



Funding and undertaking research during the first year of the COVID-19 pandemic: COVID CIRCLE lessons for funders

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GL  PID-R


UK Collaborative on
Development Research



This report provides specific recommendations for action by funders to improve the implementation of the Funders Principles both for the ongoing pandemic and for future epidemics and pandemics.



TABLE OF CONTENTS

1	EXECUTIVE SUMMARY	6
2.	INTRODUCTION	8
	2.1 Purpose	8
	2.2 Scope & aims	8
	2.3 Setting the scene	8
	2.3.1 Lessons learned from previous epidemics	9
	2.3.2 Funders principles for supporting high-quality research for the most pressing global needs in epidemics and	10
	2.4 This review	11
3.	THE FIRST YEAR OF THE COVID-19 RESEARCH FUNDING RESPONSE	16
	3.1 Overall timeline of LMIC-focused funding	16
	3.2 Funders of LMIC research	16
	3.3 International collaboration	23
	3.4 Institutions	25
4.	LESSONS LEARNT ON ENABLERS & CHALLENGES TO FULFILLING THE SEVEN PRINCIPLES	26
	4.1 Alignment to global research agendas and locally identified priorities - enablers & challenges	27
	4.1.1 Availability of research agendas and capacity for priority setting	27
	4.1.2 Partnerships & stakeholder engagement	28
	4.2 Research capacity for rapid research- enablers & challenges	28
	4.2.1 Rapid response & sustainable funding	28
	4.2.2 Funder policies & accountability	29
	4.2.3 Capacity strengthening	29
	4.3 Supporting equitable, inclusive, inter-disciplinary and cross-sectoral partnerships- enablers & challenges	30
	4.3.1 Inclusivity & interdisciplinarity	30
	4.3.2 Equity	30
	4.4 Open science & data sharing- enablers & challenges	31
	4.4.1 Policies into practice	31
	4.4.2 Infrastructure and capacity	32
	4.4.3 Research uptake	32

4.5 Protection from harm- enablers & challenges	32
4.5.1 Monitoring compliance	32
4.5.2 infection prevention & control	33
4.6 Appropriate ethical consideration- enablers & challenges	33
4.6.1 Rapid review	33
4.6.2 IP & data rights	33
4.7 Collaboration and learning through enhanced coordination	34
- enablers and challenges	
4.7.1 Research mapping	35
4.7.2 Convening	35
4.7.3 Promoting collaboration	35
4.8 Cross-cutting enablers and challenges and those	
identified beyond the funders principles	36
4.8.1 Cross-cutting barriers	36
4.8.2 Cross-cutting enablers	36
5. RECOMMENDATIONS FOR RESEARCH FUNDERS	37
5.1 Recommendations of funders for action	37
REPORT CONTRIBUTORS	39
ACKNOWLEDGEMENTS	40
REFERENCES	41

1. EXECUTIVE SUMMARY

It is essential that the global funders learn from the process of funding and undertaking research in the COVID-19 pandemic, both to inform ongoing responses within this pandemic and for future epidemics and pandemics. The COVID-19 Research Coordination and Learning Initiative (COVID CIRCLE) aims here to contribute to this through providing insights and recommendations to research funders, using evidence on the research response across both funders and researchers funding and undertaking research across low- and middle- income countries (LMICs).

As part of the development by UK funders of COVID-19 research aligned to the WHO Roadmap for the benefit of LMICs, the COVID CIRCLE initiative was established and delivered by the UK Collaborative for Development Research (UKCDR) and Global Research Collaboration for Infectious Disease Preparedness (GloPID-R). Through collaborative development while the Global Effort on COVID-19 (GECO) Health Research call (1) was being designed, a set of seven principles were developed by UKCDR, to help align research funders towards a coordinated effort for supporting high-quality research particularly important in times of epidemics and pandemics ('the Funders Principles') (2).

These principles build on best practice guidance from many stakeholders and were intended to set standards which would accelerate and improve research outputs. The commitments set out in the principles aim to ensure outputs are shared rapidly to enable consolidation and review, which in turn will inform policy and practice during the COVID-19 pandemic, and for future epidemics or pandemics.

Many examples of effective and innovative research funding and research practice in line with the principles have taken place during the COVID-19 pandemic to date. However, key challenges remain, which will require policy and funding innovation and sustained investment. Funding for COVID-19 research studies across LMICs has been thinly spread, with few multi-country research projects globally. This has resulted in a proliferation of heterogeneous small studies with limited impact for populations in LMICs (3). This has been compounded by equity issues relating to access to the products of globally funded research.

This report provides specific recommendations for action by funders to improve the implementation of the Funders Principles both for the ongoing pandemic and for future epidemics and pandemics. The learning in this report is framed around the COVID CIRCLE 'Funders Principles for Supporting High-Quality Research for the Most Pressing Global Needs in Epidemics and Pandemics'(2).

Lessons Learned

- The global research response to COVID-19 over the first year of the pandemic was unprecedented, with the UKCDR & GloPID-R COVID-19 Project Tracker capturing, as of 15th April 2021, 10,608 projects, funded by 201 funders, taking place across 142 countries, representing an investment of at least \$4.7 billion. Whilst there are limitations in the capture of this funding data limiting the conclusions that can be drawn (as detailed in the methodology), it indicates majority of funded research projects are taking place in High Income Countries, although the global distribution of funding has been shifting with greater international and domestic funding captured for research across LMICs
- Funder relationships and partnerships built during inter-epidemic periods are most easily activated during emergencies (eg. GloPID-R and WHO efforts on the COVID-19 R&D Roadmap; UKCDR and GloPID-R efforts on COVID CIRCLE).
- Both funders and researchers appreciated the early development of the WHO Blueprint & GloPID-R COVID-19 Research Roadmap priorities (4), although the delayed and in some cases lack of regionally developed research priorities hindered their ability to align both funding and research to these.
- Many funders faced multiple barriers to funding research rapidly in the pandemic (which were exacerbated when funding LMIC partners) and lessons can be learned from those who overcame these. Rapid funding was most easily facilitated through supplementing existing funded research activities and harnessing longstanding researcher partnerships and capacity.
- Researchers stated the major barrier to their research during the pandemic was rapid (or pre-existing) access to funding and suitable research capacity. Rapid research was enabled where pre-existing partnerships and some level of funding were already in place.
- Funders and researchers recognised the need for greater support for open science and data sharing practices in epidemics through ensuring trustworthy and equitable approaches which have the buy-in and support of LMICs. This was highlighted as an ongoing challenge by researchers working on COVID-19 across LMICs.
- Greater global funder collaboration is needed including joint funding to ensure that high-quality multi-country studies can be funded to address research needs during pandemics.

2. INTRODUCTION

2.1 PURPOSE

Facilitating learning from COVID-19 for research funders to improve future responses to epidemics and pandemics, in alignment with the COVID CIRCLE 'Funders Principles for Supporting High-Quality Research for the Most Pressing Global Needs in Epidemics and Pandemics'(2).

2.2 SCOPE & AIMS

This learning is framed around the agreed 'Funders Principles for Supporting High-Quality Research for the Most Pressing Global Needs in Epidemics and Pandemics' (see Section 2.3.2). We have taken a global view, with a LMIC focus. Evidence has been incorporated from the research response over the first year of the pandemic (until March 2021).

Aims

- Explore barriers and enablers to COVID-19 research funders fulfilling the Funder Principles for funding high quality research for the most pressing global needs in epidemics and pandemics.
- Identify potential enablers or windows of opportunity for the translation of the Funder Principles into practice within the ongoing research response for the COVID-19 pandemic in LMICs and for future epidemics and pandemics.

This report has been produced by synthesising data collected by the **COVID CIRCLE** team from January-June (2021) involving funder and researcher surveys; group consultations; key informant interviews and analysis of the data in the UKCDR & GloPID-R COVID-19 Project Tracker. This report focusses on implementable recommendations to the UKCDR and GloPID-R funders. These recommendations may also be of interest to other stakeholders including funders, policy makers and researchers beyond these networks. Recommendations focus on those principles where evidence was available, and further work will be necessary regarding certain principles (beyond the timeline of this report).

2.3 SETTING THE SCENE

Research funders have recognised the need to coordinate research funding during epidemics for many years, and this is the basis on which the **Global Research Collaboration for Infectious Disease Preparedness** (GloPID-R) was formed in 2013 by the European Commission and Heads of International Biomedical Research Organisations (HIROs) (5). GloPID-R is a global alliance of research funding organisations formed to facilitate coordinated research related to new and emerging infectious diseases with epidemic and pandemic potential. Since 2014 GloPID-R has mobilised and demonstrated the value in coordinating prioritisation and research funding during outbreaks including Ebola (2014-15 & 2018-19), Zika (2015-16), Lassa (2018), COVID-19 (2020-onwards). GloPID-R has achieved this through a variety of different mechanisms

including convening global members to identify research priorities, fostering joint funding partnerships and knowledge sharing (see: <https://www.glopid-r.org/our-work/>).

The World Health Organisation (WHO) Research & Development (R&D) Blueprint is a complementary global strategy and preparedness plan, allowing rapid direction for research and development activities during epidemics. The Blueprint team emerged in 2016 following the 2014-15 West Africa Ebola epidemic, building on the success of the highly effective vaccine development but aiming to address some of the gaps that were apparent in the global research response effort. The R&D Blueprint intends to develop an R&D roadmap for its list of priority diseases to guide the research effort.

Early in the COVID-19 pandemic the World Health Organisation (WHO) and GloPID-R convened the 'Global Research and Innovation Forum: Towards a Research Roadmap for the 2019 Novel Coronavirus meeting on February 11-12, 2020, resulting in the 'Coordinated Global Research Roadmap: 2019 Novel Coronavirus' (4) (WHO Roadmap), an unprecedented document for global research collaboration. Recognising the need for visibility of the aligned research funding response to address the priority areas identified in the WHO Roadmap, the **UK Collaborative on Development Research (UKCDR)** partnered with GloPID-R to launch the COVID-19 Research Project Tracker (6) on April 3 2020. The tracker maps newly funded (and repurposed) COVID-19 projects to the WHO Roadmap, allowing visibility of the funded research portfolio and its alignment to the identified research needs to deliver a more effective and coherent global research response.

The urgency and global scale of the research needs and response have been difficult to coordinate. There was particular concern that due to national research resource limitations in LMICs an uncoordinated approach could lead to a failure to address local research needs, failure of research to inform policy or unsustainable research capacity to respond to future outbreaks. The **UKCDR Epidemics Preparedness and Response Group** (in particular DHSC and MRC/UKRI who were setting up the joint GECO call (1) and Wellcome) and GloPID-R recognised the need to facilitate collective efforts for LMICs research and developed a set of Funders Principles to support high-quality research for the most pressing global needs in epidemics and pandemics and formed the initiative for **COVID-19 Research Coordination and Learning (COVID CIRCLE) Initiative** in August 2020 (2).

A key component of the COVID CIRCLE initiative was ongoing learning from the research response with a focus on LMICs. Here we present that learning from the first year of the COVID-19 research response.

