LSHTM Open Research Survey Report 2022

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Contents

Executive Summary

The LSHTM Open Science project, led by the LSHTM Library, Archive & Open Research Services (LAORS), undertook an online survey of open research at LSHTM. The purpose of the survey was to:

1. Establish current awareness and understanding of open research practices
2. Determine current and future application of open research practices
3. Identify support needs and requirements that would enable greater take-up of open research practices

The target audience were academic staff and Research Degree students associated with LSHTM, including those associated with the London campus, the MRC Unit The Gambia at LSHTM, and MRC/UVRI and LSHTM Uganda Research Unit, as well as LSHTM-affiliated organisations, such as London International Development Centre (LIDC). Even if the researcher did not currently apply open research practices in their own work, they were encouraged to take part to ensure support was appropriate to their research domain. It was not promoted to MSc students or staff members in non-research roles.

Key findings

Participant characteristics

- In total, 162 responses were received for the LSHTM Open Research survey: 75.93% (n=123) of participants identified themselves as academic staff, 22.22% (n=36) identified themselves as Research Degree students, and 1.85% (n=3) respondents were non-academic staff members.
- Most respondents were in senior roles, such as Professor, Research Fellow, Assistant Professor, and Associate Professor. The largest percentage of respondents (37.65%) indicated they had been at LSHTM for 1-5 years, followed by 22.84% who had been at LSHTM for 6-10 years.
- The majority of respondents were based in academic faculties in London: 47.53% were affiliated with the Faculty of Epidemiology and Population Health (EPH); 27.78% with the Faculty of Public Health and Policy (PHP); and 20.37% with the Faculty of Infectious and Tropical Diseases (ITD). Only six participants were located in the MRC Units.

Motivation for applying open research practices

Participants expressed several motivations for applying open research practices within their work, noting their importance in enabling research to be communicated in a timely manner, enhancing its impact within the research community and wider society, and demonstrate research rigour. There was also a recognition that the use of open research practices, such as co-production, were often the only method of obtaining data, while other research practices such as preregistration and preprint publication were also increasingly applied by the research community.

Awareness and use of open research practices

All participants indicated an awareness of multiple open research practice listed in the survey:

- Many of the open research practices applied by participants relate to the publication process: the five most widely applied research practices were [1] Open peer review, [2] preprint publication, [3] sharing of public engagement literature, [4] preregistration, and [5] code sharing.
- Approximately half of participants indicated familiarity with research verification (51.85%) and research co-production (51.23%), but do not have practical experience of applying them in research.
- Computer Assisted Designs (CAD) was the research practice applied least, with just 1.23% of participants indicating they have shared CAD files in their research. The majority of participants (54.96%) did not consider it applicable to their research, or were unfamiliar with the practice (30.25%).
- Participants indicated an intent to apply the majority of open research practices in the future: [1] The sharing of public engagement literature was considered the most likely, following by [2] sharing of preprints, [3] code sharing, [4] open peer review, and [5] preregistration.

Barriers and concerns related to the use of open research

Participants were subsequently asked to indicate any concerns and barriers that may exist related to the take-up and use of open research practices. This was addressed in two stages:

First, participants were presented with a set of 10 statements that outlined potential concerns related to the use of open research and asked to rate the extent to which they applied to their own research. The largest percentage of participants indicated that the statements were not a concern, or were only a minor concern, in their research. However, a small number of participants indicated that certain statements were a considerable concern.

- The five highest-ranked statements that were considered to be a concern were: [1] A journal might not publish findings that have previously been made openly available (70.99% of responses - 43.21% minor concern, 27.78% considerable concern), [2] Other people may copy my research idea, implement it and/or publish it before I do (70.99% of responses - 46.3% minor concern, 24.69% - considerable concern), [3] There may be unexpected intellectual property issues (66.79% of responses - 39.51% minor concern, 17.28% considerable concern), [4] There may be unexpected ethical issues (65.21% of responses - 40.37% minor concern, 24.84% - considerable concern), and [5] It may not be possible to protect participant confidentiality (60.01% of responses - 34.38% significant concern, 25.63% minor concern).

- The majority of participants did not consider the following statements to be a concern: [1] It may result in others asking me to provide assistance with their research (79.5%), [2] Others may find it difficult to understand my research (74.69%), [3] Others may find errors in my research (71.43%), [4] Others may criticise my work before it is complete (64.2%), [5] It may prevent exploratory research (50.94%).

Second, participants were presented with nine factors and asked to rate the extent to which they considered them to be barriers to the take-up and use of open research.

- The highest-ranked factors that participants 'agreed' or 'strongly agreed' were a barrier to the take-up and use of open research practices were: [1] Lack of dedicated funding (74.69%), [2] Lack of information or training on good practice (64.20%), [3] Lack of time (60.49%), [4] Lack of supporting infrastructure (60.49%), [5] Lack of positive incentives for take-up (54.32%), and [6] Lack of consideration in career development (51.85%).

- Participants were divided on whether 'lack of mandates from funder, institutional or other regulators' and 'Lack of support from senior researchers' were barriers to take-up and use.

- A lack of interest from junior researchers was not considered to be a barrier by the majority of participants (46.3% disagreed or strongly disagreed, 42.59% expressed a neutral position).

Open Research training and guidance

- Just 17.9% of participants have received formal training or other support associated with open research. The majority indicated they had not received open research training or other support (74.69%), and 7.41% indicated they did not know.
- Participants were interested in training and guidance on the majority of open research practices. The five highest rated topics for open research training and guidance were: [1] Research co-production (89.17%), [2] Sharing public engagement literature (83.97%), [3] Sharing preprints & other works prior to peer review (76.43%), [4] Research verification (75.16%), and [5] Code sharing (74.52%). The Sharing of physical materials and Computer Assisted Designs attracted least interest.
- Most participants indicated a preference for Introductory or Intermediate material. An exception to this were Code Sharing where there was greater interest in Advanced material, and Sharing Public Engagement Literature where there was greater interest in intermediate training.

Recommendations

On the basis of the research findings, the following recommendations are made to raise awareness, take-up, and use of open research practices at LSHTM:

1. **Broad recommendations**
   a. An LSHTM Open Research Survey should be performed at regular intervals (e.g. every 3 or 5 years) to monitor changes in open research knowledge and take-up over time.
   b. Ensure that open research developments reflect equality, diversity, and inclusion values within LSHTM
   c. Apply a joined-up approach, working with faculties/departments, research centres, and groups to encourage good practice and avoid unnecessary duplication of effort.

2. **Rewards and incentives**
   a. Investigate a framework for recognising and rewarding the application of open research practices within LSHTM's academic structure. For example, through greater recognition of open research in the recruitment, promotion, and personal development process.
   b. Explore the setup of an 'Open Research Champions' programme as a citizenship activity that staff and students can use to develop their knowledge and expertise and embed them within departments/research groups.
   c. Actively promote external funding and sponsorship opportunities that have an open research component. For example, funding intended to develop and enhance open research infrastructure, widen access to existing digital resources.
      Explore opportunities to use internal funds to encourage, support and recognise the use of open research practices. For example, through a regular Open Research award.

3. **Awareness raising and skills development**
   a. Review existing training & guidance available to LSHTM researchers, including those available internally and externally, and ensure they are promoted to the relevant audience.
   b. Scope training and guidance that may be developed to address gaps in current open research support.

4. **Infrastructure**

The following actions are recommended to enhance and embed open research infrastructure:

   a. Investigate the creation of a new staff role to support Open Science activities that are not covered by existing LSHTM services.
   b. Allocate responsibility for supporting Open Research 'gaps' where they may be covered by existing services, e.g. preprint sharing.
   c. Investigate the need to establish / enhance in-house platforms to support open research activities. For example, explore methods to support code sharing activities.

Method

The LSHTM Open Research survey 2022 was developed by Gareth Knight (LAORS Research Data Manager), with input from the LSHTM Open Science Working Group. The working group contains staff and student representatives at different career levels and with expertise in a range of disciplines, based in in London, Uganda, Gambia, and elsewhere.

A review of surveys performed by academic organisations on topics related to open science, open research, and open scholarship was undertaken, in order to identify key topics that should be covered. The review recognised:

- Cross-institution surveys by the Center For Open Science 'Open Scholarship Survey'[i], European University Association (EUA) Open Science survey[ii], ORION Open Science Analysis and Benchmarking self-assessment questionnaire[iii], survey on Barriers to Full Participation in the Open Science Life Cycle among Early Career Researchers[iv], Survey of open research practices among MRC-funded researchers[v], and survey of Wellcome Trust and ESRC funded researchers[vi].
- Institutional surveys performed by the Swinburne University of Technology[vii], Cardiff University[viii], Royal Holloway, University of London[ix] and University of Surrey[x].

A first draft of the survey was developed, which synthesised questions and sample responses provided by these surveys. This was circulated to the Open Science Working Group and a small number of LSHTM academics for comment. Updates were subsequently made to provide examples where appropriate (e.g. of potential concerns and barriers) and broaden the scope of questions.

The LSHTM Open Research survey was setup using JISC Online Survey (https://www.onlinesurveys.ac.uk/) and tested by a small group of LSHTM staff, including academic and professional support staff.

The survey was promoted via [1] faculty/department newsletters, [2] internal mailing lists (Noticeboard, Reproducibility) and [3] LSHTM-wide groups (Yammer). In addition, [4] each head of Faculty and department was contacted and asked to distribute the survey to staff within their unit, and [5] current LSHTM authors who had data/code recorded in the LSHTM Data Compass repository were invited to complete the survey. Finally, [6] OSWG representatives were asked to promote the survey within their department or other groups.

Data collection was performed over two survey rounds: the first round took place between 6 June – 31 July 2022, which resulted in 91 responses. Due to the low response rate, a decision was made to re-open and re-promote the survey. A second round was performed between 15 August – 2 September 2022, which attracted a further 72 responses.

1. Participant characteristics

In total, 162 responses were received during the two survey rounds: n=91 were submitted during the first round (6 Jun– 31 Jul) and n=71 during the second round (15 Aug – 2 Sept 22).

1.1. LSHTM role

Participants were asked to specify one title that best described their current role and specify the number of years that they had worked and/or studied at LSHTM. Of the 162 participants who responded to the survey:

- 75.93% (n=123) of participants identified themselves as academic staff. Most respondents were in senior roles (n=30 indicated they were a Professor, n=30 were a Research Fellow, n=29 were an Assistant Professor, and n=27 were Associate Professor).

- 22.22% (n=36) of participants identified themselves as Research Degree student.

- Three respondents (1.85%) who indicated their role as 'Other' were staff members in non-academic roles within departments.

When asked the number of years that they had worked and/or studied at LSHTM, the largest percentage of respondents (37.65%) indicated they had been at LSHTM for 1-5 years, followed by 22.84% who had been at LSHTM for 6-10 years.

Current LSHTM role	Less than 1 year	1-5 years	6-10 years	11-15 years	16-20 years	More than 20 years	Total by role	Total percentage
Research Degree Student (PhD, MPhil)	8	24	4	0	0	0	36	22.22%
Research Fellow	0	20	8	1	1	0	30	18.52%
Professor	0	3	4	6	3	14	30	18.52%
Assistant Professor	1	10	8	8	2	0	29	17.90%
Associate Professor	1	1	11	11	3	0	27	16.67%
Research Assistant	4	2	0	0	0	0	6	3.70%
Other	0	1	1	1	0	0	3	1.85%
Research Associate	0	0	1	0	0	0	1	0.62%
Total by year	14	61	37	27	9	14	162	
Percentage by year	8.64%	37.65%	22.84%	16.67%	5.56%	8.64%		

Table 1: Current LSHTM role and number of years they have worked/studied at LSHTM

1.2. LSHTM Faculty / Unit

Participants were also asked to provide the LSHTM faculty/unit and department/research theme in which they were located. Of the 162 respondents, the majority of responses were received from academic faculties in London:

- 47.53% (n=77) were affiliated with the Faculty of Epidemiology and Population Health (EPH)
- 27.78% (n=45) were affiliated with the Faculty of Public Health and Policy (PHP)
- 20.37% (n=33) were affiliated with the Faculty of Infectious and Tropical Diseases (ITD).

However, only a smaller number of responses were received from the MRC Units:

- 2.47% of participants (n=4) were affiliated with the MRC/UVRI and LSHTM Uganda Research Unit
- 1.23% (n=2) of participants were affiliated with the MRC Unit The Gambia at LSHTM

Finally, one participant (0.62%) indicated an affiliation with a LSHTM Professional Support Service.

2. Familiarity and use of open research practices

The first set of questions were intended to establish participants' current awareness and use of a set of open research practices.

The set of open research practices to be covered by the survey was developed and refined over time. The Center For Open Science 'Open Scholarship Survey' (Beaudry et al, 2022)[1] eight research practices[2] was used as a basis and revised following feedback from the LSHTM Open Science Working Group and trialling of the draft survey.

The ten open research practices covered by the LSHTM open research survey are:

1. Preregistration: Publication of a research plan or trial registration before undertaking work
2. Registered reports: Publication of an article on the research plan before undertaking work
3. Research co-production: Use of citizen science, crowdsourcing, co-creation, or other methods to encourage the public, patients, or others to contribute to research
4. Research verification: Testing claims of prior research through replication / reproduction / robustness checks
5. Sharing preprints & other scholarly works prior to peer review via an online repository
6. Open Peer review: Providing a journal or grant peer review where authors and reviewers are aware of each other's identity
7. Sharing public engagement literature (reports, pamphlets, or other resources) for purpose of informing participants/the public of research objectives & outcomes.
8. Code sharing: Making R packages, STATA DO files, or other code openly available
9. Open sharing of CAD Files, including 3D models, scans, blueprints and designs for physical objects and open hardware
10. Sharing of physical materials: Making specimens, samples, or other items available

Participants were asked to rate their knowledge of each research practice by selecting one of four options:

- Familiar. Have used it in research: The participant has applied it in their research
- Familiar. Have not used it in research: The participant is aware of the research practice, but has not applied it in their research
- Unfamiliar (until now): The participant was not previously aware of the research practice prior to completing the survey
- Not applicable to my research: there is an implicit assumption that participants are sufficiently familiar with the research practice to determine if it is applicable to their research.

