COVID-19 Research Priorities Identified by the Global Research Community

Survey & Workshops

15th July 2020

Acknowledgement

This report would not have been possible without the hundreds of researchers across the world who took part in the survey and workshops whilst facing the pandemic in their professional and personal lives. We thank them for taking the time to share their opinions with us and recognising the importance of setting the research agenda.

Contact

The Global Health Network
Centre for Tropical Medicine and Global Health
New Richards Building
Old Road Campus
Roosevelt Drive
Oxford
OX3 7LG

Professor Trudie Lang, Director: trudie.lang@ndm.ox.ac.uk
Liam Boggs, Senior Operations Manager: liam.boggs@ndm.ox.ac.uk

TABLE OF CONTENTS

INTRODUCTION

On 11th March 2020, the World Health Organisation (WHO) declared the outbreak of a new type of Coronavirus, SARS-CoV-2 that causes COVID-19 respiratory disease, a global pandemic. On 12th of March 2020 WHO published *A Coordinated Global Research Roadmap: 2019 Novel Coronavirus* (1) This document presented a Global Research Roadmap with immediate, mid-term and longer-term priorities aiming to build a robust global research response on the basis of the outcome of the *Global Research Forum* held on 11-12 February 2020 by the WHO and the Global Research Collaboration for Infectious Disease Preparedness and Response (GLOPID-R). GLOPID-R is an international network of funders that aims to facilitate coordination and information sharing. The *Global Research Forum* followed the WHO R&D Blueprint strategy as a framework. This strategy aims to coordinate and accelerate global research work to target diseases that threaten humanity, rapidly develop diagnostics, medicines and vaccines, and promptly respond to outbreaks thereby preventing epidemics.

Following the publication of the Global Research Roadmap, the African Academy of Science (AAS) conducted a consultative webinar followed by a survey in April 2020 based on the *WHO Global Research Roadmap* to define African research priorities for the COVID-19 outbreak. The *Research and Development goals for COVID-19 in Africa* report was published on 24th April 2020 (2). This report proposed a prioritization list for research and development for the COVID-19 outbreak in Africa. The findings were that African researchers largely supported the WHO Roadmap research priorities at that point in time, but they also identified a list of additional sub-priorities of relevance to the African health and research environment.

The Global Health Network (TGHN) has been established as a known and trusted community that is used by many thousands of researchers and healthcare workers across Low- and Middle-Income Countries (LMICs). There was already a strong engagement in discussion on research priorities and topics (3). The United Kingdom Collaborative on Development Research (UKCDR) initiated a collaboration with TGHN and the AAS to identify the COVID-19 global research priorities to ensure funding would be designated to the currently relevant global priorities, with particular consideration to lower resource settings.

With the aim to determine what research is most needed globally now to address the pandemic and what questions should be asked to learn for the next pandemic, we undertook a survey followed by a workshop. Survey findings were presented in the workshop to seek wider global comment and discussion on these and to discuss current priorities and unmet research areas.

AIM

The aim of this project is to identify the current global COVID-19 research priorities for this and future pandemics of COVID-19 or new pathogens.

Objectives

- To assess whether the WHO Global Research Roadmap mid-term and long-term priorities, alongside the new priorities identified by the AAS, were globally relevant, particularly to lower resource settings.
- To identify which immediate COVID-19 research priorities are most important.
- To identify which longer-term research priorities, necessary to build the research capacity to deal with future pandemics of either COVID-19 or other pathogens, are most important.

- To identify new research priority areas not captured in the WHO Research Roadmap or the AAS survey.

METHODS

Survey design

The online survey '*Research Priorities for COVID-19*' questions were developed following the structure of the WHO Research Roadmap *Mid-term and long-term priorities to contribute to control the outbreak* summary table with the addition of the new research priorities identified by the AAS during their webinar and subsequent survey. The survey had an introductory page providing information on the aim of the survey and how the data collected would be used and clarified that the participation was voluntary with the right to withdraw at any time. Consent to participate was implicit for all individuals that "opted in" to complete the survey. The survey consisted of three sections. The first section survey collected demographic details. In the second and third sections, participants ranked their top three options within nine topic areas for both immediate and longer-term priorities (18 total ranking questions). Participants also had the opportunity to indicate in open response questions any priorities that might not have been captured for each one of the topics. See Appendix 1 for full list of survey questions.

The online survey was created and distributed through the online survey tool Jisc. The online survey was piloted within a small team of researchers and global health experts who reported no difficulty interpreting and responding, and no obvious survey omissions. The full listing of survey questions will be included in the final survey report.

Survey distribution

The survey invitation was disseminated via the COVID-19 Research Implementation Knowledge Hub, the TGHN e-Newsletter sent to all subscribed users, and through Twitter, Facebook and LinkedIn. AAS and UKCDR supported the dissemination of the survey to all their members. Participants were not compensated for survey completion.

The English version of the survey was launched on 11th May 2020 17:00 BST. The Spanish, Portuguese and French version were launched on 15th May 2020 23:00 BST. The survey was closed on 22nd May 2020 10:00 am BST. Survey responses were collected for a period of 12 days.

Workshop

After the survey was closed and preliminary analysis was undertaken, a virtual workshop was led by TGHN using the teleconferencing software platform Zoom. This workshop titled "*COVID-19: determining the Global Research Priorities*" was widely disseminated via The Global Health Network's newsletter to subscribed members and was fully booked before we could share via social media. The event registration page included the agenda of the workshop and a brief narrative on issues for discussion as detailed below:

"*Several major international research funding organisations are planning further calls to respond to the current COVID-19 pandemic. To ensure their funding decisions will address critical global knowledge gaps. The Global Health Network, the African Academy of Sciences and the UKCDR have conducted a survey to seek the opinion of researchers globally as to what are the top priorities for COVID-19 research in their country and region (more information here). To complement the survey, join us for an open discussion and help us guide major research funders with your expertise on what COVID-19 research should be prioritised.*"

The format of the workshop gave a short overview of the initial quantitative and qualitative results drawn from the survey analysis and then sought comments and discussion from participants both written and spoken. Specifically, the attendees of this workshop were also asked '*If you could do any type of research study now what would it be?* The workshop was recorded, and comments and questions in the video and chat-function captured.

DATA ANALYSIS

The 'Jisc' online survey platform gathered the data into a spreadsheet format for basic statistical analysis. The survey questions were designed to ensure that only completed ones could be submitted as responses. Data was anonymised, password protected and access was restricted to the project team. Quantitative descriptive statistical analyses were undertaken within excel to provide a priority score for each research category. Research categories ranked as "priority 1" were given a score of 3, "priority 2" were given a score of 2, "priority 3" were given a score of 1 and those not selected as a priority were given a score of 0. Each priority was ranked based on the sum of all the scores. This analysis was conducted within each topic area.

Open-ended survey responses aimed to determine whether there are new priorities that were not included in the original WHO roadmap and AAS survey findings. These free-text responses were imported into NVivo qualitative data analysis package and we undertook a pragmatic 'thematic content analysis'. Responses were coded deductively following categories using:

- Group 1 - WHO priorities outlined in the WHO COVID-19 Research Roadmap and priorities emerging from the AAS findings (as listed in the survey questions).
- Group 2 - New research priorities that would fit-in within the WHO COVID-19 Research Roadmap topics.
- Group 3 - New research priorities that would not fit-in within the WHO COVID-19 Research Roadmap topics.

The analysis focused on the new research priorities included in group 2 and group 3 to identify emerging themes. Responses such as 'not applicable' and duplicate answers from the same respondent were discarded hence, 535 of 854 short-term responses and 103 of 350 long-term responses were coded. Some of the comments included in the immediate priorities section were understood to be longer-term and were coded as such.

Analysing the data from the workshop allowed a wider consideration of current COVID-19 research priorities as this step expanded beyond the limitations that the survey had by asking questions within the framework of the WHO COVID-19 Research Roadmap and AAS findings. We obtained a data set from transcribing the spoken and written comments submitted during and immediately after the workshop. Data included in this analysis comprised of the comments made using the software's 'Question and Answer' function, comments posted in the software's 'Chat' function, comments posted in Social Media (FB platform) and emails received after the delivery of the Workshop.

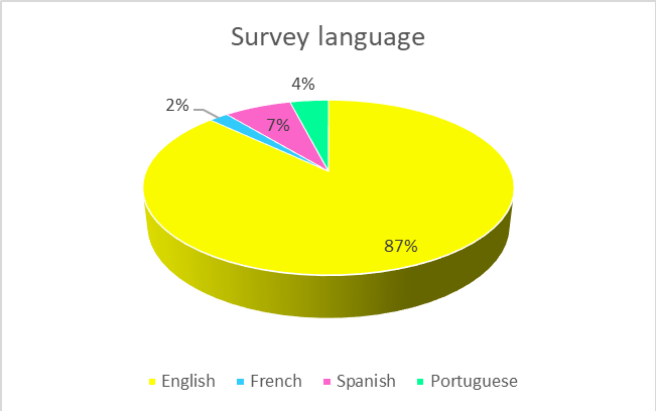
We undertook a basic and pragmatic thematic analysis in order to allow for rapid dissemination of the results. A coding framework was generated through an inductive and then deductive approach following the WHO COVID-19 Research Roadmap structure to facilitate interpretation and comparison.

RESULTS

GLOBAL DISTRIBUTION OF RESPONSES

The total number of responses was 1528.

Survey language	n= 1528
English	1324 (87%)
French	30 (2%)
Spanish	115 (7%)
Portuguese	59 (4%)



The quantitative responses were grouped to facilitate understanding of the variation of priorities between regions. Groups criteria:

- LMIC countries as defined by the World Bank Income Groups (4) - WHO Member States grouped into three income groups (low, lower-middle and upper-middle) based on the World Bank list of analytical income classification of economies for the fiscal year, which is based on the Atlas gross national income per capita estimates. (L&L-MICs = Low and Lower Middle Income Countries).
- Development Assistance Committee (DAC) List of Official Development Assistance (ODA) Recipients for reporting on aid in 2020 (5)- The DAC List of ODA Recipients shows all countries and territories eligible to receive official development assistance (ODA). These consist of all low and middle income countries based on gross national income (GNI) per capita as published by the World Bank, with the exception of G8 members, EU members, and countries with a firm date for entry into the EU. The list also includes all of the Least Developed Countries (LDCs) as defined by the United Nations (UN).
- Responses from AAS Africa's region.
- WHO regions - WHO Member States are grouped into six WHO regions: African Region, Region of the Americas, South-East Asia Region, European Region, Eastern Mediterranean Region, and Western Pacific Region (6)
- Respondents that defined themselves as "Infectious disease control expert" in question 5.
- Respondents with experience in policy advice. Data extracted from question 4.