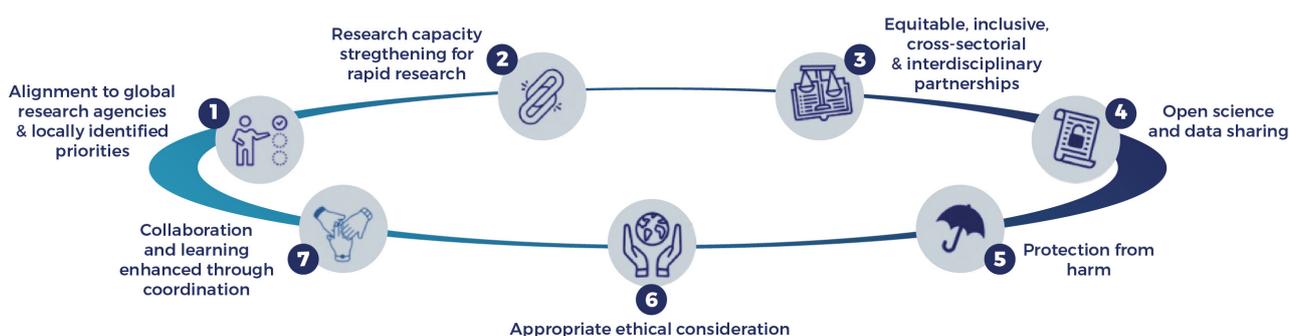
2.3.1. LESSONS LEARNED FROM PREVIOUS EPIDEMICS

Research funders have rapidly supported repurposing of existing studies and launched rapid funding calls to support research. Lessons in expediting research have been learned from undertaking research in the recent Democratic Republic of Congo Ebola outbreaks and West Africa Ebola, Zika and SARS epidemics. The COVID-19 pandemic has however led to unprecedented needs and challenges for coordination and resourcing of research in LMICs. Whilst research funders had learnt from research responses to a range of recent epidemics in LMICs, these lessons were not necessarily found to be fully transferable to the situation of a global pandemic, where research could be undertaken around the world.

At the outset of the COVID-19 Pandemic research funders recognised the need to coordinate COVID-19 research funding at all levels to prevent duplication and improve impact and that this would be particularly important in resource constrained environments. Funders such as EDCTP and the UK DHSC with MRC/UKRI launched early calls specifically to address the WHO Roadmap in LMICs. UKCDR and GloPID-R therefore agreed to a set of principles to align research funders towards a coordinated effort for supporting high-quality research for the most pressing global needs in epidemics and pandemics ('the Funders Principles').

These principles built on the substantive prior policy work by GloPID-R on research epidemic preparedness, relating to data sharing (7), clinical research (8) and social sciences (9) research combined with best practice for research with LMICs by UKCDR, ESSENCE, TDR and others (linked below) as well as the EDCTP and GECO call development.

2.3.2 FUNDERS PRINCIPLES FOR SUPPORTING HIGH-QUALITY RESEARCH FOR THE MOST PRESSING GLOBAL NEEDS IN EPIDEMICS AND PANDEMICS



These principles were developed in July 2020 (2) and are proposed for endorsement by research funders, donors, governments or any other entities supporting research to address the most pressing global needs on COVID-19 and for future epidemics and pandemics (collectively referred as "the funders"). The core principles are intended to be applicable for any epidemic and additional points of relevance for COVID-19 are indicated with an asterisk.

Principle 1. Alignment to global research agendas and locally identified priorities

To consider global research priorities, such as proposed by the World Health Organisation (WHO) and other multilateral entities or regional bodies such as the African Union, as well as local research priorities, in addition to funder strategic priorities, when funding research for global benefit.

[The WHO R&D Blueprint](#) (10) was developed to help guide the research response for epidemics and pandemics and alignment with this and associated research roadmaps developed for a coordinated response focusses the funds available. It is recognised that certain global research priorities (or additional priorities) may be of particular relevance for research in resource limited settings and consideration of locally identified priorities should also be reflected in the funding process.

* For COVID-19 the [WHO Research Roadmap for COVID-19](#) (4) has been developed by the [WHO R&D Blueprint](#) (10) team building on consensus from global researchers to help guide the research response for COVID-19*

Principle 2. Research capacity for rapid research

a. To build upon existing research capacity and systems, where available.

For research to inform the health, economic and social policy and public health response in an ongoing epidemic or pandemic (or future outbreaks of the same pathogen) it needs to be implemented as rapidly as possible. Funders recognise that building on existing research capacity, platforms and systems is the fastest way to ensure high quality research is conducted and knowledge exchanged and that the long-term impacts of epidemics and recovery are addressed. Incorporation of epidemic relevant research questions into existing research studies (for example cohorts and clinical research networks) will be encouraged where possible, applicable and appropriate, to gain benefits from both rapid research activation, knowledge mobilisation and pre-existing relevant data.

b. To support capacity strengthening necessary for the research.

Funders recognise the need for strengthening research capacity in particular in resource limited settings and will consider the sustainability of any newly funded research capacity and whether it could be embedded for rapid activation in future outbreaks. Relevant guidance is provided by the work of the [ESSENCE Group](#) (11) including the [ESSENCE Good Practice Document on Capacity Strengthening](#) (12).

Principle 3. Equitable, inclusive, cross-sectoral and interdisciplinary partnerships

a. To support equitable partnership throughout the research process.

Equitable partnerships are needed to ensure successful, embedded research, which is locally relevant. Partnerships supported should be informed by relevant guidance such as [UKCDR's Equitable Partnership Principles](#) (13); [COHRED's Research Fairness Initiative and Fair Research Contracting](#) (14), and the Commission for Research Partnerships with Developing Countries (KFPE) [11 Principles for Research Partnership](#) (15).

** Funders may additionally support the aspiration that any new vaccines, diagnostics, and treatments developed for COVID-19 are globally available, appropriate, and affordable, regardless of where they have been developed or who has funded them, aligned with the [Global Collaboration ACT Accelerator](#) (16).**

b. To promote inclusive and cross-sectoral partnerships to ensure that research is most likely to impact policy and practice.

Inclusivity is needed to ensure consideration of vulnerable or marginalised groups in the research agenda. Public and community engagement plays a particularly important role in achieving and maintaining trust for research within communities for research during outbreaks, informed by guidelines such as the [UNAIDS Good Participatory Practice Guidelines for Biomedical HIV prevention Trials](#) (17).

Research partnerships should demonstrate that community and public engagement has taken place and will continue to do so.

Cross-sectoral partnerships across communities, government, public health and non-governmental organisations all help to ensure that the research funded is most likely to impact policy and practice for the relevant government and public health organisations.

c. To promote interdisciplinary research

The importance of interdisciplinary partnerships for relevant and effective research in epidemics has been highlighted, including through the joint work of the [UK Academy of Medical Sciences](#), UK Medical Research Council and InterAcademy Partnership (18).

Principle 4. Open science and data sharing

To require that research findings and data relevant to the epidemic are shared rapidly and openly to inform the public health response.

Rapid research findings, data sharing and open access publishing can accelerate health benefits through; facilitating research projects; reducing the duplication of work; and ensuring a clearer picture of the disease through pooled results to improve intervention effectiveness. Funders will be informed by relevant guidance such as the [GloPID-R Roadmap for Data Sharing](#) (7) (in particular, the guidance on grant conditions requiring rapid sharing of quality assured data and development and review of data management plans in alignment with the [FAIR Guiding Principles](#) for scientific data management and stewardship (19) as well as the associated [GloPID-R Principles of Data Sharing in Public Health Emergencies](#) (Timely, Ethical, Accessible, Transparent, Equitable, Fair, Quality) (20).

** For COVID-19 the joint statement on [Sharing research data and findings relevant to the novel coronavirus \(COVID-19\) outbreak is pertinent](#)* (21)*

Principle 5. Protection from harm

To take all reasonable steps to anticipate, mitigate and address harm to those involved with research funded.

Everyone involved in the research chain, from research funders, planners and practitioners to local community members, has the right to be safe from harm. Funders working in international development research will be informed by guidance such as [UKCDR's guidance on safeguarding in international development research](#) (22).

** For COVID-19 there is a companion piece on practical application of the [UKCDR safeguarding guidance during COVID-19](#) (23).**

Principle 6. Appropriate ethical consideration

To ensure appropriate ethical consideration is embedded throughout research conducted, in particular regarding access to the products of research.

Ethics should be at the heart of funding decision-making and considered throughout the research, including informing approaches to ensure that the optimal value is being obtained from the research for all parties involved. Relevant guidance is provided by the Declaration of Helsinki International Ethical Guidelines for Health-related research involving humans by the Council for International Organizations of Medical Sciences (CIOMS), [Nuffield Bioethics for public health emergencies – recommendations](#) (24) and [The Global Code of Conduct for Research in Resource-Poor Settings](#) (25).

* For COVID-19 the [WHO Ethical Standards for research During Public Health emergencies: Distilling Existing Guidance to Support COVID-19 R&D](#) (26) is pertinent. *

Principle 7. Collaboration and learning enhanced through coordination

Coordination to ensure maximum impact of investments for research on the most pressing global needs for epidemics through cross- funder and cross- researcher collaboration learning and evaluation.

a. To map research funded, use these data to enhance coordination, and ensure it is publicly available.

Maximising the value of research investments requires accessible, comprehensive and coherent information on what and where others are investing to help identify funding gaps or duplication and inform or direct future investments. Research funded needs to be mapped publicly, for example through [World Report](#) (27).

For COVID-19 the [COVID-19 Research Project Tracker by UKCDR & GLOPID-R](#) (6) is pertinent. The Research Project Tracker is aligned with the [WHO Research Roadmap for COVID19](#) (4) to facilitate informed decision making and targeting of funds where there is need.

b. To foster collaboration between studies funded in epidemics and facilitate shared development of research protocols, data collection tools, data sharing and exchange of knowledge.

Collaboration between researcher communities can facilitate trust, foster new partnerships and improve research outcomes and their impact. Where relevant, funded researchers will be supported to embed in relevant or, co-create communities of practice or an equivalent that promote shared development of research protocols, data collection, purpose driven data and results sharing.

c. To where relevant to embed operational research and support impact evaluation across funded projects to learn from and improve future funder and researcher responses for epidemics.

Conducting research during epidemics is still a relatively new endeavour and it is important to embed operational research (research on research) and impact evaluation where relevant. In particular, this should aim to identify how the research response can be improved, including how to overcome barriers to achieving the Funder Principles outlined here (building on prior work undertaken by GloPID-R and GOARN Research such as the [PEARLES review](#) (28) and [GloPID-R Roadmap for Data Sharing](#) (7).

2.4 THIS REVIEW

The purpose of this review is to improve the implementation of the 'Seven Funders Principles for Supporting High-Quality Research for the Most Pressing Global Needs in Epidemics and Pandemics' for the ongoing COVID-19 pandemic and for future epidemics and pandemics.

The scope of this review focusses on implementable recommendations to global research funders (in particular members of the UKCDR and GloPID-R funders groups). These recommendations will also be of interest to other stakeholders including non-member funders, policy makers and researchers.

This review has been produced through synthesising the challenges to fulfilling the Funders Principles and potential solutions identified through the following means, by the COVID CIRCLE team over the last six months:

- COVID CIRCLE Living Mapping Review and additional 'vertical' analyses from the UKCDR & GloPID-R COVID-19 Project Tracker.
Full details available as Annex B.
- A funders survey (open 1st February to 15th March 2021) and funders group consultations (between 21st February and 22nd April 2021).
Full details available as Annex C.
- A researchers survey (open 20 March- 23 April 2021) and researcher group consultation (23 June).
Full details available as Annex D.

Challenges and potential solutions are mapped against the 'Funders Principles' and recommendations for improved practice are provided. We also provide case-studies (Annex A) to demonstrate examples of best practice in research funding against a range of the Principles.

3. THE FIRST YEAR OF THE COVID-19 RESEARCH FUNDING RESPONSE

The COVID-19 Research Project Tracker (6) was launched on April 3rd, 2020 in a joint effort by UKCDR and GloPID-R to further coordinate and synergise the funding of COVID-19 research to address the WHO Roadmap priority areas. The tracker is a live database of funded research projects across the world related to the current COVID-19 pandemic – including both newly funded and re-purposed research projects coded against the WHO Roadmap.

