Identifying research priorities for digital technology in mental health care: results of the James Lind Alliance Priority Setting Partnership

Chris Hollis, Stephanie Sampson, Lucy Simons, E Bethan Davies, Rachel Churchill, Victoria Betton, Debbie Butler, Kathy Chapman, Katherine Easton, Toto Anne Gronlund, Thomas Kabir, Mat Rawsthorne, Elizabeth Rye, André Tomlin

Digital technology, including the internet, smartphones, and wearables, provides the possibility to bridge the mental health treatment gap by offering flexible and tailored approaches to mental health care that are more accessible and potentially less stigmatising than those currently available. However, the evidence base for digital mental health interventions, including demonstration of clinical effectiveness and cost-effectiveness in real-world settings, remains inadequate. The James Lind Alliance Priority Setting Partnership for digital technology in mental health care was established to identify research priorities that reflect the perspectives and unmet needs of people with lived experience of mental health problems and use of mental health services, their carers, and health-care practitioners. 644 participants contributed 1369 separate questions, which were reduced by qualitative thematic analysis into six overarching themes. Following removal of out-of-scope questions and a comprehensive search of existing evidence, 134 questions were verified as uncertainties suitable for research. These questions were then ranked online and in workshops by 628 participants to produce a shortlist of 26. The top ten research priorities, which were identified by consensus at a stakeholder workshop, should inform research policy and funding in this field. Identified priorities primarily relate to the safety and efficacy of digital technology interventions in comparison with face-to-face interventions, evidence of population reach, mechanisms of therapeutic change, and the ways in which the effectiveness of digital interventions in combination with human support might be optimised.

Introduction

Mental health disorders constitute the single largest source of health-related economic burden worldwide.[1–3] Common disorders, including depression or anxiety, contribute most to this burden, with more than one in four people affected by these conditions at some point in their lives.[4,5] Globally, there is increasing pressure on health-care systems to provide accessible, evidence-based, and cost-effective solutions to people affected by mental health disorders.[6] In the UK, demand for mental health treatment exceeds available National Health Service (NHS) resources, with only a third of people with common mental health disorders receiving help from the NHS.[5]

In the 2017 World Psychiatric Association–*Lancet Psychiatry* Commission on the Future of Psychiatry,[7] the digital psychiatry section (part 5) highlighted the potential for digital technology to bridge the mental health treatment gap by offering more-accessible, potentially less-stigmatising, flexible, and tailored approaches to mental health care.[6,8,9] Digital technologies—including the internet, smartphones, and wearables—can connect patients, services, and health data in novel ways not previously available and through combination with existing treatments. In the UK, 88% of adults have internet access at home and 75% own a smartphone.[10] It is estimated that, by 2020, 80% of adults worldwide will own a smartphone.[11] With more people connected to the internet than ever before and in possession of different digital technology platforms (eg, smartphones, tablets, laptops, and wearables), there is potential to reach a broader population at a time when mental health services are increasingly strained.

Increasing access to digital services is a policy undertaking of the UK Government's Five Year Forward View for Mental Health,[12] and in January, 2017, the UK Government announced plans to invest more than £67 million for digital technology interventions in the NHS Improving Access to Psychological Therapies programme.[13]

A potential unintended consequence of using digital technology in mental health care is that it could create a so-called digital divide—ie, exclusion of those who are not engaged with technology for reasons of choice (self-exclusion), cost, age group, geography (eg, poor rural broadband coverage), lack of confidence, or digital literacy.[14] Furthermore, certain mental health conditions, such as depression, paranoia, or psychosis, might make it more difficult for a person to engage with or trust digital technology.[15] There is also a risk of so-called technology push, in which commercial companies seek a mental health application to fit their technology, as opposed to designing digital interventions to address the unmet needs and aspirations of people with mental health conditions.[8]

Research has shown the promise, but also the limitations, of different mental health technologies, including internet-delivered cognitive behavioural therapy for various mental health conditions.[16–20] However, the speed of digital technology development threatens to surpass the pace of traditional research evaluation methods, particularly randomised controlled trials, and thus presents challenges for developing faster and more robust evaluation methods.[21] Evidence also shows that the benefits of digital mental health interventions reported in efficacy trials might fail to

translate into real-world clinical settings and populations.[7,9,19] Furthermore, with many thousands of commercially developed (and largely unregulated) mental health apps now available, there are important concerns about the insufficiency of evidence regarding safety, usability, confidentiality, clinical effectiveness, and cost-effectiveness.[7] As a result, there is a real danger of the policy and practice of digital mental health care moving ahead of its evidence base, with a resulting loss of public and professional confidence and trust.[7,22–24]

To date, the research agenda relating to mental health digital technology has largely been influenced by the research community, technology developers, and health-policy makers, with little reference to, or input from, people with mental health problems, their families and carers, or non-academic clinicians. However, to avoid harms, increase benefit, and sustain impact, it is important that user needs and priorities drive digital technology development in mental health.[7] Furthermore, publicly funded research and health-care systems should prioritise research questions that matter primarily to patients, their families and carers, and health-care professionals and providers.[25] The interests of these parties might differ widely from those of academics, researchers, and people in industry, who typically set the research agenda.[26] The World Psychiatric Association–*Lancet Psychiatry* Commission[7] emphasised the importance of listening to the voices of patients and clinicians: "How to ensure that both patient and psychiatrist voices are heard effectively is a topic for further research, but it might be the most important, and currently under-appreciated, step needed for digital psychiatry to advance."

