BARRIERS AND FACILITATORS TO USE OF DIGITAL HEALTH TOOLS BY HEALTH CARE PRACTITIONERS AND THEIR PATIENTS, BEFORE AND DURING THE COVID-19 PANDEMIC: A MULTI-METHODS STUDY

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Word count: 5981

21 *Abstract*

22 *Objectives*

23 To explore how Health Care Practitioners (HCPs) made decisions about the implementation

24 of DHTs in their clinical practice before and during the COVID-19 pandemic.

25

26 *Design*

27 A multi-methods study, comprising semi-structured interviews conducted prior to the

28 COVID-19 pandemic. Supplemented with an online survey, that was conducted during the

29 pandemic with a different sample, to ensure the qualitative findings remained relevant

30 within the rapidly-changing healthcare context. Participants were recruited through HCP

31 networks, snowballing and social media. Data were analysed thematically.

32

33 *Setting*

34 Phone interviews and online survey.

35

36 *Participants*

37 HCPs represented a range of professions from primary and secondary care across England,

38 with varied socioeconomic deprivation.

39

40 *Results*

41 24 HCPs were interviewed, and 16 HCPs responded to the survey. In the interviews, HCPs

42 described three levels where decisions were made, which determined who would have

43 access to what DHTs: health organisation, HCP, and patient levels. These decisions resulted

44 in the unequal implementation of DHTs across health-services, created barriers for HCPs

45 using DHTs in their practice, and influenced HCPs decisions on which patients to supply

46 DHTs with. In the survey, HCPs described being provided support to overcome some of the

47 barriers at the organisation and HCP level during the pandemic. However, they cited similar

48 concerns to pre-pandemic about barriers patients faced using DHTs (e.g., digital literacy). In

49 the absence of centralised guidance on how to manage these barriers, health-services made

50 their own decisions about how to adapt their services for those who struggled with DHTs.

51

52 *Conclusions*

53 Decision-making at the health organisation, HCP and patient level influence inequalities in

54 access to DHTs for HCPs and patients. The mobilisation of centralised information and

55 resources during the pandemic can be viewed as good practice for reducing barriers to use

56 of DHTs for HCPs. However, attention must also be paid to reducing barriers to accessing

57 DHTs for patients.

58

59 Keywords

60 Internet-based intervention; health care disparities; socioeconomic factors; primary care;

61 digital health; health services accessibility; qualitative research

62

63

ARTICLE SUMMARY

Strengths and limitations of this study

- This is the first study to explore the impact of decision making around the use of Digital Health Technologies (DHTs) by health care practitioners on access to DHTs for patients, before and during the COVID-19 pandemic in England.
- We initially conducted a qualitative study just prior to the COVID-19 pandemic to explore how health care practitioners use DHTs and the potential impact on inequalities. To ensure our findings were relevant and informative in a 'post-COVID' landscape we developed and disseminated a questionnaire that explored whether COVID-19 had changed the way that healthcare professionals used DHTs.
- Double coding of a subset of interviews by five members of the team and ongoing discussion about coding structure ensured the coding scheme was robust.
- Challenges recruiting participants for both the interviews and the survey, may limit the generalisability of the findings.
- As patients were not included in this study, reflections about the barriers patients experience accessing DHTs are from the health care practitioner's perspective.

BACKGROUND

In recent years, primary care practice has rapidly increased the use of Digital Health

Technologies (DHTs) (1). DHT's include smartphone apps, digital tools for diagnosing or

treating conditions (including those that use Artificial Intelligence (2)), wearable devices

(e.g. pedometers) and platforms that provide remote healthcare (3). This has been

accelerated by the COVID-19 pandemic, in which the majority of face-to-face appointments

were suspended and Health Care Practitioners (HCPs) were required to encourage the

uptake of digital self-management tools for patients, including using remote consultations

and mobile health apps (4-6). DHTs have the potential to increase access to health

interventions, whilst reducing demand on an overstretched healthcare system (7-9). The

National Health Service (NHS) Long Term Plan has outlined the role of DHTs in transforming

'healthcare in the digital age', to achieve the goal of delivering world-class personalised

medicine in primary care practices and social care (1). However, the successful

implementation of DHTs relies on both the patients and HCPs being willing and able to

engage with these interventions (10, 11), and there are ongoing concerns about the impact

of DHTs on health inequalities (12).

