocol, what methods they will use to gather data, how to manage that data, how to involve a range of different stakeholders, how to find and apply for funding etc. I would suggest that your "essential skills" training is beginning to look like a basic "Level 1" set of general research skills followed by a Level 2 set of skills specific to different situations. Those who will work in laboratories may not need to know much about stakeholder management but will need a good understanding of safety procedures, whereas those in an allied health field such as dentistry might not need to know about intellectual property but might benefit from a better understanding of how to find funding. Perhaps a future round might begin to separate out "basic, essential skills" from more advanced and specialised areas. Of course, basic training can at least touch on the specialized skills so that a good overall understanding of the research context and landscape, but I think it is as dangerous to assume that all trainees will need all of the skills listed at the same level as it is to assume no one needs any training
I think we need to have a new section on the use of "Virtual Reality" and new technology use in research. In addition, should we be thinking about "commercial/big pharma" co-production PPIE. The roles of NGOs/charities in co-productive research (particularly the conflict of governance of these types or organizations working methods with commercial/private organizations)? What restrictions might these put on carrying out research?
Not very clear about pandemics in basic research
Mentoring Skills Workshop Series for young researchers on formulation of research questions, study design, methods of data collection, analysis and interpretation of results to build research capacity among them
What is missing: Systematic searching of literature; critical thinking (it's an essential research skill); evaluation methodologies; ethical research and conduct; qualitative analysis (the software doesn't interpret the data, a researcher has to do that); data quality (co-coding, double-checking entry, access to mentorship when new to research)
Los temas evaluados a través de las diferentes preguntas son importantes, pero se deben seleccionar en función de la intensidad, del tiempo que se tiene para desarrollar la propuesta de formación. Se pudo observar que hay preguntas de temas generales que incluyen a otras mas especificas, las cuales se colocaron como no esenciales. Translation: The topics evaluated through the different questions are important, but they must be selected according to the intensity and the time available to develop the training proposal. It could be observed that there are general questions that include more specific ones, which were placed as non-essential.
Essential is a subjective scale with objective methodology. Time of essential training would be used to scale included items in training period
To me everything is in order, I ask in the near future certificate be given to participants
Protocol registry is an important point
The questions are clear and the phrasing of the statements good
Sometimes it is not clear if it is clear or unclear. Essential and less essential is easier for me to define
There are some themes that are for sure essential but not for the first step when someone with no experience starts to work in research

Scale-up practices is necessary training
This phrase (influencing at institutional level to enable research) needs to be properly explained to know which specific influence is being referred to. Influence can be either be negative or positive
Not very important elements were mentioned as follows: Focus on research plan (research proposal) How to write a research proposal is very important for the researcher and training on the main elements of the research proposal: *1- Introduction (background (defining and formulating the problem): The importance of choosing a topic (justification for the study); literature and previous studies review:* *2- Study objectives: The overall goal; special goals; study hypotheses;* *3- Methodology: 1- Type of study: Variables: The result is a dependent variables 2- Place of study: 3- Study community: 4- Study Unit: 5- Sample size: 6- Type and method of sample collection: 7- Data collection tools: 8- Sources and period of data collection: 9- Plan and manage data entry and analysis: 10- Ethical considerations: 11- Pre-test*
How to understand the spiritual beliefs and practices of the study population before approaching the research question? (For example, how to approach a study that includes the analysis of blood samples in a population of Jehovah's Witnesses)?
I think that most of the items have been covered in this round. However, you can also include the modern analytical aspects in research/teaching with the help of machine learning and AI. Overall, very good study
I would like to kindly suggest the fact the level of vigilance over academic and sponsored research should be similar. As an example, many malpractice or fraud findings in academic research come from a lack of vigilance from regulatory agencies
in cases of "clarity—unclear", it is tough to determine if the training is essential or non-essential, but there were no other options
I appreciate the inclusion of laboratory systems in the second round. But I missed the theme research on laboratory tests themselves just like "medicines". Only the use of laboratory for research is addressed if I am not mistaken
This is a pretty comprehensive list. My only concern is that such lists and recommendations look good on paper and can be implemented with ease in the high-income countries but their implementation in the developing world is incomplete. Thank you for this important initiative. I look forward to contributing to the writing and revision of the manuscript based on this research. Kindly keep me updated. Good luck
I would like to insist on data management system

I found this difficult to understand. At the beginning the Delphi stated, "The aim of this study is to find consensus on what constitutes the minimum set of skills, knowledge and key principles that would enable those without previous experience in research to undertake high-quality health research. The target audience for this curriculum would be any healthcare professional who wants to conduct their own research project and have no previous experience in research." There is an assumption here that "those without previous experience in research" would be able to undertake "high-quality health research." In my experience, this is highly unlikely unless they are supported by an experienced supervisor. In addition, I have stated that most of the skills, knowledge and key principles should be included in a curriculum if a novice researcher wished to undertake these types of research projects. However, I do not believe that novice researchers should be undertaking these projects. For example, I don't think an individual without previous experience in research should undertake a mixed methods approach. This is like taking a driving test in a Formula 1 car. They are better to use a Mini. In my experience with Masters' students, when they carry out mixed methods, they generally do not achieve high quality research for any of the methods they use because they don't understand how to use them properly. Thus, in my opinion, the Delphi should not only include whether a set of skills, knowledge and key principles are essential to new researchers but also whether they should be encouraged to undertake the research. I would discourage new researchers from undertaking mixed methods, for example, and therefore mixed methods would not be essential for their training. However, if they insisted on undertaking mixed methods, then, obviously, mixed methods would be essential. As a result, the Delphi participants should be able to state whether they feel that individuals lacking research experience should be able to undertake certain approaches or projects. My answers would be completely different if this was the case. For now, though, if novice researchers wish to use the skills, knowledge and key principles outlined in this study, then they would need to learn about them. Thus, all of them are essential. However, I do not believe that novice researchers should use all of them with their level of experience
Encourage scientific writing standards
Security in laboratory science practicing with biological issues and virus
It appears it might be challenging to achieve consensus of some of the themes due to the disciplinary background and preferences of the respondents
The new researcher will need to be secure of what are the priorities for research in his/her setting are and be instrumentalized to organize and structure a research
New researchers need to be properly trained to think on a research based on his/her work and needs to be well instrumentalized to design and conduct the research. The topics I have chosen may help to develop these skills
There are many things that are important such as formulate problem, hypotheses, objectives and samples sizes
I think the wording and the comments of this survey are relevant
Research supervision and how to deal with supervisors
Legislation of research in countries