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[1] Beaudry J, Chen D, Cook B, Errington T, Fortunato L, Given L, et al. The Open Scholarship Survey (OSS). Open Science Framework. 2022 Aug 30; Available from: https://osf.io/nsbr3/

[2] [1] Preprints, [2] open peer review, [3] code sharing, [4] material sharing, [5] preregistration, [6] research replication, [7] research reproduction, [8] reporting of null results

2.1. Awareness and use of open research practices among participants

The question on awareness and and use of ten open research practices (Q4) was completed by all participants (n=162). Results are shown in Figure 1 (below) and Table 2 (p29)

Figure showing horizontal stacked bar chart "Awareness and use of open research practices":

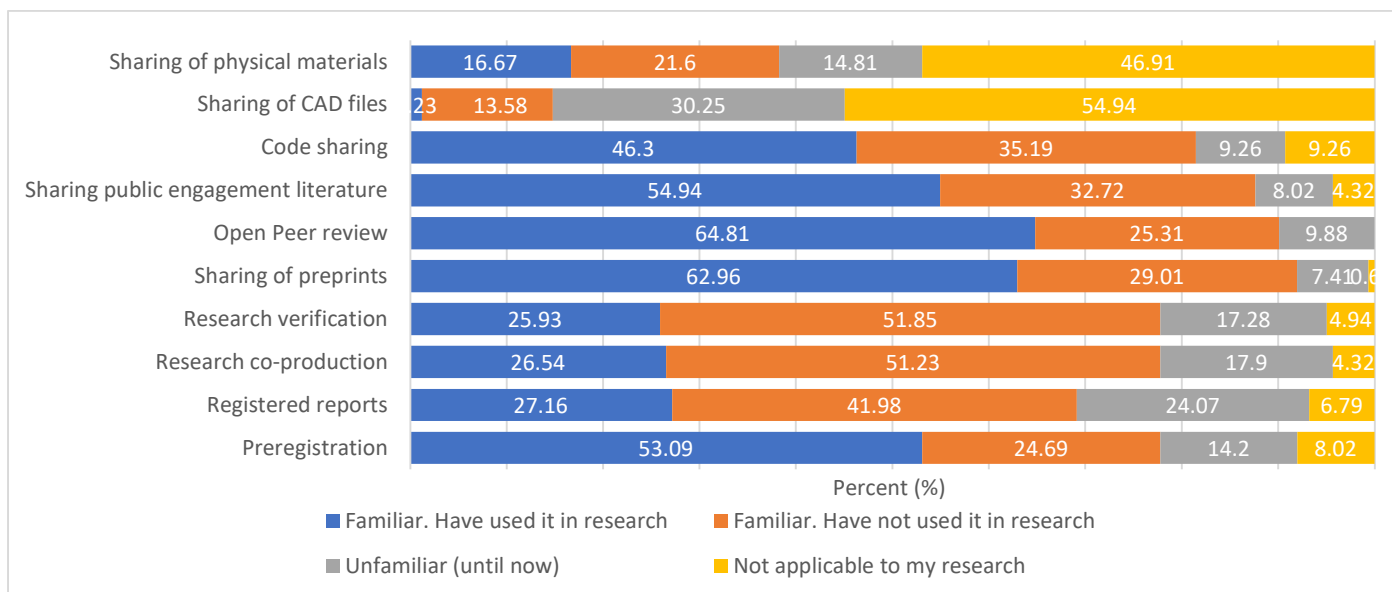| Practice	Familiar. Have used it in research	Familiar. Have not used it in research	Unfamiliar (until now)	Not applicable to my research
Sharing of physical materials	16.67	21.6	14.81	46.91
Sharing of CAD files	23	13.58	30.25	54.94
Code sharing	46.3	35.19	9.26	9.26
Sharing public engagement literature	54.94	32.72	8.02	4.32
Open Peer review	64.81	25.31	9.88	
Sharing of preprints	62.96	29.01	7.41	0.6
Research verification	25.93	51.85	17.28	4.94
Research co-production	26.54	51.23	17.9	4.32
Registered reports	27.16	41.98	24.07	6.79
Preregistration	53.09	24.69	14.2	8.02

Figure 1: Awareness and use of open research practices

All ten research practices were used by LSHTM participants, although there were considerable differences in take-up. The most commonly used open research practices are applicable to a wide-range of research disciplines, whereas those applied by only a small number of respondents are often domain-specific.

- Many of the responses relate to the publication process: the five most common open research practices were: [1] Open Peer Review (64.81%, n=105), followed by [2] the sharing of preprints (62.96%, n=102), [3] sharing of public engagement literature (54.94%, n=89), [4] preregistration (53.09%, n=86) and [5] code sharing (46.3%, n=75).

  Approximately a quarter of participants have published a registered report (27.16%, n=44), applied research co-production techniques such as crowdsourcing (26.54%, n=43), or performed research verification to test the claims of prior research (25.93%, n=42). The open research practices that were least commonly used were domain-specific practices, such as the sharing of physical materials (16.67%, n=27) and Computer Assisted Design files (1.23%, n=2).

  A limitation of the survey is that it is unclear how participant use a specific research practice if they did not provide an example. Although Open Peer Review was the most widely used research practice, many of the respondents did not indicate if they had provided an open peer review for another authors' manuscript, or had been the recipient of an open peer review for their own published work.

- The majority of participants expressed awareness of research verification (51.85%, n=84), research co-production (51.23%, n=83), and registered reports (41.98%, n=68), but had not applied them in research.

- Few participants indicated they were unfamiliar with an open research practice. Of the respondents who did, 30.25% (n=49) indicated they were unfamiliar with the sharing of Computer Assisted Design files and 24.07% (n=39) were unfamiliar with registered reports.

- Few respondents indicated that a research practice was not applicable to their research. Of those who did, the research practice may be considered to be a domain specific practice. In total, 54.94% of participants

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(n=89) indicated the sharing of Computer Assisted Design files and 46.91% (n=76) indicated the sharing of physical materials were not applicable to their research.

2.2.   Familiarity and use of open research practices by faculty

An analysis was performed on participants' awareness and use of the open research practice, based upon the faculty/unit in which they were located.

LSHTM Faculty of Epidemiology and Population Health

In total, 77 participants located in the Faculty of Epidemiology and Population Health (EPH) indicated their awareness and use of open research practices. Results are shown in Figure 2 and   Table 3 (p29)

- The sharing of preprints and other scholarly works prior to peer review was the most commonly used open research practice among EPH participants (n=54), followed by open peer review (n=51), code sharing (n=49), preregistration (n=47), and sharing of public engagement literature (n=42).

- A number of EPH participants were familiar with open research practices, such as research verification (n=42), research coproduction (n=40), and the publication of registered reports (n=30), but had not applied them in their own research

- The majority of EPH participants did not consider the sharing of Computer Assisted Design (CAD) files (n=46) or sharing of physical materials (n=42) to be relevant to their research.
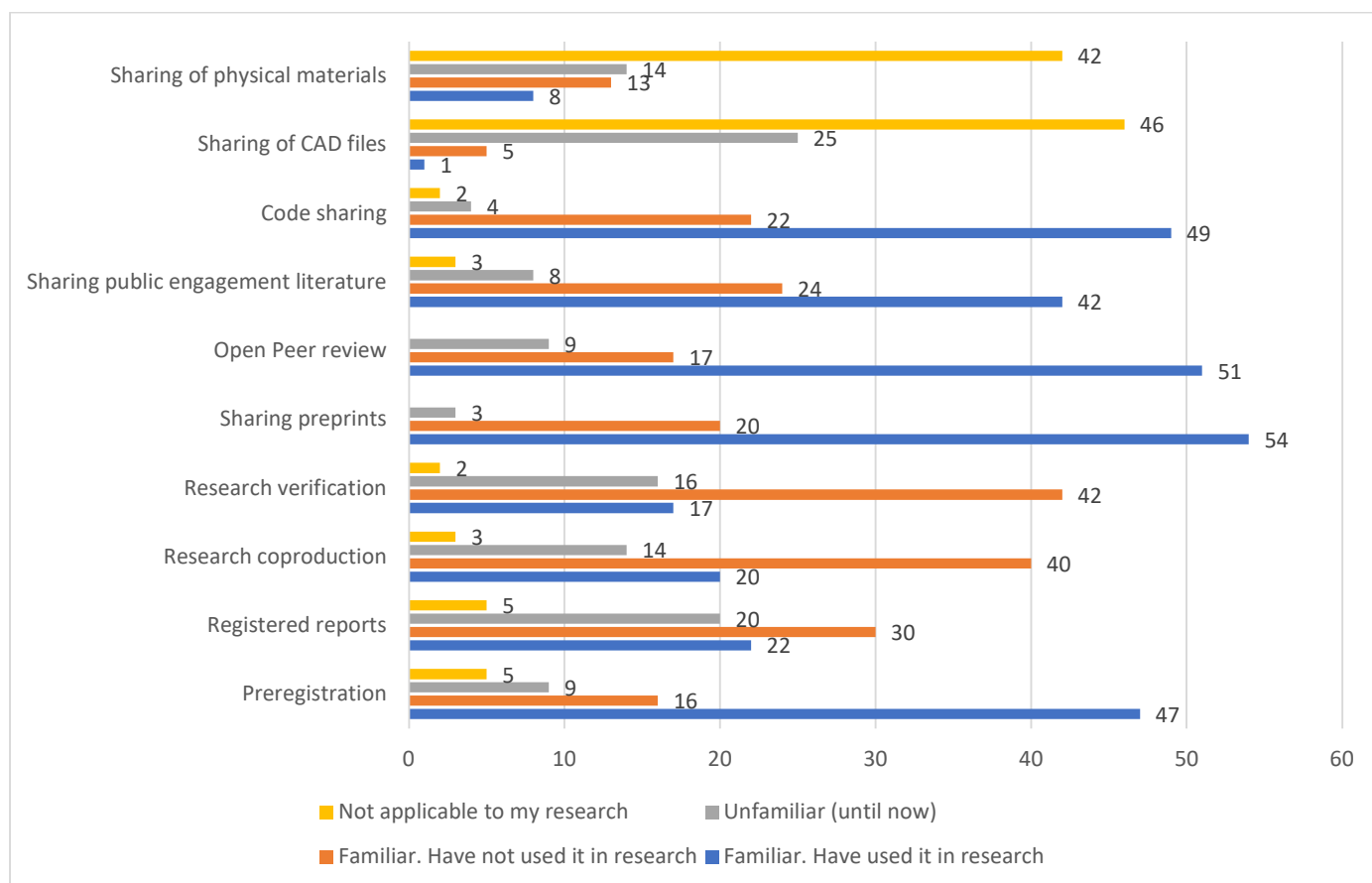

Figure 2: Familiarity and use of open research practices among EPH participants

In total, 45 participants located in the Faculty of Public Health and Policy (PHP) completed the question on familiarity and use of open research practices. Results are shown in Figure 3 and Table 4 (p29)

- The most commonly applied open research practice among PHP participants was the sharing of public engagement literature (n=28), followed by open peer review (n=23), sharing of preprints & other scholarly works prior to peer review (n=20), and preregistration (n=19).

- A number of PHP participants indicated familiarity but not use of open research practice. Participants were most familiar with research coproduction (n=23), followed by research verification (n=21), registered reports (n=20), and code sharing (n=18).