Over the past decade, inclusive methods pioneered by the James Lind Alliance (JLA), as part of the National Institute of Health Research (NIHR), have been developed for identifying priorities for medical research that are of importance primarily to patients and health-care providers.[27] The JLA Priority Setting Partnerships for research use an established method to bring together, as equals, health-care practitioners and people with lived experience of health conditions. Each Priority Setting Partnership produces a top ten list of the research questions considered highly important to stakeholders. The JLA has also replicated this process in countries outside the UK, including nine Priority Setting Partnerships in Canada, two in the Netherlands, and two in Germany.

The JLA Priority Setting Partnership project Digital Technology for Mental Health: Asking the Right Questions was established in October, 2016, to bring together people with personal lived experience of a mental health condition, their families and carers, and health-care providers, to identify unanswered questions and ultimately prioritise the top ten questions deemed the most important for digital technology in mental health care. To our knowledge, this is the first time that well-validated participatory methods involving all of

these different parties have been used to identify such research priorities.

Methods
The Priority Setting Partnership on digital mental health adhered to the JLA's step-by-step guidelines that outline the processes and methods involved in developing such partnerships to systematically identify and prioritise unanswered questions in health research.[27] These guidelines are well established, can be adapted to meet the specific requirements of a particular partnership, and have been applied to more than 50 Priority Setting Partnerships to date across many different health topics, including treatment uncertainties for acne,[28] research into miscarriage,[29] and to identify research priorities for depression,[30] bipolar disorder, dementia, and schizophrenia.

Stage 1: Establishing the Priority Setting Partnership and defining project scope
The NIHR MindTech MedTech Co-operative (MindTech) proposed the need for prioritising research questions about digital technology for mental health in February, 2016, and invited relevant organisations and key experts in the field to join the collaboration to establish a JLA Priority Setting Partnership. A steering group was formed to oversee and guide the partnership, and comprised people with personal experience of mental health problems, carers, and health and social care practitioners, with additional knowledge and expertise provided by representatives of key UK mental health charities and researchers (panel 1). Non-clinical researchers and mental health charity representatives took part in steering group discussions, but decisions were only made by a quorum of at least two people with lived experience of mental health problems or caring for others, and at least two health and social care practitioners. Developers of digital technologies for mental health and people with commercial interests in the field were excluded from the steering group. The groups were chaired by a JLA advisor (including TAG from June, 2017, to March, 2018).

The Priority Setting Partnership protocol was agreed and published on the partnership and JLA websites. The project then followed the five-stage process described by the JLA[27] (figure).

The definition of digital technologies used by this Priority Setting Partnership (panel 2) aligns with published research into digital health-care interventions and technologies.[31] Because of the need to limit the scope of the Priority Setting Partnership to ensure a manageable project, it was decided that the general effects of digital technology were outside of the scope of the project. However, it was agreed to include in the scope both the positive and negative effects of digital technologies when the intended use was to benefit people's mental health, regardless of whether the technology platform was designed specifically as a health

Panel 1: Collaborating organisations of the Priority Setting Partnership

- Centre for Assistive Technology and Connected Health (University of Sheffield)*†
- Cochrane Common Mental Disorders Group†
- Evidence-Based Mental Health
- Innovate UK Knowledge Transfer Network
- Institute of Mental Health (University of Nottingham)†
- McPin Foundation*†
- Mental Elf†
- Mental Health Foundation*†
- Mental health intelligence and leadership programme (Oxleas NHS Foundation Trust)*†
- Mind
- mHabitat*†
- MQ: Transforming Mental Health*†
- Nesta*†
- NIHR MindTech MedTech Co-operative (formerly NIHR MindTech Healthcare Technology Co-operative)*†
- NIHR Maudsley Biomedical Research Centre*
- NIHR Nottingham Biomedical Research Centre*
- NIHR School for Primary Care Research
- Nottinghamshire Healthcare NHS Foundation Trust*†
- Recovery Research Network
- Royal College of Psychiatrists
- School of Health and Related Research (University of Sheffield)†
- University of Sheffield Counselling Service*†
- University of Nottingham, School of Medicine and School of Health Sciences
- Welsh NHS Confederation
- WeMHNurses

NHS=National Health Service. NIHR=National Institute for Health Research. *Partners making a financial contribution to the Priority Setting Partnership; other partners had a key role in extending the reach of the partnership to wider communities. †Member of the steering group is affiliated to this organisation.
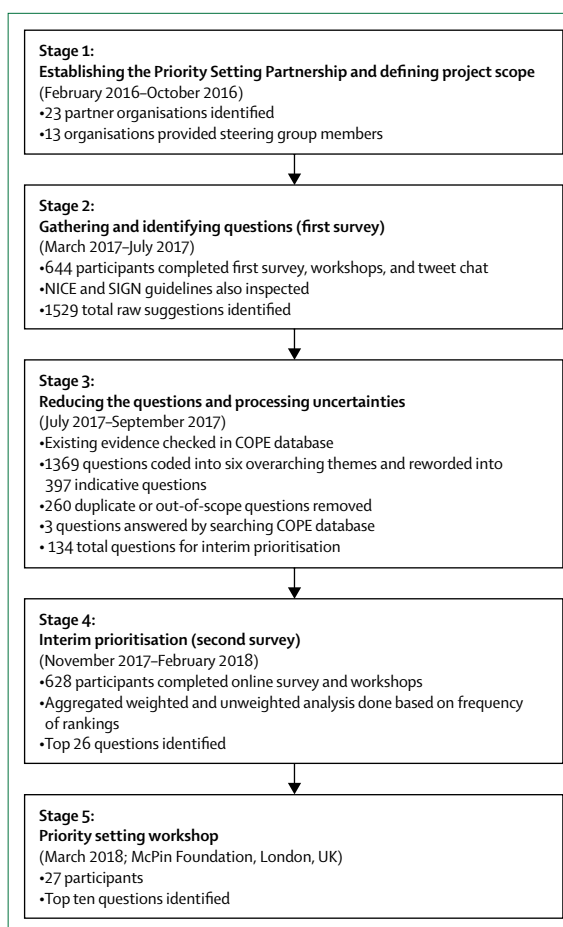
Stage 1:
Establishing the Priority Setting Partnership and defining project scope
(February 2016–October 2016)
- 23 partner organisations identified
- 13 organisations provided steering group members