The way I view it is that it would be a rather Herculean expectation to have a consensus on all themes and issues. Why? The background of the panellists matters most, as well as their experiences in previous research, the clinician or pathologist could agree with all questions bordering on setting up the laboratory, quality assurance, etc but wouldn't bother so much on mathematical modeling or too much statistics; on the other hand a research manager would be interested in almost every theme, while the data analyst would like themes like mathematical modeling. Hence, the challenge would be a give and take! If study training is done properly and roles and responsibilities are given to qualified personnel, it would obviate many problems—things like medicine, reagents, equipment are better awarded to a qualified procurement specialist. It is good to know the ethics and regulatory processes but no researcher elects his ethics committee nor his institutional review board; this is a job for a higher authority. Community participation is good and representative of community interest groups are always supposed to be part of ethics committee to approve the study! A person who has been involved in a research would always be farsighted than a person that hasn't, it is akin to a judge or the jury, if the selection of the panellists was randomly done as in Delphi study, then it's difficult to get 100% consensus, but in a paradoxical way they say variety is the spice of life!
I´ve not seen some basic concepts such as sampling methods, measures of frequency, effects and impact, confounding and how to deal with it, specifically mentioned as essential skills
How to conduct a trial during a pandemic, considerations and recommendations. Electronic records instead of paper records
1. Knowledge of regulatory submissions as well as submitting proposal to ethics committee/institutional review board is required *2. Basic knowledge about drug development, especially how clinical experience can be converted into new drug uses need to be encouraged with examples in the essential training which will increase interest of clinical practitioner into research*
Actually, all the materials seem to be important but some things will be learned during years of research
All materials are interesting but it is impossible to include all
I think that the knowledge of the government research regulations as well as accountability should be flexible. Because these may vary according to the sociocultural background where the research will be carried out. Let me not say each country for it is too vague, but each community always has its own rules that differ from another one even if they are in the same area. This is exactly what I experienced during a recent research in the west region of Cameroon
Essential research skills should be made clear, readily available even for common research subjects
In my opinion the basic essential skills and more required to execute high quality health research are captured in this study. The new items added to Round 1 unclear ones, broke the themes down to make them more understandable. But a few of the new items in the last section look vague, so there is need for them to be explained for me to be able to determine their level of essentiality. In all I think this is a worthy effort and it is encompassing
Medical device aspects are not covered
I feel there is a need to consider nourishing human side of researchers-in-training beyond the technical skills. Giving attention to psychological, social personal aspects of the new researchers would have positive impact on the individual's interest, motivation and success to researching. Enhancing the training curriculum with relevant material and techniques to develop the trainees' understanding of their own strength, vulnerabilities as well as others would improve their productivity work satisfaction, work/life balance. Another aspect I have not seen clearly mentioned among the proposed items is about training in scientific writing, teaching and presentations skills, publication, career development. Apologies if I missed that in the texts. Thank you

Some items can be grouped into one heading, for example, contingency plans and how to set up training, can be part of the research project management/operation subject. Principles of big data analysis can be a good aspect to cover as part of the essential curriculum, although should not be too much and can be part of research designs subject. An understanding of public health and epidemiology concepts is also important in designing and conducting health research.
I suspect that how people respond partly reflects their range of research experience? It is my experience, from working with health partners in remote, rural Zambia, that they are generally very switched on to research principles and that comprehensive research training is even more important in such low resource settings, for the protection of all concerned (researchers and participants). Actually, is "obtaining ethical permission" included anywhere? I may have been more inclusive than many. However, I am aware that health care staff in remote, low resource settings often have to be "jacks of all trades", undertaking the whole research process themselves, from start to finish. They may not have research teams to work with. A thorough grounding in all aspects will help. Thank you, I have enjoyed contributing to this exercise and look forward to hearing the outcomes. Kindest regards,
In principle what I see is good because it helps to analyse all aspects related in clinical trial, I thank you for all the effort that all of you make
Detailed explanation of theme is important, but it becomes unclear if it is too long...
I hereby recommend that every comment and research result is perfect for future reference
I think that the all themes under review as well as the new themes should be written in more than one to three words, like it was done with those unclear themes. Some themes were too specific and narrow, such as loss, attrition and retention. I think they should be included in a broader theme, such as research methodology/study designs. I think that a theme on how to search in the scientific indexing libraries should be included as an essential skill
How to present proposal in front of ethical committee
I think areas like medicines supply and management and laboratory techniques etc. are important aspects of research training, but would only apply to a certain subgroup of individuals who may be doing research in such fields. It may be advantageous to create the curriculum with different pathways. There would be one universal curriculum with core components and then specific ones such as, experimental medicine, epidemiology etc.
It is clear that all items would be important. I tried to focus on those essential for young researchers, in the assumption that they would be part of a research team, with a research leader, who will guide her/him in learning (for example, with "learning-by-doing" the "non-essential" skills.
While computerized mathematical models used as research tools to simulate medical outcomes could be very beneficial in certain circumstances, it does not need to be considered an essential skill for the simple reason that each of these simulations have to still be tested anyway before they can be meaningful. Besides, there are many known limits on their use in the physical and biological sciences. Current limits on the present technology include limits given by physical laws, limits given by complexity and also the limits of computation. Finally, mathematical model pertains to observations made in the past, it can therefore be used for policy-making. However, it cannot be used for decision-making, which requires observations or situations in the present
Modules covering ethical issues in research should be considered as part of essential curriculum