- The majority of PHP participants did not consider the sharing of physical materials (n=26) and Computer Assisted Design files (n=23) to be relevant to their research.
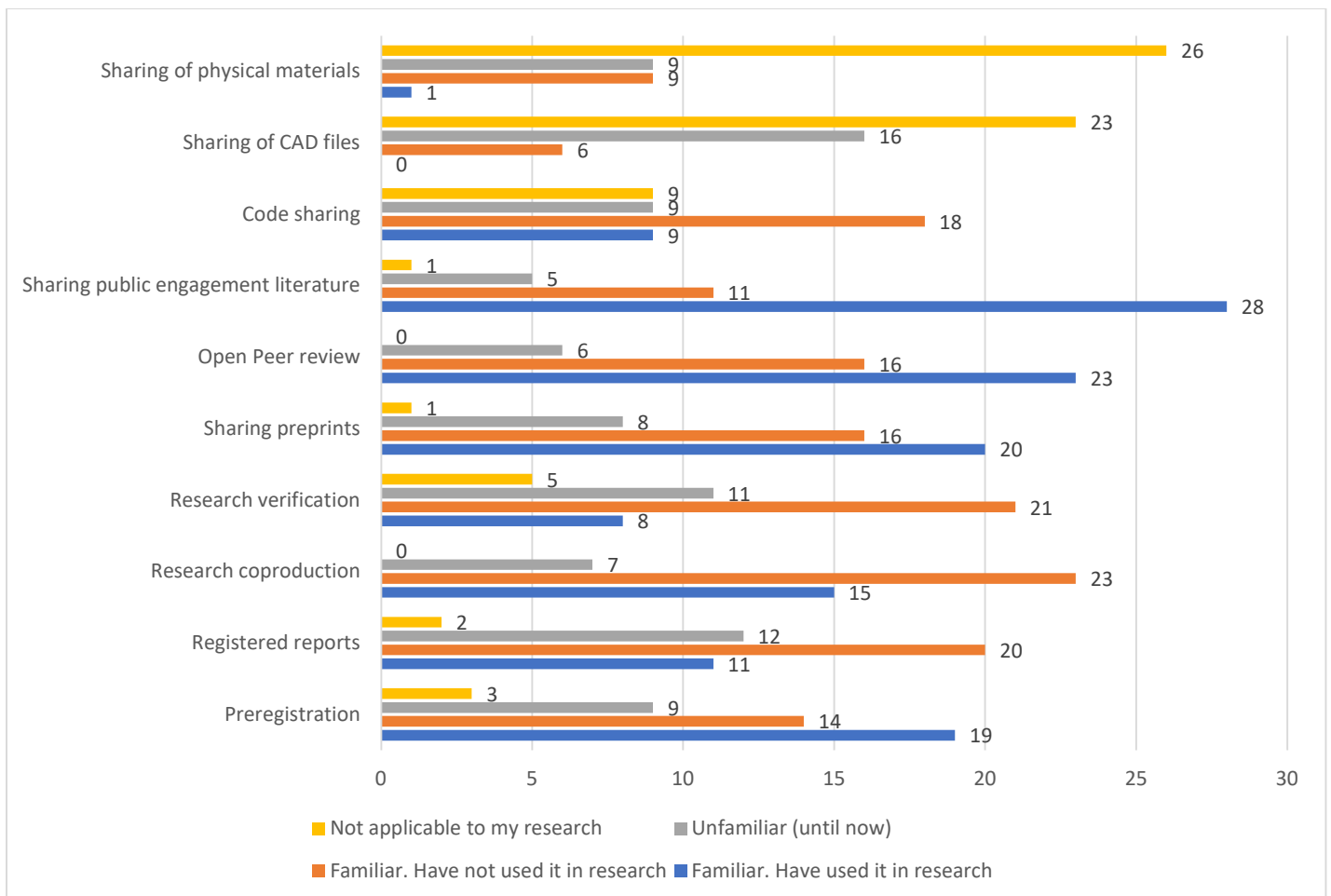
Figure 3: Familiarity and use of open research practices among PHP participants

LSHTM Faculty of Infectious and Tropical Diseases

In total, 33 participants located in the Faculty of Infectious and Tropical Diseases (ITD) completed the question on familiarity and use of open research practices. Results are shown in Figure 4 and Table 5 (p30)

- The most commonly applied open research practice among ITD participants was open peer review (n=27), followed by sharing preprints and other scholarly works prior to peer review (n=25) and preregistration (n=17).

- A number of ITD participants indicated familiarity but not use of open research practices. Participants were familiar with research coproduction (n=18), research verification (n=16) and publication of registered reports (n=15) but had not applied them in practice.

- A total of 30 ITD participants were familiar with the sharing of public engagement literature – 15 participants had shared literature in their own research and 15 participants had not.

- Most ITD participants who responded did not consider the sharing of Computer Assisted Design files to be applicable to their research (n=19).
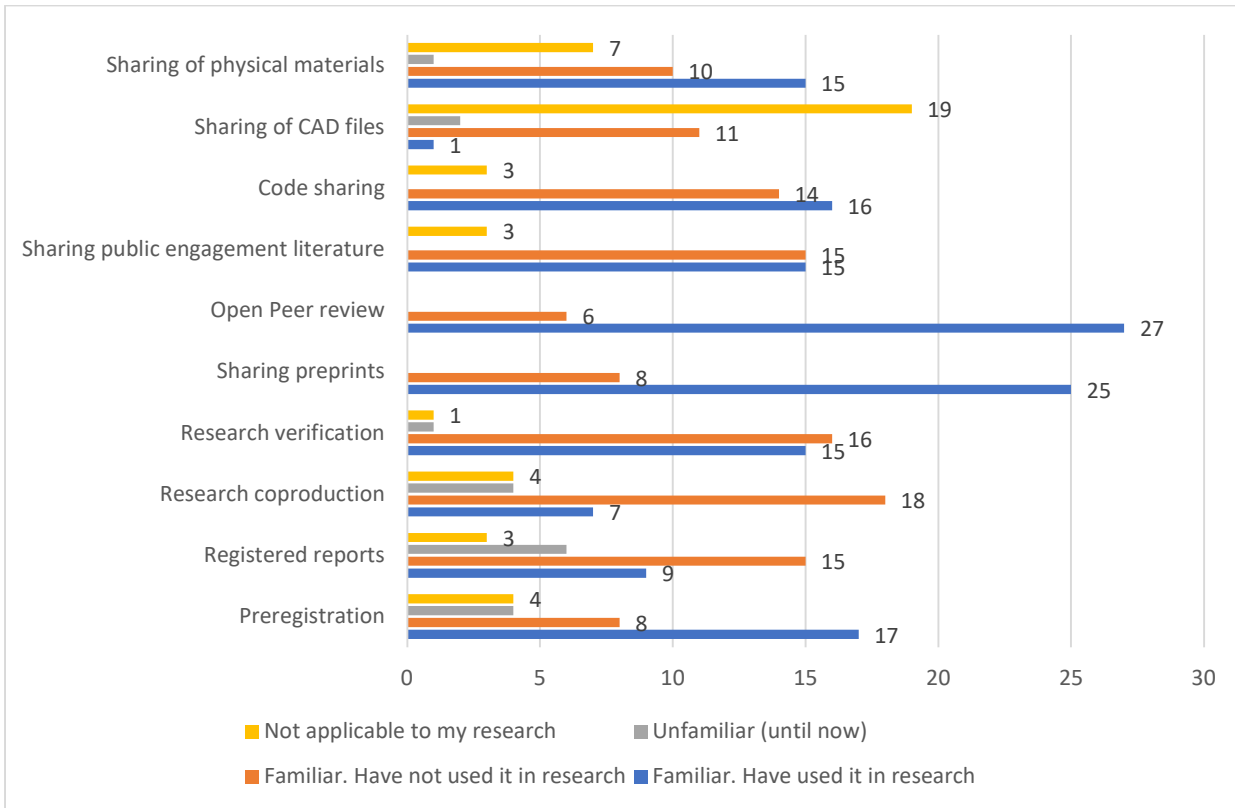
Figure 4: Familiarity and use of open research practices among ITD participants

MRC Units (Gambia and Uganda)

The survey was completed by six participants from the MRC Units – four at the MRC/UVRI and LSHTM Uganda Research Unit and two at the MRC Unit The Gambia at LSHTM. Results are shown in Figure 5 and Table 6 (p30).

The low number of responses limits the analysis that may be performed:
- Participants had applied the following open research practices in their work: sharing of public engagement literature (n=4), open peer review (n=4), sharing of preprints and other scholarly works prior to peer review (n=3), preregistration (n=3), and the sharing of physical materials (n=3)
- Participants were unfamiliar with the sharing of Computer Assisted Design files (n=6) and research coproduction (n=4)

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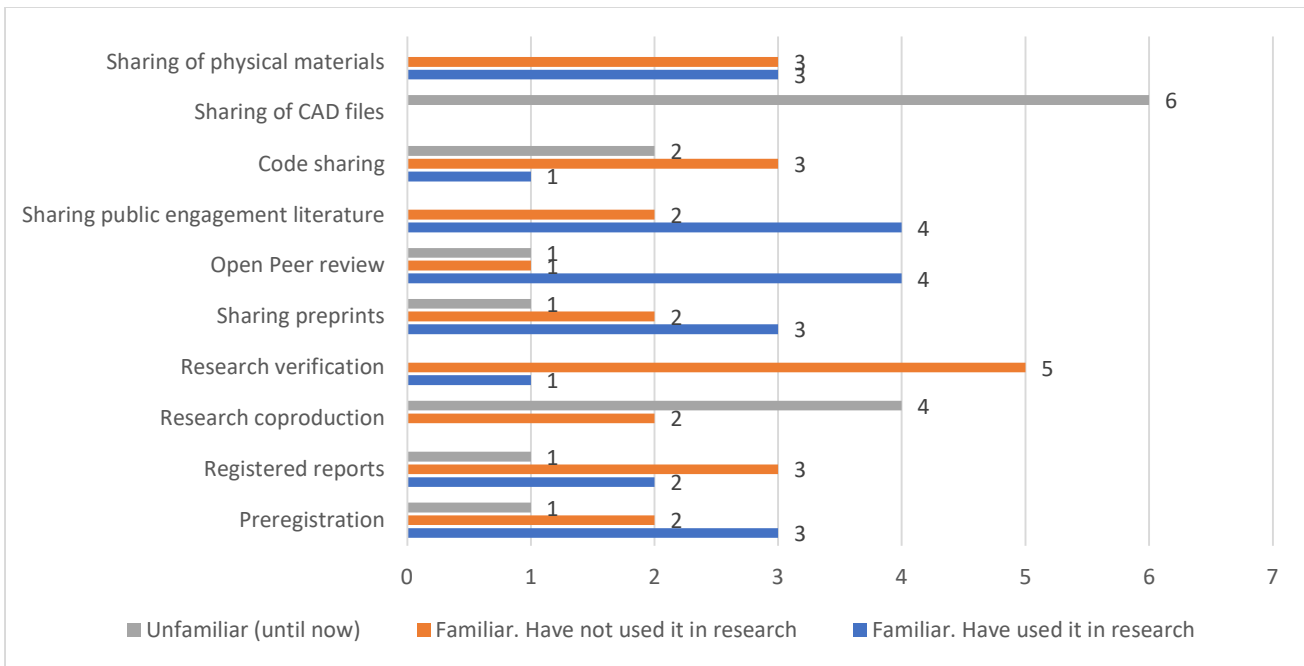*Figure 5: Familiarity and use of open research practices among MRC Gambia & Uganda participants*

2.3. Awareness and use of open research practices among research degree students

The survey found that awareness and use of open research practices was limited among Research Degree students (n=36) who participated in the open research survey. Results are shown in Figure 6 and Table 7 (p30).

- The sharing of preprints and public engagement material were the most common research practice applied by 50% of RD students (n=18 for both), followed by performance of open peer reviews and preregistration of their research plan (n=12 for both), code sharing and research verification (n=11 for both).

- A number of RD students indicated familiarity but not use of open research practices. RD students were familiar with [1] the publication of registered reports (n=22), [2] code sharing and research co-production (n=16 for both), [3] Preregistration (n=15), [4] Research verification, Open Peer review and Sharing public engagement literature (n=13), and [5] Sharing preprints (n=12).

- Only a small number (n=5) of RD students were familiar with Computer Assisted Designs (CAD) for physical objects and none had created them for their research. Most RD students were unfamiliar with them (n=14) or considered them not to be applicable for their research (n=17).
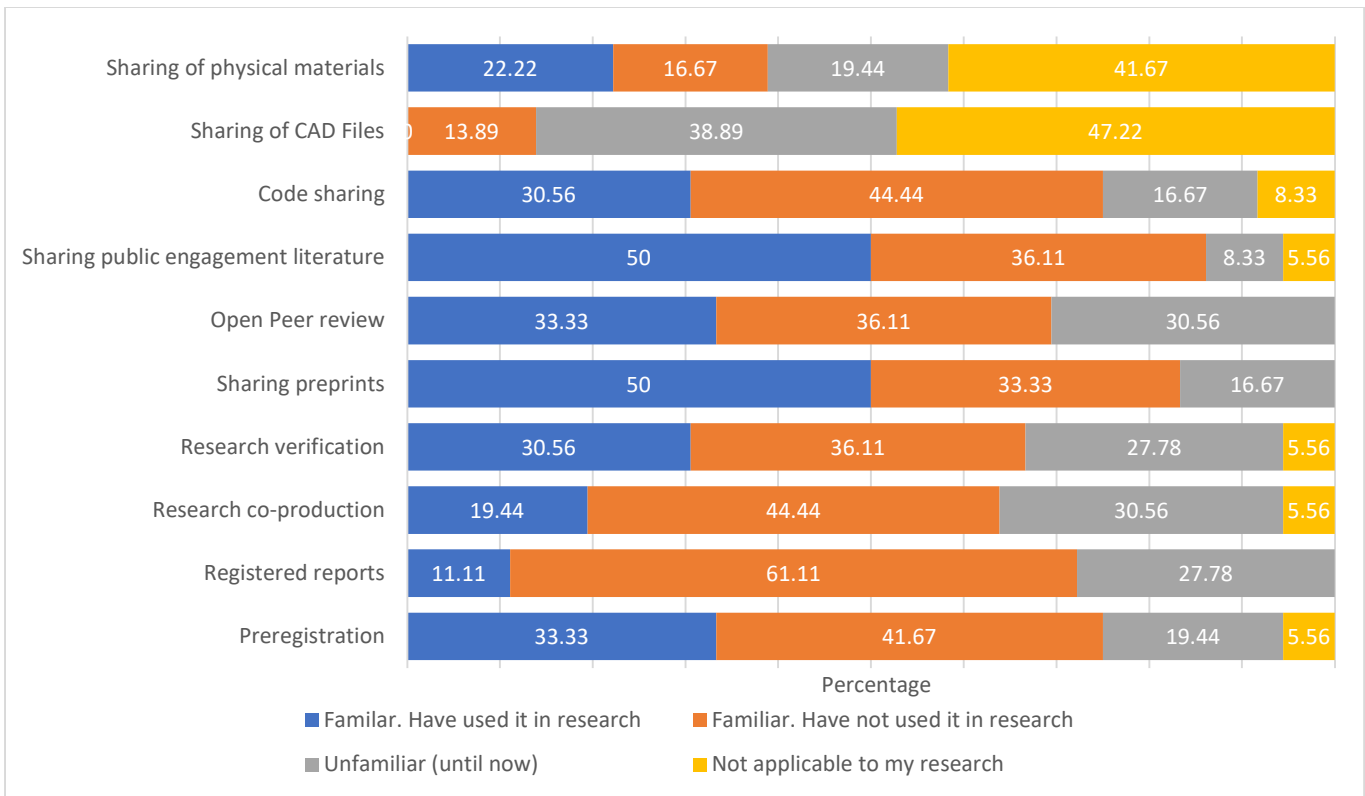
Figure 6: Familiarity and use of open research practices among research degree students

2.4. Reasons for applying open research practices

The reasons that participants' apply open research practices in their own research was explored in free text (Q5). In total, 98 participants completed the free text field, highlighting factors such as its contribution to society, ability to publish research quickly, comply with research practice requirements, improve research rigour, as well as its contribution to career development.

a. Benefit to research participants and wider society

Participants highlighted the need to ensure scientific research is relevant and used effectively, so that it can benefit participants and society as a whole:

> "The public fund research, participate in research, and are key stakeholders."