In order to facilitate interpretation of the tracker data, COVID CIRCLE established a Living Mapping Review (LMR) on Wellcome Open Research to provide three-monthly analyses across the tracker data (9). The LMR provides an overview of the full database, giving a comprehensive picture of the research funding response from the data available in the tracker.

The full methodology and limitations of the database are outlined in the LMR, however it is important to reiterate here that the comprehensiveness of the tracker is limited to the funders that have either provided data for the tracker, or had their data extracted from online sources (if available) and is further limited by the quality of that available data. In this respect, there were challenges in engaging with (and obtaining data from) health research funders beyond existing networks, either due to a lack of contacts or capacity from funders to contribute to the project (especially for funders whose award information is not in English such as China). This therefore means that the analysis presented below needs to be interpreted with caution, due to the many limitations. Additionally, the tracker does not contain information from industry.

The latest version (30), published on 1st July 2021 shows that, as of 15th April 2021, the database contained 10,608 projects funded by 201 funders taking place across 142 countries – representing an investment of at least \$4.7 billion. The majority of research funded aligns well to the WHO Roadmap Priorities, however low levels of funding for ‘Ethics considerations for research’ and ‘Animals and environmental research’ persist. In addition, the majority of funded research projects are taking place in High Income Countries, although the global distribution of funding has gradually been shifting with greater international and domestic funding captured for research across LMICs. However, many research gaps remain in LMICs including health systems, optimal personal protective use, health care worker support and community engagement. The LMR also shows that research is being funded beyond the remit of the WHO Roadmap, specifically relating to broader vaccine research, social sciences disciplines (policy and economy; education; logistics; and food security) and environmental research. In some cases, funders and researchers are increasingly starting to focus on recovery (rather than response) and COVID CIRCLE is now mapping the COVID-19 tracker data to the ‘UN Research Roadmap for the COVID-19 Recovery’ to capture this work better. Full details of this analysis are available in our ‘Living Mapping Review for COVID-19 funded research projects: nine-month update’ (30).

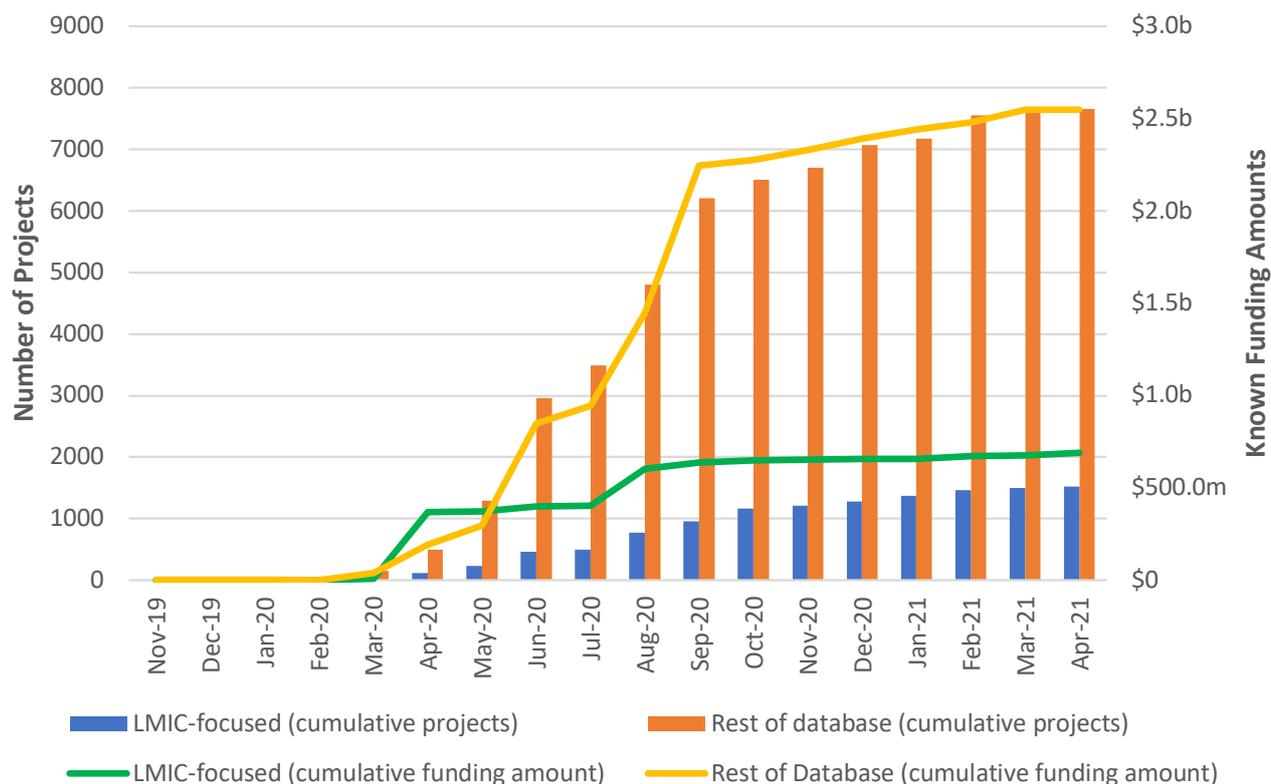
This report undertakes supplementary analyses on that same data set, with a focus on LMIC based (and 'LMIC-focused') research (defined as any research project that is taking place in at least one LMIC, even where this is in collaboration with HICs). These analyses specifically contribute to our learning in relation to the extent to which the Funders Principles may have been applied over the first year of the research response. Highlights are presented below, and the full analysis is available in the Annex.

3.1 OVERALL TIMELINE OF LMIC-FOCUSED FUNDING

To understand the (approximate) timeline of the research response to the pandemic, Figure 1 displays data on the publication date of award information by funders (where available). The increase in the number of LMIC-focused projects was greatest in August 2020 (276 projects) – two months after the peak increase for the rest of the (non-LMIC-focused) database in June 2020 (1,678 projects). Figure 1 also shows that a greater proportion of LMIC-focused data was added to the tracker in the final six months under consideration (November 2020 - April 2021) compared to the rest of the database.

In terms of funding amounts, while Figure 1 shows that the greatest increase for LMIC-focused projects took place in April 2020 (\$28.2m), five months prior to the greatest increase experienced for the rest of the database (\$841.3m in September 2020), it is worth reiterating the issues with the completeness of the financial information. Specifically, financial information could only be obtained for 59.2% of the projects in the entire database. This figure is reduced to 45.1% when only considering LMIC-focused projects. With less than half of the LMIC-focused projects having financial information, greater emphasis in this analysis is therefore placed on the number of projects.

Figure 1 – Cumulative number of projects and known funding amounts by publication date of award information of projects on tracker



Note for Figure 1: Financial information available for 59.2% of all projects in entire database (45.1% for LMIC-focused projects). Publication date available for 86.5% of projects in entire database (88.9% for LMIC-focused projects).

3.2 FUNDERS OF LMIC RESEARCH

A total of 102 funders based in 35 countries have funded LMIC-focused COVID-19 research. Looking at the timeline (Figure 2), Canadian funders were the first to fund LMIC-focused COVID-19 research—collectively responsible for 82.1% of all funded LMIC-focused projects by March 2020. More specifically, Figure 2 shows the Canadian Institutes of Health Research (CIHR) and the International Development Research Centre (IDRC) alone accounted for 67.9% of all funded LMIC-focused projects by this time.

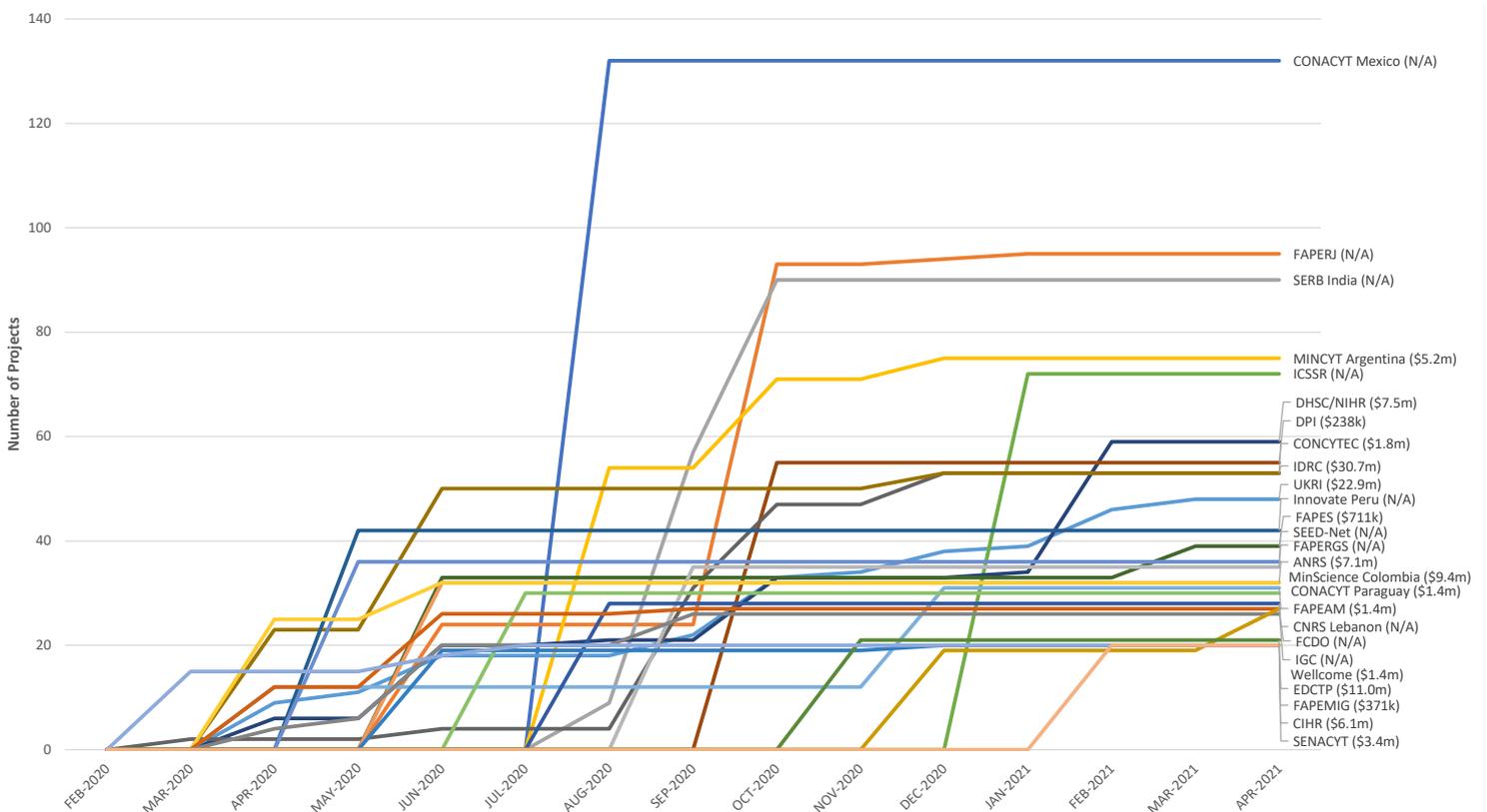
To understand the thematic nature of the research funded by the ten funders with the greatest number of LMIC-focused research, table 1 summarises their portfolios, respectively, against the WHO priority areas. Notably, the top two priority areas for each of the ten funders included in table 1 were either the priority area of ‘Social sciences in the outbreak response’ or ‘Virus: natural history, transmission and diagnostics’. At the other end of the spectrum, less than half of the funders in table 1 funded any projects under the ‘Animal and environmental research on the virus origin, and management measures at the human-animal interface’ priority area, with only half funding any research relevant to either ‘Candidate vaccines R&D’, or ‘Ethics considerations for research’.