Stage 2:
Gathering and identifying questions (first survey)
(March 2017–July 2017)
- 644 participants completed first survey, workshops, and tweet chat
- NICE and SIGN guidelines also inspected
- 1529 total raw suggestions identified

Stage 3:
Reducing the questions and processing uncertainties
(July 2017–September 2017)
- Existing evidence checked in COPE database
- 1369 questions coded into six overarching themes and reworded into 397 indicative questions
- 260 duplicate or out-of-scope questions removed
- 3 questions answered by searching COPE database
- 134 total questions for interim prioritisation

Stage 4:
Interim prioritisation (second survey)
(November 2017–February 2018)
- 628 participants completed online survey and workshops
- Aggregated weighted and unweighted analysis done based on frequency of rankings
- Top 26 questions identified

Stage 5:
Priority setting workshop
(March 2018; McPin Foundation, London, UK)
- 27 participants
- Top ten questions identified

Figure: **Flow chart of the James Lind Alliance Priority Setting Partnership five-stage process and results**
NICE=National Institute for Health and Care Excellence. SIGN=Scottish Intercollegiate Guidelines Network. COPE=Current Overview of Published Evidence.

intervention (eg, peer support via social media such as Twitter or Facebook). The final statement of scope agreed for the Priority Setting Partnership is presented in the full protocol (appendix).

Stage 2: Gathering and identifying questions (first survey)

The first survey was created in SurveyMonkey and was open from March 28 to July 5, 2017, with additional face-to-face workshops and a tweet chat also conducted during this time. The survey consisted of an explanation of what participants were being invited to do, an embedded link to the explanatory film on YouTube, the primary question for gathering uncertainties, and demographic questions. The survey was reviewed by the steering group and piloted by five people with personal experience of mental health problems and four health and social care professionals.

In the survey, participants were asked "What questions do you have about using digital technology for mental health problems?"; respondents were reminded these were questions for research and asked to contribute up to three questions. The project website directed people to the survey and the link was also distributed by the steering group and wider partners across networks and contacts. We prepared newsletter articles and blog posts, which were shared widely by a wide range of organisations. The Mental Elf, a leading UK blogging website run by mental health experts, featured a blog at the launch of the survey and social media channels were used extensively to publicise the survey.

Two other methods were adopted to gather questions: five national workshops that were run in-person, specifically with groups identified as less confident with digital technology; and a tweet chat with a community using social media for professional development. The tweet chat was hosted by the @WeMHNurses online community (a host website for tweet chats aimed predominantly at nurses) and took place on June 5, 2017, from 2000 h until 2100 h.

Panel 2: Definition of digital technologies

For the purposes of this Priority Setting Partnership, digital technologies referred to all interventions, tools, and services (including, but not limited to, remote therapy, diagnostics, treatment support, monitoring and self-management, and potentially transformative approaches such as virtual reality, avatars, and robots) using information communications technology (eg, the internet, personal computers, laptops, tablets, social media, mobile phone applications [apps], and wearable devices) with the intention of benefitting or improving people's mental health, whether used in conjunction with, or independently of, mental health services. We excluded technologies that people with lived experience of mental health problems cannot access directly or interact with themselves, such as electronic health records and other health-care administrative systems.

The demographic profile of respondents was reviewed by the steering group midway through the survey to check on the range of participants. It was noted that we needed to reach more young people, people in the devolved nations of the UK (Wales, Scotland, and Northern Ireland), older people, more men, and more people from diverse ethnic groups. Strategies were implemented for reaching these groups, including identifying specific organisations and groups to reach out to, and building on the strong links within partner organisations (eg, the McPin Foundation, a charity dedicated to involving people with lived experience of mental health problems in research, invited younger people on their mailing list to participate).

In addition, we identified relevant research recommendations from previous JLA Priority Setting Partnerships in mental health, as well as from the National Institute for Health and Care Excellence (NICE) and the Scottish Intercollegiate Guidelines Network (SIGN) treatment guidelines (details on guidelines inspected are shown in the appendix).

Stage 3: Reducing the questions and processing uncertainties

The purpose of this stage of the Priority Setting Partnership was to review the questions submitted, remove out-of-scope questions, create a list of unique researchable questions, and check if any of these questions had already been answered through previous research. An organising framework to categorise the remaining questions was developed, following a process of qualitative data analysis.[32] Six overarching themes emerged during inductive thematic analysis using NVivo software, in which common elements in questions (raw suggestions) were identified relating to digital technology use in mental health (appendix). To pilot the approach, two researchers independently coded 90 questions and compared the category labels. Disagreements were resolved through discussion. This initial framework was tested with further questions. At each stage, further refinements were made and an overarching framework developed to cluster the individual category labels. The work was carried out by researchers (LS, SS, KE), the MindTech Team, and Minervation (a UK-based organisation specialising in producing evidence-based health-care information), with each stage reviewed and approved by a quorate subgroup of the steering group (called the data management subgroup).