If you really have no knowledge of clinical trials then even GCP alone are overwhelming. These topics are very broad and include technical topics that even for me are new and I am in trials for over 10 years. Start with the basics and rather have a follow-up course when you master the entry level to trials. You are trying to cover all angles in one go—from sites that do not have the skill of writing a protocol to maybe a Dr that wants to do his own research and needs to know how to write a protocol and that is very challenging. Who comprises the focus group?
Should "essential skills" be only those that a group of people with different interests could benefit from? For example, modelling would be essential for some people, while RCTs would be essential for someone else... whereas stats would underlie both study types and people of different groups
Cultural sensitivity material and data transfer

Appendix 11: Membership of the Process for *Developing an Evidence-led Essential Research Skills Training Curriculum* Consortium

Name	Institution	In what country are you based (if in more than one please select the one in which the majority of your work in based)
Urbanik Tomasz	Priv. Cardiology Centre	PL - Poland
Hosein	NA	CA - Canada
Jens-Peter Reese	Universität Würzburg	DE - Germany
Claudia Marotta	Operational Research Unit, Doctors with Africa CUAMM, Padua, Italy	IT - Italy
Eduard-Alexandru Bonci	Luliu Hatieganu University of Medicine and Pharmacy	RO - Romania
Anns Issac	Asia Pacific Observatory on Health Systems and Policies	IN - India
Sarah E. Harrison	Department of Health and Social Care	GB - United Kingdom
Naglaa Arafa	Ain Shams University	EG - Egypt
Heather C. Guidone	Center for Endometriosis Care	US - United States
Maryam Rumaney	www.mbrumaney.co	ZA - South Africa
Tom Hall	St George's University of London	GB - United Kingdom
Elnimeiri M	Faculty of Medicine, Alneelain University	SD - Sudan
Jenny Haas	Advanced Cardiovascular Research	US - United States
Mihaela Adela Vintan	University of Medicine and Pharmacy Luliu Hatieganu Cluj Napoca, Romania	RO - Romania
Lovenish Bains	Maulana Azad Medical College, New Delhi	IN - India
Bitunguramye Levicato	Kyambogo University	UG - Uganda
Joshua Chiroma Gandi	University of Jos	NG - Nigeria
Abbas Abel Anzaku	Institute of Human Virology, Nigeria	NG - Nigeria
Betty Nakabuye	Uganda Martyrs Hospital Lubaga	UG - Uganda
Palma, G.I.	Universidad del Valle	CO - Colombia
Juliana Fernandes	Universidade Federal de Pernambuco	BR - Brazil

Kathryn H. Jacobsen	George Mason University	US - United States
Paula Leitã	Portuguese Diabetic Association	PT - Portugal
Sergio Muñoz Villaverde	Fundación Instituto Hospital del Mar de Investigaciones Biomédicas	ES - Spain
Alie Eleveld	Safe Water and AIDS Project	KE - Kenya
Rustem Shaymuratov	Kazan State Medical University	RU - Russia
Giorgia Coratti	Catholic university of Sacred Heart, Rome	IT - Italy
Bright Sandow	Father Thomas Alan Rooney Memorial Hospital	GH - Ghana
Marcio G Pavan	Fiocruz	BR - Brazil
U. B. Goso	Borno State Public Service (OHOS)	NG - Nigeria
Musitwa moses	Seven Doctors	UG - Uganda
Raluca-Monica Pop	George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Targu Mures	RO - Romania
Neil Tuttle	Griffith University	AU - Australia
Nicole Humphreys	Northeast Health Wangaratta	AU - Australia
Greters, ME	Pontifícia Universidade Católica de Campinas	BR - Brazil
Danielson Antunez Rojas	Instituto Hondureño de Seguridad Social (IHSS)	HN - Honduras
Mussi Rodolfo	Comite de Etica de CER Investigaciones Clinicas (IRB CECIC)	AR - Argentina
Anokye Kumi E	Kwame Nkrumah University of Science and Technology	GH - Ghana
Mohammad Sharif Hossain	International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR)	BD - Bangladesh
Valrie J. McKenzie	University of Technology	JM - Jamaica
Belen	CS Trinidad	ES - Spain
Sa'adatu T. Sule	RH Care Clinic and Consultancy	NG - Nigeria
Theodoros Aslanidis	Saint Paul General Hospital	GR - Greece
Davies Sondashi	Arthur Davison Children's Hospital	ZM - Zambia
Christine Rogers	University of Cape Town	ZA - South Africa

Chukwunonso Livinus Udeh	54gene	NG - Nigeria
Corrales López D	Servicio Extremeno de Salud (SES)	ES - Spain
Mihayo M. G.	Ifakara Health Institute	TZ - Tanzania
Caesar Mack Kargbo	Impact Community Foundation	SL - Sierra Leone
Blackmore A. M.	Ability Centre	AU - Australia
Gil M. M.	Obstetrics and Gynecology Department. Hospital Universitario de Torrejón. School of Medicine. Universidad Francisco de Vitoria	ES - Spain
Ayuba Samson Abubakar	Sightsavers-COUNTDOWN Project	NG - Nigeria
Rujan Shrestha	Sun Yat Sen Medical university	NP - Nepal
Wisdom Dorkenoo	Community Development – Ministry of Local Government and Rural Development	GH - Ghana
Mary-Anne Bopape	Bashumi Consulting	ZA - South Africa
Mariano Andrés	Alicante General University Hospital, Miguel Hernandez University	ES - Spain
Muhammad, I. A.	Usmanu Danfodiyo University Sokoto	NG - Nigeria
Lilia Jannet Saldarriaga Sandoval	Universidad Nacional de Tumbes	PE - Peru
Arun Nair	Waikato Hospital	NZ - New Zealand
Mamoun Ahram	The University of Jordan	JO - Jordan
Narayanan Kalyanaraman	Meenakshi Mission Hospital and Research Centre	IN - India
L. V. Graudins	Alfred Health	AU - Australia
Ilangovan K	Indian Council of Medical Research - National Institute of Epidemiology	IN - India
Nxumalo S M	International Center for AIDS Care and Treatment Programs (ICAP)	SZ - Swaziland
Lydiah	Individual	KE - Kenya
Zayithwa Fabiano	College of Medicine, University of Malawi	MW - Malawi
Praise Ngaiyambe	College of Medicine	MW - Malawi
Grace Nthunya Ngui	International Centre for Reproductive Health	KE - Kenya