Global distribution of survey responses (n=1528) Total number of countries = 117	LMIC	DAC List of ODA Recipients for reporting on aid in 2020	African Academy of Sciences region	WHO regions
	LMICs = 981 (64%) High Income Countries = 547 (36%) L&L-MICs = 694 (45%)	DAC countries = 973 (64%) respondents from 79 countries Non DAC countries = 555 (36%) respondents from 38 countries	n = 623 (41%)	African region = 612 (40%) Americas regions = 279 (18%) Eastern Mediterranean region = 32 (2%) European region = 460 (30%) South East Asia region = 87 (6%) Western Pacific region = 58 (4%)

Workshop

A total of 91 participants joined the workshop via Zoom and the session was live-streamed via The Global Health Network's Facebook page, spanning over 38 countries in Latin America and the Caribbean, Middle East, Africa, Asia, Australia, Europe and North America.

QUANTITATIVE DATA

DEMOGRAPHICS

1. Gender

Gender	Global (n=1528)	LMIC (n= 981)	L&L-MICs (n=694)	DAC countries (n=896)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Infectious disease control expert (n=499)	Experience in policy advice (n=287)
Female	692 (45%)	402	234	397	207	203	151	38	243	14	40	196	119

Male	828 (54%)	578	458	573	414	407	121	48	217	18	18	299	165
Other	1 (0.1%)	0	0	0	0	0	0	0	1	0	0	1	1
Prefer not to say	7 (0.5%)	3	2	2	2	2	3	1	1	0	0	3	2

2. Age

Age	**Global (n=1528)**	**LMIC (n= 981)**	**L&L-MICs (n=694)**	**DAC countries (n=973)**	**Africa (AAS) (n=632)**	**WHO Africa (n=612)**	**WHO Americas (n=279)**	**WHO SE Asia (n=87)**	**WHO Europe (n=460)**	**WHO Eastern Mediterranean (n=32)**	**WHO Western Pacific (n=58)**	**Infectious disease control expert (n=499)**	**Experience in policy advice (n=287)**
20-29	156 (10%)	129	114	129	88	85	25	15	18	6	7	27	24
30-39	438 (29%)	329	251	327	229	227	68	26	98	4	15	142	70
40-49	412 (27%)	255	188	252	161	159	68	27	132	11	15	138	88
50-59	325 (21%)	165	94	164	89	87	70	14	135	4	15	126	56
60-69	171 (11%)	86	38	84	45	44	39	4	72	6	6	57	42

70+	26 (2%)	17	9	17	11	10	9	1	5	1	0	9	7

3. Research career stage

Research career stage	Global (n=1528)	LMIC (n= 981)	L&L-MICs (n=694))	DAC countries (n=973)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Infectious disease control expert (n=499)	Experience in policy advice (n=287)
PhD, medical or other student or earlier	310 (20%)	244	200	241	161	158	54	25	53	8	12	96	53
Post-doctoral researcher	181 (12%)	109	78	107	83	82	14	7	67	4	7	64	24
Research leader	538 (35%)	282	167	277	163	158	86	33	234	13	14	216	112
Member of a research team	322 (21%)	238	170	240	153	151	85	14	50	5	17	83	60
Other	177 (12%)	108	79	108	63	63	40	8	56	2	8	40	38

4. Research experience

Research experience	Global (n=1528)	LMIC (n= 981)	L&L-MICs (n=694))	DAC countries (n=973)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Infectious disease control expert (n=499)
Biomedical / laboratory sciences	517 (34%)	321	227	319	219	211	83	24	169	14	14	242
Clinical or epidemiological sciences	725 (47%)	515	396	508	307	302	168	49	154	17	35	287
Social and behavioural sciences	435 (28%)	290	212	288	202	200	71	23	111	9	21	100
Policy advice (i.e. if you either advise on or are responsible for health/research strategy)	287 (19%)	209	121	210	137	134	60	18	49	6	20	108
Other	234 (15%)	122	78	122	86	85	26	9	105	4	5	37

5. Expertise in disease control

Expertise in disease control	Global (n=1528)	LMIC (n= 981)	L&L-MICs (n=694)	DAC countries (n=973)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Experience in policy advice (n=287)
Having an expert professional interest	499 (33%)	565	264	559	358	353	169	41	253	19	41	157
Having a general professional interest	876 (57%)	359	393	359	225	219	99	43	115	12	11	108
Neither of the above	153 (10%)	57	37	55	40	40	11	3	92	1	6	22

6. Organization or healthcare work setting

	Global (n=1528)	LMIC (n=981)	L&L-MICs (n=694)	DAC countries (n=973)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Infectious disease control expert (n=499)	Experience in policy advice (n=287)
Academia (university, college,..)	769 (50%)	400	263	399	261	257	101	37	332	17	25	254	118
Commercial Research Organisation	22 (1%)	14	9	13	8	8	5	1	7	1	0	7	4

Community Health Centre/Facility	29 (2%)	25	22	25	17	17	6	3	3	0	0	6	4
Consultancy	24 (2%)	17	14	18	12	12	6	1	4	0	1	6	7
Government Ministry	43 (3%)	39	29	40	23	21	11	6	2	2	1	16	22
Government research organisation	87 (6%)	77	54	77	55	53	21	2	7	2	2	38	16
Hospital (Private)	67 (4%)	50	38	49	23	23	16	11	15	2	0	15	6
Hospital (Public)	161 (10%)	103	62	96	53	50	39	2	54	4	12	50	16
Industry (including Pharma)	11 (1%)	7	6	7	3	3	2	3	3	0	0	5	1
International organisation (IGO)	38 (2%)	26	25	26	19	19	7	5	6	0	1	17	18
Journal / Publishing company	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-government organisation (NGO)	132 (9%)	108	94	108	85	85	17	9	10	1	10	37	41
Public Health institute	48 (3%)	40	21	40	21	21	19	0	6	1	1	24	12
Regulatory organisation	4 (1%)	4	2	4	2	2	1	0	0	0	1	0	1

Other research organisation	38 (2%)	33	25	33	21	21	10	3	2	0	2	11	11
Self-employed	11 (1%)	6	6	6	4	4	2	0	3	0	2	4	2
Unemployed	17 (1%)	14	12	14	9	9	5	1	1	1	0	3	3
Other	27 (2%)	18	12	18	7	7	11	3	5	1	0	6	5

7. Country of work

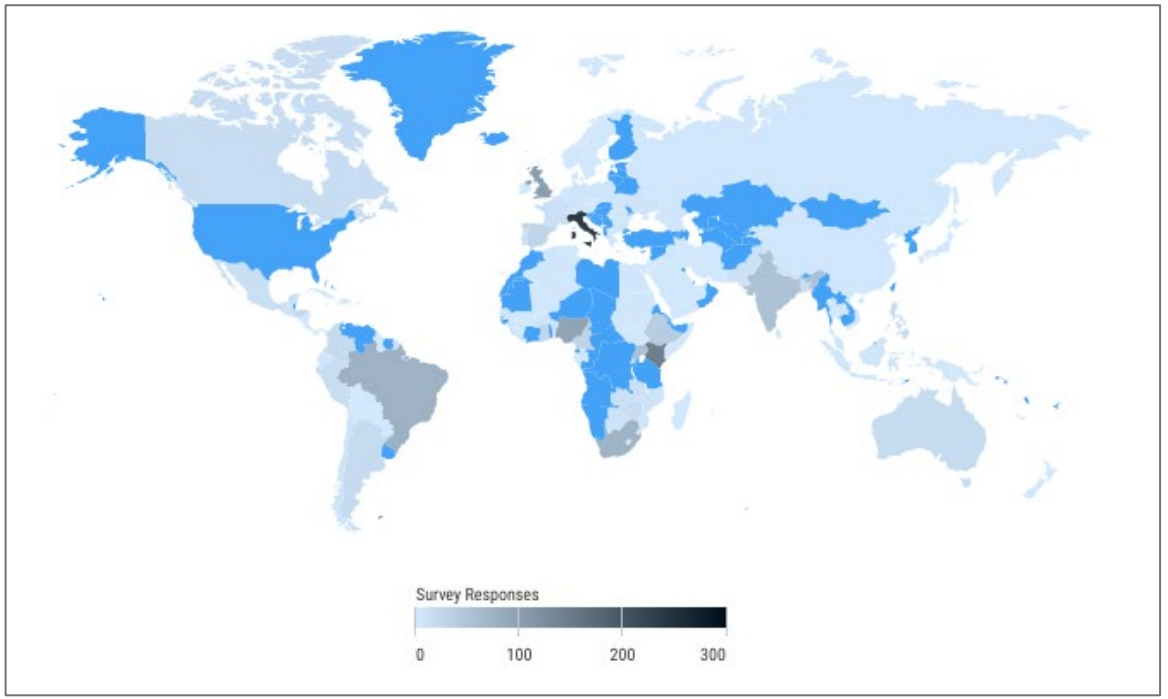
Country	Total
AE - United Arab Emirates	1
AR - Argentina	19
AT - Austria	2
AU - Australia	18
BD - Bangladesh	12
BE - Belgium	5
BF - Burkina Faso	6
BG - Bulgaria	5
BJ - Benin	4
BM - Bermuda	1
BO - Bolivia	2
BR - Brazil	75
BW - Botswana	7
CA - Canada	16
CD - Congo, Democratic Republic of the	9
CG - Congo, Republic of the	1
CH - Switzerland	7

CI - Cote d'Ivoire	9
CL - Chile	7
CM - Cameroon	27
CN - China	3
CO - Colombia	19
CR - Costa Rica	1
CU - Cuba	1
CZ - Czech Republic	2
DE - Germany	6
DK - Denmark	1
DO - Dominican Republic	7
DZ - Algeria	3
EC - Ecuador	4
EG - Egypt	3
ES - Spain	27
ET - Ethiopia	39
FR - France	12
FX - France, Metropolitan	1
GA - Gabon	2
GB - United Kingdom	102
GE - Georgia	1
GH - Ghana	24
GM - Gambia, The	5
GN - Guinea	1
GR - Greece	6
GT - Guatemala	7
GY - Guyana	1
HN - Honduras	25
HT - Haiti	1

ID - Indonesia	4
IE - Ireland	1
IL - Israel	2
IN - India	54
IQ - Iraq	1
IR - Iran	1
IT - Italy	240
JE - Jersey	1
JM - Jamaica	3
JO - Jordan	1
JP - Japan	1
KE - Kenya	144
KG - Kyrgyzstan	1
KR - Korea, South	2
LB - Lebanon	2
LK - Sri Lanka	3
LR - Liberia	6
LS - Lesotho	1
LU - Luxembourg	1
ME - Montenegro	1
MG - Madagascar	1
MK - Macedonia	1
ML - Mali	2
MM - Burma	3
MW - Malawi	18
MX - Mexico	13
MY - Malaysia	8
MZ - Mozambique	6
NG - Nigeria	93