> "Science belongs to all of us, and public participants must be able to access research they have contributed to and that affects their lives (especially if they have paid for it through taxation)"

> "Research participants provide their biological samples and data freely to improve the health and wellbeing of others. We have a moral obligation to make the best use of the information and make sure it is used to its maximum to generate high quality information."

> "For the sharing of public engagement literature, this has been central to the way research projects operate in Kenya where I work, and sharing policy briefs to the government of Kenya and other key stakeholders has been a fundamental part of the efforts to inform policy that we have engaged in in COVID and other recent research"

b. Timeliness of research

The ability to make research available in a timely manner was considered important for health benefits to be gained. Participants noted the need to quickly share research with stakeholders, such as policy makers, funders, and regulatory authorities:

> "With research related to COVID-19, there was no time to wait for peer-review to be completed before making the work publicly available."

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"Open access to research resources, ideas, outputs make for a more equitable and faster moving field. Generally better for moving ideas forward, improving knowledge etc"

"For preprints this was because the research needed to be shared in a timely manner as the topic was time sensitive."

"Higher transparency; publishing the research plans also means getting the research project/idea out there faster than having to wait for all results to be acquired"

c. Research practice requirement

Participants noted that the use of open research was considered a key requirement for conducting research, obtaining research funding, or publishing scientific results within their research domain:

"These are recognized as best practice in the field and some, e.g. public protocols, are required by funders and the data provider. "

"For some of them, e.g. preregistration, it is a requirement for a clinical trial if you want to publish the results in a decent journal, but also because I think it's just good practice to be open about what you're planning on doing. For others, because it seemed appropriate for the individual study."

"Sharing DNA plasmids and other molecular tools is standard practice in my field, as is early publication (pre-prints) and data sharing (conferences). "

"I was motivated to share code and use pre-print servers as that is the expected standard in my field of study. With research related to COVID-19, there was no time to wait for peer-review to be completed before making the work publicly available."

d. Research rigour

Participants also noted the role of open research in demonstrating the rigour of research methods and improve confidence in research results:

"The aim is to provide sufficient information to allow other researchers to fully understand the methods to allow reproducibility"

"transparency and building trust in the quality and relevance of the research that I am involved in

"For preregistration this was to uphold transparency and scientific rigour; also it is often a pre-requisite for publication."

"Benefit to my own work of exposing research findings to more scrutiny from scientists and public; accountability"

"Increases the validity and trustworthiness of research and the research process. Facilitates collaboration and learning. I have benefitted from others sharing code"

"For transparency and to ensure analyses are conducted as stated; for ethical reasons (to make the most of the available data); to allow others to use data and methods for their own research."

"They are considered good research practice because they help to advance science by avoiding duplication, increasing transparency and reproducibility. Some are requirements of funders."

Participants also noted their own frustration when being unable to access underlying data/code:

"belief in transparency/reproducibility, and being annoyed when doing reviews I haven't been able to access key data, or see how people coded a particular analysis"

"Better science, reproducibility. Also - honestly - I tend to think that when all the code is supplied reviewers nit-pick and ask questions less as they could just go look at the code.

e. Research impact and career development

A small number of participants noted the benefits of practising open research from a career perspective. The sharing of research resources with the scientific community and wider public was considered beneficial to the researcher themselves (particularly early career researchers) enabling them to improve their visibility and more effectively "brand" themselves as researchers.

> *"Depositing in preprint archives a good way to get the research out and have your name associated with it"*

2.5. Examples of open research practices

In total, 74 of the 162 respondents (45.67%) provided examples of one or more open research practices that they had applied in free text responses (requested in Q6a). The sharing of research data and research code were the most common examples reported, however application of open access publishing is likely to be higher due to research funder mandates. Results are shown in Figure 7, below.
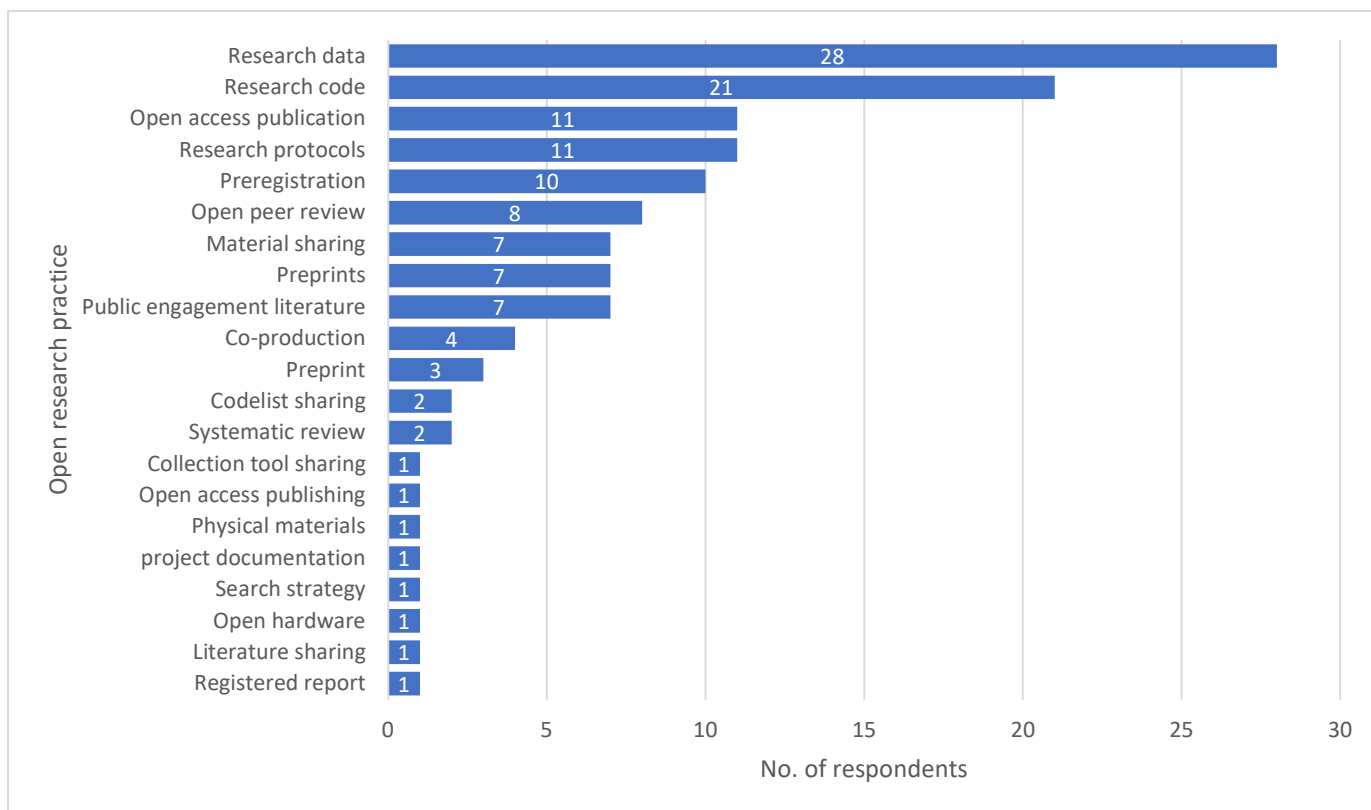
Figure 7: Open research practices applied by LSHTM researchers

The following section outlines a few of the responses provided for Q6a "If you have been involved in research that has applied one or more open research practices, please can you briefly describe it?".

General statements

> *"All my research work is based on open science principles and I publish all methods, data and papers openly wherever possible. I've done work directly on open software, hardware and SOPs and work on community projects."*

> *"My lab preprints all research articles at the time of submission to peer-reviewed journals (total 68 in MedRxiv/BioRxiv). We develop bioinformatics software that is always released open-source… I have published a paper in F1000 with open review, and versioned updates to article content."*

> *"All trial documents include Protocols, CRFs, statistical analysis plan are made freely available and can be utilised globally. Publish on Wellcome Open (open review and pre-published before peer review); Creation of one of the first data sharing platform to be used in the UK. Freebird"*

Pre-registration

"The trials that I work on are always preregistered. I try to make sure that the code I have written is easily accessible (e.g. in supplementary material or on Github) and, where possible, that the data are available too."

"All the trials I work on have preregistration. There is a public facing website were patient info sheets etc are available for viewing. Some of my publications include online appendices that have code for the statistical analyses. Open peer review at journals that have this option."

Research co-production

"AHRI and the Uganda MRC Unit - I have a current project in both those locations based on co-design by young people"

Material sharing

"Have been involved in the drug resistant TB survey for Zimbabwe. We shipped some specimens overseas for confirmatory testing. We filled in documentation that is required to export the specimens. I am also reviewed a journal article as part of open peer review"

"I have pioneered techniques for genetically modifying parasites. We have sent our lines to around 60 different laboratories worldwide."

"I have registered trials, published protocols and intend to publish more protocols, shared project updates on open research platforms (e.g., ResearchGate), co-create materials with key community members, shared preprints prior to peer review etc"

"My website details the resources I share (plasmids) and describes my public engagement activities"

"I have been involved in a number of research work that shared samples with collaborators in UK and US. These includes ENID (Early Nutrition and Immune Development) study"

Data and code sharing

"I've been involved in multiple project in which we have shared the analysis code via LSHTM's Data Compass. While journals have not required this, we believed it was best practice as it is really only the code that can detail precisely how an analysis was conducted. However well written a methods section in a journal paper is, it cannot provide the level of detail and reproducibility of the analysis code."

"I led a project to inform the design of COVID-19 Test, trace and Isolate policies, primarily via mathematical modelling and we have published modelling code, made preprints available and made publicly available interview data with members of the public as to their perceptions of testing and contact tracing in the UK. For other projects in which we have collected sensitive data among stigmatised population I have been more concerned about making data publicly available, though we have started to more commonly post preprints and have provided a process for applying for data access."

"For our studies using CPRD data, we regularly publish codelists and code on Data Compass and Github. A summary of the protocol is published on CPRD's website. We often submit preprints (especially during the COVID-19 pandemic). For systematic reviews, we register all protocols on PROSPERO and have several times published full research protocols in journals such as BMJ Open"

"Our evaluation of P4P and the Countdown project both shared data and Stata code/excel files enabling replication, or re-analyse by others. The P4P evaluation included a published study protocol. Dissemination involved a series of policy briefs, workshops and practice documents for health workers/managers."

3. Intent to apply Open Research practices in future research

3.1. Intent to apply Open Research practices

Participants indicated if they intended to apply each of the 10 stated open research practices in the "near future" (Q6). The timescale for future use was intentionally broad to allow a variety of interpretations. For example, during the next 2 years or in their next project. Results are shown in Figure 8 and Table 11 (p32).