Dr Tusharkanti Dey	All India Institute of Hygiene, Public Health	IN - India
Sudhir Prabhu H	Father Muller Medical College, Mangalore, Karnataka	IN - India
Burchmore H	University of Exeter	GB - United Kingdom
Gusmaroli G	OIB Biella - SC Neurologia	IT - Italy
Natalia Grinko	Bukovinian State Medical University	UA - Ukraine
Tatenda Grace Chirenda	Mount Saint Mary's Mission Hospital	ZW - Zimbabwe
Cynthia Onyefulu	University of Technology	JM - Jamaica
Daniela Morelli	Institute for Clinical Effectiveness and Health Policy (IECS)	AR - Argentina
Afuribe-Nwachukwu J. C.	Federal University, Lokoja	NG - Nigeria
Nathan Barreh	The Aga Khan University Hospital	KE - Kenya
Edward S. Dove	School of Law, University of Edinburgh	GB - United Kingdom
Ioannis Skoularigis	University of Thessaly Medical School	GR - Greece
Collis P	British Heart Foundation	GB - United Kingdom
Marwa EL-Sayed Mohamed	Faculty of Pharmacy-Tanta University	EG - Egypt
C. Sridevi	AIG hospital	IN - India
Nuevas Tecnologias en Diabetes y Endocrinología	NTDE	ES - Spain
Mokiwa J.	Praxis for Health and Development	TZ - Tanzania
Joseph Bonney	Komfo Anokye Teaching Hospital	GH - Ghana
Ian Kronborg	Western Health Footscray Victoria	AU - Australia
Helen Monaghan	The George Institute for Global Health	AU - Australia
Sanjay Singh	National Tuberculosis Institute, Bengaluru	IN - India
Natasha Moloczij	Victorian Comprehensive Cancer Centre	AU - Australia
Edna Maradiaga	Universidad Nacional Autonoma de Honduras Facultad de Ciencias Medicas,Unidad de Investigación Científica	HN - Honduras
Preet R	Dept of Epidemiology and Global Health, Umeå University, Sweden	SE - Sweden
Reem Siraj Alsulaimani	King Saud University	SA - Saudi Arabia

Enoch Boamah Frimpong	Ghana Prisons	GH - Ghana
Juan Ramon de-Moya-Romero	Hospital Clinico Universitario de Valencia	ES - Spain
Eman Sobh	Faculty of Medicine for Girls, Al-Azhar University	EG - Egypt
Namrata Patel	Individual	US - United States
Jeremiah Kutak Aboi MADAKI	University of Jos, Nigeria	NG - Nigeria
Ana Polanco	Hospital Nacional de Niños 'Benjamin Bloom'	SV - El Salvador
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Samanta Biswas	International Centre for Diarrhoeal Disease Research	BD - Bangladesh
Abarra Taklewold	AMBO University	ET - Ethiopia
Farooq Azam Rathore	PNS Shifa Hospital	PK - Pakistan
Eleanor J. Mitchell	University of Nottingham	GB - United Kingdom
Ana Castro-Avila	University of York	CL - Chile
Anita Yeconia	Haydom Global Health Research Center	TZ - Tanzania
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Edgard Rojas Huerto	Essalud	PE - Peru
Giorgia De Berardis	CORESEARCH	IT - Italy
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Henriette Raventos	Universidad de Costa Rica	CR - Costa Rica
Suja Raj L	Sree Chitra Tirunal Institute for Medical Sciences & Technology (SCTIMST)	IN - India
Annette Ives	Independent contribution	CH - Switzerland
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Drew Prescott	Intrinsic Imaging	US - United States
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Edries	University of Gezira	SD - Sudan
Nicole Martin-Chen	Ministry of Health and Wellness	JM - Jamaica
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Meegoda, MKDL	University of Sri Jayewardenepura	LK - Sri Lanka
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Magaji AM	Ministry of Health, Gombe, Gombe State	NG - Nigeria
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Henry Musukwa	Arthur Davison Children's Hospital	ZM - Zambia
Kirsty Le Doare	St. George's University of London	UG - Uganda
Ijeoma Chibueze Victor	FCT-Hospitals Management Board, Abuja	NG - Nigeria
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Fernando Rubinstein	Instituto de Efectividad Clinica y Snitaria (IECS)	AR - Argentina
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Samuel Maria	University College Hospital	NG - Nigeria
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Tracey Smythe	Individual	GB - United Kingdom