NI - Nicaragua	1
NL - Netherlands	3
NO - Norway	1
NP - Nepal	8
NZ - New Zealand	1
PA - Panama	3
PE - Peru	15
PG - Papua New Guinea	2
PH - Philippines	20
PK - Pakistan	9
PL - Poland	5
PR - Puerto Rico	1
PS - West Bank	1
PT - Portugal	12
PY - Paraguay	2
RO - Romania	3
RS - Serbia	1
RU - Russia	3
RW - Rwanda	8
SA - Saudi Arabia	2
SD - Sudan	3
SE - Sweden	2
SG - Singapore	1
SL - Sierra Leone	6
SM - San Marino	1
SN - Senegal	4
SO - Somalia	3
SS - South Sudan	2
SV - El Salvador	2

SZ - Swaziland	3
TH - Thailand	1
TN - Tunisia	2
TT - Trinidad and Tobago	1
TZ - Tanzania	24
UA - Ukraine	6
UG - Uganda	56
US - United States	52
VN - Vietnam	4
YE - Yemen	1
ZA - South Africa	73
ZM - Zambia	12
ZW - Zimbabwe	16



Map - Global distribution of survey responses

IMMEDIATE AND LONGER-TERM RESEARCH PRIORITIES ANALYSIS

Results from the second and third survey section are reported together. In the second survey section participants were asked to consider what are the immediate priorities that can bring immediate impact during the active phase of the pandemic in their country. Within each research topic, they were asked to select up to three of the listed priorities and then rank these with 1 = most important, 2 = second most important and 3 = third most important. Participants could choose less than three items if they felt that the alternatives were not priorities for their country. In the second section, we asked participants to do the same exercise, but this time please considering the longer-term research priorities necessary to build the research capacity in their country to deal with future pandemics of either COVID-19 or other pathogens.

Top priorities have been colour-coded following the table below to ease interpretation.

Priority 1
Priority 2
Priority 3

Midterm and long-term priorities as listed in pages 15-16 in the **WHO COVID-19 Research roadmap** (1) are marked in **bold**. file:///C:/Users/adlhg/Downloads/coordinated-global-research-roadmap%20(1).pdf

See Appendix 2 for a summary of the top three priorities for global and low resource settings for each theme.

Immediate	Global n=1528	LMIC (n=981)	L&L-MICs (n=694)	DAC countries (n=973)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Infectious disease control expert (n=499)	Experience in policy advice (n=287)
1. Support development of diagnostics products to improve clinical processes.	**2041**	**1368**	**998**	**1356**	892	872	359	126	575	46	63	642	317
2. Support work to develop cheaper, faster easier to use in field antigen tests (for virus detection)	2059	1354	963	1343	898	876	348	123	574	50	88	638	**391**
3. Support work to develop cheaper, faster easier to use in field antibody test tests (for determining exposure).	1317	838	555	831	508	502	277	72	398	23	45	421	277
4. Support work to examine alternative approaches to delivering testing (e.g. centralised versus devolved lab facilities).	766	590	446	590	428	422	129	32	130	19	34	227	181
5. Understand virus compartments,	639	375	259	370	182	180	163	45	212	11	28	242	105

shedding and natural history of disease.													
6. Develop tools and conduct studies to monitor phenotypic change and potential adaptation of the virus.	434	245	183	244	165	163	60	16	167	10	18	138	81
7. Characterize immunity (naturally acquired, population and vaccine-induced, including mucosal immunity).	490	438	268	434	224	222	182	48	392	11	37	327	168
8. Develop disease models in animals	114	77	50	77	40	40	26	9	29	2	8	51	22
9. Determine Virus stability in the environment.	334	205	144	203	123	122	55	18	123	5	11	106	77
10. Establish capacity for genotyping virus e.g. to detect new mutations over time	303	214	154	210	137	137	48	20	78	10	10	112	57

Longer-term	Global (n=1528)	LMIC (n=981)	L&L-MICs (n=694)	DAC countries (n=973)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Infectious disease control expert (n=499)	Experience in policy advice (n=287)
1. Support development of diagnostics products to improve clinical processes.	**1457**	**988**	**755**	**979**	**643**	**632**	**226**	**103**	**413**	**37**	**46**	**493**	**250**
2. Support work to develop cheaper, faster easier to use in field antigen tests (for virus detection)	1171	793	611	785	527	513	204	85	290	36	43	361	202
3. Support work to develop cheaper, faster easier to use in field antibody test tests (for determining exposure).	999	663	470	655	412	411	174	59	300	20	35	323	220
4. Support work to examine alternative approaches to delivering testing (e.g. centralised versus devolved lab facilities).	809	571	429	568	392	386	133	48	189	19	34	266	184
5. Understand virus compartments, shedding and natural history of disease.	839	507	341	504	317	309	187	37	261	17	28	285	138
6. D403evelop tools and conduct studies to monitor phenotypic	946	580	394	571	365	362	158	52	321	10	43	287	159

change and potential adaptation of the virus.													
7. Characterize immunity (naturally acquired, population and vaccine-induced, including mucosal immunity).	1119	675	403	672	389	379	263	52	360	20	45	394	207
8. Develop disease models in animals	269	161	102	158	95	95	53	12	93	3	13	99	41
9. Determine Virus stability in the environment.	497	300	192	297	181	177	93	22	174	15	16	140	121
10. Establish capacity for genotyping virus e.g. to detect new mutations over time	645	401	270	400	250	247	125	33	203	9	28	204	128

ANIMAL AND ENVIRONMENTAL RESEARCH ON THE VIRUS ORIGIN, AND MANAGEMENT MEASURES AT THE HUMAN-ANIMAL INTERFACE

Immediate	**Global (n=1528)**	**LMIC (n=981)**	**L&L-MICs (n=694)**	**DAC countries (n=973)**	**Africa (AAS) (n=632)**	**WHO Africa (n=612)**	**WHO Americas (n=279)**	**WHO SE Asia (n=87)**	**WHO Europe (n=460)**	**WHO Eastern Mediterranean (n=32)**	**WHO Western Pacific (n=58)**	**Infectious disease control expert (n=499)**	**Experience in policy advice (n=287)**
1. Identify animal source and route of transmission (hosts, any evidence of continued spill-over to humans and transmission	2305	1415	1042	1401	939	920	367	121	**770**	41	86	739	362

between animals and humans).													
2. Improve understanding of socioeconomic and behavioural risk factors for spill-over and transmission between animals and humans	**2552**	**1699**	**1182**	**1690**	**1053**	**1037**	**503**	**147**	**699**	**57**	**109**	**812**	**510**
3. Environmental studies of SARS-Cov-2 including waste and sewage management practices	1716	1174	823	1162	714	698	343	118	445	47	65	588	347
4. Design and test suitable risk reduction strategies at the human-animal-environment interface	1991	1220	869	1207	775	763	354	115	648	37	74	641	391

Longer-term	**Global (n=1528)**	**LMIC (n=981)**	**L&LMICs (n=694)**	**DAC countries (n=973)**	**Africa (AAS) (n=632)**	**WHO Africa (n=612)**	**WHO Americas (n=279)**	**WHO SE Asia (n=87)**	**WHO Europe (n=460)**	**WHO Eastern Mediterranean (n=32)**	**WHO Western Pacific (n=58)**	**Infectious disease control expert (n=499)**	**Experience in policy advice (n=287)**
1. Identify animal source and route of transmission (hosts, any evidence of continued spill-over to humans and transmission	2432	1533	1142	1520	1008	993	386	158	766	47	82	799	438

between animals and humans).													
2. Improve understanding of socioeconomic and behavioural risk factors for	2454	1574	1071	1564	992	977	473	132	725	52	95	801	499
3. Environmental studies of SARS-Cov-2 including waste and sewage management practices	1647	1148	805	1132	710	695	328	101	418	44	61	552	315
4. Design and test suitable risk reduction strategies at the human-animal-environment interface	1860	1185	813	1175	737	723	355	109	558	36	79	588	338

Immediate	Global (n=1528)	LMIC (n=981)	L&L-MICs (n=694)	DAC countries (n=973)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Infectious disease control expert (n=499)	Experience in policy advice (n=287)
1. Describe transmission dynamics of COVID-19 and understand spread of disease nationally, regionally and globally.	2188	1379	998	1370	859	847	381	139	686	54	81	702	353
2. Establish suitable cohorts and prospectively collect longitudinal laboratory and outcome data.	879	575	401	569	337	320	179	55	262	26	36	323	180
3. Perform rapid population cross sectional surveys to establish extent of virus transmission using standardised sampling framework	1137	774	604	764	534	524	172	66	311	26	38	353	218
4. Use m-Health technology and GIS mapping to characterise disease spread patterns	677	490	344	488	284	283	164	53	150	11	16	227	164
5. Describe disease severity and susceptibility to facilitate effective clinical and public health response to COVID-19 –	1581	992	682	980	635	619	269	91	501	35	66	513	256

identify groups at high risk of severe infection													
6. Have a special focus on potentially at risk groups including malnourished individuals and people with HIV, TB Sickle Cell	672	533	374	532	390	389	91	44	107	13	28	229	136
7. Evaluate impact of control and mitigation measures e.g. modelling to estimate the effects of social distancing measures and other non-pharmaceutical interventions.	1001	562	356	558	326	321	250	32	332	14	52	320	236
8. Identify resilient populations and better understand the protective determinants	735	390	251	386	232	231	131	29	310	10	24	231	132

Longer-term	**Global (n=1528)**	**LMIC (n=981)**	**L&L-MICs (n=694)**	**DAC countries (n=973)**	**Africa (AAS) (n=632)**	**WHO Africa (n=612)**	**WHO Americas (n=279)**	**WHO SE Asia (n=87)**	**WHO Europe (n=460)**	**WHO Eastern Mediterranean (n=32)**	**WHO Western Pacific (n=58)**	**Infectious disease control expert (n=499)**	**Experience in policy advice (n=287)**
1. Describe transmission dynamics of COVID-19 and understand spread of disease	1965	1271	930	1261	827	813	328	110	597	48	69	657	381

nationally, regionally and globally.													
2. Establish suitable cohorts and prospectively collect longitudinal laboratory and outcome data.	1329	909	627	894	539	524	284	87	350	28	56	479	255
3. Perform rapid population cross sectional surveys to establish extent of virus transmission using standardised sampling framework	938	645	500	640	410	400	134	72	266	31	35	254	183
4. Use m-Health technology and GIS mapping to characterise disease spread patterns	916	627	454	627	405	401	174	48	236	13	44	319	190
5. Describe disease severity and susceptibility to facilitate effective clinical and public health response to COVID-19 – identify groups at high risk of severe infection	1106	709	489	699	432	425	239	65	314	25	38	362	198
6. Have a special focus on potentially at risk groups including malnourished	730	519	346	516	357	356	114	44	180	8	28	228	123

individuals and people with HIV, TB Sickle Cell													
7. Evaluate impact of control and mitigation measures e.g. modelling to estimate the effects of social distancing measures and other non-pharmaceutical interventions.	899	496	318	488	282	277	194	45	323	16	44	280	177
8. Identify resilient populations and better understand the protective determinants	790	433	289	431	291	288	129	33	303	13	24	259	143