All participants (n=162) completed the question, indicating intent by selecting 'Yes', 'No', or 'I don't know'. Of the responses provided:

- Participants indicated an intent to apply the majority of open research practices in the future. The sharing of public engagement literature was considered the most likely (67.9%, n=110), following by sharing of preprints (62.96%, n=102), code sharing (62.96%, n=102), open peer review (62.35%, n=101), preregistration (49.38%, n=80), and research co-production (48.15%, n=78).
- Participants were divided on whether research verification would be applied in the future, with 33.33% (n=54) indicating they would, 31.48% (n=51) indicating they would not, and 35.19% (n=57) who were uncertain. Similar uncertainty was expressed related to the publication of registered reports - 40.74% (n=66) indicated they did not know, 35.19% (n=57) indicated they would publish a Registered Report, and 24.07% (n=39) indicated they would not.
- Most participants indicated they would not be sharing physical materials (52.47%, n=85) or Computer Assisted Designs (63.58%, n=103) in the near future.
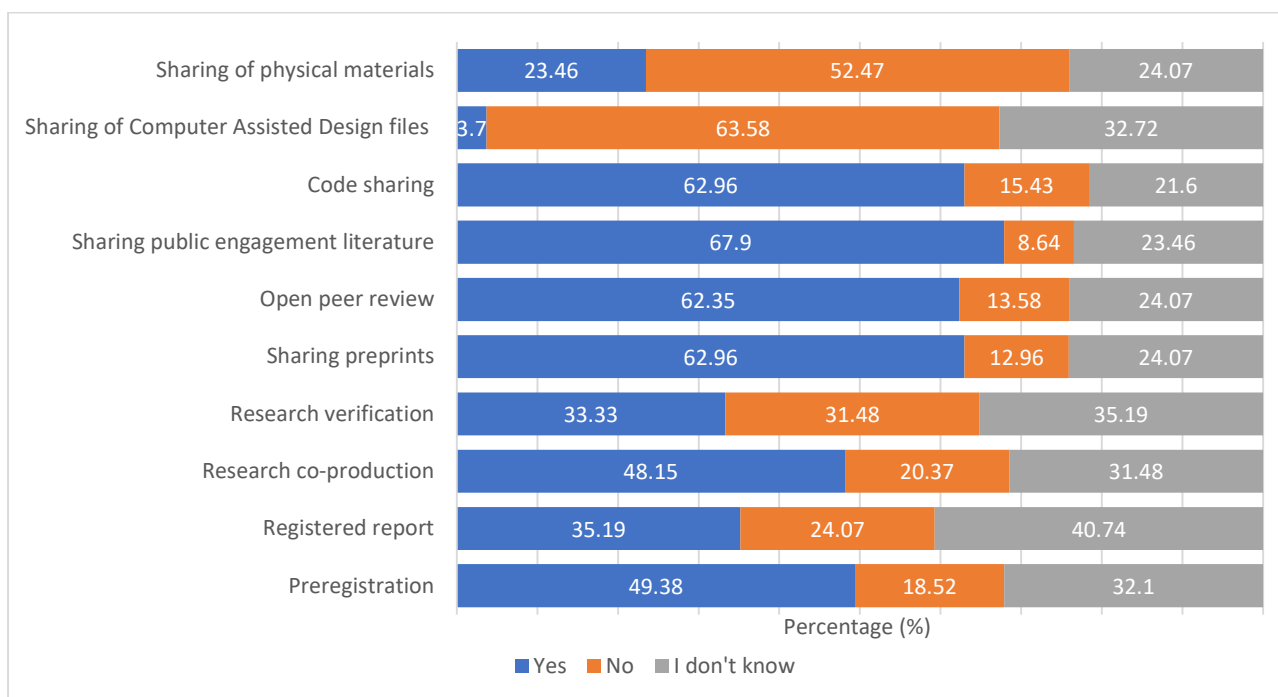
Figure 8: Intent to apply each open research practice as a percentage

3.2. Comparison of familiarity with research practice and intent to apply in future

Participants' current familiarity and use of the 10 open research practices were compared to their intent to apply the open research practice in future research, as outlined in Table 8, Table 9 and Table 10 (p31)

- Participants who had previously used a research practice were more likely to indicate an intent to use it in future research, in comparison to participants who had not used it previously, or were previously unaware of the research practice (Table 8).
- No link could be found between participants' current familiarity with an open research practice and future intent to apply it, in cases where they have not used it in research, were previously unfamiliar, or considered it to be nonapplicable to their research.

3.3.   Motivation to apply open research practices more widely

Participants were asked to specify the factors that would that would motivative them to apply open research practices more widely in their research, by selecting one or more responses from a list and/or entering a free text response (Q9). Results are shown in Figure 9 (below) and Table 12 (p32).
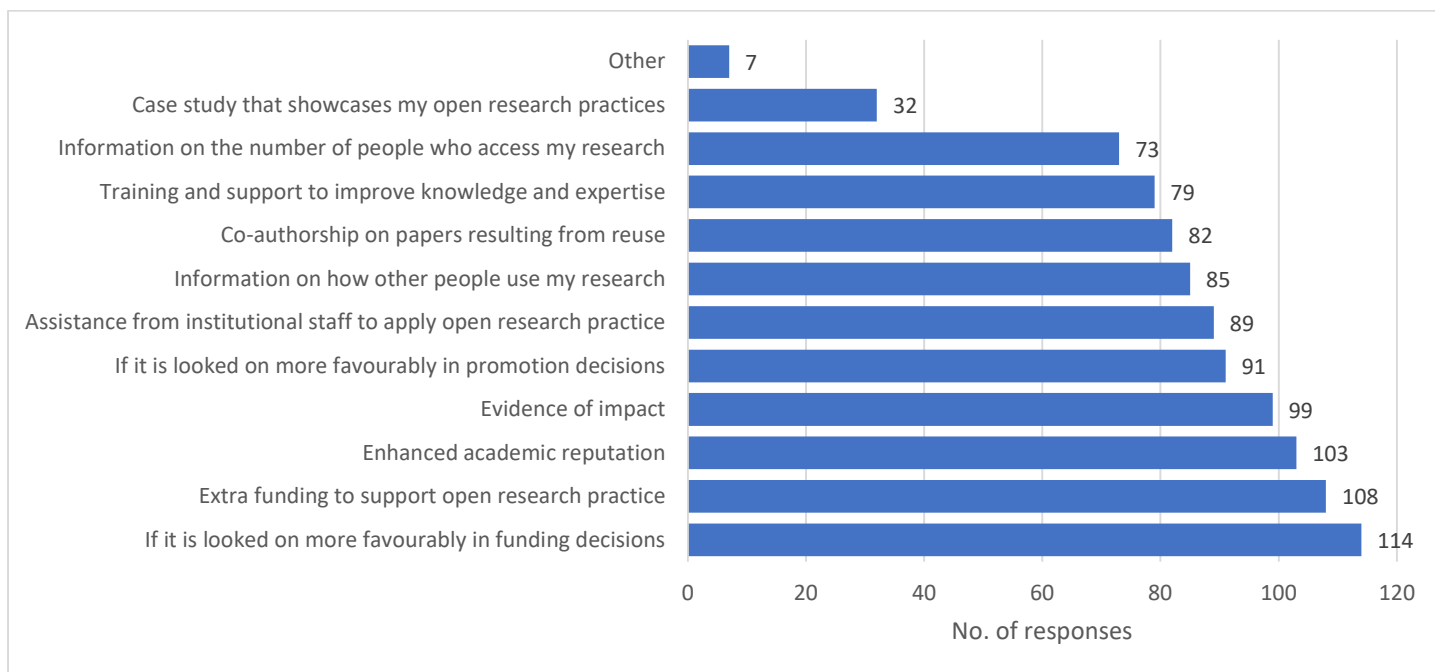
Figure 9: Factors that would motivate participants to apply open research practices more widely in their research

Participants that completed the free text field (Q9a) specified other factors that would motivate them to apply open research practices more widely:

General
"All the above because these are uniformly great ideas! Overall it is a philosophical and actual engagement with open principles that we need. The senior management culture is a long way behind the cutting edge here."

Research recognition
"I am highly motivated - and try to do it where at all possible, but sometimes this comes at major cost to me and to members of my team because of lack of understanding and lack of value placed on this within LSHTM."

Case studies on applying open research practices
"the research I do is 99% reliant on data that's already freely available and doesn't involve coding or anything like that which could be shared. There isn't really a barrier as such; it just isn't especially relevant. I suppose if funders required and supported, for example, the publication of a research plan then we would do it!... I'm not at all sure how it could be applied. In which case, some case studies showcasing *other* people's practices, from similar research methods/disciplines, would be really useful!"

Research support
"Properly resourced contracts team to support fast MTA."

"time! Admin support would help immensely with some of the work of doing this"

4. Barriers and concerns related to the use of open research

Participants were asked to indicate any concerns and barriers that may exist related to the take-up and use of open research practices. This was addressed in two stages, as outlined in 4.1 and 4.2.

4.1. Potential concerns on the use of open research

First, participants were presented with a set of 10 statements that outlined potential concerns related to the use of open research and asked to rate the extent to which they applied to their own research (Q7). Results are shown in Figure 10 (below) and Table 13 (p32).

The concerns were: [1] It may prevent exploratory research (e.g. preregistration); [2] Other people may copy my research idea, implement it and/or publish it before I do; [3] There may be unexpected intellectual property issues; [4] There may be unexpected ethical issues; [5] It may not be possible to protect participant confidentiality; [6] Others may criticise my work before it is complete; [7] Others may find it difficult to understand my research; [8] Others may find errors in my research; [9] It may result in others asking me to provide assistance with their research; and [10] A journal might not publish findings that have previously been made openly available.

This question was optional, which resulted in differences in the number of responses. Of the concerns listed in Table 13, Concern 2, 3, 6, 7 and 10 were completed by every respondent (n=162), concern 4, 8, and 9 was absent in one response (n=161), concern 5 was absent in two responses (n=160), and concern 1 was not answered by three participants (n=159).
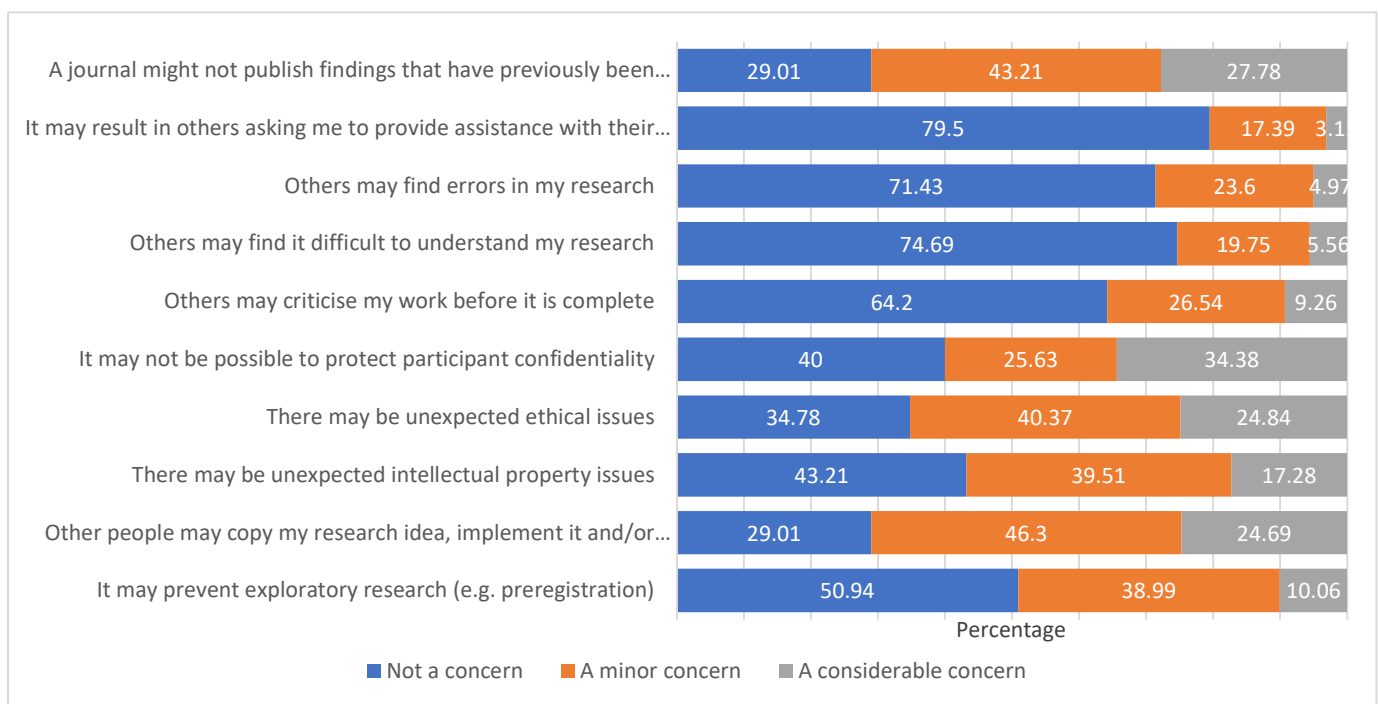
Figure 10: Potential concerns on the use of open research practices in own research

The largest percentage of participants indicated that the statements were not a concern, or were only a minor concern, in their research. However, a small number of participants indicated that certain statements were a considerable concern.

The following five statements were the highest-ranked concerns raised by participants:

1. The statement "A journal might not publish findings that have previously been made openly available" was the highest-rated concern (70.99% of responses), with 43.21% (n=70) indicating it is a minor concern and 27.78% (n=45) indicating it is a considerable concern.

2. The statement "Other people may copy my research idea, implement it and/or publish it before I do" was also considered a concern in 70.99% of responses - 46.3% (n=75) indicating it is a minor concern and 24.69% (n=40) indicating is a considerable concern.

3. The statement "There may be unexpected intellectual property issues" was a concern in 66.79% of responses, with 39.51% (n=64) indicating it is a minor concern and 17.28% (n=28) indicating it is a considerable concern.

4. The statement "There may be unexpected ethical issues" was a concern in 65.21% of responses, with 40.37% (n=65) indicating it is as a minor concern and 24.84% (n=40) indicating it is a considerable concern.

5. The statement "It may not be possible to protect participant confidentiality" was a concern in 60.01% of response, with 34.38% (n=55) indicating it was a significant concern and 25.63% (n=41) indicated it is a minor concern.

Most participants did not consider the following statements to be a concern in relation to their own research:

1. "It may result in others asking me to provide assistance with their research" (79.5%, n=128).
2. "Others may find it difficult to understand my research" (74.69%, n=121)
3. "Others may find errors in my research" (71.43%, n=115)
4. "Others may criticise my work before it is complete" (64.2%, n=104)
5. "It may prevent exploratory research (e.g. preregistration)" (50.94%, n=81)

4.2. Barriers to take-up and use of open research practices

Second, participants were presented with nine factors and asked to rate the extent to which they considered them to be barriers to the take-up and use of open research (Q8), with the option to provide other concerns/barriers or add further information in a text box (Q8a).