DHTs have been found to be effective in supporting patients to self-care for a range of

health conditions (8, 13-16). Health interventions designed specifically to support

disadvantaged groups can be more effective for those groups, thus reducing inequalities (8,

15, 17, 18). However, recent evidence has found that such benefits may be limited for

people from lower socio-economic groups, who do not have the resources (such as time,

finances, technical proficiency) to access and use DHTs (19-21). Less is known about how

114   HCPs use DHTs for helping patients to manage their own health and wellness, the barriers

115   they face doing so, and the implications this may have for the access to DHTs for their

116   patients (2, 10, 20, 22). There are indications that HCPs face challenges incorporating DHTs

117   into their existing systems and practices [18], and establishing risk and rapport with patients

118   in remote consultations (10, 22). Patients have also reflected that they feel HCPs have

119   limited knowledge of what self-care DHTs are available and effective (20).

120

121   Our multi-methods study was designed to explore how HCPs (e.g., General Practitioners

122   (GPs), nurses, pharmacists) used and made decision about DHTs in their clinical practice

123   before and during the COVID-19 pandemic. We aimed to 1) understand barriers and

124   facilitators to the use of DHTs by HCPs, and the implications for the access patients have to

125   DHTs, and 2) whether these changed during the pandemic.

126

METHODS

127

128   **Design**
129   This study adhered to the COREQ (Consolidated Criteria for Reporting Qualitative Research)

130   guidelines on the reporting of qualitative research (23). It was a multi-methods study,

131   comprising semi-structured interviews and an online survey with HCPs working in English

132   primary and secondary care services. The primary study was the semi-structured interviews

133   that were conducted prior to the pandemic (November 2019-March 2020). This was

134   supplemented with the survey, a secondary study that was conducted during the pandemic

135   (July 2020-August 2020) with a different sample. Both studies explored how HCPs accessed

136   and used DHTs. However, the survey also explored how the COVID-19 pandemic affected

137 HCP attitudes to and usage of DHTs. The qualitative findings from the survey were

138 compared with the findings from the interviews, in order to explore similarities and

139 differences in DHT use that occurred due to the COVID-19 pandemic, and to ensure that the

140 qualitative findings remained relevant within a rapidly shifting healthcare context. The

141 methodological orientation of the study was a mixed inductive and deductive approach (24,

142 25). Ethical approval was granted by the University of Bath's Psychology Research Ethics

143 Committee for the interviews and survey (PREC reference number: 19-211 and 20-142

144 respectively).

145 **Interviews**
146 *Participants*

147 Participants for the interviews were recruited through a range of networks, including

148 National Institute of Health and Care Research School of Primary Care Research, community

149 networks, social media (snowballing), and Academic Health Service Networks across

150 England. We recruited HCPs who represented primary and secondary care health

151 professionals from a range of backgrounds from across England, working in locations that

152 varied in their level of socioeconomic deprivation (Table 1). Socio-economic deprivation was

153 determined by collecting the postcode of the health service where the HCP worked, and

154 mapping it to the England Indices of Multiple Deprivation (IMD)(26).

155

156 *Procedure/Data collection*
157 The topic guide (see Supplementary material) was developed through author collaboration,

158 consultation with qualitative experts, and input from Patient and Public Involvement

159 representatives. The topic guide was piloted and revised for clarity following feedback from

160 two GPs.

161

162   All interviews were semi-structured and conducted over the telephone by the same

163   researcher (JL). All participants were provided with written information via email about the

164   study before agreeing to be interviewed. Participants were informed that the purpose of the

165   study was to explore which DHTs are used by healthcare professionals in their clinical work,

166   how these tools were used to support their daily tasks (both client and non-client facing),

167   and their experiences with different DHTs. At the beginning of each interview participants

168   were given the opportunity to ask questions, were assured of their voluntary participation,

169   and could withdraw their data until anonymisation and analysis. Participants provided

170   informed consent using an online form before the interview. Interviews were conducted via

171   phone at a mutually convenient time, lasted 17 to 51 minutes (mean = 32 minutes; median

172   = 30 minutes), and took place in private, quiet settings, often participants' offices or homes.