Figure 3 restricts the analysis by displaying which funders based in high-income countries (HICs) awarded the greatest number of LMIC-focused research to understand the international research response to the challenges of the pandemic faced by LMICs.

Four of the 16 funders included in Figure 3 have demonstrated an active and significant commitment to funding research addressing challenges relating to COVID-19 in LMICs throughout the time period under consideration, having awarded projects in at least 5 different months. At a national level, funders based in the UK awarded 222 LMIC-focused projects – the most of any HIC (accounting for 13% of all LMIC-focused projects), followed by funders based in Canada (5.2%), France (5.0%) and the United States (3.5%).

When looking at the LMIC-focused portfolio of these funders (Table 2), research projects are typically more concentrated on a smaller number of WHO priority areas compared to the portfolio of funders based in LMICs (Table 1).

Figure 2 - Timeline of funders awarding the greatest number of LMIC-focused research projects by date of publication of award information. funding amounts indicated in brackets*.



Minimum 20 LMIC-focused research projects with database date information.

Note for Figure 2. Emphasis has been placed on presenting the number of projects as opposed to amounts awarded by funders as financial information was only available for 59.2% of all projects in entire database (45.1% for LMIC-focused projects). Publication date available for 86.5% of projects in entire database (88.9% for LMIC-focused projects).

**Funding amounts for individual organisations do not account for co-funding between multiple organisations as no information was provided on how funding amounts were divided between the co-funding organisations.*

Table 1 - Portfolio by WHO priority area of top 10 funders of LMIC-focused research.

Numbers shaded in grey indicate the WHO Priority Area with the greatest number of projects for that funder.

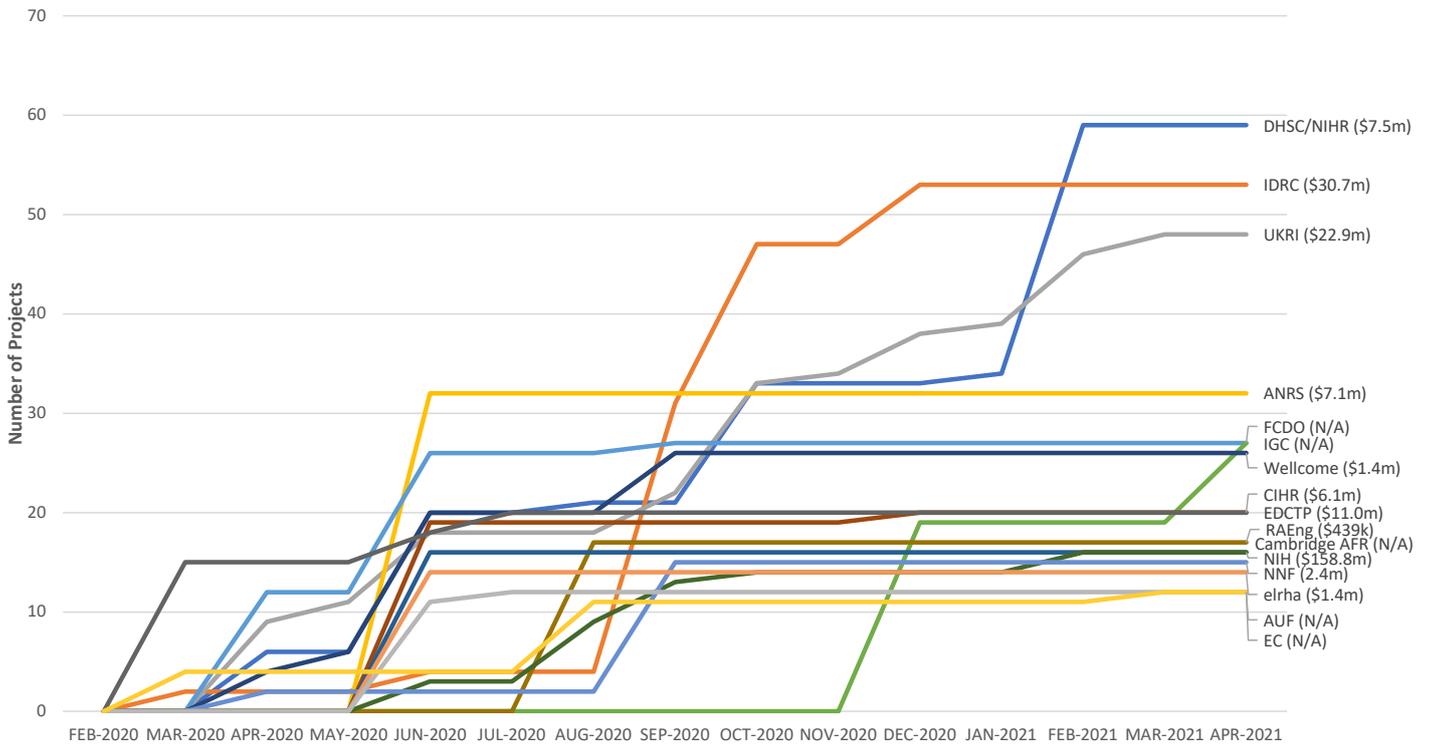
	Virus: natural history, transmission and diagnostics	Animal and environmental research	Epidemiological studies	Clinical characterization and management	Infection prevention and control	Candidate therapeutics R&D	Candidate vaccines R&D	Ethics considerations for research	Social sciences in the outbreak response	TOTAL LMIC - focused Projects
CONACYT Mexico	38	1	14	17	15	12	4	2	42	132
FAPERJ	34	2	14	38	4	17	3	0	6	95
SERB India	28	0	30	9	11	24	2	0	2	90
FAPESP	34	0	7	45	3	22	6	0	10	78
MINCYT Argentina	21	2	11	17	17	7	0	0	15	75
UKRI	17	2	15	7	10	3	1	2	42	74
ICSSR	0	0	0	3	8	0	0	2	59	72
DHSC/NIHR	8	0	10	3	15	2	0	2	42	59
DPI - Universidade de Brasilia	5	0	6	5	6	4	0	1	25	55
IDRC	1	0	6	5	5	1	0	0	48	55

Note for Table 1: Emphasis has been placed on presenting the number of projects as opposed to amounts awarded by funders as financial information was only available for 59.2% of all projects in entire database (45.1% for LMIC-focused projects).

Abbreviations and acronyms:

- CONACYT** - Consejo Nacional de Ciencia y Tecnología
(Mexico National Council of Science and Technology);
- DHSC** - Department of Health and Social Care (UK);
- DPI** - Decanato de Pesquisa e Inovação (Dean of Research and Innovation);
- FAPERJ** - Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro
(Research Foundation of the State of Rio de Janeiro);
- ICSSR** - Indian Council of Social Science Research;
- IDRC** - International Development Research Centre;
- MINCYT** - Ministerio de Ciencia, Tecnología e Innovación
(Argentina Ministry of Science, Technology and Innovation);
- NIHR** - National Institute for Health Research;
- SERB** - Science and Engineering Research Board;
- UKRI** - UK Research and Innovation.

Figure 3 - Timeline of funders based in high-income countries awarding the greatest number of LMIC-focused Research Projects by date of publication of award information. Funding amounts indicated in brackets*.



Minimum 10 LMIC-focused research projects with database date information.

Note: Emphasis has been placed on presenting the number of projects as opposed to amounts awarded by funders as financial information was only available for 59.2% of all projects in entire database (45.1% for LMIC-focused projects). Publication date available for 86.5% of projects in entire database (88.9% for LMIC-focused projects).

**Funding amounts for individual organisations do not account for co-funding between multiple organisations as no information was provided on how funding amounts were divided between the co-funding organisations.*

Table 2 - Portfolio by WHO priority area of top 10 funders based in high-income countries of LMIC-focused research.

Numbers shaded in grey indicate the WHO Priority Area with the greatest number of projects for that funder.

	Virus: natural history, transmission and diagnostics	Animal and environmental research	Epidemiological studies	Clinical characterization and management	Infection prevention and control	Candidate therapeutics R&D	Candidate vaccines R&D	Ethics considerations for research	Social sciences in the outbreak response	TOTAL LMIC - focused Projects
UKRI	17	2	15	7	10	3	1	2	42	74
DHSC/NIHR	8	0	10	3	15	2	0	2	42	59
IDRC	1	0	6	5	5	1	0	0	48	55
ANRS	4	4	12	5	2	2	0	0	11	35
FCDO	2	0	5	1	7	0	0	1	20	28
Wellcome	4	0	8	2	6	5	1	3	14	28
IGC	0	0	1	0	1	0	0	0	27	27
EDCTP	12	0	11	7	1	1	2	0	1	23
CIHR	3	1	5	4	1	1	0	0	10	20
Institut Pasteur	7	2	8	4	1	0	0	0	0	17
RAEng	2	0	0	4	6	0	1	0	6	17

Note for Table 2: Emphasis has been placed on presenting the number of projects as opposed to amounts awarded by funders as financial information was only available for 59.2% of all projects in entire database (45.1% for LMI-focused projects).

Abbreviations and acronyms:

- ANRS** - Agence nationale de recherche sur le sida et les hépatites virale (National Agency for AIDS Research);
- CIHR** - Canadian Institutes of Health Research;
- DHSC** - Department of Health and Social Care (UK);
- EDCTP** - European & Developing Countries Clinical Trials Partnership;
- FCDO** - Foreign, Commonwealth and Development Office;
- IDRC** - International Development Research Centre;
- IGC** - International Growth Centre;
- NIHR** - National Institute for Health Research;
- RAEng** - Royal Academy of Engineering;
- UKRI** - UK Research and Innovation.

3.3 INTERNATIONAL COLLABORATION

Of the more than 10,500 projects in the tracker being conducted in 142 countries, available data suggests that only 425 projects (4.0%) take place across multiple countries, thereby making them ‘multi-country projects’. Although likely an underestimation, due to variability in reporting this level of detail, this does indicate low levels of ‘multi-country projects’ during the pandemic. However, the data also suggests that projects taking place across multiple countries mostly involve at least one LMIC (62.8% of multi-country projects), as indicated in table 3. Looking at collaborations across income groups, while table 3 suggests that the most common type of cross-income group collaboration occurs between HICs and middle-income countries (MICs), collaborations with the least developed and low-income countries occurred more frequently with MICs rather than HICs.

Table 3 - Summary of types of multi-country collaborations

TYPE OF MULTI-COUNTRY COLLABORATION	NUMBER OF PROJECTS
Any multi-country collaboration	425
At least one LMIC	267
At least one LMIC and at least one high-income country	153
At least one least developed and/or low-income country and at least one high-income country	42 (21 when excluding projects that also focus on a middle-income country)
At least one middle-income country and at least one high-income country	132 (111 when excluding projects that also focus on a least developed and/or low-income country)
At least one least developed and/or low-income country and at least one middle-income country	81 (60 when excluding projects that also focus on a high-income country)

Note for Table 3: Emphasis has been placed on presenting the number of projects as opposed to amounts awarded by funders as financial information was only available for 59.2% of all projects in entire database (45.1% for LMIC-focused projects).

The top funders of the 425 multi-country projects are displayed in Table 4. Of these, 8 projects were pre-existing and explicitly repurposed for COVID-19 (although many more may have been linked to pre-existing funding). In total, 70 organisations have funded multi-country projects (which is reduced to 46 when only considering LMIC-focused research) and 90% of those are based in HICs. Across those funders with at least one multi-country project, on average, 52.7% of the portfolio is LMIC-focused. However, when only considering funders that have multi-country projects that involve at least one LMIC, the average proportion of the portfolio that is LMIC-focused increases to 80.1%.