CLINICAL MANAGEMENT

Immediate	**Global (n=1528)**	**LMIC (n=981)**	**L&L-MICs (n=694)**	**DAC countries (n=973)**	**Africa (AAS) (n=632)**	**WHO Africa (n=612)**	**WHO Americas (n=279)**	**WHO SE Asia (n=87)**	**WHO Europe (n=460)**	**WHO Eastern Mediterranean (n=32)**	**WHO Western Pacific (n=58)**	**Infectious disease control expert (n=499)**	**Experience in policy advice (n=287)**
1. Define the natural history of COVID-19 infection though careful standardised and comprehensive clinical and	1063	726	569	718	478	471	156	81	294	26	35	362	185

laboratory description of cases													
2. Identify prognostic factors for severe disease	1086	626	439	623	386	375	185	65	406	28	27	394	183
3. Determine interventions that improve the clinical outcome of COVID-19 infected patients	**2017**	**1291**	**930**	**1285**	**844**	**824**	**408**	**105**	**561**	**47**	72	**663**	**358**
4. Determine optimal clinical practice strategies to improve the processes of care (e.g. develop criteria for early diagnosis, when to discharge, when to use adjuvant therapies for patients and contacts).	1508	936	644	924	517	506	313	81	502	30	**76**	462	264
5. Develop clinical management protocols for dual infections e.g. COVID patients with HIV, TB or other common infections	731	610	438	605	440	440	100	37	100	14	40	259	145
6. Develop protocols for management of severe disease in	1111	742	501	733	464	456	203	69	324	15	44	358	224

the absence of intensive care facilities.													
7. Develop innovative approaches for respiratory support as alternatives to ventilation	530	324	203	315	183	181	102	41	169	13	24	162	109
8. Determine how best to link key research questions with researchers in affected regions who are able to recruit patients.	237	158	116	158	118	117	39	9	61	5	6	58	63
9. Develop platform(s) to maximize commonality of data collection across trials, and collaborations between trials.	539	253	153	255	141	138	123	23	225	11	19	164	118

Longer-term	**Global (n=1528)**	**LMIC (n=981)**	**L&L-MICs (n=694)**	**DAC countries (n=973)**	**Africa (AAS) (n=632)**	**WHO Africa (n=612)**	**WHO Americas (n=279)**	**WHO SE Asia (n=87)**	**WHO Europe (n=460)**	**WHO Eastern Mediterranean (n=32)**	**WHO Western Pacific (n=58)**	**Infectious disease control expert (n=499)**	**Experience in policy advice (n=287)**
1. Define the natural history of COVID-19	1476	928	699	921	578	568	251	**93**	**477**	**40**	47	**491**	**277**

infection though careful standardised and comprehensive clinical and laboratory description of cases													
2. Identify prognostic factors for severe disease	1184	752	533	750	465	456	216	65	380	27	40	407	186
3. Determine interventions that improve the clinical outcome of COVID-19 infected patients	1357	903	641	893	**586**	**582**	257	81	370	12	**55**	411	260
4. Determine optimal clinical practice strategies to improve the processes of care (e.g. develop criteria for early diagnosis, when to discharge, when to use adjuvant therapies for patients and contacts).	1313	811	573	801	505	497	**272**	67	413	22	42	387	255
5. Develop clinical management protocols for dual infections e.g. COVID patients with HIV, TB or other common infections	888	681	510	678	436	427	166	72	174	28	21	336	173
6. Develop protocols for management of severe disease in the absence of intensive care facilities.	794	516	343	510	327	319	134	45	234	21	41	251	162
7. Develop innovative approaches for respiratory	593	389	259	379	236	233	106	50	162	10	32	174	127

support as alternatives to ventilation													
8. Determine how best to link key research questions with researchers in affected regions who are able to recruit patients.	438	288	190	284	191	185	88	13	122	14	16	168	97
9. Develop platform(s) to maximize commonality of data collection across trials, and collaborations between trials.	671	379	231	377	241	239	118	26	240	9	39	226	112

INFECTION PREVENTION AND CONTROL, INCLUDING HEALTH CARE WORKERS' PROTECTION.

Immediate	**Global (n=1528)**	**LMIC (n=981)**	**L&L-MICs (n=694)**	**DAC countries (n=973)**	**Africa (AAS) (n=632)**	**WHO Africa (n=612)**	**WHO Americas (n=279)**	**WHO SE Asia (n=87)**	**WHO Europe (n=460)**	**WHO Eastern Mediterranean (n=32)**	**WHO Western Pacific (n=58)**	**Infectious disease control expert (n=499)**	**Experience in policy advice (n=287)**
1. Understand the effectiveness of movement control strategies to prevent secondary transmission in health care and community settings	**1817**	**1110**	**831**	**1101**	**727**	**715**	278	**110**	**606**	36	**72**	**586**	**280**
2. Optimize the effectiveness of PPE and its use in reducing the risk of	1680	1033	**729**	1024	638	625	**329**	88	538	**40**	60	548	271

transmission in health care and community settings.													
3. Develop new PPE approaches using local materials and manufacturing processes	1366	942	677	938	601	596	267	98	329	21	55	458	263
4. Understand behavioural and cultural factors influencing compliance with evidence-based IPC measures.	1017	711	495	707	482	471	188	40	256	34	28	332	218
5. Research into water sanitation and hygiene practices in communities during the outbreak	551	396	296	397	274	271	81	37	131	11	20	197	136
6. Research to support health systems strengthening and building of resilience post the outbreak	1060	687	457	678	434	424	219	44	305	28	40	368	257
7. Develop architectural designs for isolation and quarantine facilities that can be constructed using local materials and expertise within short time periods	510	285	195	274	153	150	85	41	202	8	24	161	93

8. Mental health support for frontline healthcare workers	849	529	317	526	283	278	191	50	275	10	45	255	151

Longer-term	Global (n=1528)	LMIC (n=981)	L&L-MICs (n=694)	DAC countries (n=973)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Infectious disease control expert (n=499)	Experience in policy advice (n=287)
1. Understand the effectiveness of movement control strategies to prevent secondary transmission in health care and community settings	**1879**	**1199**	**874**	**1182**	**791**	**777**	**306**	**97**	**591**	**44**	**64**	**582**	**321**
2. Optimize the effectiveness of PPE and its use in reducing the risk of transmission in health care and community settings.	1277	869	617	855	534	530	239	89	337	20	62	421	219
3. Develop new PPE approaches using local materials and manufacturing processes	1145	810	583	808	498	491	239	87	263	23	42	415	230
4. Understand behavioural and cultural factors influencing compliance with evidence-based IPC measures.	1150	745	533	733	494	481	204	57	341	29	38	354	227

5. Research into water sanitation and hygiene practices in communities during the outbreak	635	422	299	421	270	267	131	40	164	12	21	231	141
6. Research to support health systems strengthening and building of resilience post the outbreak	1308	791	532	794	484	471	257	60	425	32	63	443	249
7. Develop architectural designs for isolation and quarantine facilities that can be constructed using local materials and expertise within short time periods	616	387	278	380	245	242	95	47	202	11	19	220	136
8. Mental health support for frontline healthcare workers	673	393	236	392	231	229	135	34	235	12	28	175	122

CANDIDATE THERAPEUTICS RESEARCH & DEVELOPMENT

Immediate	**Global (n=1528)**	**LMIC (n=981)**	**L&L-MICs (n=694)**	**DAC countries (n=973)**	**Africa (AAS) (n=632)**	**WHO Africa (n=612)**	**WHO Americas (n=279)**	**WHO SE Asia (n=87)**	**WHO Europe (n=460)**	**WHO Eastern Mediterranean (n=32)**	**WHO Western Pacific (n=58)**	**Infectious disease control expert (n=499)**	**Experience in policy advice (n=287)**
1. Identification of existing candidates for clinical evaluation in addition to the ones already prioritized.	1766	1117	818	1104	746	726	269	104	550	40	77	609	284

2. Support basic science to identify new drug targets	1767	1109	760	1086	703	693	299	98	586	43	48	574	279
3. Identification of candidates from traditional medicine for clinical assessment	1134	887	722	882	655	643	145	79	202	23	42	412	214
4. Investigations on convalescent anti serum potency as a therapeutic option	956	590	390	587	269	263	229	91	308	13	52	311	198
5. Develop a Multicentre Master Protocol to evaluate efficacy and safety.	1193	757	515	754	455	451	237	59	345	24	41	404	269
6. Develop mechanisms to support coordinated collaboration to implement clinical trials for evaluation of safety/efficacy of therapeutics.	1825	1127	737	1119	690	683	382	77	571	37	75	537	387

Longer-term	Global (n=1528)	LMIC (n=981)	L&L-MICs (n=694)	DAC countries (n=973)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Infectious disease control expert (n=499)	Experience in policy advice (n=287)
1. Identification of existing candidates for clinical evaluation in addition to the ones already prioritized.	1438	959	723	948	640	630	210	95	423	31	49	500	256
2. Support basic science to identify new drug targets	2167	1293	852	1279	807	790	408	112	746	49	62	**705**	**405**
3. Identification of candidates from traditional medicine for clinical assessment	997	740	571	734	500	496	161	84	211	17	28	365	210
4. Investigations on convalescent anti serum potency as a therapeutic option	1008	647	453	634	392	386	198	47	317	23	37	312	141
5. Develop a Multicentre Master Protocol to evaluate efficacy and safety.	1300	864	600	860	477	464	286	96	351	30	73	404	285
6. Develop mechanisms to support coordinated collaboration to	1548	992	672	986	644	636	297	72	437	28	78	486	304

implement clinical trials for evaluation of safety/efficacy of therapeutics.													