173   HCPs received a £70 payment as compensation.

174

175   Each participant took part in one interview, with no repeat interviews. Short field notes

176   were taken during the interviews. All interviews were audio-recorded, transcribed,

177   anonymised and imported into NVivo Software (NVivo qualitative data analysis Software;

178   QSR International Pty Ltd. Version 1.6.2). Transcripts and findings were not returned to

179   participants for comment or correction. Interviews were undertaken with all willing

180   participants, with the sample size guided by principles of information power rather than

181   data saturation (27).

182

183 *Data Analysis*

184 Analysis of qualitative data began shortly after data collection started and was ongoing and

185 iterative. Corrected, anonymised transcripts were coded using NVivo software. An inductive

186 thematic analysis approach was used for the analysis of the qualitative interviews (24),

187 subsequently a deductive approach was taken to investigate similarities and differences

188 between themes emerging from the surveys (25). Initial codes were developed by JL. Five

189 members of the multidisciplinary research team also coded a sample of transcripts and then

190 met to discuss and develop significant broader patterns of meaning (potential themes). ST

191 organized the codes into final themes, which were agreed upon by the core team (ST, BA,

192 and CD).

193

194 *Research team and reflexivity*

195 Personal characteristics

196 JL, a female PhD student in clinical and developmental psychology during data collection,

197 conducted all interviews. JL received postgraduate training in qualitative methodology and

198 had experience with semi-structured interviews and thematic analysis. She was supervised

199 by senior academics experienced in qualitative research (CD and BA).

200

201 Relationship with participants

202 There was no prior relationship between the research team and study participants. The

203 participants knew that the study was about the use of DHTs in primary healthcare, and that

204 JL was a student researcher. The position taken by JL was that DHTs have the potential to

205 empower people in self-monitoring and care and facilitate HCPs to share wider range of

206 resources with patients from diverse backgrounds. However, JL felt that there may be

207 barriers in assessing the quality of different DHTs by HCPs, and accessibility regarding both

208 hardware and software issues for patients from more disadvantaged backgrounds.

209

210 **COVID-19 Survey**

211 As interviews occurred before the first UK COVID-19 lockdown in Mar 2020, we developed

212 an online survey to capture evolving healthcare delivery, ensuring continued relevance to

213 the changing context. The survey sought to understand general views on DHTs and

214 specifically how the COVID-19 pandemic affected their usage. The survey (see

215 Supplementary materials) included free text responses, multiple choice questions and Likert

216 scales. Feedback from three GP stakeholders informed the optimisation of the survey.

217

218 Participants were invited to complete the survey through advertisements on social media

219 (Twitter) and email, disseminated through academic primary care research networks and

220 departments. English-speaking HCPs that use DHTs were included in the study, with no

221 further exclusion criteria used for participant recruitment. Data collection took place

222 between July 2020 and August 2020. Informed consent was obtained before survey

223 participation. Participants were given the option to enter a prize draw for a £50 Amazon gift

224 voucher as an incentive.

225

226 ST analysed the free text responses thematically by ST using the coding structure developed

227 during the analysis of the qualitative interview data (included in the coding tree in the

228 Supplementary material). Themes emerging from the survey were discussed and refined by

229 ST, CD and BA.

230

RESULTS

232 In total 24 HCPs were interviewed: 10 GPs, 4 nurses, 8 pharmacists, 1 psychologist and 1

233 systems manager; their characteristics are outlined in Table 1. Participants approached the

234 study if they were interested, there were no participants who dropped out of the interview

235 study. Most of the HCPs were women (63%), in the 31-40 age range (58%), worked in a GP

236 practice (46%), had been in their role for 1-5 years (58%) and had 1-5 years' experience

237 using digital health tools in their practice (67%). The median practice IMD decile was 4

238 (interquartile range 3-8) (26), indicating the participants worked in more deprived areas

239 than average for England.

240

241 22 HCPs consented to take part in the survey, however 3 participants were excluded as they

242 did not report their job title and an additional 3 participants were excluded as they did not

243 finish the survey. We do not have information on the completion rate of the surveys, as we

244 only received surveys that were completed. This left a total of 16 HCPs: 7 GPs, 4 pharmacist,

245 2 nurses, 1 dietitian, 1 clinical psychologist and 1 cardiac surgeon (Table 1). There were 9

246 women and 7 men, with an age range of 28 to 66 (M= 41, SD= 11.6) and the years of

247 experience ranging from 1 year to 43 years qualified.