Table 4 - Top-10 funders of multi-country projects and LMIC-focused multi-country projects by number of projects

FUNDER	NUMBER OF MULTI-COUNTRY PROJECTS
European Commission	59
UK Research and Innovation (UKRI)	51
International Development Research Centre (IDRC)	39
Canadian Institutes of Health Research (CIHR)	25
Dept. Health and Social Care / National Institute for Health Research (DHSC/NIHR)	24
Sino-German Center for Research Promotion	20
Wellcome	16
Agence Nationale de Recherche sur le Sida et les Hépatites Virale (ANRS)	15
Volkswagen Stiftung	14
National Institutes of Health (NIH)	13
Research Council of Norway	13
FUNDER	NUMBER OF LMIC-FOCUSED MULTI-COUNTRY PROJECTS
International Development Research Centre (IDRC)	38
UK Research and Innovation (UKRI)	33
Dept. Health and Social Care / National Institute for Health Research (DHSC/NIHR)	20
Canadian Institutes of Health Research (CIHR)	19
Sino-German Center for Research Promotion	19
Agence Nationale de Recherche sur le Sida et les Hépatites Virale (ANRS)	15
Wellcome	15
BRICS-STI	12
European Commission	12
European & Developing Countries Clinical Trials Partnership (EDCTP)	11

Table 5 - Top-10 funders of multi-country projects and LMIC-focused multi-country projects by known funding amounts

FUNDER(S)	KNOWN FUNDING AMOUNT AWARD TO MULTI-COUNTRY PROJECTS
National Institutes of Health (NIH)	\$259.8m
European Commission	\$82.8m
International Development Research Centre (IDRC)	\$25.8m
UK Research and Innovation (UKRI)	\$10.7m
Agence Française de Développement (AFD)	\$10.5m
COVID-19 Therapeutics Accelerator (Wellcome / Bill & Melinda Gates Foundation)*	\$9.1m
Canadian Institutes of Health Research (CIHR)	\$8.7m
UKRI / Dept. Health and Social Care / National Institute for Health Research*	\$8.7m
Dept. Health and Social Care / National Institute for Health Research (DHSC/NIHR)	\$7.4m
Research Council of Norway (RCN)	\$5.6m
FUNDER(S)	
National Institutes of Health (NIH)	\$157.5m
European Commission	\$45.4m
International Development Research Centre (IDRC)	\$25.0m
Agence Française de Développement (AFD)	\$10.5m
COVID-19 Therapeutics Accelerator (Wellcome / Bill & Melinda Gates Foundation)*	\$9.1m
UK Research and Innovation (UKRI)	\$8.8m
Dept. Health and Social Care / National Institute for Health Research (DHSC/NIHR)	\$7.4m
Canadian Institutes of Health Research (CIHR)	\$5.9m
European & Developing Countries Clinical Trials Partnership (EDCTP)	\$5.2m
UKRI / Dept. Health and Social Care / National Institute for Health Research*	\$4.6m

Note: Financial information available for 59.2% of all projects in entire database (45.1% for LMIC-focused projects).

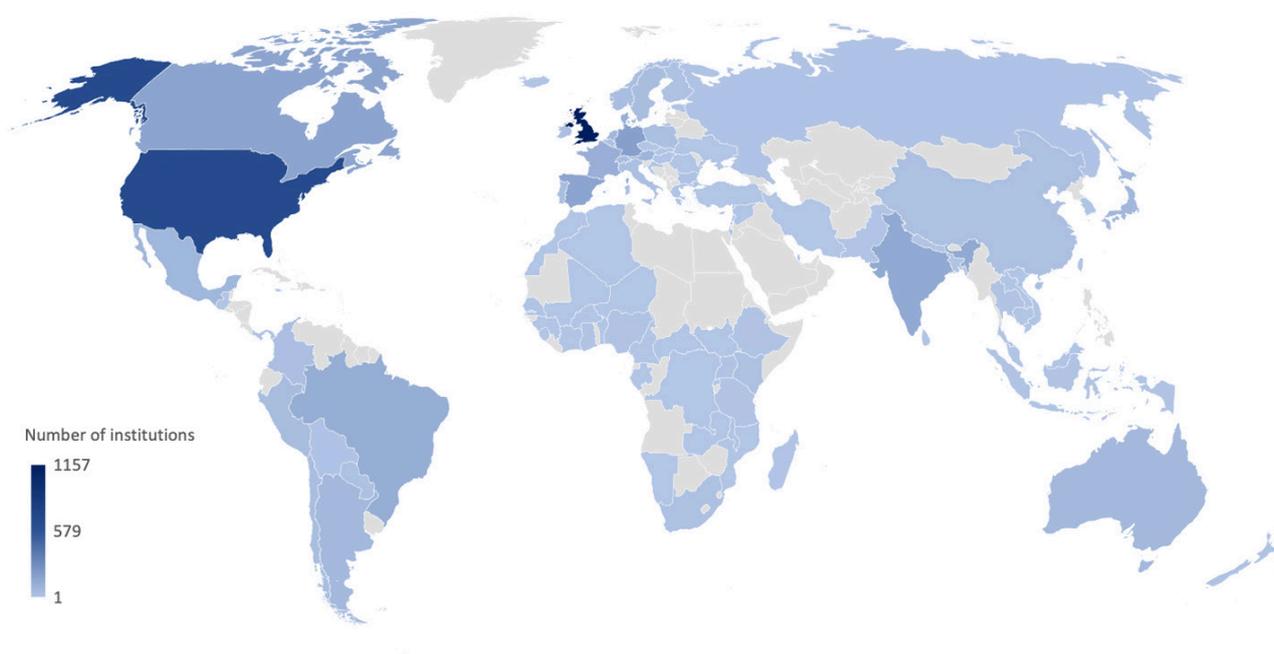
*Indicates co-funding between multiple organisations listed.

3.4 INSTITUTIONS

The 10,608 COVID-19 research projects under consideration for this analysis were awarded to 3,995 institutions based in 101 countries (Figure 4) – though institutional data was missing for 578 projects (5.4%).

While individual Canadian institutions ranked highly in terms of being designated as the ‘lead’ institution for the greatest number of projects (including six institutions in the top ten), lead institutions are most commonly located in the UK (1,157 institutions), the United States (663), and Germany (182). Overall, of the 3,995 institutions leading on COVID-19 research, only 720 (18.0%) are based in LMICs.

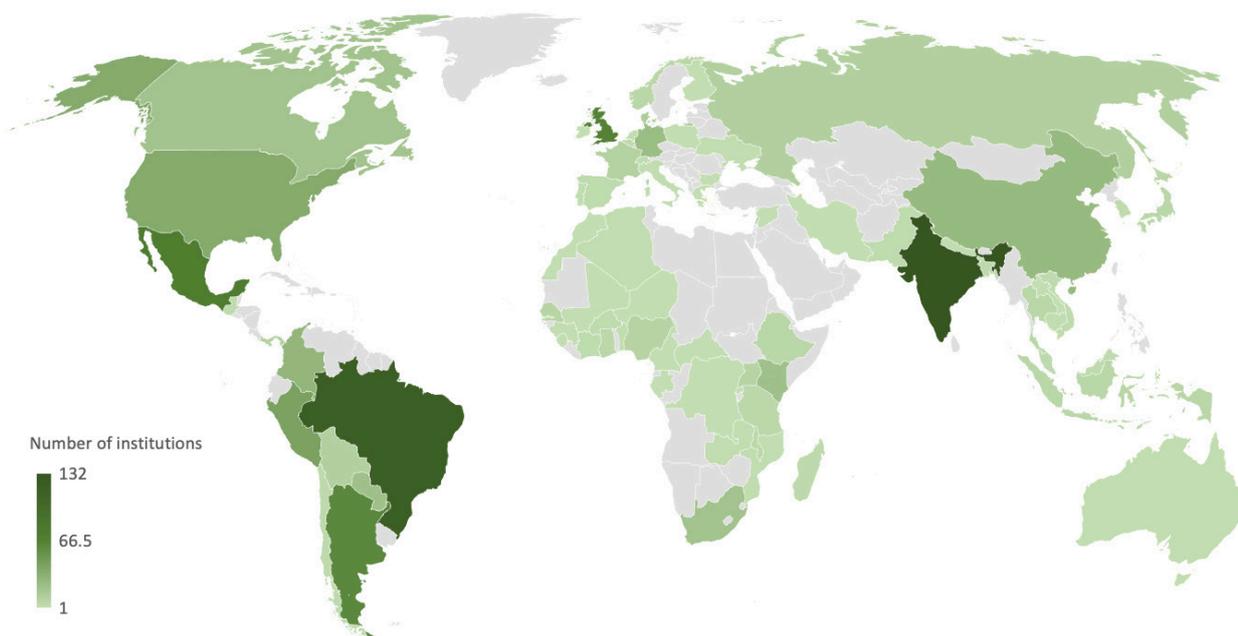
Figure 4 - Location of institutions leading on COVID-19 research



When only considering LMIC-focused research, a total of 910 institutions based in 78 countries were designated as the lead institution (figure 5) – most commonly located in India (132 institutions) and Brazil (118). Furthermore, at an individual level, each of the top five institutions leading on the greatest number of LMIC-focused research projects is based in Brazil.

While 214 of these institutions leading on LMIC-focused research are based in HICs, approximately one quarter of these institutions (24.8%) have led on more than one LMIC-focused project. On average, LMIC-focused research constituted 49.7% of the portfolio of a lead HIC institution that has led on at least one LMIC-focused project. This figure is reduced to 32.2% when only considering HIC institutions that have led on at least two LMIC-focused projects.

Figure 5 - Location of institutions leading on LMIC-focused COVID-19 research



4. LESSONS LEARNT ON ENABLERS & CHALLENGES TO FULFILLING THE SEVEN PRINCIPLES

Enablers and challenges to effective research during the first year for the COVID-19 response have been elucidated through the COVID CIRCLE surveys and stakeholder consultations and are here mapped against the COVID CIRCLE Funders Principles with associated potential solutions. Cross-cutting enablers and challenges are presented at the end of this section.

Timeliness is one of the most important factors in the response to epidemics and pandemics and many of the barriers highlighted are related to this factor. Several of the solutions cut across multiple principles and are presented at the end. Evidence relating to certain principles (in particular 'partnerships' and 'protection from harm') will require further collation beyond the timeline of this review.

4.1 ALIGNMENT TO GLOBAL RESEARCH AGENDAS AND LOCALLY IDENTIFIED PRIORITIES- ENABLERS & CHALLENGES

1. Alignment to global research agendas and locally identified priorities:

To consider global research priorities, such as proposed by the World Health Organisation (WHO) and other multilateral entities or regional bodies such as the African Union, as well as local research priorities, in addition to funder strategic priorities, when funding research for global benefit. The WHO R&D Blueprint was developed to help guide the research response for epidemics and pandemics and alignment with this and associated research roadmaps developed for a coordinated response focusses the funds available.

It is recognised that certain global research priorities (or additional priorities) may be of particular relevance for research in resource limited settings and consideration of locally identified priorities should also be reflected in the funding process. * For COVID-19 the WHO Research Roadmap for COVID-19 has been developed by the WHO R&D Blueprint team building on consensus from global researchers to help guide the research response for COVID-19

4.1.1 AVAILABILITY OF RESEARCH AGENDAS AND CAPACITY FOR PRIORITY SETTING

The WHO has led the global response to the COVID-19 pandemic with the prompt triggering of its R&D Blueprint mechanism. Through a collaborative meeting with GloPID-R (February 14-15 2020), key research priorities were identified rapidly. This roadmap facilitated funders and researchers to closely align their activities to the areas of greatest research need. The timely availability of the WHO Research Roadmap was viewed as key to enable funders to align their responses to it.