To check whether questions had already been answered by research, a database of relevant literature, called Current Overview of Published Evidence (COPE), was developed using Mendeley software. To compile COPE, the Cochrane Common Mental Disorders Group Information Specialist ran a search of the Ovid Medline, Embase, PsycINFO, and The Cochrane Library databases, as well as a series of specific (pragmatic) searches of the Epistemonikos, Health Evidence, DoPHER, and PROSPERO databases because of the limitations in the search functionality and idio-syncrasies of each platform (see appendix for details of the screening process). We used systematic processes to categorise and format each relevant systematic review that involved a digital technology intervention for use in mental health care or support, to make these searchable and accessible in Mendeley. We marked each reference with a unique identifier relating to the six overarching themes, allowing us to search the key components of a submitted unique question and assess whether any high-quality, published systematic reviews had answered any of the questions.

For each unique researchable question, the COPE database was checked for current evidence and the results of each search recorded. Questions identified to have been answered by at least one relevant, critically reviewed, high-quality, up-to-date systematic review were removed from the potential indicative questions list. The remaining questions were confirmed as verified uncertainties and were put forward for the interim prioritisation stage.

Stage 4: Interim prioritisation (second survey)

The interim prioritisation survey was open from Nov 28, 2017, to Feb 15, 2018. The aim was to rank the verified uncertainties in order of those considered most important by people with personal experience of mental health problems, their carers, and health and social care practitioners. The refined set of questions was entered into a new online survey using an optimal card sort method, and participants were invited to select the ten questions important to them, with the option to identify the three most important questions from their top ten. As more than 130 verified uncertainties remained at this stage, the steering group decided to reduce the response burden by presenting each participant with a random sample of 45 questions presented in a random order. The survey was hosted on the project website and participants

were invited by partner organisations and via newsletters, online, and social media campaigns.

Questions from this stage were ranked on the basis of the frequency with which they had been chosen; questions that appeared in participants' top ten lists were given one point, and questions that appeared in top three lists were given two points. The weighted analysis (all top three questions given two points) was compared to the unweighted analysis (one point) and a sensitivity check was done. Although we initially intended to identify a top 25 list, results showed that not all participants identified a top three, and one question was ranked quite highly in the unweighted list (top ten), but fell to number 26 when compared with the weighted list (top three). Thus, the steering group agreed by consensus to adopt the aggregate question list including all of the top 26 questions.

Stage 5: Priority setting workshop

Participants were invited to the final workshop held at the McPin Foundation in London. Participants included steering group members, people with personal experience of mental health problems, carers, and health and social care professionals.

Before the workshop, participants prioritised the top 26 questions to ensure familiarity with the questions and their personal preferences. The workshop was facilitated by three JLA advisors (including TAG), who chaired the small group activity. The workshop used a nominal group technique, with small and large groups; this facilitated process helps to prevent dominance of views by individual participants or of particular perspectives, and to encourage quieter members to participate. The small groups were predetermined to ensure balance of people with lived experience of mental health problems, carers, and health and social care practitioners, as well as people who had been part of the steering group.

Priority setting was spread over the day and comprised four stages. In the first stage, participants were split into three groups, and each participant was invited to talk about their highest and lowest priorities from their pre-workshop prioritisation, with time allowed for discussion when everyone had had their say. In the second stage, the same small groups were asked to rank all 26 questions on the basis of their stage 1 discussion. Each question was printed on an A4 card and laid on a table, enabling physical interaction in placing the question in a ranked order. The rankings from each group were then combined. In the third stage, participants were divided into three different groups, again balanced for participant background, and presented with the combined rankings. Participants were asked to focus on whether they thought the right questions were in the top ten and were given the opportunity to make changes to the order of questions through discussion. In the fourth and final stage, the rankings were combined and discussed as a whole group. In the absence of a consensus, agreements were reached by raised-hands voting.

Results

Stage 2: Gathering and identifying questions (first survey)

A total of 644 participants took part in the first survey: 583 participants completed the online survey, 28 took part in the tweet chat, and 33 attended the face-to-face workshops. Workshop participants completed printed copies of the survey, which were manually entered into the online Survey Monkey results, and numbers were included in the total number of participants.

A total of 1369 online and workshop submissions were split (sometimes more than three questions were asked by participants, requiring them to be separated) to give a total of 1471 questions. 58 other questions were identified from the tweet chat and from NICE and SIGN guidelines, giving a total of 1529 questions.

Stage 3: Reducing the questions and processing uncertainties

The 1529 questions submitted in the first survey (called raw suggestions) were then reviewed, and any that fell out of scope of the Priority Setting Partnership or were considered too vague (160 questions) were removed, leaving 1369 questions (figure). The raw suggestions were then coded into the framework, resulting in six overarching themes: access, audience, rights, delivery, risks, and outcomes (appendix). The raw suggestions in each section of the framework were reviewed for similarity and were combined and rephrased into summary questions. Through this process of thematic analysis and clustering of raw suggestions of similar themes into overarching questions, a total of 397 indicative questions were formulated.