248

249 Table 1: Participant demographics

Demographic characteristics	Qualitative interview sample N=24	Survey sample N=16

Gender (n)		
Male	9	6
Female	15	10
Age range (n)		
21-30	5	4
31-40	14	7
41-50	3	2
51-60	2	2
61-70	0	1
Place of work (n)		
Medical School & GP Practice	1	0
GP Practice	11	9
University	1	0
Hospital	5	3
Turning Point	1	0
Community Pharmacy	2	4
NHS Trust	2	0
Integrated Urgent Care Service	1	0
Length of time in role (n)		
<1 year	7	0
1-5 years	14	11
6-10 years	0	2
>10 years	3	3
Time using digital health tools (n)		
"The whole time"	1	Not collected
"Not long"	1	
<1 year	3	
1-5 years	16	
6-10 years	2	
>10 years	1	
Socio-economic deprivation of practice area (Median, Interquartile range)		
Practice IMD Decile (1 most deprived and 10 least deprived)	4 (3-8)	Not collected

250

251

Digital Healthcare Tools used

HCPs discussed a range of technologies that they considered to be a DHT, including:

treatment algorithms, digital self-care behavioural interventions, email text and video call

255   consultations, correspondence with patients (e.g., practice text message systems), and data

256   storage systems.

257

258   **Results from thematic analysis**

259   There were two main themes that emerged from the interviews conducted prior to the

260   pandemic: the role of DHTs in HCPs clinical practice, and decision-making at three levels that

261   determined who got access to what DHTs. There was an additional theme from survey,

262   where HCPs described changes in access to and the use of DHTs during the pandemic. An

263   outline of the themes and subthemes are available in Table 2.

264   Table 2: Themes and subthemes

Theme	Subtheme
Role of digital healthcare tools	None
Levels of access to digital health tools: Health organisation level	• Influence of strategic decisions and incentive structures
Levels of access to digital health tools: Health Care practitioner level	• Health Care Practitioner's digital skills • Health Care Practitioner's knowledge of what DHTs were available and effective • Health Care Practitioner's perceptions about digital health tools • Health Care Practitioner's access to training and informal support within the organisation or practice
Levels of access to digital health tools: Patient level	• Health Care Practitioner's perceptions of which patients can use and benefit from digital health technologies • Health Care Practitioner's making judgements about who to use DHTs with
Changes in access to and use of DHTs during the pandemic	• How HCPs adapted to a remote-led model of care during the pandemic • Barriers and facilitators to providing care through DHTs during the COVID pandemic • Barriers and facilitators for patients accessing care through DHTs during the COVID pandemic

265

266 ***Pre-pandemic interviews***

267 <u>Role of digital healthcare tools</u>

268 In the interviews that were conducted prior to the COVID-19 pandemic, HCPs generally

269 viewed DHTs as having the potential to make information and services easier for patients to

270 access. However, some HCPs felt that DHTs were not suitable for everyone under every

271 circumstance, and that remote consultations could not replace the '*human side and that*

272 *caring side'* (ID P5) and they '*shouldn't be done at the expense of face-to-face consultations.'*

273 *(ID P8)*

274

275 <u>Decision-making at three levels that determined who got access to what digital</u>
276 <u>health tools</u>
277
278 Prior to the pandemic, three levels were identified where decisions were made about who

279 should have access to what DHTs and what support they would receive to access them.

280 These were the 1) health organisation, 2) HCP, and 3) patient levels.

281

282 *Health Organisation level*
283 *Influence of strategic decisions and incentive structures*
284 HCPs described how strategic decisions made by individual health services and incentive

285 structures created challenges for the adoption and implementation of DHTs. There was

286 generally a perception that there was no cohesive digital strategy across healthcare services

287 with '*…all practices are doing slightly different things' (ID P2).* An HCP felt that it was

288 challenging for practices to prioritise the adoption of DHTs because they were not

289 supported by traditional incentives structures, which would compensate for the time

290 involved in managing the new digital treatments and services:

291   *'… [digital health is] not one of the key performance indicators (…) it's not*

292   *yet at the point where commissioners are saying, look, you know, you said*

293   *to us, you're going to offer digital interventions. Show us by March that*

294   *you've offered 2500. (…). it's often commissioners that drives practice*

295   *because obviously commissioners are the ones that actually pay for the*

296   *services.' (ID P15)*

297 *HCP level*
298
299 The uptake of DHTs by HCPs and their decision to recommend them to patients, was

300 influenced by: the HCP's digital skills, their knowledge of what DHTs were available and

301 effective, their perceptions of the quality of DHTs, and the availability of training and

302 informal support for HCPs to use DHTs.