CANDIDATE VACCINES RESEARCH & DEVELOPMENT

Immediate	**Global (n=1528)**	**LMIC (n=981)**	**L&L-MICs (n=694)**	**DAC countries (n=973)**	**Africa (AAS) (n=632)**	**WHO Africa (n=612)**	**WHO Americas (n=279)**	**WHO SE Asia (n=87)**	**WHO Europe (n=460)**	**WHO Eastern Mediterranean (n=32)**	**WHO Western Pacific (n=58)**	**Infectious disease control expert (n=499)**	**Experience in policy advice (n=287)**
1. Identification of candidates for clinical evaluation in addition to the ones already prioritized.	2181	1393	1022	1381	937	918	337	125	659	48	94	730	366
2. Capacity development for basic science and pre-clinical development of new vaccines	2267	1459	1058	1450	963	956	375	133	688	45	70	730	392
3. Develop a multi-country Master Protocol for Phase 2b/Phase 3 vaccine evaluation to determine whether candidate vaccines are safe and effective before widespread distribution.	2623	1601	1048	1578	922	906	568	148	852	49	100	852	531

4. Identify correlation and protection from EPI and other vaccines e.g. BCG	1407	1038	739	1032	629	615	288	103	302	35	64	462	330

Longer-term	Global (n=1528)	LMIC (n=981)	L&L-MICs (n=694)	DAC countries (n=973)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Infectious disease control expert (n=499)	Experience in policy advice (n=287)
1. Identification of candidates for clinical evaluation in addition to the ones already prioritized.	1925	1232	893	1218	798	781	308	103	607	55	71	663	349
2. Capacity development for basic science and pre-clinical development of new vaccines	2703	1682	1196	1670	1092	1076	477	167	835	59	89	892	496
3. Develop a multi-country Master Protocol for Phase 2b/Phase 3 vaccine evaluation to determine whether candidate vaccines are safe and effective before widespread distribution.	2191	1431	964	1411	844	829	453	130	630	42	107	684	424
4. Identify correlation and protection from EPI and other vaccines e.g. BCG	1398	999	717	991	632	623	276	90	330	20	59	433	288

Immediate	Global (n=1528)	LMIC (n=981)	L&L-MICs (n=694)	DAC countries (n=973)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Infectious disease control expert (n=499)	Experience in policy advice (n=287)
1. Identify key knowledge gaps and research priorities in relation to ethical issues arising out of proposed restrictive public health measures (e.g., quarantine, isolation, cordon sanitaire).	2153	1517	1157	1499	1044	1032	321	138	555	43	64	712	355
2. Define a research governance framework that enables effective and ethical collaboration between multiple stakeholders, including WHO, the global research community, subject matter experts, public health officials, funders, and ethicists.	1950	1241	894	1239	771	756	372	126	561	48	87	644	404
3. Investigate models for deferred consent during emergency research	619	439	299	436	244	236	145	44	145	18	31	240	121
4. Establish processes for speeding up ethical review	1175	768	561	765	475	468	230	84	324	24	45	387	220

of COVID-19 related research proposals													
5. Establish a panel of trans-national ethicists to provide rapid support to local ethical committees assessing COVID-19 related research proposals	749	467	304	458	263	260	172	43	227	14	33	234	156
6. Accelerated regulatory support for new intervention candidates	526	291	190	289	186	182	104	23	187	10	20	183	120
7. Sustained education, access, and capacity building to facilitate effective cross-working and collaboration across the research thematic areas.	855	515	321	510	330	321	153	26	303	19	33	263	166
8. Accelerated dissemination of results through pre-print media	325	159	108	151	101	100	39	13	162	6	5	72	59
9. ERCs ensure a continued legacy of cross-disciplinary and collaborative work after this outbreak with capacity building measures built into protocols	370	226	128	225	121	121	83	15	128	3	20	118	56

Longer-term	Global (n=1528)	LMIC (n=981)	L&L-MICs (n=694)	DAC countries (n=973)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Infectious disease control expert (n=499)	Experience in policy advice (n=287)
1. Identify key knowledge gaps and research priorities in relation to ethical issues arising out of proposed restrictive public health measures (e.g., quarantine, isolation, cordon sanitaire).	2036	1360	998	1352	897	880	370	109	564	48	65	643	399
2. Define a research governance framework that enables effective and ethical collaboration between multiple stakeholders, including WHO, the global research community, subject matter experts, public health officials, funders, and ethicists.	1906	1250	898	1241	799	783	339	**119**	538	43	84	649	372
3. Investigate models for deferred consent during emergency research	659	435	329	429	262	256	121	49	199	17	17	222	132
4. Establish processes for speeding up ethical review of COVID-19 related research proposals	666	470	326	463	270	265	151	53	159	13	25	248	138

5. Establish a panel of trans-national ethicists to provide rapid support to local ethical committees assessing COVID-19 related research proposals	745	480	340	479	312	308	115	49	218	12	43	234	137
6. Accelerated regulatory support for new intervention candidates	523	346	222	337	204	201	108	46	147	7	14	191	111
7. Sustained education, access, and capacity building to facilitate effective cross-working and collaboration across the research thematic areas.	1144	721	468	713	464	464	210	44	358	17	50	355	214
8. Accelerated dissemination of results through pre-print media	298	175	117	169	97	93	58	15	108	11	13	72	40
9. ERCs ensure a continued legacy of cross-disciplinary and collaborative work after this outbreak with capacity building measures built into protocols	529	307	201	307	183	181	121	15	177	9	26	168	99

Immediate	Global (n=1528)	LMIC (n=981)	L&L-MICs (n=694)	DAC countries (n=973)	Africa (AAS) (n=632)	WHO Africa (n=612)	WHO Americas (n=279)	WHO SE Asia (n=87)	WHO Europe (n=460)	WHO Eastern Mediterranean (n=32)	WHO Western Pacific (n=58)	Infectious disease control expert (n=499)	Experience in policy advice (n=287)
1. Promote the prioritization of knowledge needs according to epidemic dynamics.	914	687	560	678	482	473	128	68	202	23	20	326	115
2. Ensure that knowledge is produced according to local, national and regional needs.	1146	891	662	885	588	570	209	62	213	49	43	374	248
3. Examine optimal ways of communicating about potential interventions in high density low socioeconomic statu urban settings	1029	740	513	727	488	479	195	70	219	22	44	339	224
4. Investigate ways of ensuring transparency of information flow and mitigating false information spread by various mechanisms	1189	661	458	661	396	390	248	58	438	18	37	369	204
5. Investigate psychosocial issues around discrimination of persons with COVID-19 and their	789	575	442	574	379	375	125	65	175	18	31	240	139

relatives or contact persons													
6. Ensure that that knowledge outputs and methodological limitations are easily understood by non-social scientists.	399	193	128	191	115	114	65	17	182	2	19	113	61
7. Investigate innovate approaches to short term economic support of vulnerable populations such as cash transfer by mobile money mechanism.	540	356	221	349	216	215	109	40	151	7	18	166	119
8. Studies of Leadership and decision strategies in response to the COVID Pandemic.	313	186	123	183	85	83	62	25	107	15	21	112	73
9. Develop and employ strong methodologies and theoretical frameworks to tackle current epidemic challenges.	243	146	100	143	88	88	49	14	81	0	11	69	33
10. Develop innovative interdisciplinary science	348	152	94	153	97	97	49	13	175	2	12	110	51
11. Develop guidelines and Standard Operating Procedures (SOPs) to operationalize epidemic mitigation mechanisms.	420	244	177	244	135	135	86	27	143	0	29	138	82
12. Develop and connect global research networks with response partners.	227	130	66	129	55	53	63	11	75	11	14	99	45

13. Engage with communities to bring their voices to decision-making processes	369	233	168	233	170	170	59	13	106	3	18	121	108
14. Support work to understand non-intended consequences of epidemic-control decisions.	225	99	54	95	62	62	49	6	99	4	5	78	56
15. Support work to understand contextual vulnerability.	127	77	48	77	44	44	28	6	43	0	6	42	21
16. Understand how decisions in the field may inadvertently undermine response goals.	84	44	31	43	25	22	14	4	39	5	0	26	19
17. Understand how social and economic impacts need to be mitigated.	479	273	154	273	167	163	94	11	188	6	17	170	91

Longer-term	**Global (n=1528)**	**LMIC (n=981)**	**L&L-MICs (n=694)**	**DAC countries (n=973)**	**Africa (AAS) (n=632)**	**WHO Africa (n=612)**	**WHO Americas (n=279)**	**WHO SE Asia (n=87)**	**WHO Europe (n=460)**	**WHO Eastern Mediterranean (n=32)**	**WHO Western Pacific (n=58)**	**Infectious disease control expert (n=499)**	**Experience in policy advice (n=287)**
1. Promote the prioritization of knowledge needs according to epidemic dynamics.	1216	823	620	805	525	515	191	82	360	27	41	445	224
2. Ensure that knowledge is produced according to	1235	879	637	872	567	559	267	57	280	33	39	418	263

local, national and regional needs.													
3. Examine optimal ways of communicating about potential interventions in high density low socioeconomic status urban settings	1009	724	526	721	467	449	197	56	231	42	34	348	193
4. Investigate ways of ensuring transparency of information flow and mitigating false information spread by various mechanisms	952	551	408	552	375	367	170	48	322	16	29	322	155
5. Investigate psychosocial issues around discrimination of persons with COVID-19 and their relatives or contact persons	723	506	386	500	342	338	111	50	193	12	19	223	150
6. Ensure that that knowledge outputs and methodological limitations are easily understood by non-social scientists.	541	348	220	348	201	197	103	42	165	12	22	158	80
7. Investigate innovate approaches to short term economic support of vulnerable populations such as cash transfer by mobile money mechanism.	449	316	223	317	194	194	89	39	104	8	15	161	100
8. Studies of Leadership and decision strategies in	464	273	198	270	162	160	85	26	154	7	32	130	98

response to the COVID Pandemic.													
9. Develop and employ strong methodologies and theoretical frameworks to tackle current epidemic challenges.	285	185	110	179	107	106	57	11	93	4	14	87	34
10. Develop innovative interdisciplinary science	327	170	94	169	105	105	44	17	148	1	12	127	57
11. Develop guidelines and Standard Operating Procedures (SOPs) to operationalize epidemic mitigation mechanisms.	300	174	120	173	99	99	62	17	108	0	14	71	50
12. Develop and connect global research networks with response partners.	199	109	70	108	57	57	52	11	71	0	8	70	36
13. Engage with communities to bring their voices to decision-making processes	209	144	97	144	97	96	30	9	53	3	18	66	48
14. Support work to understand non-intended consequences of epidemic-control decisions.	203	109	62	105	78	78	26	7	77	3	12	54	45
15. Support work to understand contextual vulnerability.	143	79	44	74	46	46	20	9	64	0	4	40	28
16. Understand how decisions in the field may	94	48	21	47	27	27	25	5	34	3	0	33	18

inadvertently undermine response goals.													
17. Understand how social and economic impacts need to be mitigated.	348	175	106	175	98	95	71	15	135	9	23	93	84

QUALITATIVE DATA

The survey collected a total of 1291 free-text entries from 1528 respondents. The following table shows the distribution of responses by survey language.