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Alexander Kondwani	North West University	ZA - South Africa
Amina Wakkesho	Mbagathi Hospital	KE - Kenya
Rizaldy Taslim Pinzon	Duta Wacana Christian University School of Medicine Yogyakarta Indonesia	ID - Indonesia
Abdullah Yonis	Univeristy of Exeter (exeter.ac.uk)	GB - United Kingdom
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Raquel Gil-Gouveia	Hospital da Luz, Lisboa	PT - Portugal
Jo Vallis	Friends of Chitambo SCIO	GB - United Kingdom
Nuria Sanchez Clemente	London School of Hygiene and Tropical Medicine	GB - United Kingdom
Flávia Thedim Costa Bueno	Fiocruz	BR - Brazil
Valdesoiro-Navarrete Laura	Hospital Universitari Parc Tauli	ES - Spain
Shahanaz Parveen	National Institute of advanced Nursing Education & Research (NIANER)	BD - Bangladesh
David M	Fundação Oswaldo Cruz	BR - Brazil
Abdulai M. Kamara	College of Medicine and Allied Health Sciences	SL - Sierra Leone
Maximo Tacuchi	L. A. Universal Research Center, Inc.	US - United States
Dr Rajdeep Dhandhukiya	Private practitioner	IN - India
Chie Narita	Dilfi corporation	JP - Japan
Susilo Wulan	STIKES Tri Mandiri Sakti Bengkulu	ID - Indonesia
Ubong inyang	Inyang & Son	NG - Nigeria
Erick Obondo	Maseno University	KE - Kenya
Pietro Pala	Individual	UG - Uganda
Elizabeth Burgess-Pinto	MacEwan University	CA - Canada

Cristiane Campello Bresani-Salvi	Oswaldo Cruz Foundation	BR - Brazil
Dr Neerja Sood	Indira Gandhi National Open University	IN - India
Azra Mahmud	King Abdul Aziz Cardiac Center, National Guard Health Affairs	SA - Saudi Arabia
Luigia Scudeller	IRCCS Ca' Granda Ospedale Maggiore Policlinico di Milano	IT - Italy
Netongo P	University of Yaounde I	CM - Cameroon
Citra Palanisamy	Clinical Research	MY - Malaysia
Covadonga M. Díaz-Caneja	Department of Child and Adolescent Psychiatry, Institute of Psychiatry and Mental Health. Hospital General Universitario Gregorio Marañón. IiSGM. CIBERSAM. School of Medicine, Universidad Complutense. Madrid	ES - Spain
Ngugi D	Kenya Medical Research Institute (KEMRI)	KE - Kenya
Mariam Hassan	Shaukat Khanum Memorial Cancer Hospital and Research Centre	PK - Pakistan
Tsayem Fouéméné Roméo	University of Yaounde I and Zion laboratory	CM - Cameroon
Karen Cloete	TASK	ZA - South Africa
Alice Matimba	Advanced Courses and Scientific Conferences, Wellcome Genome Campus	GB - United Kingdom
Justin T. Lana	Clinton Health Access Initiative	PA - Panama
Sharon Abramowitz	Independent	US - United States
John H. Amuasi	Kwame Nkrumah University of Science and Technology, Department of Global Health AND Kumasi Center for Collaborative Research in Tropical Medicine, Kumasi, Ghana	GH - Ghana
Abosam E	Ahfad University for Women	SD - Sudan
Nina Gobat	University of Oxford	GB - United Kingdom
Sanja Arsić	Precision for Medicine	RS - Serbia
Joana Rita Monteiro Ferreira	NOVA Medical School	PT - Portugal
Gail Melvin	University Hospitals of Leicester NHS Trust	GB - United Kingdom

Haidar	Epicentre/Médecins Sans Frontières	FR - France
Pavicic L	Department of Emergency Medicine of Krapina-Zagorje County	HR - Croatia
Jackeline Alger	Universidad Nacional Autónoma de Honduras	HN - Honduras
Joby V. George	Medanta: The Medicity and The Global Health Network	IN - India
A. Roxana Lescano	NAMRU-6	PE - Peru
Luiza Helena Madia Lourenço	Universidade de Brasília	BR - Brazil
Ogunfowokan O	University of Lincoln College Malaysia	NG - Nigeria

Appendix 12: *Stakeholder Review Workshop* (17 December 2020) attendees

First Name	Last Name	Organization	Job Title	Which country is your work primarily based in? Please list as many as applicable
Neal	Alexander	The London School of Hygiene & Tropical Medicine (LSHTM)	Professor of Medical Statistics and Epidemiology	United Kingdom
Jackeline	Alger	Unidad de Investigación Científica, Facultad de Ciencias Médicas, Universidad Nacional Autonoma de Honduras	Faculty	Honduras
Mir Nabila	Ashraf	International Centre for Diarrhoeal Disease Research	Research Fellow	Bangladesh
Caesar	Atuire	University of Ghana	Senior Lecturer	Ghana, UK, Italy
Joseph	Bonney	Komfo Anokye Teaching Hospital/ Kumasi Center for Collaborative Research in Tropical Medicine	Emergency Medicine Specialist/ Research Fellow	Ghana
Maria del Mar	Castro Noriega	Centro Internacional de Entrenamiento e Investigaciones Médicas (CIDEIM)	Clinical researcher	Colombia
Mathildah	Chithila-Munthali	Agency for Scientific Research & Training (ASRT)	Executive Director	Malawi
Anniza	De Villiers	South African Medical Research Council	Senior Scientist	South Africa
Jocelyn	DeJong	Faculty of Health Sciences, American University of Beirut, Lebanon	Professor and Associate Dean	Lebanon, Jordan, Middle East region primarily
Helen	Demarest	Medicines for Malaria Venture	Director Clinical Operations	Sub-Saharan Africa, South East Asia, Latin America