Questions were removed if they were too broad, not researchable, or were simply information-seeking (eg, "How do we identify which digital interventions will work best for whom?"), were deemed policy-related or quality-related questions (eg, "How do apps that monitor adherence [eg, to treatment] ensure that the person for whom it was intended completes set tasks?"), or were questions asking for information about, or access to, digital technology in general (eg, "What existing online sources of support [eg, therapy or counselling] are available for people with mental health conditions?"). These questions, totalling 260, were removed from the longer list, leaving 137 potential questions for interim prioritisation. Only three questions of the 137 were considered to have been answered by the systematic review evidence found in COPE, with 134 questions remaining as verified uncertainties (see appendix for the list of questions answered by evidence in COPE). These 134 questions were entered into the interim prioritisation survey to identify the top 25 questions considered most important by participants.

Stage 4: Interim prioritisation (second survey)

The 360 people from the first survey who opted into future communications were sent a personal invitation

	First survey*, n (%)	Second survey†, n (%)
Total participants‡	616	615
Online survey	583	615
Workshops	33	NA‡
Gender	n=605	n=615
Male	169 (28%)	172 (28%)
Female	416 (69%)	433 (70%)
Other	13 (2%)	6 (1%)
Not stated	7 (1%)	4 (1%)
Experience§	n=616	n=615
Lived experience of mental health problems	353 (57%)	357 (58%)
Carer of someone with mental health problems	163 (26%)	157 (26%)
Health and social care practitioner	365 (59%)	345 (56%)
Stated confidence with digital technology¶	n=607	n=615
High	497 (82%)	494 (80%)
Medium	70 (12%)	91 (15%)
Low	36 (6%)	29 (5%)
Not sure	4 (1%)	1 (0%)
Age range, years	n=608	n=615
≤15	6 (1%)	3 (0%)
16–24	63 (10%)	62 (10%)
25–54	405 (67%)	447 (73%)
≥55	127 (21%)	98 (16%)
Not stated	7 (1%)	5 (1%)
Location	n=608	n=615
Scotland	77 (13%)	28 (5%)
Wales	27 (4%)	9 (1%)
England	455 (75%)	457 (74%)
Northern Ireland	18 (3%)	8 (1%)
Outside of the UK	26 (4%)	63 (10%)
Not stated	5 (1%)	50 (8%)
Ethnicity	n=608	n=615
White British or white other	534 (88%)	542 (88%)
Black, African, Caribbean, or black British	11 (2%)	5 (1%)
Asian or Asian British	23 (4%)	28 (5%)
Mixed or multiple ethnic groups	17 (3%)	12 (2%)
Other(s)	11 (2%)	8 (1%)
Not stated	12 (2%)	20 (3%)

*Online and workshops. †Online only. ‡Not all participants completed all sections of demographic data collection; participants from the second survey workshops did not provide demographic data. §At each stage of data collection, respondents were able to identify as having any or all of these experiences. ¶Based on scores from the five-point Likert scale: low confidence, 1–2 (combined); medium confidence, 3; and high confidence, 4–5 (combined).

Table 1: Demographics of survey respondents

to take part. 615 participants completed the second online interim prioritisation survey. Repeat face-to-face workshops, following a similar format, were held with two organisations: one at the People's Forum and the

Involvement Centre at Glenfield Hospital (Leicester, UK), and another at Nottinghamshire Healthcare NHS Foundation Trust, with 13 participants taking part and completing printed copies of the survey. In total, 628 participants completed the interim prioritisation survey.

The characteristics of the first and second survey respondents are summarised in table 1. The majority of respondents were female, and most were in the 25–54 years age band. Over half of respondents had lived experience of mental health problems, and over half were health or social care practitioners. A large majority of respondents indicated a high level of confidence with digital technology.

Stage 5: Priority setting workshop

A total of 27 participants attended, 14 with personal experience of mental health problems, three family members or carers of people with mental health problems, and 15 health and social care professionals (participants could be in more than one category). The top ten research priorities were agreed and are shown in table 2 (the top 26 are shown in the appendix).

Five of the final top ten research priorities were also included in the top ten ranked questions in the interim prioritisation survey (table 2). The top ranked research question—"What are the benefits and risks of delivering mental health care through technology instead of face-to-face and what impact does the removal of face-to-face human interaction have?"—was ranked as the number one priority in both the final workshop and the interim prioritisation survey. Relatedly, two questions addressed the relative efficacy and safety of digital technology versus face-to-face interventions and how best to optimise the effectiveness of digital interventions in combination with human support. Other top ten priorities focused on understanding how digital technology affected the interpersonal and communicative aspects of psychological therapies, and how mental health conditions (eg, depression) can affect engagement with digital technologies. One question asked whether social media can be effective in reducing social isolation in people with mental health problems. Three questions in the top ten addressed health services issues: specifically, whether digital technology increases access to mental health services, including groups who are under-represented in traditional services (two questions), and where in clinical care pathways digital technologies should be used to achieve the best outcomes (one question). One of the top ten priorities related to identifying the best methods to evaluate and endorse mental health apps.