The question was completed by all participants (n=162). Results are shown in Figure 11 (below) and Table 14 (p32).
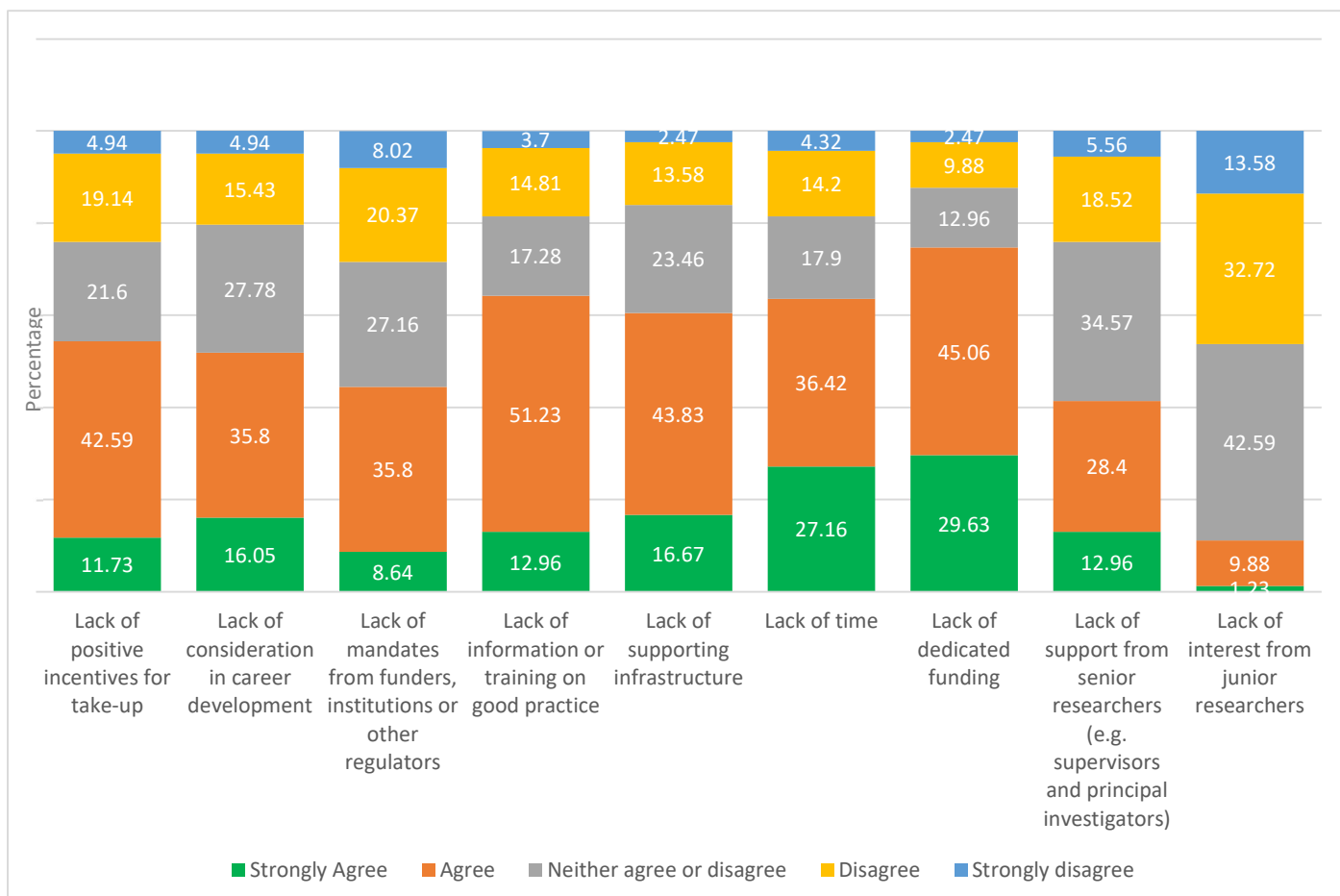
The largest percentage of participants 'agreed' or 'strongly agreed' that a lack of dedicated funding, information or training on good practice, time, supporting infrastructure, positive incentives for take-up, and consideration in career development were barriers to open research take-up and use. However, they were divided on whether a lack of mandates from funders, institutions or other regulators; and lack of support from senior researchers were a barrier. The majority of participants did not consider a 'lack of interest from junior researchers' to be a barrier.

1. **Lack of dedicated funding**

A 'lack of dedicated funding' for open research was the highest rated factor, with 74.69% (n=121) of participants indicating they 'agreed' or 'strongly agreed' that it was a barrier to open research take-up and use.

Participants outlined situations where research funders would not support open research practices in free text. For instance, some open research practices must be applied during the pre-award or post-completion stage:

> *"a big issue is not just the lack of funding but when some of these activities would happen, often long after a grant has closed, therefore someone is adding that to their (paid) workload"*

Two participants noted that the time necessary to apply open research may not be covered by research funds:

> *"Funders have twice pulled funding from my co-produced research, leaving us to try to rescue the relationships we have built up and forcing us to work for free to finish some of the outputs"*

> *"Open access has direct costs which are not covered. For instance putting the data together but no funding is available for this."*

Finally, a respondent noted that some funders do not support publication of 'non-traditional' research outputs:

> *"Funding to publish study protocols which are normally only accepted by open access journals."*

2. **Lack of information or training on good practice**

A 'lack of information or training on good practice' related to open research was the second-highest rated factor, with 64.20% (n=104) of participants indicating they 'agreed' or 'strongly agreed' that it was a barrier to open research take-up and use.

The free text comments recognised that LSHTM provided some training on open research topics, but that it could be further developed:

> *"LSHTM courses run by… library have been hugely helpful in open research. Also makes a BIG positive difference having our own, well run and well supported data repository"*

> *"I've been to a training on open research, which is only a bit helpful. Colleagues often have good ideas and resources but I don't know how to organise/access them when relevant to my work. It would also be helpful to have an expert who can field more specific questions, as often senior researchers aren't particularly informed or helpful."*

> *"There may well be training available, but I recognise I am not as well informed on best practice as I should be, and would benefit from training."*

3. **Lack of time**

A 'lack of time' was the third-highest rated factor for LSHTM researchers, with 60.49% (n=103) of participants indicating they 'agreed' or 'strongly agreed' that it was a barrier to open research take-up and use. In part, this may be linked to concerns related to the lack of dedicated funding to support open research practices and the time period when activities are performed.

> *"My main barriers are lack of time and funding. While we might like to publish a full research protocol in advance of doing a study, this takes considerable time and effort. These protocols are peer reviewed like full*

papers and authors need to respond to peer review comments. There is an opportunity cost to doing this and sometimes it makes more sense to get on and do the research."

The need for institutional support to apply open research practices in a timely manner was noted by some participants who completed the optional text field.

"With crystal clear guidance from the School on how to manage effectively, we should be able to do it. Of course, there is a time element to many of these things, and the School needs to provide timely assistance if they want to promote these practices. Research and project support staff are already severely overloaded, so any work the School wants to promote must be given substantial internal support. I'm thinking of consistent, ongoing delays with legal contracts for example. If there is need for contracts to ensure some of these open practices and it is something the School want to promote, then there needs to be improvements in internal support and delivery times."

"Materials transfer agreements can take months or years (my record is a year and a half for one). This includes cases where the same materials are being shared many times. Better MTA standardisation and more manpower in the contracts team would help this."

4. Lack of supporting infrastructure

A 'lack of supporting infrastructure' was the fourth-highest rated factor for LSHTM researchers, with 60.49% (n=98) of participants indicating they 'agreed' or 'strongly agreed' that it was a barrier to open research take-up and use. This may potentially cover systems, staff, or other resources.

The free text comments recognised that LSHTM possesses digital repositories to host research data, code, and other outputs. However, there are potential gaps:

"One of the main barriers is suitable infrastructure. E.g. As far as I know LSHTM doesn't have a GitHub account/plan for open access sharing of source code for statistical/mathematical models."

5. Lack of positive incentives for take-up

This was the fifth-highest rated factor for LSHTM researchers, with 54.32% (n=88) indicating they 'agreed' or 'strongly agreed' that it was a barrier to open research take-up and use. The free text comments provided further details, highlighting the role of LSHTM, research funders, and journal publishers in encouraging open research practice.

Three participants commented on the 'lack of consideration in career development' factor, noting that open research is not currently recognised in development objectives and metrics:

"…senior team [does not] properly recognise non-research paper outputs (code, packages, etc) when looking at career progression. Data & code sharing don't seem to be widely encouraged, although we have good platforms for doing so. I find it curious that the school firmly recognises contributions of statistical methodologists, but not methodologists in the broader sense of coding, open methods etc. Hopefully the new data centre may help with this."

"LSHTM does not appear to recognise engagement work as 'proper' research in promotion processes that prioritise large grant income and number of papers over more nuanced, ethical, sustainable practice which is not assessed at all, to my knowledge"

6. Lack of consideration in career development

A 'Lack of consideration in career development' was the sixth-highest rated factor, with 51.85% (n=84) indicating they 'agreed' or 'strongly agreed' that it was a barrier. In total, 27.78% (n=45) provided a neutral response (Neither agree or disagree) and 20.37% (n=33) indicated they 'disagreed' or 'strongly disagreed'.

7. Lack of mandates from funders, institutions or other regulators

Participants were divided on whether a lack of funder, institutional or other regulator mandates related to open research was a barrier to take-up and use. A large percentage of participants (44.44%, n= 72) 'agreed' or 'strongly' agreed that it is, but 28.40% (n=46) 'disagreed' or 'strongly disagreed' that it was a barrier, and 27.16% (n=44) provided neutral response (neither agree or disagree).

The free text comments recognised that the role of journal publishers in encouraging open research practices:

> *"it has to be mandated and properly followed-up. Even when journals say "data must be made available" you still get people not doing it and the paper gets published anyway. there shouldn't be many excuses any more."*

> *"Some journals still follow traditional practices e.g. discouraging pre-prints and prior publication of intermediate results so that they can get the "one big paper"; some also discourage publication of detailed data/code."*

> *"The fact that most medical journals do not require some open research practices is a major barrier. On some open research practices, the medical journal world is well behind economics, where the sharing of data and analysis code is now fairly routine in the publication process"*

8. Lack of support from senior researchers

Similarly, participants' were divided on whether a lack of support from senior researchers (e.g. supervisors and principal investigators) was a barrier. A large percentage of participants (41.36%, n= 67) agreed or strongly agreed that it is, but 34.57% (n=56) provided a neutral response (neither agree or disagree), and 24.07% (n=39) did not consider it a barrier ('disagreed' or 'strongly disagreed'). It may be difficult for a junior researcher to apply open research practices against the wishes of a senior researcher, however.

> *"It would be great if there was support from senior researchers with the publication of the code/do-file, e.g. it would be great (but not sure if financially possible) if a senior statistician could check the code/ do-file before it is published."*

9. Lack of interest from junior researchers

A lack of interest from junior researchers was not considered to be a barrier by the majority of participants - 46.3% (n=75) disagreed or strongly disagreed with the statement and 42.59% (n=69) expressed a neutral position (neither agree or disagree). In total, 11.11 % (n=18) participants indicated that it was a barrier.

Other potential barriers to open research

Participants were invited to outline other factors that may limit their ability to apply open research practices in free text (Q8a). The responses provided highlighted the regulatory framework and practice-specific barriers.

Confidentiality requirements

Regulatory requirements, such as Data Protection legislation, ethical commitments, and contractual requirements related to the protection of confidential information were noted as potential barriers.

> *"Participant confidentiality is a concern and lack of guidance about best-practice, particularly around GDPR and what counts as de-identified (e.g. must you have a certain number of people in each possible group... i.e. more than 5 people in each possible combination of factors?)."*

> *"Journals sometimes stipulate that material must be shared if the work is to be published, but in some cases this is not possible due to participant consent or concerns about privacy issues. This can cause some uncertainty."*

> *"Those working in health often cite participant confidentiality as a barrier - but in my view this is a smokescreen for simply not wanting others to see the data and be willing to be scrutinised. Anonymity can be dealt with if there is the appropriate institutional guidance and infrastructure."*

"Some of our research is commercially sensitive and open to attack from the tobacco and other industries. Publishing/pre-registering studies and methods may give such industries prior warning of the research, so they can undermine it in advance."

"There may be huge regulatory barriers in sharing research - for example, we have been asked to share blood samples from our trial with investigators looking at methods for HPV vaccine immune response serological assays. Although our consent forms allow for sharing samples & data with other researchers, a lab in Germany cannot accept the samples without an amendment to our protocol & consent forms to specifically state that we will share the samples with researchers in Germany. This is a huge amount of work - needing ethics approval in both UK and Tanzania, and reconsenting participants"

Practice-specific barriers

Preprints

The following challenges were noted by one respondent in multiple sections of the survey:

"A challenge for junior researchers when journals offer to put papers as preprints not realising they can say no. Particularly critical for work that is not time sensitive and will benefit from peer review - in a protected space.

"The push for preprints - which are appropriate for time sensitive research (as during COVID-19 when science moved so quickly) is not appropriate for a lot of other forms of research - and can result in confusion over what has actually been published. I think the system for this is a mess - driven by unscrupulous sites and journals"

"less happy to publish our results before peer-review as reviewers comments can modify the paper and its results."

Open peer review

"Open Peer review is the only one which is a moot point because it has clear downsides (e.g. who accepts to do reviews, who says what they really think)"

"I'm hesitant to use open peer review because I feel it may be difficult to give honest criticism as a junior researcher, especially on work submitted by senior researchers in my field."

"Specifically for open peer review - I feel that breaking anonymity of reviewers can substantially threaten the ability of a reviewer to provide an honest challenge to the paper they are considered. E.g. I have reviewed (anonymously) a paper by a former boss who still works in the same faculty. I would not have felt able to provide this review if it had been open, as I would not have felt able to critique their paper as objectively"

"Regarding open peer review, one concern is that authors may not take my comments as seriously if they search me and see that I'm a fairly junior researcher. So maybe there's also a self-esteem component that is important too."

Code sharing and software development

"For software to be truly impactful it requires continued development and support for users, however, it is near impossible to get funding to support this work. Information on where to look for this funding, or small internal funds made available through LSHTM would be really appreciated."