Survey language n= 1528	**Immediate priorities comments**	**Longer-term priorities comments**
English (n=1324)	854	350
French (n=30)	46	4
Spanish (n=115)	22	1
Portuguese (n=59)	13	1

A total of 97 participants joined the workshop via Zoom and the session had over 1000 views through live streaming via the TGHN Facebook page, spanning over 38 countries in Latin America and the Caribbean, Middle East, Africa, Asia, Australia, Europe and North America.

NEW RESEARCH PRIORITIES

2019 NOVEL CORONAVIRUS – Survey and Workshop results		
WHO & AAS	**New Immediate priorities**	**New Longer-term Priorities**
Virus natural history, transmission and diagnostics		Ensure effective measures including community surveillance are in place to rapidly identify emerging zoonotic diseases by developing animal screening techniques

Epidemiological studies	Examine relationships to other lung diseases e.g. Tuberculosis, Lung Cancer, Sarcoidosis, Idiopathic Pulmonary Fibrosis	Research into long term health impacts and complications of contracting COVID-19 – with emphasis on children/those with comorbidities The impact of improved WASH (Water, Sanitation and Hygiene) practices on WASH-related infections diseases.
Clinical Management	Clinical guidelines for post-hospitalisation home management and community rehabilitation. Palliative care Vitamin D levels and disease severity	
Infection prevention and control, including health care workers' protection		How to ensure effective social distancing in public spaces and congregate settings post-lockdown.
Candidate therapeutics R&D	Investigate the potential role of natural/alternative/herbal/traditional remedies and practices in treatment of COVID-19 Evaluate therapeutics in the community in early infection	
Candidate vaccines R&D	Innovative vaccine delivery modalities	
Ethics Considerations for Research	Ethical considerations for resource allocation to LMICs. Ethical considerations of recruitment of final year medical/nursing students during the pandemic	
Social Sciences in the Outbreak Response	Understanding COVID-19 in the contexts of conflict, civil war, and refugee situations	Examine the effects of the pandemic on the participation of the public in democratic processes
New areas		

The environmental impact of the response to COVID-19.	Impact of public health interventions on the environment (including air pollution and carbon dioxide emissions) Impact of disinfectants and hand sanitisers on the environment Impact of large-scale personal protective equipment production and disposal.
Preparing for the next pandemic.	Ensure effective measures including community surveillance and animal screening techniques are in place to rapidly identify emerging zoonotic diseases Evaluation of governmental policies and lessons learnt in preparation for the next pandemic.
Cross-cutting	The use of technology and innovation in pandemic response. Assess effective ways of conducting cross-disciplinary research

PRIORITIES REQUIRING GREATER EMPHASIS

Existing priorities now requiring greater research emphasis - Survey and Workshop results
Infection recurrence
Understanding infections and outcomes in vulnerable populations including children, refugees, persons living with disabilities, ethnic groups
Improved diagnostic tools for safer sample collection, faster and easier assays
Relationship between repeated viral exposure and disease severity (in frontline workers)
The effects of the disease on pregnant women
Health Systems research & strengthening to mitigate impact of COVID-19 on capacity
Potential for zoonotic leap between human and companion animals

Health impact of redirecting resources and public health interventions towards COVID-19 on mental health, reproductive maternal newborn and child health, non-communicable diseases, other infectious diseases (especially vaccine preventable disease, Dengue, HIV, chikungunya, tuberculosis, malaria, NTDs)
Adherence to public health interventions such as quarantine and social distancing
Effectiveness of public health interventions
Public health messaging and addressing myths and mistrust
Engaging relevant stakeholders (including religious leaders) in research to enhance community sensitization, adherence to infection, prevention and control measures and surveillance

CONCLUSION

The survey data evidences that that the WHO COVID-19 Research Roadmap is globally applicable. It also provides evidence that the new priorities identified by the AAS in Africa are relevant globally. This survey has provided new information ranking immediate and longer-term research priorities, marking those areas that require a greater emphasis and identifying new research priorities.

Some of these new priorities reflect the progress of the pandemic and acquisition of knowledge as to where the gaps lie; notably research in children, pregnancy and that there is a strong call for research that assesses the effectiveness of public health measurers put into place across the globe to reduce transmission of this virus. These were alongside a demand for social science research to determine public perception, determine better ways to change behaviours and build trust. We also identified a range of new priorities relating to addressing COVID-19 in lower resource settings, where multiple ongoing infectious diseases and other co-morbidities and where pressures are competing within the health and policy systems.

LIMITATIONS

One of the survey limitations was the questions structure and length. We built the questions to align with the WHO COVID-19 Research Roadmap and AAS survey. It was observed that a higher number of top-listed research topics to be chosen as more relevant and this could have been influenced by the order of the questions.

The workshop, however was open and purposefully inviting researchers to make whatever comments they wanted in regard to where current research priorities lie. Therefore, these data bring further confidence to our overall findings in that the analysis of all these comments further confirms our findings from the survey, in adding further to the confirmation of the WHO roadmap and AAS survey, but even more importantly, confirming the same new priorities and ranking these to reflect the same immediate, and long-term requirements for research.

ETHICS

This project sits under the umbrella of the mixed methods action research protocol A continuous mixed methods action research study to assess the impact of capacity development and process improvement tools, resources and activities made available by The Global Health Network and to determine how this could be further strengthened by identification of barriers and enablers to research in Low and Middle Income Countries (OxTREC reference number: 541-18) lead by Professor Trudie Lang. The study sponsor is the University of Oxford and this project is funded by the National Institute for Health Research under the COVID-19 Research Implementation Hub. The Global Health Network receives core operational support from The Bill & Melinda Gates Foundation.

REFERENCES

1. World Health Organisation. A Coordinated Global Research Roadmap: 2019 Novel Coronavirus. 2020.

2. African Academy of Sciences. Research and Development goals for COVID-19 in Africa The African Academy of Sciences Priority Setting Exercise [Internet]. Available from: https://www.aasciences.africa/sites/default/files/2020-04/Research and Development Goals for COVID-19 in Africa.pdf

3. The Global Health Network. Open Working Groups • Coronavirus [Internet]. [cited 2020 Jun 19]. Available from: https://coronavirus.tghn.org/open-working-groups/

4. 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 Countrie. Available from: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

5. Organisation for Economic Co-operation and Development (OECD). DAC List of ODA Recipients - OECD [Internet]. 2020 [cited 2020 Jun 19]. Available from: http://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/daclist.htm

6. WHO. Definition of regional groupings. WHO [Internet]. 2017 [cited 2020 Jun 19]; Available from: http://www.who.int/healthinfo/global_burden_disease/definition_regions/en/

APPENDIX 1 – RESEARCH PRIORITIES FOR COVID-19 SURVEY QUESTIONS

Welcome to the Research Priorities for COVID-19 survey.

The aim of this survey is to seek the opinion of researchers globally as to the top priorities for COVID-19 research in their country and region. Several major international research funding organisations are planning further calls to respond to the current COVID-19 pandemic. To ensure their funding decisions will address critical global knowledge gaps, The Global Health Network in partnership with the African Academy of Sciences and UK Collaborative on Development Research are asking for your help to make certain current research priorities are globally correct, appropriate and applicable. We are taking a global approach with a strong focus on low resource settings.

We have combined research priorities set out by the WHO in the WHO Coordinated Global Research Roadmap: COVID-19, March 2020 and a further list of additional priorities defined by the African Academy of Sciences with African based researchers. To complement WHO work, we would like your opinion on these current priorities so that funding agencies can direct funding to support the most critical priority research questions to address across the globe.

In this busy time we know it is a lot to ask, however, we would greatly appreciate just 10 minutes of your time to answer these questions to help us inform international funding and policy bodies in their decision making going forward.

This is a collaborative initiative between The Global Health Network, The African Academy of Sciences and the UK Collaborative on Development Research (UKCDR). Findings will be shared openly.

The deadline to complete this survey is Friday 22 May at 10:00 am (BST).

If you have any problems accessing the competition, please contact us on info@theglobalhealthnetwork.org

First, a few questions about you:

1. **Are you:**
    - Female
    - Male
    - Other
    - Prefer not to say

2. **What is your age:**
    - 20-29
    - 30-39
    - 40-49

- 50-59
- 60-69
- 70+

3. **Which best describes your research role and career stage:**
    - PhD, medical or other student or earlier
    - Post-doctoral researcher
    - Research leader
    - Member of a research team (please describe your role/drop down box?)
    - Other (please describe – text box)

4. **In which areas do you have significant experience? (can tick more than one answer)**
    - Biomedical / laboratory sciences
    - Clinical or epidemiological sciences
    - Social and behavioural sciences
    - Policy advice (i.e. if you either advise on or are responsible for health/research strategy)
    - Other (please describe – text box)

5. **In relation to infectious disease control, would you describe yourself as:**
    - Having an expert professional interest
    - Having a general professional interest
    - Neither of the above

6. **What type of organisation or healthcare setting do you work within?**
    - Academia (university, college,...)
    - Commercial Research Organisation
    - Community Health Centre/Facility
    - Consultancy
    - Government Ministry
    - Government research organisation
    - Hospital (Private)
    - Hospital (Public)
    - Industry (including Pharma)
    - International organisation (IGO)
    - Journal / Publishing company

- Non-government organisation (NGO)
- Public Health institute
- Regulatory organisation
- Other research organisation
- Self-employed
- Unemployed
- Other

7. **In what country are you based (if in more than one please select the one in which the majority of your work in based)**
   Drop-down list of countries

Now we would like you to tell us where the key research gaps lie in your country in regard to this COVID-19 Pandemic

These questions are divided into two sections: Immediate research priorities and longer-term research priorities. The first section asks you to consider the immediate priorities that need addressing within the short term that can bring immediate impact during the active phase of the pandemic. By immediate we mean the active phase of this pandemic in your country.

Within each research topic please select up to three of the listed priorities and then rank these with 1 = most important, 2 = second most important and 3 = third most important. You may choose less than three items if you feel the alternatives are not priorities for your country at all.

In the second section, we ask you to do the same exercise, but this time please consider the longer-term research priorities necessary to build the research capacity in your country to deal with future pandemics of either COVID-19 or other pathogens. By longer term we mean the research necessary to build the research capacity in your country to deal with future pandemics of either COVID-19 or other pathogens.