Discussion

If research is to be of value to decision makers, including people with lived experience of mental health problems, health and social care providers, and health care commissioners and policy makers, the identification and

	Question	Ranking after second survey (stage 4)	Number of linked raw suggestions (first survey)	Number (%) of raw suggestions*		
				People with lived experience	Carers	Health or social care practitioners
1	What are the benefits and risks of delivering mental health care through technology instead of face-to-face and what impact does the removal of face-to-face human interaction have?	1	4	4 (100%)	1 (25%)	1 (25%)
2	How do certain mental health conditions (eg, depression) affect how people engage with technology?	25	1	1 (100%)	1 (100%)	0 (0%)
3	How can treatment outcomes be maximised by combining existing treatment options (medication, psychological therapies, etc) with digital mental health interventions?	11	23	13 (57%)	8 (35%)	16 (70%)
4	At what point in the care pathway (eg, crisis intervention, prevention, engagement, treatment, maintenance, and recovery) are digital interventions most safe and effective?	3	99	60 (61%)	24 (24%)	56 (57%)
5	How should apps for mental health be evaluated and endorsed?	2	4	3 (75%)	1 (25%)	3 (75%)
6	What impacts will the adoption of digital technology in mental health services have on capacity, access to services, waiting times, and preferred appointment times?	13	16	12 (75%)	3 (19%)	8 (50%)
7	Are therapies (eg, cognitive behavioural therapy) delivered via digital technology as effective as those delivered face-to-face?	5	14	11 (79%)	2 (14%)	12 (86%)
8	Can the common elements of therapy (eg, empathy, gestures, non-verbal cues) that come from person-to-person interactions be maintained with digital technology interventions?	21	24	12 (50%)	10 (42%)	15 (63%)
9	Do digital health interventions increase reach and access to groups and people less well served by traditional mental health services (eg, black and ethnic minorities, men with depression, people in rural areas, etc)?	8	3	1 (33%)	0 (0%)	3 (100%)
10	How can social media be used more effectively to bring people with mental health problems together and help them connect (eg, in their communities), rather than isolating them in their homes?	19	4	1 (25%)	1 (25%)	3 (75%)

*At each stage of data collection, respondents were able to identify as any or all of (1) a person with lived experience of mental health problems, (2) a carer of someone with mental health problems, or (3) a health and social care practitioner.

Table 2: Top ten research priorities for digital technology in mental health care, identified by the Priority Setting Partnership

framing of research questions must involve the people affected by these decisions. The top ten research priorities for digital technology in mental health care, reached by consensus between people with lived experience of mental health problems, their families and carers, and health and social care practitioners, demonstrate important uncertainties and gaps in the evidence base, identifying priorities for future research. A key area of uncertainty concerned the relative efficacy and safety of digital mental health interventions compared with traditional face-to-face care. Although there is some existing evidence to support the equivalence of guided (remote therapist-supported), internet-delivered cognitive behavioural therapy and face-to-face treatment for depression and anxiety, there are still very few studies for other mental health conditions, or in children and young people. There is also little evidence from comparisons of face-to-face treatments with new forms of digital interventions, such as ecological momentary interventions delivered by smartphones or virtual reality, or evidence for the effectiveness of blending internet-delivered cognitive behavioural therapy with face-to-face treatment.[33–35]

An important limitation of the existing evidence base for digital interventions compared with face-to-face treatment is the highly selected nature of the samples recruited to clinical trials, including participants willing to be randomised to either intervention. More pragmatic, real-world evaluations are also needed that include patient populations with a range of preferences for digital interventions, face-to-face treatment, or a combination of the two in the form of blended interventions[36], and in which technologies are embedded into clinical care pathways.[9] From a policy perspective, there is sometimes an assumption that the main benefits of digital mental health interventions lie in widening access and increasing health service efficiencies, rather than in greater treatment efficacy, with face-to-face interventions still regarded as the gold standard. One of the consequences of this assumption is that the public might feel that digital interventions are second-class interventions, which in turn could negatively affect preferences and expectancies. Therefore, research establishing therapeutic equivalence, or even superiority, would be crucial to underpinning public trust and confidence in digital interventions.

The top ten research priorities identified by the Priority Setting Partnership reflect uncertainties about the mechanisms of action of digital interventions, particularly their effect on the therapeutic alliance between therapist and patient, and concerns about the potential impact of removing the human aspects of face-to-face treatments. Although it is often assumed that an insufficient therapeutic alliance is responsible for poor engagement and adherence with digital mental health interventions, we did not find any research that has addressed this question. Notably, where the therapeutic alliance has been assessed in guided internet-delivered cognitive behavioural therapy, it appears equivalent to face-to-face treatment, even in the absence of visual or audio communication.[37] These identified top ten research priorities raise a fundamental question about the nature of the therapeutic relationship as an agent of change in the next generation of digital interventions using artificial intelligence, chatbots, and virtual human therapists.[38]

The top ten research priorities demonstrate the need to understand whether certain groups of people particularly benefit from the availability of digital technology in mental health care, with the aim of personalising interventions and improving outcomes. Research is needed to understand how different user characteristics and symptoms—including mood, anxiety, and cognitive functioning—can affect uptake, adherence, and outcomes for digital interventions. For example, users with depression might find it difficult to complete interventions that require sustained concentration, whereas users with social anxiety, agoraphobia, or conditions associated with shame and stigma (such as alcohol-use or substance-use disorders or bulimia nervosa) might find it easier to engage with digital interventions rather than face-to-face therapy.[39]

A key question identified in the top ten priorities is whether the promise that digital interventions can increase reach and access to treatment for underserved groups is realised in practice. This question requires research by and with health service organisations to assess the reach and uptake of digital technology interventions in different populations. Investigations into how to make technologies more engaging and easier to use for people who lack confidence with technology and have low digital literacy are also needed, and will require research in the area of human factors and human–computer interaction, focusing on engagement and user experience.[21] The question of where digital technologies, including decision-aids, are best placed in clinical pathways and workflows is particularly relevant for wearables and smartphones that generate so-called digital phenotypes with the aim of predicting relapse and supporting early intervention.[7,9]