Benefits of open research practices

"Want to note that some of the barriers are things that I worry about, but I doesn't mean I think they override importance of transparency. For example, I would be embarrassed if someone spots a mistake in my work, but think it is better for this to be noticed through public code than never being noticed."

"I used to worry about my amateur code, but I am less concerned now as I think people and reviewers understand and it's good to see how people do things."

5. Open Research training and guidance

The final section explored the open research training and guidance needs of participants.

5.1. Previous training on open research practices

Participants were first asked if they had previously received formal training or other support associated with open research practices (Q10). Of 162 responses, 17.9% (n=29) had received open research training, 74.69% (n=121) indicated they had not received training, and 7.41% (n=12) indicated they did not know.

In total, 21 participants provided a free text response on the type and source of training they had received:

- *LSHTM-organized events (n=12):* 8 indicated they had attended LSHTM Library, Archive & Open Research Services (LAORS) training on data management and open access publishing; and 4 indicated attendance of research centre seminars on GitHub and crowdsourced organised by research groups such as the Centre for Mathematical Modelling of Infectious Diseases (CMMID).

- *Other universities (n=2):* One participant had attended an open research course held at the University of Southampton in 2017, and a second participant had attended a training course on use of GitHub for code sharing at Imperial College London.

- *Research funder (n=2):* The first was a Plan S seminar organised by the Wellcome Trust and the second was an unstated webinar held by National Institute for Health and Care Research (NIHR).

- *Other institutions (n=2):* A respondent had received in-person and online training on "how to conduct crowdsourcing activities and co-create intervention components with key community representatives, from UNC Project China during the past 5 years, and a second respondent had attended a UK Reproducibility Network event on 'Advanced Methods in Reproducible Research' in 2020.

- *Unknown location (n=3):* Three participants indicated they had attended open research events (open data practices, publication process and authorship), but did not provide further information.

5.2. Future open research training and guidance

Second, we sought to determine future open research training and guidance needs of participants (Q11 and Q11a).

Several university open research surveys provide an initial question that asks the participant if they are interested in attending training on an open research topic (with a Yes/No response). For the LSHTM survey, it was assumed that participants would express an interest in training on many open research topics, if training was available. Instead, we sought to determine the proficiency level that future training and guidance should be developed for, based upon the participant's current level of expertise (Introductory, Intermediate, or Advanced).

This question was optional, with some variation in the number of responses received for each open research topic (between 155-157 of the 162 participants). Results are shown in Figure 12 (below) and Table 15 (p33).
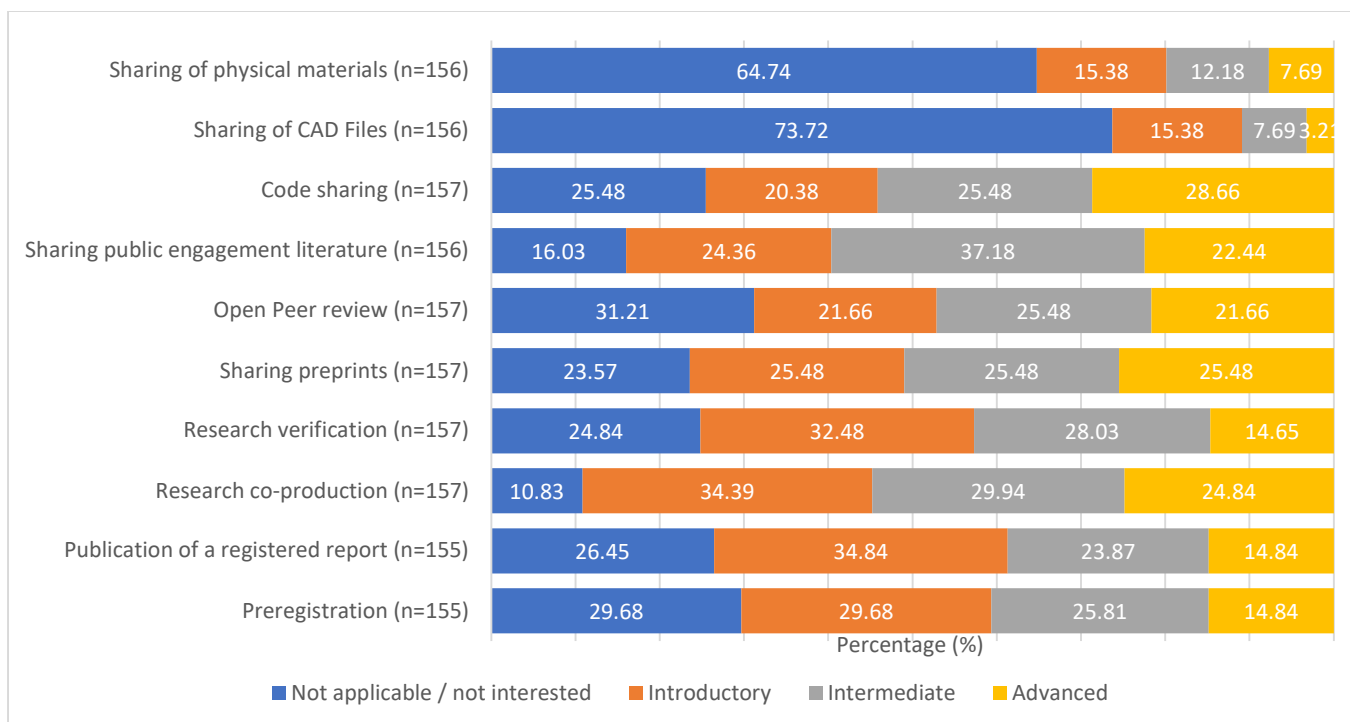
Figure 12: If LSHTM were to offer training and guidance on open research practices, what proficiency level should it be aimed toward to help you in your research (based upon your current level of expertise)?

Participant preference for training and guidance on open research practices are outlined below:

1. **Research co-production**
   89.17% of 157 participants were interested in training and guidance on research co-production. Of these, the largest number indicated a preference for Introductory material (n=54), followed by Intermediate (n=47) and Advanced (n=39).

2. **Sharing public engagement literature**
   83.97% of 156 participants were interested in training and guidance on sharing public engagement literature. Of these, there was greater interest in intermediate training (n=58), followed by introductory training (n=38) and advanced training (n=35).

3. **Sharing preprints & other works prior to peer review**
   76.43% of 157 participants were interested in training and guidance. Of these, an equal number were interested in Introductory, Intermediate, and Advanced (n=40 for each).

4. **Research verification**
   75.16% of 157 participants were interested in training and guidance on research verification. Of these, the largest number indicated a preference for Introductory material (n=51), followed by Intermediate (n=44) and Advanced (n=23).

5. **Code sharing**
   74.52% of 157 participants were interested in training and guidance. Of these, there was greater interest in Advanced material (n=45), followed by Intermediate training (n=40), and Introductory material (n=32).

   One participant provided further details on a topic where guidance was needed:
   "I'm interested in how to share code after a project more than using a full version control system as I use Stata and not R."

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6. **Publication of a registered report**

   73.55% of 155 participants were interested in training and guidance. Of these, there was greater interest in Introductory material (n=54), followed by Intermediate (n=37) and Advanced (n=23).

7. **Preregistration**

   70.32% of 155 participants expressed an interest in training and guidance. Of these, there was greater interested in Introductory (n=46), followed by Intermediate (n=40) and Advanced (n=23) material.

8. **Open Peer review**

   68.79% of 157 participants expressed an interest in training and guidance. Of these, there was higher interest in Intermediate training (n=40), with an equal number expressing an interest in Introductory and Advanced training (n=34 for both).

9. **Sharing of physical materials**

   35.26% of 156 participants expressed an interest in training and guidance on the sharing of physical materials, such as samples. Of these, there was greater interested in Introductory (n=24), followed by Intermediate (n=19), and Advanced (n=12) materials.

   One participant provided further details on a topic where guidance is needed:
   "Support to deposit materials in repositories. The school doesn't have any favoured places or support for depositing. Can be very difficult to use even established resources like Addgene (plasmids) as MTAs are too slow. These should be standardised and lists of approved repositories be shared with researchers."

10. **Sharing of Computer Assisted Designs**

    26.28% of 156 participants expressed an interest in training and guidance on sharing of CAD Files, such as 3D models for physical objects. Of these, most were interested in Introductory (n=24), followed by Intermediate (n=12), and Advanced materials (n=5).

Other training and guidance requirements

Finally, we invited participants to specify other open research practices on which they require training and guidance. Several responses highlighted the need for further guidance on information security, data anonymisation, post-project data archiving, and preparing data for sharing, tailored to the needs of specific research studies. The need for guidance on how open research can be used for career development was also suggested:

> *"Funding open research practices and how to convert them into 'promotion-worthy' points on CVs (especially for junior/fixed term researchers)"*

> *"getting DOIs, how to work out impact and turn that into reportable numbers for funders"*

APPENDIX A: Survey responses

Open research practice	Familiar. Have used it in research	Familiar. Have not used it in research	Unfamiliar (until now)	Not applicable to my research
Preregistration	86	40	23	13
Registered reports	44	68	39	11
Research co-production	43	83	29	7
Research verification	42	84	28	8
Sharing of preprints & other scholarly works	102	47	12	1
Open Peer review	105	41	16	0
Sharing public engagement literature	89	53	13	7
Code sharing	75	57	15	15
Sharing of CAD files	2	22	49	89
Sharing of physical materials	27	35	24	76

Table 2: Awareness and application of open research practices among all participants

Open research practice	Familiar. Have used it in research	Familiar. Have not used it in research	Unfamiliar (until now)	Not applicable to my research
Preregistration	47	16	9	5
Registered reports	22	30	20	5
Research coproduction	20	40	14	3
Research verification	17	42	16	2
Sharing preprints & other scholarly works prior to peer review	54	20	3	0
Open Peer review	51	17	9	0
Sharing public engagement literature	42	24	8	3
Code sharing	49	22	4	2
Sharing of CAD files	1	5	25	46
Sharing of physical materials	8	13	14	42

Table 3: Familiarity and use of open research practices among EPH participants

Open research practice	Familiar. Have used it in research	Familiar. Have not used it in research	Unfamiliar (until now)	Not applicable to my research
Preregistration	19	14	9	3
Registered reports	11	20	12	2
Research coproduction	15	23	7	0
Research verification	8	21	11	5
Sharing preprints & other scholarly works prior to peer review	20	16	8	1
Open Peer review	23	16	6	0
Sharing public engagement literature	28	11	5	1
Code sharing	9	18	9	9
Sharing of CAD files	0	6	16	23
Sharing of physical materials	1	9	9	26

Table 4: Familiarity and use of open research practices among PHP participants

Open research practice	Familiar. Have used it in research	Familiar. Have not used it in research	Unfamiliar (until now)	Not applicable to my research
Preregistration	17	8	4	4
Registered reports	9	15	6	3
Research coproduction	7	18	4	4
Research verification	15	16	1	1
Sharing preprints & other scholarly works prior to peer review	25	8	0	0
Open Peer review	27	6	0	0
Sharing public engagement literature	15	15	0	3
Code sharing	16	14	0	3
Sharing of CAD files	1	11	2	19
Sharing of physical materials	15	10	1	7

Table 5: Familiarity and use of open research practices among ITD participants

Open research practice	Familiar. Have used it in research	Familiar. Have not used it in research	Unfamiliar (until now)	Not applicable to my research
Preregistration	3	2	1	0
Registered reports	2	3	1	0
Research coproduction	0	2	4	0
Research verification	1	5	0	0
Sharing preprints & other scholarly works prior to peer review	3	2	1	0
Open Peer review	4	1	1	0
Sharing public engagement literature	4	2	0	0
Code sharing	1	3	2	0
Sharing of CAD files	0	0	6	0
Sharing of physical materials	3	3	0	0

Table 6: Familiarity and use of open research practices among MRC Gambia & Uganda participants

Status	Familiar. Have used it in research	Familiar. Have not used it in research	Unfamiliar (until now)	Not applicable to my research
Preregistration	12	15	7	2
Registered reports	4	22	10	0
Research co-production	7	16	11	2
Research verification	11	13	10	2
Sharing preprints	18	12	6	0
Open Peer review	12	13	11	0
Sharing public engagement literature	18	13	3	2
Code sharing	11	16	6	3
Sharing of CAD Files	0	5	14	17
Sharing of physical materials	8	6	7	15

Table 7: Familiarity and use of open research practices among research degree students

	Familiar. Have used it in research	Familiar. Have not used it in research	Unfamiliar (until now)	Not applicable to my research
Preregistration	66	12	2	
Registered report	33	16	8	
Research co-production	33	34	10	1
Research verification	35	14	3	2
Sharing preprints	85	13	4	
Open Peer review	79	18	4	
Sharing public engagement literature	76	29	4	1
Code sharing	74	24	4	
Sharing of CAD Files	1	2	3	
Sharing of physical materials	23	9	3	3

Table 8: Participant current familiarity with a research practice and future intent to apply it (yes, intend to apply it)

	Familiar. Have used it in research	Familiar. Have not used it in research	Unfamiliar (until now)	Not applicable to my research
Preregistration	9	6	5	10
Registered report	3	17	10	9
Research co-production	3	21	6	3
Research verification	3	35	9	4
Sharing preprints	5	12	3	1
Open Peer review	7	9	6	
Sharing public engagement literature	2	6	3	3
Code sharing		12	4	9
Sharing of CAD Files	0	13	24	66
Sharing of physical materials	1	14	15	55

Table 9: Participant current familiarity with a research practice and future intent to apply it (no, do not intend to apply it)