LMIC-based stakeholder perspectives were incorporated into the WHO Research Roadmap through the in-person consultations and supplemented by collaborative exercises (including the effort between The Global Health Network, COVID CIRCLE and the African Academy of Sciences (31). Delayed development or absence of regional research priorities was a clear barrier for alignment. A regional set of priorities has been developed through an all of Africa approach led by the Africa Centres for Disease Control and Prevention, African Academy of Sciences, WHO Regional Office for Africa, and the African Union Development resulting in a consolidated regional research agenda (32). Other regions, however, are still yet to develop research agendas for COVID-19 which align with local needs.

The shift to virtual global meetings has provided greater opportunity for LMIC participation in multilateral research agenda updates. Open access to research outputs has further improved the update of research agendas. The more recent efforts to develop these need to be built on and both GloPID-R and UKCDR can play a role in ensuring these meet their respective funder audiences.

For future epidemics and pandemics research agendas from WHO and/or other advisory/funding agencies need to be aligned and adapted to local research needs of LMICs. The articulation of the needs and gaps and strategies to address them should be led by LMICs rather than being directed by external stakeholders.

4.1.2 PARTNERSHIPS & STAKEHOLDER ENGAGEMENT

Harnessing existing partnerships and networks with in-depth contextual knowledge enabled the identification of local priorities including those unique to vulnerable groups such as refugee and migrant populations. Engaging local and regional stakeholders in research priority setting ensured on- the-ground knowledge was factored into research particularly, in the identification of evolving local and regional priorities.

However, a major gap for funders was the lack of information regarding the local needs and gaps based on different regions. Establishing geographical hubs led by LMICs (which GloPID-R is currently piloting) will address this gap and be key for preparedness. Such hubs will enable understanding the local funding landscape and potentially facilitate interactions with regional research and policy organisations. Funders also stated a barrier to funding LMIC research priorities was the shortage of appropriate reviewers.

4.2 RESEARCH CAPACITY FOR RAPID RESEARCH ENBALERS & CHALLENGES

2. Research capacity for rapid research

a. To build upon existing research capacity and systems, where available.

For research to inform the health, economic and social policy and public health response in an ongoing epidemic or pandemic (or future outbreaks of the same pathogen), it needs to be implemented as rapidly as possible. Funders recognise that building on existing research capacity and systems is the fastest way to ensure high quality research is conducted and knowledge exchanged and that the long-term impacts of epidemics and recovery are addressed. Incorporation of epidemic relevant research questions into existing research studies (for example cohorts and clinical research networks) will be encouraged where possible, applicable and appropriate, to gain benefits from both rapid research activation, knowledge mobilisation and pre-existing relevant data.

b. To support capacity strengthening necessary for the research.

Funders recognise the need for strengthening research capacity in particular in resource limited settings and will consider the sustainability of any newly funded research capacity and whether it could be embedded for rapid activation in future outbreaks. Relevant guidance is provided by the work of the ESSENCE Group including the ESSENCE Good Practice Document on Capacity Strengthening.

4.2.1 RAPID RESPONSE & SUSTAINABLE FUNDING

To generate urgently needed evidence in response to the pandemic, rapid response funding calls were launched. Several approaches were taken by funders to ensure initiation of rapid research including supplementing existing grants, pivoting on-going research to COVID-19 and expediting proposal review and funding processes (specific examples are given in the case studies).

However, funders identified the challenge of ensuring quality was not compromised in rapid research, particularly with respect to maintenance of research rigor and adherence to ethical standards. Further, shortages of appropriate reviewers, delayed ethical approvals due to insufficient capacity in local LMIC Institutional Review Boards also prohibited rapid research. The demand for researchers with expertise in particular disciplines in LMICs outstripped supply, further inhibiting rapid research in some fields, pointing to the need for further individual research capacity strengthening.

Where there was availability of previous or existing local and institutional sources of funding researchers were able to rapidly mobilise a research response particularly where established, trusted and effective working relationships were already in place, along with existing staff capacity. Many researchers found challenges in obtaining funding for COVID-19 research in LMICs during the pandemic and were reliant on funding already in place for other research to initiate new COVID-19 research activities.

Many pre-existing projects had to submit new proposals during the COVID-19 pandemic causing unnecessary bureaucracy in cases where researchers were already set up to conduct the research needed. Researchers specifically pointed to the lack of funding for sustained collaboration which could have been pivoted to COVID-19. The lack of fora and regional networks was also identified as a barrier. In some cases, researcher-related delays resulted from the grant application processes where, for instance, there were delays in responding to funder enquiries on proposed research or other administrative queries relating to financial checks. Here, a well-structured organisational set up in research offices, particularly in LMICs, could address this.

4.2.2 FUNDER POLICIES & ACCOUNTABILITY

Funding new research involves complex processes and differing accountabilities (eg. to governmental or charity laws) which contributed to delays in both funder and researcher activities and, in effect, delayed rapid initiation of research. Although many funders modified their funding policies to facilitate rapid funding decision making some challenges relating to disbursement of funding were identified. Bureaucratic processes involved in administering funds, particularly to LMIC-based partners and lengthy contracting and due diligence processes often delayed rapid research funding and may have led to limited funding of projects involving LMIC researchers. Finding independent reviewers to review funding decisions was also recognised as a barrier in funding LMIC institutions.

Funders are accountable for public funds and need to balance rapid funding against inherent accountability which can contribute to delays in rapid research. A potential approach to addressing this challenge involves empowering funders to take emergency

decisions in advance of emergencies/crises. Through these laid down policies and procedures funders can override contract law to speed up funding allocation in emergencies such as the COVID-19 pandemic.

4.2.3 CAPACITY STRENGTHENING

Individual research capacity strengthening through training and leadership among LMIC researchers is a continuing need to provide a broad base of researchers to respond to epidemics and pandemics.

Sustainable funding and supplementing existing successful networks (with prior funding arrangements) during the pandemic, rather than setting up new partnerships, was also identified as a way to prevent delays. Such networks need sustainable funding between epidemics to build capacity and partnerships with academic stakeholders and importantly policy stakeholders across LMICs (without needing to competitively re-apply). Further, preparedness planning should include the provision of contingency funding for such epidemics research groups in order that resourcing decisions can be made at their level to expedite research in the event of an outbreak.

4.3 SUPPORTING EQUITABLE, INCLUSIVE, INTER-DISCIPLINARY AND CROSS-SECTORAL PARTNERSHIPS- ENABLERS & CHALLENGES

3. Supporting equitable, inclusive, cross-sectoral and interdisciplinary partnerships

a. To support equitable partnership throughout the research process.

Equitable partnerships are needed to ensure successful, embedded research, which is locally relevant. Partnerships supported should be informed by relevant guidance such as UKCDR's Equitable Partnership Principles; COHRED's Research Fairness Initiative and Fair Research Contracting, and the Commission for Research Partnerships with Developing Countries (KFPE) 11 Principles for Research Partnership. * Funders may additionally support the aspiration that any new vaccines, diagnostics, and treatments developed for COVID-19 are globally available, appropriate, and affordable, regardless of where they have been developed or who has funded them, aligned with the Global Collaboration ACT Accelerator. *

b. To promote inclusive and cross-sectoral partnerships to ensure that research is most likely to impact policy and practice.

Inclusivity is needed to ensure consideration of vulnerable or marginalised groups in the research agenda. Public and community engagement plays a particularly important role in achieving and maintaining trust for research within communities for research during outbreaks, informed by guidelines such as the UNAIDS Good Participatory Practice Guidelines for Biomedical HIV prevention Trials. Research partnerships should demonstrate that community and public engagement has taken place and will continue to do so. Cross-sectoral partnerships across communities, government, public health and non-governmental organisations all help to ensure that the research funded is most likely to impact policy and practice for the relevant government and public health organisations.

c. To promote interdisciplinary research. The importance of interdisciplinary partnerships for relevant and effective research in epidemics has been highlighted, including through the joint work of the UK Academy of Medical Sciences, UK Medical Research Council and InterAcademy Partnership.

4.3.1 INCLUSIVITY & INTERDISCIPLINARITY

Examples of best practice for inclusivity involved engaging research partners with local expertise which ensured 'voices from the ground' were heard. This promoted the inclusion of marginalised and vulnerable groups and ensured their unique research priorities were factored in research.

For an effective response to the COVID-19 pandemic, a wide breadth of interdisciplinary research is crucial for gaining insights into various aspects of the disease and its impacts. Interdisciplinary partnerships promote the generation of rich research evidence, uptake of research outputs and policy change. However, in some cases, these partnerships are still perceived as being between the various biomedical disciplines with limited or no involvement of the social sciences and thus, constituted a challenge to interdisciplinary research. The data from the COVID-19 Project Tracker however indicates some level of partnership with social sciences research with 10.5% of projects categorised against one of the seven medical research priorities areas AND either ethics or social sciences. (see Annex).

4.3.2 EQUITY

Some funders and researchers recognised that the short timelines for development of novel research projects during the pandemic limited the ability to set up truly equitable partnerships, for example there was limited funding or time for partnership development and difficulty connecting with partners. Again, pre-existing partnerships with established trust were more likely to result in equity (eg. ISARIC, MORU Clinical Care Asia Network). Networking, webinars and opportunities for researchers to communicate and engage were viewed as enablers with an emphasis on co-creation and shared ownership of resources. Issues with equity in access to the products of research is covered in 3.6.

4.4 OPEN SCIENCE & DATA SHARING- ENABLERS & CHALLENGES

4. Open science and data sharing

a. To require that research findings and data relevant to the epidemic are shared rapidly and openly to inform the public health response.

Rapid research findings, data sharing and open access publishing can accelerate health benefits through; facilitating research projects; reducing the duplication of work; and ensuring a clearer picture of the disease through pooled results to improve intervention effectiveness. Funders will be informed by relevant guidance such as the GloPID-R Roadmap for Data Sharing (in particular, the guidance on grant conditions requiring rapid

sharing of quality assured data and development and review of data management plans in alignment with the FAIR Guiding Principles for scientific data management and stewardship) as well as the associated GloPID-R Principles of Data Sharing in Public Health Emergencies (Timely, Ethical, Accessible, Transparent, Equitable, Fair, Quality).
* For COVID-19 the joint statement on Sharing research data and findings relevant to the novel coronavirus (COVID-19) outbreak is pertinent*

4.4.1 POLICIES INTO PRACTICE

Existing data sharing initiatives and best practice guidance such as the GloPID-R Data Sharing Roadmap were perceived to have influenced data sharing practice in response to the pandemic. Data sharing agreements built into equitable partnerships also encouraged data sharing. Some examples of best practice relating to data sharing are detailed in the Annexed Case Studies relating to 'ICODA' and 'afrimap'. However, implementation was impaired by the limited awareness of existing policies, lack of clarity on optimal requirements for data sharing (for the various types of research) and a lack of standardisation of data sharing requirements among funders and researchers. The limited experience of some funders and researchers with data sharing and in-country legal prohibitions contributed to data sharing hesitancy and was thus a significant challenge to adherence to best practice.

4.4.2 INFRASTRUCTURE AND CAPACITY

Internet access and access to databases enabled adherence to the data sharing principle, particularly by LMIC researchers. Conversely, limited capacity in LMICs to adhere to data sharing requirements was identified as an important challenge to conducting effective research especially regarding meeting data storage requirements. Poor data quality and lack of standardisation were continued issues observed by researchers alongside hesitancy in sharing clinical data or data secrecy. This was further worsened by inadequate funder support, for instance, in provision of specific funding for technical support for data sharing and outlining optimal requirements.