The top ten priorities also identified the need to develop faster, more robust, and proportionate research methods to evaluate the safety, usability, and effectiveness of mental health apps.[7,21] Finally, harnessing the potential of social media for reducing social isolation in people with mental health problems, as well as mitigating its risks, was identified as a priority for research.[40]

This is the first JLA Priority Setting Partnership to focus explicitly on digital technology in health care, and the first in mental health not to focus on a specific condition (eg, schizophrenia, bipolar disorder, or depression). The breadth of the intervention (digital technology) and the broad clinical area (ie, all mental health conditions) meant that raw suggestions tended to focus on general issues or overarching themes, rather than on the effectiveness of a specific digital technology intervention for a particular condition. Where a more specific question was submitted, these tended to be ranked lower than more generic questions in the interim prioritisation. Although this predominance of generic questions might be viewed as a limitation, it also reflects the deliberate composition of the Priority Setting Partnership and sampling frame that prioritised user and clinical needs over technology-driven research.

Over 600 people contributed to both the initial question-gathering survey and the interim prioritisation, balanced between service users and health-care practitioners. A strength of the study was the use of robust JLA methods for establishing and supporting Priority Setting Partnerships, which have been replicated internationally in other health-care domains. The survey respondents were broadly representative of the UK population with respect to location and ethnicity. The ethnic and gender mix of our respondents was also identical to that of people accessing talking therapies (Improving Access to Psychological Therapies services) for common mental health problems in the UK.[41] More than two-thirds of respondents were female, which reflects the greater prevalence of common mental health problems in women and the tendency for more women than men to respond to JLA surveys. The majority of participants were confident users of digital technology, which replicates findings in the UK population as a whole,[42] and we found a similar high degree of confidence in internet use among our respondents compared with other surveys in health-care settings of service users with common mental health problems.[43] We acknowledge that the use of online survey methods might have excluded those less confident with digital technology, and thus we held five national face-to-face workshops with groups identified as less confident with digital technology. However, by using online survey methods, we had the advantage of reaching a widely geographically dispersed population, including the majority of people with common mental health problems who do not or cannot access traditional mental health services.[5] A limitation of the study is that, although we recruited participants representative of the UK population, the results might not be generalisable to other countries with significantly different sociodemographic composition, health-care systems, and patterns of internet use, or to subpopulations including specific ethnic groups, children, or older people. Therefore, we

recommend the replication of this JLA Priority Setting Partnership method to establish research priorities for digital mental health care in other countries or specific populations of interest.

Following the publication of the top ten research priorities for digital technology in mental health care, the UK's NIHR Evaluation, Trials, and Studies Co-ordinating Centre will begin the process of translating these priorities into researchable questions for NIHR research calls. We intend to audit the uptake of these research priorities in NIHR researcher-led applications and commissioned calls. Globally, this study and these service user-driven and practitioner-driven priorities, generated by robust methods, should support a growth in user-driven research in digital technology for mental health. For the potential of digital mental health care to be realised, the key challenge will be to build an evidence base for digital technology interventions and tools that incorporates the voices and priorities of mental health service users and practitioners.