Noshin	Farzana	International Centre for Diarrhoeal Disease Research	Research Investigator	Bangladesh
Adama	Faye	Institut de Santé et Développement	Directeur	Sénégal
Morenike	Folayan	Obafemi Awolowo University, Ile-Ife	Professor	Nigeria
Toral	Gathani	University of Oxford	Senior Clinical Research Fellow and Consultant Surgeon	United Kingdom
Carlo	Giaquinto	University of Padova and PENTA	Professor	Europe
Nancy	Gore Saravia	CIDEIM	Director	Colombia
Mariam	Hassan	Shaukat Khanum Memorial Cancer Hospital and Research Centre	Clinical Research Office	Pakistan
Andres	Jaramillo	CIDEIM	Coordinator Research Promotion and Development Unit	Colombia
Sandra	Johnson	Medicines for Malaria Venture (MMV)	Outsourcing Director	UK, Australia, Zambia, Gambia, DRC, Congo, Cote d'Ivoire, Cameroon, Gabon, Tanzania, South Africa, Brazil, Thailand, Kenya
Leigh	Jones	Oxford University Clinical Research Unit (OUCRU)	Head of Training	Vietnam, Thailand
Wafa	Kammoun	Regional Training Center (EMR)-TDR-Institut Pasteur de Tunis-Tunisia		Tunis-Tunisia
Roxana	Lescano	Red de Comités de Ética de la Investigación del Perú - (REDCEI)	Directora, Gestion de la Investigacion	Peru
Eusebio	Macete	Manhica Foundation	Director	Moçambique
Yodi	Mahendradhata	Universitas Gadjah Mada	Associate Professor	Indonesia
Mahesh	Maskey	Nepal Public Health Foundation	Executive Chair	Nepal

Gustavo	Matta	Oswaldo Cruz Foundation	Full Research in Public Health	Brazil
Dr Sangeeta	Mishra	Paropkaar Maternity and Women's Hospital	Hospital Director	Nepal, India
Aliya	Naheed	International Centre for Diarrhoeal Disease Research	Head Initiative for Non-communicable Diseases	Bangladesh
Pacifique	Ndishimye	Rwanda Biomedical Centre	Senior Researcher	Rwanda, Romania, Morocco
Thea	Norman	Bill & Melinda Gates Foundation	Senior Programme Officer	United States
Chinwe	Ochu	Nigeria Centre for Disease Control	Ag. Director, Prevention, Programmes & Knowledge Management	Nigeria
Oluwagbenga	Ogunfowokan	Department of Family Medicine	Principal Investigator/ Consultant Physician	Nigeria
Lara	Pandya	European and Developing Countries Clinical Trials Partnership (EDCTP)	Strategic Partnerships Officer	Sub-Saharan Africa
Inma	Peñas	European Commission DG RTD	Policy Officer (focal point for the EDCTP)	Belgium
Mike	Penkunas	United Nations University International Institute for Global Health	Research Fellow	Malaysia
Thy	Pham	Bill and Melinda Gates Foundation	Senior Programme Officer	USA
Steffi	Sowinski	European Commission	Policy Officer	Europe
Oscar	Tapera	SADTAP Health Research Institute	Director of Research & Evaluations	Zimbabwe
Mahnaz	Vahedi	Special Programme for Research and Training in Tropical Diseases (TDR)	Scientist	Switzerland
Abhinav	Vaidya	Kathmandu Medical College Public Limited	Professor of Community Medicine	Nepal

Cristiani	Vieira Machado	Oswaldo Cruz Foundation - Fiocruz	Vice-president	Brazil, other Latin American countries
Clare	Viney	The Careers Research and Advisory centre (CRAC)	CEO	United Kingdom
Sinéad	Whitty	The Global Health Network	Training Manager	Ireland, Kenya, South Africa, Malawi, Uganda, Nigeria, Tanzania, Congo, DRC, Burkina Faso, India, Nepal, Bangladesh, UK

Appendix 13: Stakeholder Review Workshop: Programme Agenda

Workshop session	Thursday 17 December (13-15 hrs)	Time
Welcome	Aim and Objectives **Trudie Lang and Dermot Maher** • *Context setting: global research inequities* • *Building on the shared goal of research capacity initiatives such as the Global Competency Framework for Clinical Research* • *Study rationale and approach* • *Objectives of this workshop*	13:00-13:15
Examining the study process and results	Developing an Evidence-led Essential Research Skills Training Curriculum: Overview of Study Methodology Arancha, Bonny and Nicole Questions & Answers	13:15-13:30 13:30 – 13:40
Polling & Discussion	Objective 1: Validate the grouping of the themes (potential module titles) *Are these titles an accurate reflection of the content of the themes? yes/no (poll) – If not, why? (chat)* *Does this address the key Essential principles of the research process (poll)? If not, why? (chat)* Objective 2: Global applicability of the findings *Is this proposed curriculum globally applicable?* *yes/no (poll) – If not, why? (chat)* *Applicability to all research methodologies: Would this proposed curriculum be relevant to different types of research? yes/no (poll) – If not, why? (chat)* Discussion section guided by TGHN	13:40-14:20
Reflection and wrap up	Trudie Lang and Dermot Maher	14:20-14:30