Lack of standardised infrastructure resulted in a proliferation of data platforms being used with limited inter-linkage. This was compounded by the barrier that data is already kept separately in different sectors, creating issues with standardisation and linkage.

4.4.3 RESEARCH UPTAKE

Funders identified the need for open science to explicitly support research uptake through putting greater focus on ensuring that data is shared in a useable format for different audiences including decision makers and policy makers.

4.5 PROTECTION FROM HARM- ENABLERS & CHALLENGES

5. Protection from harm:

To take all reasonable steps to anticipate, mitigate and address harm to those involved with research funded. Everyone involved in the research chain, from research funders, planners and practitioners to local community members, has the right to be safe from harm. Funders working in international development research will be informed by guidance such as UKCDR's guidance on safeguarding in international development research. * For COVID-19 there is a companion piece on practical application of the UKCDR safeguarding guidance during COVID-19.*

4.5.1 MONITORING COMPLIANCE

The availability of Standard Operating Protocols (SOPs) for research, safeguarding guidance and ethical standards were enablers to practicing the protection from harm principle. The requirement of research projects to undergo ethics review also promoted adherence to safeguarding guidance although monitoring compliance following the award of grants was identified as an important challenge.

Here, there is a need to balance regular monitoring of grantees with allowing sufficient time for undertaking research.

4.5.2 INFECTION PREVENTION & CONTROL

Conducting research during a pandemic presents unique risks of potential harm to researchers and research participants. Of importance is the increased risk of COVID-19 transmission. Innovative methods of conducting research while maintaining social distancing, remote activities which prevent face-to face contact (where feasible) and adhering to other infection and prevention control measures have been crucial for protection from harm. Regular PCR testing (among research teams) and personal protective equipment use were also identified as enablers to effective research. However, severe personal protective equipment shortages were a challenge to protection from harm and were exacerbated in LMIC settings.

4.6 APPROPRIATE ETHICAL CONSIDERATION - ENABLERS & CHALLENGES

6. Appropriate ethical consideration:

To ensure appropriate ethical consideration is embedded throughout research conducted, in particular regarding access to the products of research. Ethics should be at the heart of funding decision-making and considered throughout the research, including informing approaches to ensure that the optimal value is being obtained from the research for all parties involved. Relevant guidance

is provided by the Declaration of Helsinki International Ethical Guidelines for Health-related research involving humans by the Council for International Organizations of Medical Sciences (CIOMS) , Nuffield Bioethics for public health emergencies – recommendations and The Global Code of Conduct for Research in Resource-Poor Settings. * For COVID-19 the WHO Ethical Standards for research During Public Health emergencies: Distilling Existing Guidance to Support COVID-19 R&D is pertinent. *

4.6.1 RAPID REVIEW

A major consideration for rapid research is ensuring rapid ethics reviews do not compromise research quality. Availability of WHO ethics guidelines specific to COVID-19 (33) was viewed as an enabler to guide best practice. Rapid ethics reviews were facilitated by the formation of COVID-19 specific ethics review boards and outlining processes for expedited review of projects with existing ERB approvals. Collaboration with local research partners with expertise in local ethics review processes was identified as a key enabler for ensuring contextually appropriate ethical considerations. Several factors contributed to delayed ethics approvals including limited capacity which was exacerbated by bureaucratic processes and in some instances, a lack of standardised ethics guidelines for COVID-19 research.

4.6.2 IP & DATA RIGHTS

Intellectual Property and data rights were viewed as major barriers to equity in research and to access to the products of research in LMIC contexts. The GloPID-R SAG report (33) has already identified this as a key area for members to determine how funders can rethink their guidance and influence going forwards. The report highlights the needs to explore 'new conceptions of IP, technology transfer, and data sovereignty that better produce social goods than the current patent/trademark/copyright trade-secrets system'. This work will be explored through the GloPID-R data sharing working group.

4.7 COLLABORATION AND LEARNING THROUGH ENHANCED COORDINATION- ENABLERS AND CHALLENGES

7. Collaboration and learning enhanced through coordination:

To ensure maximum impact of investments for research on the most pressing global needs for epidemics through cross- funder and cross-researcher collaboration learning and evaluation.

a. To map research funded, use these data to enhance coordination, and ensure it is publicly available. Maximising the value of research investments requires accessible, comprehensive and coherent information on what and where others are investing to help identify funding gaps or duplication and inform or direct future investments. Research funded needs to be mapped publicly, for example through World Report.

For COVID-19 the COVID-19 Research Project Tracker by UKCDR & GLOPID-R is pertinent. The Research Project Tracker is aligned with the WHO Research Roadmap for COVID19 to facilitate informed decision making and targeting of funds where there is need.

b. To foster collaboration between studies funded in epidemics and facilitate shared development of research protocols, data collection tools, data sharing and exchange of knowledge. Collaboration between researcher communities can facilitate trust, foster new partnerships and improve research outcomes and their impact. Where relevant, funded researchers will be supported to embed in relevant or, co-create communities of practice or an equivalent that promote shared development of research protocols, data collection, purpose driven data and results sharing.

c. To where relevant to embed operational research and support impact evaluation across funded projects to learn from and improve future funder and researcher responses for epidemics. Conducting research during epidemics is still a relatively new endeavour and it is important to embed operational research (research on research) and impact evaluation where relevant. In particular, this should aim to identify how the research response can be improved, including how to overcome barriers to achieving the Funder Principles outlined here (building on prior work undertaken by GloPID-R and GOARN Research such as the PEARLES review and GloPID-R Roadmap for Data Sharing.

4.7.1 RESEARCH MAPPING

The COVID CIRCLE initiative aimed to strengthen the coherence of the research response to COVID-19 and facilitate coordination and collaboration among funders and researchers. In particular, mapping and analysis of projects captured in the UKCDR and GloPID-R tracker, enabled identification of research gaps and opportunities for collaboration. Many funders reported having used the tracker to support strategy review, funding call specifications and funding decisions during the pandemic. The benefits were seen in the transparency on what is being funded, identification of the gaps and mapping to the WHO Roadmap.

Funders and researchers identified that it is also important to track other factors relevant to research quality including capacity strengthening and strength and equity of partnerships in research involving LMICs. Visibility of capacity is essential to ensure researchers are aware of what capacity is available and how they can collaborate. Various efforts such as those by The Global Health Network, The African Academy of Sciences and ESSENCE for Health Research are mapping capacity, but these could be strengthened.

4.7.2 CONVENING

Virtual conferencing during the pandemic has greatly enhanced global convening. The WHO Blueprint has shown positive convening power, bringing together 10,000 people in their last research agenda priority setting meeting. GloPID-R has also convened a range of successful Synergies meetings with global participation on Vaccines, Therapeutics, Transmission, Social Sciences Research, Long COVID and Research in LMICs (35, 36, 37, 3). A remaining challenge is how to translate such convening into greater and more effective collaboration.

4.7.3 PROMOTING COLLABORATION

Existing partnerships and networks which promoted exchange of ideas, data sharing and dissemination of research outputs were identified as enablers of effective research, although insufficient investment to sustain these partnerships was identified as a challenge. Further, the lack of key collaborative networks in South East Asia, for example, similar to the Africa CDC was a challenge to coordination and collaboration. The move to virtual events following COVID-19 travel restrictions encouraged greater participation and engagement in COVID-19 related research conferences and meetings.

Funders identified that 'how they fund' could be improved to support collaboration, as current models do not effectively promote it. The issue of large numbers of trials and trial networks was viewed as one that funders could and should address, to ensure that prioritised research questions can be answered in the most efficient and effective way, particularly in LMICs. This is especially pertinent as many of these small trials have resulted in underpowered studies unable to meet their aims. Funder collaboration to promote and ensure, fewer and more efficient trials was sought and aligns with the recent G7 Clinical Trials Charter (38).

The GECCO case study (Annex) highlights the development of the COVID CIRCLE Researcher platform specifically to support their community of researchers undertaking COVID-19 research across LMICs to collaborate (along with researchers funded by other UK based calls). Activities on this platform are aimed at facilitating research to policy and practice.

Improved collaboration across research funding and public health funding was also identified as an enduring challenge, with some national funders able to cover both but increased linkage and highlighting of gaps needed.

4.8 CROSS-CUTTING ENABLERS AND CHALLENGES AND THOSE IDENTIFIED BEYOND THE FUNDERS PRINCIPLES

4.8.1 CROSS CUTTING BARRIERS

Timeliness and availability of funds were perhaps unsurprisingly the main cross-cutting barriers identified by both funders and researchers during the pandemic. For researchers, all aspects of setting up new high-quality research projects were more challenging both due to the pandemic and in partnerships in LMICs.

For funders, governance (including bureaucracy) and political issues were key cross-cutting barriers to applying the Funders Principles.

The COVID-19 tracker funding analysis showed limited international and interdisciplinary projects and the huge proliferation of small national based projects. It also shows that many funding calls were time-limited and there was not sustained funding activity throughout the first year of the pandemic.

4.8.2 CROSS CUTTING ENABLERS

Pre-existing arrangements, including: funding mechanisms, funding relationships and research networks and collaborations were identified as key enablers to ensuring an effective research response to the COVID-19 pandemic in alignment with the Funders Principles. The need to build partnerships during inter-epidemic periods was therefore seen as key. Visibility of these partnerships was also seen as a key enabler, with both research capacity and research activity mapping viewed as important for this.

Whilst many pieces of good policy guidance exist (as referenced in the principles) greater guidance on applying best practice now needs to be developed to strengthen the implementation of the principles and recommendations in this report, incorporating the lessons learned. It was concluded that guidance for implementation on practice across the principles, could improve research generally beyond epidemics and pandemics. This would then be more likely to result in 'high- quality research for the most pressing global needs' for future epidemics and pandemics.

5. RECOMMENDATIONS FOR RESEARCH FUNDERS

The challenges and potential solutions outlined to achieving the Funders Principles require action from a range of stakeholders. Highlighted here are the recommendations on the actions that funders could pursue either individually or collectively. These build from the greater detail provided on enablers and challenges to implementing the Funders Principles (section 4.), the analysis of the first year of the COVID-19 research funding response (section 3.) and the case-studies (Annex A). Key recommendations include the need for greater long-term funding of networks which provide the capacity to pivot to emerging diseases; the need for greater guidance, support and systems to realise Open Science; and greater global coordination including joint funding mechanisms.

5.1 RECOMMENDATIONS TO FUNDERS FOR ACTION

1. Alignment to global research agendas and locally identified priorities

- a. Support for the development and strengthening of research networks involving local funders in advance of future pandemics to facilitate leadership for regional and local research priority setting, and adaptation of priorities and sub-priorities from WHO and/ or other advisory agencies for local needs of LMICs.
- b. Provide agile mechanisms for dedicated funding or direct funding to low-and middle-income countries to match their research needs for epidemics and pandemics.

2. Research capacity for rapid research

- a. Ensure sustained funding for building research capacity in between epidemics and pandemics (including highly trained researchers through training including leadership training and small grants for early researchers) linked with public health capacity building (including surveillance), clinical trial and research platforms and national clinical data systems (where available). These can then be built on and linked by rapid response supplemental funding.
- b. Funder coordination to rethink the proposal review process during emergencies through a risk-based approach.
- c. Introduce funder policies which outline governance to override normal funding processes in emergency situations. Test these funding mechanisms during peace time to leverage them during emergencies.

3. Equitable, inclusive, cross-sectoral and interdisciplinary partnerships

- a. Increase emphasis on interdisciplinary research for epidemics involving LMICs.
- b. Increase (high-income country) funder activity on epidemic research in least developed and low-income countries in recognition that supporting HIC research gaps alone does not end a pandemic.