Section 1 – Immediate research Priorities

The Immediate Priorities for COVID-19 research in your country (within the active phase of this pandemic within your country)

Please consider the immediate priorities for COVID-19 research in your country - these are the research questions that should be addressed within the active phase of this pandemic within your country.

Within each research topic please select up to three of the listed priorities and then rank these with 1 = most important, 2 = second most important and 3 = third most important. You may choose less than three items if you feel the alternatives are not priorities for your country at all.

1. Virus natural history, transmission and diagnostics

- Support development of diagnostics products to improve clinical processes.
- Support work to develop cheaper, faster easier to use in field antigen tests (for virus detection)
- Support work to develop cheaper, faster easier to use in field antibody test tests (for determining exposure).
- Support work to examine alternative approaches to delivering testing (e.g. centralised versus devolved lab facilities).
- Understand virus compartments, shedding and natural history of disease.
- Develop tools and conduct studies to monitor phenotypic change and potential adaptation of the virus.
- Characterize immunity (naturally acquired, population and vaccine-induced, including mucosal immunity).
- Develop disease models in animals
- Determine Virus stability in the environment.
- Establish capacity for genotyping virus e.g. to detect new mutations over time

Please suggest any other priorities that you feel are not captured in this topic

2. Animal and environmental research on the virus origin, and management measures at the human-animal interface

- Identify animal source and route of transmission (hosts, any evidence of continued spill-over to humans and transmission between animals and humans).
- Improve understanding of socioeconomic and behavioural risk factors for spill-over and transmission between animals and humans
- Environmental studies of SARS-Cov-2 including waste and sewage management practices
- Design and test suitable risk reduction strategies at the human-animal-environment interface.

Please suggest any other priorities that you feel are not captured in this topic

3. Epidemiological studies

- Describe transmission dynamics of COVID-19 and understand spread of disease nationally, regionally and globally.
- Establish suitable cohorts and prospectively collect longitudinal laboratory and outcome data.
- Perform rapid population cross sectional surveys to establish extent of virus transmission using standardised sampling framework
- Use m-Health technology and GIS mapping to characterise disease spread patterns
- Describe disease severity and susceptibility to facilitate effective clinical and public health response to COVID-19 – identify groups at high risk of severe infection
- Have a special focus on potentially at risk groups including malnourished individuals and people with HIV, TB Sickle Cell
- Evaluate impact of control and mitigation measures e.g. modelling to estimate the effects of social distancing measures and other non-pharmaceutical interventions.
- Identify resilient populations and better understand the protective determinants

Please suggest any other priorities that you feel are not captured in this topic

4. Clinical Management

- Define the natural history of COVID-19 infection though careful standardised and comprehensive clinical and laboratory description of cases
- Identify prognostic factors for severe disease
- Determine interventions that improve the clinical outcome of COVID-19 infected patients
- Determine optimal clinical practice strategies to improve the processes of care (e.g. develop criteria for early diagnosis, when to discharge, when to use adjuvant therapies for patients and contacts).
- Develop clinical management protocols for dual infections e.g. COVID patients with HIV, TB or other common infections
- Develop protocols for management of severe disease in the absence of intensive care facilities.
- Develop innovative approaches for respiratory support as alternatives to ventilation
- Determine how best to link key research questions with researchers in affected regions who are able to recruit patients.
- Develop platform(s) to maximize commonality of data collection across trials, and collaborations between trials.

Please suggest any other priorities that you feel are not captured in this topic

5. Infection prevention and control, including health care workers' protection

- Understand the effectiveness of movement control strategies to prevent secondary transmission in health care and community settings
- Optimize the effectiveness of PPE and its use in reducing the risk of transmission in health care and community settings.
- Develop new PPE approaches using local materials and manufacturing processes.
- Understand behavioural and cultural factors influencing compliance with evidence-based IPC measures.
- Research into water sanitation and hygiene practices in communities during the outbreak
- Research to support health systems strengthening and building of resilience post the outbreak
- Develop architectural designs for isolation and quarantine facilities that can be constructed using local materials and expertise within short time periods
- Mental health support for frontline healthcare workers

Please suggest any other priorities that you feel are not captured in this topic

6. Candidate therapeutics R&D

- Identification of existing candidates for clinical evaluation in addition to the ones already prioritized.
- Support basic science to identify new drug targets
- Identification of candidates from traditional medicine for clinical assessment
- Investigations on convalescent anti serum potency as a therapeutic option
- Develop a Multicentre Master Protocol to evaluate efficacy and safety.
- Develop mechanisms to support coordinated collaboration to implement clinical trials for evaluation of safety/efficacy of therapeutics.

Please suggest any other priorities that you feel are not captured in this topic

7. Candidate vaccines R&D

- Identification of candidates for clinical evaluation in addition to the ones already prioritized.
- Capacity development for basic science and pre-clinical development of new vaccines
- Develop a multi-country Master Protocol for Phase 2b/Phase 3 vaccine evaluation to determine whether candidate vaccines are safe and effective before widespread distribution.
- Identify correlation and protection from EPI and other vaccines e.g. BCG

Please suggest any other priorities that you feel are not captured in this topic

8. Ethics Considerations for Research

- Identify key knowledge gaps and research priorities in relation to ethical issues arising out of proposed restrictive public health measures (e.g., quarantine, isolation, cordon sanitaire).
- Define a research governance framework that enables effective and ethical collaboration between multiple stakeholders, including WHO, the global research community, subject matter experts, public health officials, funders, and ethicists.
- Investigate models for deferred consent during emergency research
- Establish processes for speeding up ethical review of COVID-19 related research proposals
- Establish a panel of trans-national ethicists to provide rapid support to local ethical committees assessing COVID-19 related research proposals.
- Accelerated regulatory support for new intervention candidates
- Sustained education, access, and capacity building to facilitate effective cross-working and collaboration across the research thematic areas.
- Accelerated dissemination of results through pre-print media
- ERCs ensure a continued legacy of cross-disciplinary and collaborative work after this outbreak with capacity building measures built into protocols

Please suggest any other priorities that you feel are not captured in this topic

9. Social Sciences in the Outbreak Response

- Promote the prioritization of knowledge needs according to epidemic dynamics.
- Ensure that knowledge is produced according to local, national and regional needs.
- Examine optimal ways of communicating about potential interventions in high density low socioeconomic status urban settings
- Investigate ways of ensuring transparency of information flow and mitigating false information spread by various mechanisms
- Investigate psychosocial issues around discrimination of persons with COVID-19 and their relatives or contact persons
- Ensure that that knowledge outputs and methodological limitations are easily understood by non-social scientists.
- Investigate innovate approaches to short term economic support of vulnerable populations such as cash transfer by mobile money mechanism.
- Studies of Leadership and decision strategies in response to the COVID Pandemic.
- Develop and employ strong methodologies and theoretical frameworks to tackle current epidemic challenges.

- Develop innovative interdisciplinary science
- Develop guidelines and Standard Operating Procedures (SOPs) to operationalize epidemic mitigation mechanisms.
- Develop and connect global research networks with response partners.
- Engage with communities to bring their voices to decision-making processes.
- Support work to understand non-intended consequences of epidemic-control decisions.
- Support work to understand contextual vulnerability.
- Understand how decisions in the field may inadvertently undermine response goals.
- Understand how social and economic impacts need to be mitigated.

Please suggest any other priorities that you feel are not captured in this topic

Section 2 – Longer-term research priorities

Priorities for COVID-19 research in your country in the longer term i.e. after the next six months (longer term research necessary to build the research capacity in your country to deal with future pandemics of either COVID-19 or other pathogens).

Please consider the longer-term priorities for COVID-19 research in your country, i.e. after the next six months. By longer-term we mean the research necessary to build the research capacity in your country to deal with future pandemics of either COVID-19 or other pathogens.

Within each research topic please select up to three of the listed priorities and then rank these with 1 = most important, 2 = second most important and 3 = third most important. You may choose less than three items if you feel the alternatives are not priorities for your country at all.

1. Virus natural history, transmission and diagnostics

- Support development of diagnostics products to improve clinical processes.
- Support work to develop cheaper, faster easier to use in field antigen tests (for virus detection)
- Support work to develop cheaper, faster easier to use in field antibody test tests (for determining exposure).
- Support work to examine alternative approaches to delivering testing (e.g. centralised versus devolved lab facilities).
- Understand virus compartments, shedding and natural history of disease.
- Develop tools and conduct studies to monitor phenotypic change and potential adaptation of the virus.
- Characterize immunity (naturally acquired, population and vaccine-induced, including mucosal immunity).
- Develop disease models in animals
- Determine Virus stability in the environment.
- Establish capacity for genotyping virus e.g. to detect new mutations over time

Please suggest any other priorities that you feel are not captured in this topic

2. Animal and environmental research on the virus origin, and management measures at the human-animal interface

- Identify animal source and route of transmission (hosts, any evidence of continued spill-over to humans and transmission between animals and humans).
- Improve understanding of socioeconomic and behavioural risk factors for spill-over and transmission between animals and humans
- Environmental studies of SARS-Cov-2 including waste and sewage management practices
- Design and test suitable risk reduction strategies at the human-animal-environment interface.

Please suggest any other priorities that you feel are not captured in this topic

3. Epidemiological studies

- Describe transmission dynamics of COVID-19 and understand spread of disease nationally, regionally and globally.
- Establish suitable cohorts and prospectively collect longitudinal laboratory and outcome data.
- Perform rapid population cross sectional surveys to establish extent of virus transmission using standardised sampling framework
- Use m-Health technology and GIS mapping to characterise disease spread patterns
- Describe disease severity and susceptibility to facilitate effective clinical and public health response to COVID-19 – identify groups at high risk of severe infection
- Have a special focus on potentially at risk groups including malnourished individuals and people with HIV, TB Sickle Cell
- Evaluate impact of control and mitigation measures e.g. modelling to estimate the effects of social distancing measures and other non-pharmaceutical interventions.
- Identify resilient populations and better understand the protective determinants

Please suggest any other priorities that you feel are not captured in this topic

4. Clinical Management

- Define the natural history of COVID-19 infection though careful standardised and comprehensive clinical and laboratory description of cases
- Identify prognostic factors for severe disease
- Determine interventions that improve the clinical outcome of COVID-19 infected patients
- Determine optimal clinical practice strategies to improve the processes of care (e.g. develop criteria for early diagnosis, when to discharge, when to use adjuvant therapies for patients and contacts).
- Develop clinical management protocols for dual infections e.g. COVID patients with HIV, TB or other common infections
- Develop protocols for management of severe disease in the absence of intensive care facilities.
- Develop innovative approaches for respiratory support as alternatives to ventilation
- Determine how best to link key research questions with researchers in affected regions who are able to recruit patients.
- Develop platform(s) to maximize commonality of data collection across trials, and collaborations between trials.