Appendix 14: Implementation Workshop (10 February 2021) attendees

Participants' name	Organization	Job Title	Country/Region Name
Abbas Abel Anzaku	Institute of Human Virology	Program Officer, Laboratory Scientist	Nigeria
Abdulai M Kamara	Ebovac Salone	Study Field Worker	Sierra Leone
Abdullah Yonis	University of Exeter	Medical scientist	United Kingdom
Aboi JK Madaki	University of Jos/Jos University Teach Hospital	Researcher/clinician	Nigeria
Adam Muhammad	Health Care	Medical officer	Nigeria
Adela Ngwewondo	Institute of Medical Research and Medicinal Plants Studies	Researcher	United States of America
Aisha Malik	Warwick Medical school	Tutor	United Kingdom
Alebachew Kebede	Addis Ababa University	Bio-informatician	Ethiopia
Alie Eleveld	Safe Water and AIDS Project (SWAP)	Technical Advisor	Kenya
Amadou Seck	WCA BIOINF	Data Management	Senegal
Amanda Wanyana	UVRI IAVI	Medical Officer	Uganda
Ana Castro	University of York	Research fellow	United Kingdom
Ana Polanco	Hospital Nacional de Niños "Benjamín Bloom"	Jefe de Departamento	El Salvador
Angela Papa	PPD	Director	Japan
Anna Jammeh	Ministry of Health	Epidemiologist	Gambia
Anns Issac	World Health Organization (WHO)	Technical Officer	India
Antsa Rakotondrandriana	Programme National de Lutte contre le Paludisme	Responsable de données du Laboratoire	Madagascar
Ashish Indani	Tata Consultancy Services	Head, Research and Innovation	India
Atinuke Olaleye	Babcock University	Senior Lecturer	Canada
Belay Tessema	University of Gondar	Professor	Germany
Bright Sandow	Ghana Health Service	Public Health Researcher	Ghana
Bunu Goso Umara	Initiative for Educational Awareness and Economic Development (INEAED)	Administrator	Nigeria
Caesar Mack Kargbo	World Vision Sierra Leone	Research Assistant	Sierra Leone
Chukwunonso Udeh	54gene	Senior Clinical Research Associate	Nigeria
Claudia Marotta	Doctor with Africa Cuamm	Public Health Officer and Researcher	Italy

Claudia Silveira Viera	Unioeste	Professor	Brazil
Cristiane Campello Bresani Salvi	Oswaldo Cruz Foundation	Researcher	Brazil
Cynthia Onyefulu	University of Technology	Professor	Jamaica
Daniel Yilma Bogale	Jimma University	Associate Professor	Ethiopia
Daniela Morelli	IECS	Investigator	Argentina
Dawit Ejigu	St Paul Hospital Millennium Medical College (SPHMMC)	Associate Professor	Ethiopia
Dolores Carrer	INIMEC-CONICET-UNC	Researcher	Argentina
Dr Meghana Kulkarni	Independent Consultant	Freelance	India
Dr Sudhir Prabhu	Father Muller Medical College, Mangalore	Professor in Community Medicine	India
Dr Salvatory	Hubert Kairuki Memorial University	Lecturer	Tanzania, United Republic of
Eman Sobh	Al-Azhar university	Associate professor	Saudi Arabia
Ethar Abosam	Pharmacy	Pharmacist	Saudi Arabia
Etienne Guirou	Malaria Research and Training Center	Postdoctoral fellow	Mali
Evans Anokye Kumi	Kwame Nkrumah University of Science and Technology	Lecturer	United States of America
Ewurama Owusu	University of Ghana	Lecturer/Researcher	Ghana
Fernando Rubinstein	Instituto de Efectividad Clínica y Sanitaria (IECS)	Director de Educacion	Argentina
Fiorella Gago	Udelar	Professor	Uruguay
Fridah Mwendia	African Academy of Sciences	Senior Programme Officer- Clinical Trials	Kenya
Giorgia Coratti	Catholic University of Sacred Heart	Research Physical Therapist, MSc	Italy
Gloria Palma	Universidad del Valle	Professor	Colombia
Greters Mário Edvin	Pontíficia Universidad Católica de Campinas	Professor Doutor	Brazil
Helen Burchmore	Public and patient Involvement Facilitator	NIHR	United Kingdom
Helma Hofland	Maasstad Hospital Rotterdam	Nurse Researcher	Netherlands
Henriette Raventos	Universidad de Costa Rica	Profesora	Costa Rica
Henry Musukwa	CHAPAS-4	Data Clerk	Zambia
Hiwot Amare Hailemariam	Jimma University	Assistant Professor of Medicine	Ethiopia
Ijeoma Victor	FCT- Hospitals Management Board	Health Data Analyst	Nigeria
Imrana Muhammad Arzika	Usmanu Danfodiyo University Sokoto	Research Student	Nigeria
Isabel Melgueira	Centro Hospitalar de Setúbal	Nurse Manager	Portugal
Jackeline Alger	Faculty of Medical Sciences, Universidad Nacional Autonoma de Honduras (UNAH)	Parasitologist, Faculty Member of the Research Unit, board member of the Instituto de Enfermedades	Honduras

		Infecciosas y Parasitologia Antonio Vidal	
Joana Ferreira	NOVA medical School	Master's Degree student in Clinical Research Managment	Portugal
Jorge Acosta-Reyes	Universidad del Norte	Docente tiempo completo	Colombia
Jose Martinez-Raga	Hospital Universitario Dr Peset	Head of Psychiatry	Spain
Joseph Bonney	Komfo Anokye Teaching Hospital/ Kumasi Center for Collaborative Research	Emergency Medicine Specialist/ Research Fellow	Ghana
Juliana Fernandes	Federal University of Pernanbuco (UFPE)	Professor	Brazil
Justin Lana	Clinton Health Access Initiative	Epidemiologist, Technical Advisor	United States of America
Karen Cloete	TASK	Head of QA, Regulatory and Academy	South Africa
Kathryn H. Jacobsen	George Mason University	Professor	United States of America
Kirsty Le Doare	MRC/UVRI	Professor	United Kingdom
laura ciaffi	UMI233 IRD	researcher	Cameroon
Laureano Mestra	The Mast Cell Research Institute	Chief Medical Officer	Colombia
Leonardo Chavane	The Manhiça Health Research Centre (CISM)	Researcher	Mozambique
Lovenish Bains	Maulana Azad Medical College	Associate Professor	India
Luigia Scudeller	IRCCS Policlinico di Milano	Clinical Epidemiologist	Italy
Madia Lourenço Luiza Helena	The Global Health Network	Regional Coordinator	Brazil
Mahamadou Ali THERA	Malaria Research and Training Center (MRTC) /University of Science, Techniques and Technologies of Bamako (USTTB)	Scientific Director	Mali
Malaya Santos	St. Luke's Medical Center College of Medicine (SLMCCM)	Professor	Philippines
Mamoun Ahram	University of Jordan	Professor	Jordan
Marcelo Franco	Oswaldo Cruz Foundation - Fiocruz	Pharmacovigilance manager	Belgium
Maria del Mar Castro Noriega	Centro Internacional de Entrenamiento e Investigaciones Médicas (CIDEIM)	Clinical Researcher	Germany
Mariam Hassan	Shaukat Khanum Memorial Caner Hospital and Research Centre	Clinical Research Administrator	Pakistan
Mariano Andres	Alicante General University Hospital-ISABIAL	Consultant & researcher	Spain
Martínez Díaz-Caneja Covadonga	Hospital General Universitario Gregorio Marañón	Psiquiatra. Coordinadora del grupo de investigación.	Spain
Maryam Rumaney	www.mbrumaney.co	Freelance scientific consultant	South Africa