References
1 Lozano R, Naghavi M, Foreman K, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012; **380:** 2095–128.
2 Whiteford HA, Ferrari AJ, Degenhardt L, Feigin V, Vos T. The global burden of mental, neurological and substance use disorders: an analysis from the Global Burden of Disease Study 2010. *PloS One* 2015; **10:** e0116820.
3 Global Burden of Disease Study 2013 Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2015; **386:** 743–800.
4 Ginn S, Horder J. "One in four" with a mental health problem: the anatomy of a statistic. *BMJ* 2012; **344:** e1302.
5 Davies SC. Annual Report of the Chief Medical Officer 2013, public mental health priorities: investing in the evidence. London: Department of Health, 2014.
6 Naslund JA, Aschbrenner KA, Araya R, et al. Digital technology for treating and preventing mental disorders in low-income and middle-income countries: a narrative review of the literature. *Lancet Psychiatry* 2017; **4:** 486–500.
7 Bhugra D, Tasman A, Pathare S, et al. The WPA-Lancet Psychiatry Commission on the Future of Psychiatry. *Lancet Psychiatry* 2017; **4:** 775–818.
8 Hollis C, Morriss R, Martin J, et al. Technological innovations in mental healthcare: harnessing the digital revolution. *Br J Psychiatry* 2015; **206:** 263–65.
9 Mohr DC, Weingardt KR, Reddy M, Schueller SM. Three problems with current digital mental health research... and three things we can do about them. *Psychiatr Serv* 2017; **68:** 427–29.
10 Ofcom. Communications market report 2017: internet and online content. Aug 3, 2017. https://www.ofcom.org.uk/__data/assets/pdf_file/0021/105438/uk-internet-online.pdf (accessed Aug 16, 2018).
11 The Economist. Planet of the phones: the smartphone is ubiquitous, addictive and transformative. Feb 26, 2015. https://www.economist.com/leaders/2015/02/26/planet-of-the-phones (accessed Aug 16, 2018).
12 NHS. Implementing the Five Year Forward View for mental health. July, 2016. https://www.england.nhs.uk/wp-content/uploads/2016/07/fyfv-mh.pdf (accessed Aug 16, 2018).
13 Prime Minister unveils plans to transform mental health support. Jan 9, 2017. https://www.gov.uk/government/news/prime-minister-unveils-plans-to-transform-mental-health-support (accessed Aug 16, 2018).
14 Ennis L, Rose D, Denis M, Pandit N, Wykes T. Can't surf, won't surf: the digital divide in mental health. *J Ment Health* 2012; **21:** 395–403.
15 Firth J, Torous J. Smartphone apps for schizophrenia: a systematic review. *JMIR MHealth and UHealth* 2015; **3:** e102.
16 Donker T, Petrie K, Proudfoot J, Clarke J, Birch MR, Christensen H. Smartphones for smarter delivery of mental health programs: a systematic review. *J Med Internet Res* 2013; **15:** e247.
17 Li J, Theng Y-L, Foo S. Game-based digital interventions for depression therapy: a systematic review and meta-analysis. *Cyberpsychol Behav Soc Netw* 2014; **17:** 519–27.
18 Musiat P, Tarrier N. Collateral outcomes in e-mental health: a systematic review of the evidence for added benefits of computerized cognitive behavior therapy interventions for mental health. *Psychol Med* 2014; **44:** 3137–50.
19 Gilbody S, Littlewood E, Hewitt C, et al. Computerised cognitive behaviour therapy (cCBT) as treatment for depression in primary care (REEACT trial): large scale pragmatic randomised controlled trial. *BMJ* 2015; **351:** h5627.
20 Blaya JA, Fraser HS, Holt B. E-health technologies show promise in developing countries. *Health Aff (Millwood)* 2010; **29:** 244–51.
21 Murray E, Hekler EB, Andersson G, et al. Evaluating digital health interventions: key questions and approaches. *Am J Prev Med* 2016; **51:** 843–51.
22 Andersson G, Titov N. Advantages and limitations of internet-based interventions for common mental disorders. *World Psychiatry* 2014; **13:** 4–11.
23 Huguet A, Rao S, McGrath PJ, et al. A systematic review of cognitive behavioral therapy and behavioral activation apps for depression. *PLoS One* 2016; **11:** e0154248.
24 Torous J, Roberts LW. Needed innovation in digital health and smartphone applications for mental health: transparency and trust. *JAMA Psychiatry* 2017; **74:** 437–38.
25 Kelly S, Lafortune L, Hart N, et al. Dementia priority setting partnership with the James Lind Alliance: using patient and public involvement and the evidence base to inform the research agenda. *Age Ageing* 2015; **44:** 985–93.
26 Boney O, Bell M, Bell N, et al. Identifying research priorities in anaesthesia and perioperative care: final report of the joint National Institute of Academic Anaesthesia/James Lind Alliance Research Priority Setting Partnership. *BMJ Open* 2015; **5:** e010006.
27 The James Lind Alliance Guidebook. Version 7. March 2018. http://www.jla.nihr.ac.uk/jla-guidebook/ (accessed Aug 16, 2018).
28 Layton A, Eady EA, Peat M, et al. Identifying acne treatment uncertainties via a James Lind Alliance Priority Setting Partnership. *BMJ Open* 2015; **5:** e008085.

29   Prior M, Bagness C, Brewin J, et al. Priorities for research in miscarriage: a priority setting partnership between people affected by miscarriage and professionals following the James Lind Alliance methodology. *BMJ Open* 2017; **7:** e016571.

30   Joyce C. Identifying questions that need answers in depression. June 3, 2016. https://www.dc.nihr.ac.uk/blog/identifying-questions-that-need-answers-in-depression/3532 (accessed Aug 16, 2018).

31   Hollis C, Falconer CJ, Martin JL, et al. Annual Research Review: Digital health interventions for children and young people with mental health problems—a systematic and meta-review. *J Child Psychol Psychiatry* 2017; **58:** 474–503.

32   Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in Psychology* 2006; **3:** 77–101.

33   Andersson G, Cuijpers P, Carlbring P, Riper H, Hedman E. Guided internet-based vs. face-to-face cognitive behavior therapy for psychiatric and somatic disorders: a systematic review and meta-analysis. *World Psychiatry* 2014; **13:** 288–95.

34   Freeman D, Reeve S, Robinson A, et al. Virtual reality in the assessment, understanding, and treatment of mental health disorders. *Psychol Med* 2017; **47:** 2393–400.

35   Schueller SM, Aguilera A, Mohr DC. Ecological momentary interventions for depression and anxiety. *Depress Anxiety* 2017; **34:** 540–45.

36   Kowalski CJ, Mrdjenovich AJ. Patient preference clinical trials: why and when they will sometimes be preferred. *Perspect Biol Med* 2013; **56:** 18–35.

37   Berger T. The therapeutic alliance in internet interventions: a narrative review and suggestions for future research. *Psychother Res* 2017; **27:** 511–24.

38   Cavanagh K, Millings A. (Inter)personal computing: the role of the therapeutic relationship in e-mental health. *Journal of Contemporary Psychotherapy* 2013; **43:** 197–206.

39   Fairburn CG, Patel V. The impact of digital technology on psychological treatments and their dissemination. *Behav Res Ther* 2017; **88:** 19–25.

40   Naslund JA, Aschbrenner KA, Marsch LA, Bartels SJ. The future of mental health care: peer-to-peer support and social media. *Epidemiol Psychiatr Sci* 2016; **25:** 113–22.

41   Baker C. Mental health statistics for England: prevalence, services and funding. Apr 25, 2018. https://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN06988#fullreport (accessed Aug 16, 2018).

42   Ofcom. Internet use and attitudes. 2017. https://www.ofcom.org.uk/research-and-data/internet-and-on-demand-research/internet-use-and-attitudes (accessed Aug 16, 2018).

43   Robotham D, Satkunanathan S, Doughty L, Wykes T. Do we still have a digital divide in mental health? A five-year survey follow-up. *J Med Internet Res* 2016; **18:** e309.