Please suggest any other priorities that you feel are not captured in this topic

5. Infection prevention and control, including health care workers' protection

- Understand the effectiveness of movement control strategies to prevent secondary transmission in health care and community settings
- Optimize the effectiveness of PPE and its use in reducing the risk of transmission in health care and community settings.
- Develop new PPE approaches using local materials and manufacturing processes.
- Understand behavioural and cultural factors influencing compliance with evidence-based IPC measures.
- Research into water sanitation and hygiene practices in communities during the outbreak
- Research to support health systems strengthening and building of resilience post the outbreak
- Develop architectural designs for isolation and quarantine facilities that can be constructed using local materials and expertise within short time periods
- Mental health support for frontline healthcare workers

Please suggest any other priorities that you feel are not captured in this topic

6. Candidate therapeutics R&D

- Identification of existing candidates for clinical evaluation in addition to the ones already prioritized.
- Support basic science to identify new drug targets
- Identification of candidates from traditional medicine for clinical assessment
- Investigations on convalescent anti serum potency as a therapeutic option
- Develop a Multicentre Master Protocol to evaluate efficacy and safety.
- Develop mechanisms to support coordinated collaboration to implement clinical trials for evaluation of safety/efficacy of therapeutics.

Please suggest any other priorities that you feel are not captured in this topic

7. Candidate vaccines R&D

- Identification of candidates for clinical evaluation in addition to the ones already prioritized.
- Capacity development for basic science and pre-clinical development of new vaccines
- Develop a multi-country Master Protocol for Phase 2b/Phase 3 vaccine evaluation to determine whether candidate vaccines are safe and effective before widespread distribution.
- Identify correlation and protection from EPI and other vaccines e.g. BCG

Please suggest any other priorities that you feel are not captured in this topic

8. Ethics Considerations for Research

- Identify key knowledge gaps and research priorities in relation to ethical issues arising out of proposed restrictive public health measures (e.g., quarantine, isolation, cordon sanitaire).
- Define a research governance framework that enables effective and ethical collaboration between multiple stakeholders, including WHO, the global research community, subject matter experts, public health officials, funders, and ethicists.
- Investigate models for deferred consent during emergency research
- Establish processes for speeding up ethical review of COVID-19 related research proposals
- Establish a panel of trans-national ethicists to provide rapid support to local ethical committees assessing COVID-19 related research proposals.
- Accelerated regulatory support for new intervention candidates
- Sustained education, access, and capacity building to facilitate effective cross-working and collaboration across the research thematic areas.
- Accelerated dissemination of results through pre-print media
- ERCs ensure a continued legacy of cross-disciplinary and collaborative work after this outbreak with capacity building measures built into protocols

Please suggest any other priorities that you feel are not captured in this topic

9. Social Sciences in the Outbreak Response

- Promote the prioritization of knowledge needs according to epidemic dynamics.
- Ensure that knowledge is produced according to local, national and regional needs.
- Examine optimal ways of communicating about potential interventions in high density low socioeconomic status urban settings
- Investigate ways of ensuring transparency of information flow and mitigating false information spread by various mechanisms
- Investigate psychosocial issues around discrimination of persons with COVID-19 and their relatives or contact persons
- Ensure that that knowledge outputs and methodological limitations are easily understood by non-social scientists.
- Investigate innovate approaches to short term economic support of vulnerable populations such as cash transfer by mobile money mechanism.
- Studies of Leadership and decision strategies in response to the COVID Pandemic.
- Develop and employ strong methodologies and theoretical frameworks to tackle current epidemic challenges.
- Develop innovative interdisciplinary science
- Develop guidelines and Standard Operating Procedures (SOPs) to operationalize epidemic mitigation mechanisms.
- Develop and connect global research networks with response partners.
- Engage with communities to bring their voices to decision-making processes.
- Support work to understand non-intended consequences of epidemic-control decisions.
- Support work to understand contextual vulnerability.
- Understand how decisions in the field may inadvertently undermine response goals.
- Understand how social and economic impacts need to be mitigated.

Please suggest any other priorities that you feel are not captured in this topic

APPENDIX 2 – SURVEY RESULTS: TOP THREE RESEARCH PRIORITIES FROM THE WHO ROADMAP CATEGORIES SHOWING LESS RESOURCES COUNTRIES AS A SUB-SET OF THE GLOBAL RESPONSES.

	Priority	Immediate		Longer-term	
		Global (n=1528)	Less resourced countries (n=694)	Global (n=1528)	Less resourced countries (n=694)
Virus natural history, transmission and diagnostics	**1**	Support work to develop cheaper, faster easier to use in field antigen tests (for virus detection)	**Support development of diagnostics products to improve clinical processes.**		
	2	**Support development of diagnostics products to improve clinical processes.**	Development of cheaper, faster easier to use in field antigen tests (for virus detection)		
	3	Support work to develop cheaper, faster easier to use in field antibody test tests (for determining exposure).		**Characterize immunity (naturally acquired, population and vaccine-induced, including mucosal immunity).**	Support work to develop cheaper, faster easier to use in field antibody test tests (for determining exposure).
Animal and environmental research on the	**1**	**Improve understanding of socioeconomic and behavioural risk factors for spill-over and transmission between animals and humans**			**Identify animal source and route of transmission (hosts, any evidence of continued spill-over to humans and**

virus origin, and management measures at the human-animal interface				**transmission between animals and humans).**
	2	**Identify animal source and route of transmission (hosts, any evidence of continued spill-over to humans and transmission between animals and humans).**		**Improve understanding of socioeconomic and behavioural risk factors for spill-over and transmission between animals and humans**
	3	**Design and test suitable risk reduction strategies at the human-animal-environment interface**		
Epidemiological studies	**1**	**Describe transmission dynamics of COVID-19 and understand spread of disease nationally, regionally and globally.**		
	2	**Describe disease severity and susceptibility to facilitate effective clinical and public health response to COVID-19 – identify groups at high risk of severe infection**	Establish suitable cohorts and prospectively collect longitudinal laboratory and outcome data.	
	3	Perform rapid population cross sectional surveys to establish extent of virus transmission using standardised sampling framework	**Describe disease severity and susceptibility to facilitate effective clinical and public health response to COVID-19 – identify groups at high risk of severe infection**	Perform rapid population cross sectional surveys to establish extent of virus transmission using standardised sampling framework
Clinical Management	**1**	**Determine interventions that improve the clinical outcome of COVID-19 infected patients**	**Define the natural history of COVID-19 infection** though careful standardised and comprehensive clinical and laboratory description of cases	
	2	**Determine optimal clinical practice strategies to improve the processes of care (e.g. develop criteria for early**	**Determine interventions that improve the clinical outcome of COVID-19 infected patients**	

		diagnosis, when to discharge, when to use adjuvant therapies for patients and contacts).			
	3	Develop protocols for management of severe disease in the absence of intensive care facilities.	**Define the natural history of COVID-19 infection** though careful standardised and comprehensive clinical and laboratory description of cases	**Determine optimal clinical practice strategies to improve the processes of care (e.g. develop criteria for early diagnosis, when to discharge, when to use adjuvant therapies for patients and contacts).**	
Infection prevention and control, including health care workers' protection	**1**	**Understand the effectiveness of movement control strategies to prevent secondary transmission in health care and community settings**			
	2	**Optimize the effectiveness of PPE and its use in reducing the risk of transmission in health care and community settings.**		Research to support health systems strengthening and building of resilience post the outbreak	**Optimize the effectiveness of PPE and its use in reducing the risk of transmission in health care and community settings.**
	3	Develop new PPE approaches using local materials and manufacturing processes		**Optimize the effectiveness of PPE and its use in reducing the risk of transmission in health care and community settings.**	Develop new PPE approaches using local materials and manufacturing processes
Candidate therapeutics R&D	**1**	**Develop mechanisms to support coordinated collaboration to implement clinical trials for evaluation of safety/efficacy of therapeutics.**	**Identification of existing candidates for clinical evaluation in addition to the ones already prioritized.**	**Develop mechanisms to support coordinated collaboration to implement clinical trials for evaluation of safety/efficacy of therapeutics.**	Support basic science to identify new drug targets

	2	Support basic science to identify new drug targets		**Identification of existing candidates for clinical evaluation in addition to the ones already prioritized.**	
	3	**Identification of existing candidates for clinical evaluation in addition to the ones already prioritized.**	**Develop mechanisms to support coordinated collaboration to implement clinical trials for evaluation of safety/efficacy of therapeutics.**	Support basic science to identify new drug targets	**Develop mechanisms to support coordinated collaboration to implement clinical trials for evaluation of safety/efficacy of therapeutics.**
Candidate vaccines R&D	**1**	**Develop a multi-country Master Protocol for Phase 2b/Phase 3 vaccine evaluation to determine whether candidate vaccines are safe and effective before widespread distribution.**	Capacity development for basic science and pre-clinical development of new vaccines	Capacity development for basic science and pre-clinical development of new vaccines	
	2	Capacity development for basic science and pre-clinical development of new vaccines	**Develop a multi-country Master Protocol for Phase 2b/Phase 3 vaccine evaluation to determine whether candidate vaccines are safe and effective before widespread distribution.**	**Develop a multi-country Master Protocol for Phase 2b/Phase 3 vaccine evaluation to determine whether candidate vaccines are safe and effective before widespread distribution.**	
	3	**Identification of candidates for clinical evaluation in addition to the ones already prioritized.**		**Identification of candidates for clinical evaluation in addition to the ones already prioritized.**	

Ethics Considerations for Research	**1**	**Identify key knowledge gaps and research priorities in relation to ethical issues arising out of proposed restrictive public health measures (e.g., quarantine, isolation, cordon sanitaire).**	
	2	**Define a research governance framework that enables effective and ethical collaboration between multiple stakeholders, including WHO, the global research community, subject matter experts, public health officials, funders, and ethicists.**	
	3	Establish processes for speeding up ethical review of COVID-19 related research proposals	**Sustained education, access, and capacity building to facilitate effective cross-working and collaboration across the research thematic areas.**
Social Sciences in the Outbreak Response	**1**	Investigate ways of ensuring transparency of information flow and mitigating false information spread by various mechanisms	**Ensure that knowledge is produced according to local, national and regional needs.**
	2	**Ensure that knowledge is produced according to local, national and regional needs.**	**Promote the prioritization of knowledge needs according to epidemic dynamics.**
	3	Examine optimal ways of communicating about potential interventions in high density low socioeconomic status urban settings	