	Familiar. Have used it in research	Familiar. Have not used it in research	Unfamiliar (until now)	Not applicable to my research
Preregistration	11	22	16	3
Registered report	8	35	21	2
Research co-production	7	28	13	3
Research verification	4	35	16	2
Sharing preprints	12	22	5	0
Open Peer review	19	14	6	0
Sharing public engagement literature status	11	18	6	3
Code sharing status	1	21	7	6
Sharing of CAD Files	1	7	22	23
Sharing of physical materials	3	12	6	18

Table 10: Participant current familiarity with a research practice and future intent to apply it (I don't know)

Open Research practice	Yes	No	I don't know
Preregistration	80	30	52
Registered report	57	39	66
Research co-production	78	33	51
Research verification	54	51	57
Sharing preprints	102	21	39
Open peer review	101	22	39
Sharing public engagement literature	110	14	38
Code sharing	102	25	35
Sharing of Computer Assisted Design files	6	103	53

Open Research practice	Yes	No	I don't know
Sharing of physical materials (such as samples)	38	85	39

Table 11: Intent to apply each open research practice in the near future

Motivation	No.
If it is looked on more favourably in funding decisions	114
Extra funding to support open research practice	108
Enhanced academic reputation	103
Evidence of impact	99
If it is looked on more favourably in promotion decisions	91
Assistance from institutional staff to apply open research practice	89
Information on how other people use my research	85
Co-authorship on papers resulting from reuse	82
Training and support to improve knowledge and expertise	79
Information on the number of people who access my research	73
Case study that showcases my open research practices	32
Other	7

Table 12: Factors that would motivate participants to apply open research practices more widely in their research

No	Potential concerns	Not a concern	A minor concern	A considerable concern	Total responses
1	It may prevent exploratory research (e.g. preregistration)	81	62	16	159
2	Other people may copy my research idea, implement it and/or publish it before I do	47	75	40	162
3	There may be unexpected intellectual property issues	70	64	28	162
4	There may be unexpected ethical issues	56	65	40	161
5	It may not be possible to protect participant confidentiality	64	41	55	160
6	Others may criticise my work before it is complete	104	43	15	162
7	Others may find it difficult to understand my research	121	32	9	162
8	Others may find errors in my research	115	38	8	161
9	It may result in others asking me to provide assistance with their research	128	28	5	161
10	A journal might not publish findings that have previously been made openly available	47	70	45	162

Table 13: Potential concerns on the use of open research practices in own research (number of responses)

No	Potential barrier	Strongly Agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
1	Lack of positive incentives for take-up	19	69	35	31	8
2	Lack of consideration in career development	26	58	45	25	8
3	Lack of mandates from funders, institutions or other regulators	14	58	44	33	13
4	Lack of information or training on good practice	21	83	28	24	6
5	Lack of supporting infrastructure	27	71	38	22	4
6	Lack of time	44	59	29	23	7
7	Lack of dedicated funding	48	73	21	16	4
8	Lack of support from senior researchers (e.g. supervisors and principal investigators)	21	46	56	30	9
9	Lack of interest from junior researchers	2	16	69	53	22

Table 14: To what extent do you consider the following factors to be barriers to take-up and use of open research practices in your own research? (Please select *ONE* answer per row)

Open research practice	Not applicable / not interested	Introductory	Intermediate	Advanced
Preregistration (n=155)	46	46	40	23
Publication of a registered report (n=155)	41	54	37	23
Research co-production (citizen science, crowdsourcing, co-creation) (n=157)	17	54	47	39
Research verification: Testing claims of prior research (n=157)	39	51	44	23
Sharing preprints & other works prior to peer review (n=157)	37	40	40	40
Open Peer review (n=157)	49	34	40	34
Sharing public engagement literature (n=156)	25	38	58	35
Code sharing (n=157)	40	32	40	45
Sharing of CAD Files including 3D models for physical objects (n=156)	115	24	12	5
Sharing of physical materials (such as samples) (n=156)	101	24	19	12

Table 15: If LSHTM were to offer training and guidance on open research practices, what proficiency level should it be aimed toward to help you in your research (based upon your current level of expertise)?

Page 1: LSHTM Open Research Survey

The aim of this survey is to gather information on the current adoption of open research practices among LSHTM researchers and identify areas where support is needed. Even if you do not apply open research practices in your own research, we would like you to take part in this survey. Your participation will help to ensure that the support provided is appropriate for your research discipline. Your responses to the survey will inform the design of open research training and other support provided at LSHTM.

Broadly, open research (also called 'open science' or 'open scholarship') refers to efforts to ensure that different elements of the research process are robust, transparent, and accessible.

The survey is aimed at LSHTM researchers in any role and at any career stage. This includes academic staff, research degree students, and research support staff working in London, the MRC Unit The Gambia at LSHTM, MRC/UVRI and LSHTM Uganda Research Unit, and LSHTM-affiliated organisations.

Do I have to take part?

Participation in this survey is voluntary and will not influence future research opportunities. We estimate that it will take approximately 10 minutes.

What will happen to information collected about me?

The survey results will be written up as a report that will be made publicly available. Anonymous data will be made publicly available in a digital repository. These outputs will not provide information that will allow identification of you or your responses.

If you wish to exclude your response from analysis, please provide your Receipt number. These will be displayed on the 'Completion Receipt' displayed when you submit the survey.

If you have any comments or questions, please contact the LSHTM Research Data Manager, Gareth Knight (gareth.knight@lshtm.ac.uk).

Please indicate your consent to participate in the survey before proceeding

- o   I consent to participating in the survey

Page 2: About You

First, please provide brief details about yourself and where you are located in LSHTM.

Q1. Which of the following best describes your current LSHTM role? (select one). Required

- o   Research Degree Student (PhD, MPhil)
- o   Research Assistant
- o   Research Associate
- o   Research Fellow
- o   Reader
- o   Associate Professor
- o   Assistant Professor
- o   Professor
- o   Trial Assistant
- o   Trial Manager
- o   Data Manager
- o   Administrator
- o   Other

Q1a. If you selected Other, please specify (text box)

Q2. In total, how many years have you worked/studied at LSHTM? (select one) Required

- o Less than 1 year
- o 1-5 years
- o 6-10 years
- o 11-15 years
- o 16-20 years
- o More than 20 years

Q3. Where are you located within the LSHTM structure? (Select one) Required

- o LSHTM - Faculty of Epidemiology and Population Health
- o LSHTM - Faculty of Infectious and Tropical Diseases
- o LSHTM - Faculty of Public Health and Policy
- o LSHTM - Professional Support Services (e.g. ITS, LAORS)
- o MRC Unit The Gambia at LSHTM
- o MRC/UVRI and LSHTM Uganda Research Unit
- o Other

Q3a. Which EPH department are you located in? (select one) Required

- o Dept of Infectious Disease Epidemiology
- o Dept of Medical Statistics
- o Dept of Non-Communicable Disease Epidemiology
- o Dept of Population Health
- o Other department

Q3b. Which ITD department are you located in? (select one) Required

- o Dept of Clinical Research
- o Dept of Disease Control
- o Department of Infection Biology
- o Bloomsbury Research Institute
- o Wolfson Cell Biology Facility
- o Teaching and Diagnostic Unit
- o Other department

Q3c. Which PHP department are you located in? (select one) Required

- o Dept of Global Health and Development
- o Dept of Health Services Research and Policy
- o Public Health, Environments and Society
- o UK Faculty of Public Health
- o Other department

Q3d. Which MRC Uganda area are you located in? (select one) Required

- o UG-Basic Science
- o UG-Co-Infections
- o UG-HIV Care
- o UG-HIV Prevention & Epidemiology
- o UG-HIV Prevention & Epidemiology
- o UG-Uganda Science Support
- o UG-Non-Communicable Diseases
- o Other

Q3e. Which MRC Gambia area are you located in? (select one) Required

- o GM-Child Survival Theme
- o GM-Disease Control and Elimination Theme
- o GM-Gambia Clinical Services/Comms
- o GM-General Administration
- o GM-IS
- o GM-Laboratory Management
- o GM-Nutrition Theme
- o GM-Vaccinology Theme
- o GM-West African Initiative

Q3f. Which Professional Support Service are you located in? (text box)

Q3g. Other

If you selected Other, please specify: (text box)

Page 3: Open Research Practices

On this page, we will ask you questions on your awareness and use of various open research practices.

Q4. How familiar are you with the following open research practices? (Please select *ONE* answer per row) Required

Please don't select more than 1 answer(s) per row. Please select at least 10 answer(s).

	Unfamiliar (until now)	Familiar. Have not used it in research	Familiar. Have used it in research	Not applicable to my research
1. Preregistration: Publication of a research plan or trial registration before undertaking work				
2. Registered reports: Publication of an article on the research plan before undertaking work				
3. Research co-production: Use of citizen science, crowdsourcing, co-creation, or other methods to encourage the public, patients, or others to contribute to research				
4. Research verification: Testing claims of prior research through replication / reproduction / robustness checks				

5. Sharing preprints & other scholarly works prior to peer review via an online repository				
6. Open Peer review: Providing a journal or grant peer review where authors and reviewers are aware of each other's identity				
7. Sharing public engagement literature (reports, pamphlets, or other resources) for purpose of informing participants/the public of research objectives & outcomes				
8. Code sharing: Making R packages, STATA DO files, or other code openly available				
9. Sharing of CAD Files, including 3D models, scans, blueprints and designs for physical objects and open hardware				
10. Sharing of physical materials: Making specimens, samples, or other items available				

Q5. What was the motivation for applying these research practices? (text box)

Q6. Do you intend to apply these open research practices in the near future? E.g. next 2 years, in your next project. (Please select *ONE* answer per row) Required

Please don't select more than 1 answer(s) per row. Please select at least 10 answer(s).

	Yes	No	I don't know
1. Preregistration			
2. Publication of a registered report			
3. Research co-production (such as citizen science, crowdsourcing, co-			

creation, or other methods)			
4. Research verification: Testing claims of prior research			
5. Sharing preprints & other works prior to peer review			
6. Open Peer review			
7. Sharing public engagement literature			
8. Code sharing			
9. Sharing of CAD Files including 3D models for physical objects			
10. Sharing of physical materials (such as samples)			

Q6a. If you have been involved in research that has applied one or more open research practices, please can you briefly describe it? (or provide a web link) (text box)

Page 4: Open Research barriers & concerns

Q7. The table below shows potential concerns that may be raised on the use of open research practices. Please can you rate them in relation to your own research? (Please select *ONE* answer per row) Required

Please don't select more than 1 answer(s) per row. Please select at least 5 answer(s).

	Not a concern	A minor concern	A considerable concern
It may prevent exploratory research (e.g. preregistration)			
Other people may copy my research idea, implement it and/or publish it before I do			
There may be unexpected intellectual property issues			
There may be unexpected ethical issues			
It may not be possible to protect participant confidentiality			
Others may criticise my work before it is complete			
Others may find it difficult to understand my research			
Others may find errors in my research			
It may result in others asking me to provide			

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
assistance with their research					
A journal might not publish findings that have previously been made openly available					

Q8. To what extent do you consider the following factors to be barriers to take-up and use of open research practices in your own research? (Please select *ONE* answer per row)

Please don't select more than 1 answer(s) per row. Please select at least 5 answer(s).

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
Lack of positive incentives for take-up					
Lack of consideration in career development					
Lack of mandates from funders, institutions or other regulators					
Lack of information or training on good practice					
Lack of supporting infrastructure					
Lack of time					
Lack of dedicated funding					
Lack of support from senior researchers (e.g. supervisors and principal investigators)					
Lack of interest from junior researchers					

Q8a. If appropriate, please mention any other concerns / barriers or provide further information on the above.
(free text)

Page 5: Open Research support

Q9. What would motivate you to apply open research practices more widely in your research? (select all that apply)

- o Enhanced academic reputation
- o Information on the number of people who access my research
- o Information on how other people use my research
- o Co-authorship on papers resulting from reuse
- o Case study that showcases my open research practices
- o If it is looked on more favourably in funding decisions
- o If it is looked on more favourably in promotion decisions
- o Extra funding to support open research practice
- o Evidence of impact
- o Training and support to improve knowledge and expertise
- o Assistance from institutional staff to apply open research practice
- o Other. Please explain

Q9a. Please mention other factors that would motivate you to apply a specific open research practice more widely (free text)

Q10. Have you received formal training or other support associated with any of the open research practices mentioned? (e.g. attended LSHTM seminar/webinar, enrolled in an online training module) Required

- o Yes
- o No
- o I don't know

Q10a. If you can recall, please state the training/support received and where it was obtained. (free text)

Q11. If LSHTM were to offer training and guidance on open research practices, what proficiency level should it be aimed toward to help you in your research (based upon your current level of expertise)? (Please select *ONE* answer per row)

	Introductory	Intermediate	Advanced	Not applicable / not interested
1. Preregistration				
2. Publication of a registered report				
3. Research co-production (citizen science, crowdsourcing, co-creation)				
4. Research verification: Testing claims of prior research				
5. Sharing preprints & other works prior to peer review				
6. Open Peer review				
7. Sharing public engagement literature				
8. Code sharing				

9. Sharing of CAD Files including 3D models for physical objects				
10. Sharing of physical materials (such as samples)				

Q11a. Are there any other open research topics that it would be helpful to cover / additional content that should be added to existing support? (text box)

Q12. If you have other suggestions or comments on open research support at LSHTM, please write them below (text box)

Q13. If you would like to be contacted for follow-up, please type your email address

Please enter a valid email address.

Page 6: Thank you for completing the survey!

Thank you for completing the LSHTM Open Research survey.

If you would like to discuss open research practices within your own project, or have any questions about the survey, please contact Gareth Knight (Research Data Manager in the LSHTM Library, Archive and Open Research Service) on gareth.knight@lshtm.ac.uk.

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