4. Open science and data sharing

- a. Raise awareness among funders and reviewers of the advantages of the open-science approach for epidemics and pandemics and existing initiatives and policy guidance.
- b. Develop clear consistent data management and sharing guidelines across funders working with the research community, for rapid sharing data for different kinds of research (i.e. for biomedical research versus social sciences research) within epidemics and pandemics in alignment with the GloPID-R Data Sharing Roadmap.
- c. Provide guidance and funding to support with data sharing during epidemics or pandemics e.g. set up of data sharing platforms in advance.
- d. Evaluate the implementation & impact of open science during COVID-19.

5. Protection from harm

- a. Specific funding allocation for PPE equipment training and other IPC controls for those involved in the research process.

6. Appropriate Ethical Consideration

- a. Removal of operational bottlenecks to speed up ethics review process in emergencies.
- b. Increased research activity to explore ethical dilemmas in epidemics specifically in LMICs.

7. Collaboration and learning enhanced through coordination

- a. Provide funding for repurposing or extending existing partnerships, collaboration networks or coordination mechanisms.
- b. Enhanced collaboration between funders - potentially via reviewing analyses of tracker data to understand funding landscape and identify synergies and possible joint international funding calls to improve funding efficiency.
- c. Learn from existing rapid funding mechanisms (see case studies on R2HC and EDCTP) and those funders who developed rapid funding for COVID-19 (eg. UKRI, CIHR rolling calls) .

8. Cross-cutting

- a. Develop guidelines for “operationalising” the seven funders principles.
- b. Embed application of the seven principles in the entire funding process.
- c. Launch joint funding calls to enable international research partnerships beyond individual funder remits.
- d. Provide funding for diverse types of research e.g. health systems research funding, applied research, implementation science, cohort studies.
- e. Develop guidance for funders to support research uptake within the timescales of an epidemic.



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REFERENCES

1. Global Effort on COVID-19 (GECO) Health Research - Call Specification: <https://www.nihr.ac.uk/documents/global-effort-on-covid-19-geco-health-research-call-specification/24832>
2. Norton A, Mphahlele J, Yazdanpanah Y, et al.: Strengthening the global effort on COVID-19 research. *Lancet*. 2020; 396(10248): 375. [https://doi.org/10.1016/s0140-6736\(20\)31598-1](https://doi.org/10.1016/s0140-6736(20)31598-1)
3. GloPID-R, UKCDR & COVID-19 Clinical Research Coalition Cross-Working Group on COVID-19 Research in LMICS. Priorities for COVID-19 research response and preparedness in low-resource settings. Comment. *The Lancet* (May 6th 2021). DOI: [https://doi.org/10.1016/S0140-6736\(21\)00980-6](https://doi.org/10.1016/S0140-6736(21)00980-6)
4. World Health Organisation: A Coordinated Global Research Roadmap: 2019 Novel Coronavirus. 2020; [cited 2020 Jul 30]. Reference Source
5. Matthiessen L, Colli W, Delfraissy J-F, et al. Coordinating funding in public health emergencies. *Lancet*. 2016. [https://doi.org/10.1016/S0140-6736\(16\)30604-3](https://doi.org/10.1016/S0140-6736(16)30604-3)
6. UKCDR & GloPID-R: COVID-19 Research Project Tracker. 2020. <https://www.ukcdr.org.uk/covid-circle/covid-19-research-project-tracker/>
7. Norton A; Pardinaz- Solis R; Carson G. GloPID-R Roadmap for Data Sharing in Public Health Emergencies. 2019. Available at: <https://www.glopid-r.org/our-work/data-sharing/>
8. Norton A; Sigfrid L; Aderoba A; Nasir N; Bannister P; Collinson S; Lee J; Boily-Larouche G; Golding J; Depoortere E; Carson G; Kerstiens B; Yazdanpanah Y. Preparing for a pandemic: highlighting themes for research funding and practice- perspectives from the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R). *BMC Medicine Commentary* (September 2020). DOI: 10.1186/s12916-020-01755-y
9. GloPID-R Social Sciences Working Group Report. TOWARDS PEOPLE-CENTRED EPIDEMIC PREPAREDNESS & RESPONSE: From Knowledge to Action. 2019. Available at: <https://www.glopid-r.org/wp-content/uploads/2019/07/towards-people-centered-epidemic-preparedness-and-response-report.pdf>
10. WHO R&D Blueprint. Available at: <https://www.who.int/teams/blueprint>
11. ESSENCE on Health Research. WHO. Available at: <https://www.who.int/tdr/partnerships/essence/en/>
12. ESSENCE Seven Principles for Strengthening Research Capacity in Low- and Middle-Income Countries (2014). UKCDR. Available at: <https://www.ukcdr.org.uk/research/essence-seven-principles-for-strengthening-research-capacity-in-low-and-middle-income-countries-2014/>

13. Finding and building effective and equitable research collaborations or partnerships: The role of funders in equitable and effective international development research collaborations (2017). UKCDR. Available at: <https://www.ukcdr.org.uk/resource/finding-and-building-effective-and-equitable-research-collaborations/>
14. Fair Research Contracting. COHRED. Available at: <https://www.cohred.org/FRC/>
15. 11 Principles for Research Partnership. Commission for Research Partnerships with Developing Countries (KFPE). Available at: <https://11principles.org/>
16. Access to COVID-19 Tools (ACT) Accelerator: A Global Collaboration to Accelerate the Development, Production and Equitable Access to New COVID-19 diagnostics, therapeutics and vaccines. WHO. 2020. Available at: [https://www.who.int/publications/m/item/access-to-covid-19-tools-\(act\)-accelerator](https://www.who.int/publications/m/item/access-to-covid-19-tools-(act)-accelerator)
17. Good Participatory Practice (GPP) Guidelines. AVAC, UNAIDS. 2011. Available at: <https://www.avac.org/good-participatory-practice>
18. Interdisciplinary research in epidemic preparedness and response. 2019. The Academy of Medical Sciences, UK Medical Research Council, InterAcademy Partnership. Available at: <https://acmedsci.ac.uk/policy/policy-projects/multidisciplinary-research-in-epidemic-preparedness-and-response->
19. Wilkinson, M. D. et al. The FAIR Guiding Principles for scientific data management wardship. Sci. Data 3:160018 doi: 10.1038/sdata.2016.18 (2016).
20. GloPID-R report. Principles of data-sharing in public health emergencies. Available at: <https://www.glopid-r.org/wp-content/uploads/2018/06/glopid-r-principles-of-data-sharing-in-public-health-emergencies.pdf>
21. Press release: Sharing research data and findings relevant to the novel coronavirus (COVID-19) outbreak. Wellcome. 2020. Available at: <https://wellcome.org/press-release/sharing-research-data-and-findings-relevant-novel-coronavirus-ncov-outbreak>
22. Briefing paper: Safeguarding in International Development Research. UKCDR. 2019. Available at: https://www.ukcdr.org.uk/wp-content/uploads/2019/06/20190603-UKCDR-Safeguarding-Briefing_updated.pdf
23. Safeguarding in International Development Research: Practical application of UKCDR Safeguarding Guidance during COVID-19. UKCDR. 2020. Available at: https://www.ukcdr.org.uk/wp-content/uploads/2020/04/010420-UKCDR-Safeguarding-Companion-Piece_Practical-application-of-guidance-during-COVID-19.pdf
24. Report: Research in global health emergencies. Nuffield Council on Bioethics. 2020. Available at: <https://www.nuffieldbioethics.org/publications/research-in-global-health-emergencies>
25. TRUST (2018) Global Code of Conduct for Research in Resource-Poor Settings, DOI: 10.48508/GCC/2018.05. Available at: <https://www.globalcodeofconduct.org/>

26. Policy Brief: Ethical standards for research during public health emergencies: Distilling existing guidance to support COVID-19 R&D. WHO. 2020.
Available at: <https://apps.who.int/iris/bitstream/handle/10665/331507/WHO-RFH-20.1-eng.pdf?ua=1>
27. World Report. National Institutes of Health.
Available at: <https://worldreport.nih.gov/wrapp/#/search?searchId=615100ac9f3d606d3a5efcdc>
28. Sigfrid, L., Bannister, P. G., Maskell, K., Regmi, S., Collinson, S., Blackmore, C., Ismail, S. A., Harriss, E., Longuere, K.-S., Gobat, N., Clarke, M., & Carson, G. (2019). Addressing political, economic, administrative, regulatory, logistical, ethical, and social challenges to clinical research responses to emerging epidemics and pandemics: A systematic review. *The Lancet*, 394, S86. [https://doi.org/10.1016/S0140-6736\(19\)32883-1](https://doi.org/10.1016/S0140-6736(19)32883-1)
29. Norton A; Bucher A; Antonio E; Advani N; Grund H; Mburu S; Clegg E; Boily-Larouche G; Lay M; Carson G; Tufet Bayona M. Baseline results of a living systematic review for COVID-19 funded research projects. Wellcome Open Research. September 2020. DOI: 10.12688/wellcomeopenres.16259.1
30. Norton A, Bucher A, Antonio E et al. A living mapping review for COVID-19 funded research projects: nine-month update [version 4; peer review: 2 approved]. *Wellcome Open Res* 2021, 5:209 (<https://doi.org/10.12688/wellcomeopenres.16259.4>)
31. Norton A; De La Horra Gozalo A; Feune de Colombi N; Alogo M; Mutheu Asego J; Al-Rawni Z; Antonio E; Parker J; Mwangi W; Adhiambo C; Marsh K; Tufet Bayona M; Piot P; Lang T. The remaining unknowns: A mixed methods study of the current and global health research priorities for COVID-19. *BMJ global health* (July 2020). DOI: 10.1136/bmjgh-2020-003306
32. Policy Paper: Research and Development Priorities for COVID-19 in Africa.
Available at: https://www.aasciences.africa/sites/default/files/202102/Research%20and%20Development%20Priorities%20for%20COVID-19%20in%20Africa%20-%20ENG_Final%20%28003%29.pdf
33. WHO Guidance for research ethics committees for rapid review of research during public health emergencies. Available at: <https://www.who.int/publications/i/item/9789240006218>
34. GloPID-R SAC Report. COVID-19 Research Recommendations & Considerations for GloPID-R 2021-2023. Available at: <https://www.glopid-r.org/covid-19-research-recommendations-considerations-for-glopid-r-2021-2023/>
35. The COVID-19 Research GloPID-R Synergies Meeting Working Group., Meeting Co-chairs. Ending COVID-19: progress and gaps in research—highlights of the July 2020 GloPID-R COVID-19 Research Synergies Meetings. *BMC Med* 18, 342 (2020). <https://doi.org/10.1186/s12916-020-01807-3>

36. Norton A, Olliaro P, Sigfrid L et al. Long COVID: tackling a multifaceted condition requires a multi-disciplinary approach. Correspondence. The Lancet Infectious Diseases (February 3rd 2021). DOI: [https://doi.org/10.1016/S1473-3099\(21\)00043-8](https://doi.org/10.1016/S1473-3099(21)00043-8)
37. Carson, G., Long Covid Forum Group. Research priorities for Long Covid: refined through an international multi-stakeholder forum. BMC Med 19, 84 (2021). <https://doi.org/10.1186/s12916-021-01947-0>
38. Policy paper: G7 Therapeutics and Vaccines Clinical Trials Charter. 4th June 2021. Available at: <https://www.gov.uk/government/publications/g7-health-ministers-meeting-june-2021-communique/g7-therapeutics-and-vaccines-clinical-trials-charter>