Masauso Moses Phiri	University of Zambia	Lecturer and Research Fellow	Zambia
Melanie Almonte	Imperial College Healthcare NHS Trust	Research Team Lead/Research Fellow	United Kingdom
Michael Mihayo	Ifakara Health Institute	Clinician	Tanzania, United Republic of
MKDL Meegoda	University of Sri Jayewardenepura	Senior Lecturer	Sri Lanka
Mohammad Sharif Hossain	International Centre for Diarrhoeal Disease Research	Research Investigator	Bangladesh
Moses Ngari	KEMRI Wellcome Trust Research Programme	Statistician	Kenya
Muñoz Villaverde Sergio	Institut Hospital del Mar d'Investigacions Mediques (IMIM)	Oncology clinical research nurse	Spain
Musitwa Moses	International Medical Link	Medical officer	Uganda
Naglaa Arafa	Ain Shams University	Assistant professor	Egypt
Nancy Pollo	Primary Care Research South	Coordinator/ Administrator	United States of America
Nathan Nshakira	Kabale University	Lecturer	Uganda
Neerja Sood	Indira Gandhi National Open University	Assistant Professor	India
Nicole Martin-Chen	National Epidemiology Unit-MOH	Director	Jamaica
Noubar Clarisse Dah	Centre de Recherche en Sante de Nouna	Co-investigator	Burkina Faso
Oladeji Sofoluke	Molecular Laboratory, Ogun State Ministry of Health & African Clinical Trials Consortium, UNN, (ACTC & UNNCECT)	Molecular Scientist	Nigeria
Oluwagbenga Ogunfowokan	National Hospital Abuja	Consultant Physician	Nigeria
Phil Collis	National Institute of Health Research (NIHR)	Patient Research Ambassador	United Kingdom
Prakash Ghosh	International Centre for Diarrhoeal Disease Research	Research Investigator	Bangladesh
Primus Chi	KEMRI-Wellcome Trust Research Programme	Mid-Level Social Scientist	Kenya
Rajdeep Dhandhukiya	B J Medical College	Assistant Professor	India
Raluca Pop	SPH Cluj	MBA student	Romania
Ralueke Ekezie	Global Research Nurses (GRN)	Research Nurse	Nigeria
Raman Preet	Umeå University	Research Coordinator	Sweden
Raquel Gil-Gouveia	Hospital da Luz Lisboa	Neurology Department Head	Portugal
Rebby Athembo	AAR health care	Medical officer	Kenya
Rizaldy Pinzon	Bethesda Hospital/Duta Wacana University	Associate Professor	Indonesia
Roxana Lescano	Naval Medical Research Unit No. 6 (NAMRU-6)	Head, Research Administration Program, IRB member,	Peru

		Research Integrity Officer	
Sa'adatu Sule	Independent Consultant	RMNCAH specialist	Nigeria
Samanta Biswas	International Centre for Diarrhoeal Disease Research	Medical Officer	Bangladesh
Sanjay Singh	National Tuberculosis Institute, Bengaluru	Researcher	India
Sifiso Nxumalo Eswatini	Columbia University (ICAP Eswatini)	Study Coordinator	Eswatini
Sondashi Davies	Arthur Davison Hospital	Pharmacist	Zambia
Suja Raj L	Sree Chitra Tirunal Institute For Medical Sciences and Technology	Lecturer in Nursing	India
Susilo Wulan	STIKES Tri Mandiri Sakti Bengkulu	Lecturer	Indonesia
Techno Spark 4	Assosa University	PhD candidate	Ethiopia
Tomasz Urbanik	Priv. Cardiology Center	M.D., Ph. D.	Poland
Trokon Yeabah	Division of Infectous Disease/NPHIL	Data Manager	Liberia
Tsogo a Bebouraka Monique Pélagie	University of Yaounde I	PhD Student	Cameroon
Unyuzimana Marie Aimée	GlaxoSmithKline (GSK)	WHO Fellow / CRDL Trainee	Rwanda
Valrie McKenzie	University of Technology	Senior Lecturer	Jamaica
Victor Ayeni	Olabisi Onabanjo University Teaching Hospital, Sagamu	Senior Registrar I	Nigeria
Vijay Kumar Mishra	Public Health Foundation of India	Research Scientist	India
Welile Sikhondze	Eswatini Ministry of Health	Research Advisor	Eswatini

Appendix 15: Stakeholder Review Workshop - Programme Agenda

	Wednesday 10 February 2021 (13.00-14:30 hrs GMT)
Welcome	
TDR and The Global Health Network	Aim and Objectives
Examining the study process and results	Developing an Evidence-led Essential Research Skills Training Curriculum: Overview of Study Methodology Q&A
Polling & Discussion	The aim of this workshop will focus on understanding how best to implement the Essential Research Skills Training Curriculum: • gathering the expectations from potential users of what this training should provide • understanding local contexts, trying to identify barriers and solutions, and • understanding what is valued about research training Discussion section guided by The Global Health Network
Reflection and wrap up	TDR and The Global Health Network

Further information and contact details

If you require further information, you can contact:

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