303

304 *HCP digital skills*
305
306 HCP use of DHTs in their practice and their ability to recommend them to their patients, was

307 reliant on their digital skills. Some HCPs described finding technology '*intuitive and quite*

308 *basic'* (ID P17). Others felt a lack of digital skills were a barrier to them supporting patients:

309 '*I've actually found that simple things [using DHTs] I don't know how to do, it means that I*

310 *can't do my job, just because I've not had the training'* (ID P22).

311

312 There was a perception by some of the participants that older HCPs would struggle to learn

313 about and use new DHTs, because they '*were not responsive to learning the new ways of*

314 *doing things…'* (ID P30).

315

316 *HCP's knowledge of what DHTs were available and effective*

317

318 HCPs were aware there were lots of DHTs available that may be able to support their

319 practice and patients, but many felt they did not have specific knowledge of what they

320 should use or how they worked. One participant spoke about how multiple different digital

321 systems were being introduced in their practice, that '*have got amazing functionality but we*

322 *don't know about it and we don't know how to use it*' (ID P10). Another described how there

323 were '*websites and apps that I've got experience of using and are very happy to*

324 *recommend'*, while other DHTs they had heard of but '*don't know how good they are'* which

325 impacts how they '*sell*' DHTs to their patients (ID P8). A participant described how the high

326 workload for HCPs presented challenges for them to remember what DHTs are available and

327 how to use them in a short consultation:

328 *'…people will do the training and then they've got loads of other things do*

329 *it. They'll forget about it. So at the point (…) I'm thinking this client could*

330 *maybe do digital, but I can't remember how to log on.' (ID P15)*

331

332 *HCP perceptions about the quality of DHTs*

333

334 HCPs made judgements about what DHTs to use or recommend to patients based on their

335 perceptions of the quality or reliability of DHTs. They talked about the challenges in

336 determining which DHTs were trustworthy, and which were '*flawed and quite risky'* (ID

337 P10). Some HCPs talked about being happy to recommend government-led online sources

338 of information, like the National Institute of Clinical Excellence (NICE) website, because it

339 was a '*reputable source'* (ID P13).

340

341 There was a sense from some of the HCPs that DHTs could not always be trusted to manage

342 or deliver patient care. One participant felt that if there was something important that

343 needed to be communicated with a patient '*someone needs to phone as well, we can't*

344 *totally trust the technology*' (ID P20). Another recalled incidences where '*systems have just*

345 *gone down and then you're completely stuck*', making it impossible to access essential

346 patient information (ID P7).

347

348 *Access to training and informal support within the organisation or practice*
349 HCPs described how the provision and quality of formal training to use DHTs was variable

350 across health services, and consequently it was '*learn by using*' (ID P4). Some felt formal

351 training for DHTs was not accessible for HCPs because they had to '*take time out of your*

352 *practice*' (ID P1), which they did not have. For those who had attended training, some HCPs

353 felt it was useful, while others felt they did not '*meet a broad range of people's learning*

354 *needs*' (ID P13).

355

356 Many of the HCPs described how they learned about DHTs and their features through other

357 HCPs in the health service where they worked. The availability and quality of this support

358 was not consistent across practices or organisations, and was determined by the level of

359 digital skills of the people working in the individual health service:

360   *'…someone in the practice has either figured it out or seen it elsewhere*

361   *and then they show someone else and so some people know how to do it.*

362   *Some people don't. It's all a bit patchy…' (ID 10)*

363 <u>Patient level</u>

364 HCPs made judgements about which patients would benefit from DHTs. Their perceptions

365 often influenced whether they recommend DHTs or used them with patients.

366

367 *HCP's perceptions of which patients can use and benefit from DHTs*

368 HCPs generally believed that DHTs were most suitable for digitally literate, '*young, fit'* (ID

369 P2) individuals, and those who were '*able bodied and mentally able'* (ID P32).

370

371 HCPs identified patient groups who they thought faced barriers accessing and using DHTs.

372 This included patients with '*very low literacy'* (ID P10), '*whose language is not English'* (ID

373 P5), and those who '*never embraced the internet or any digital tech'* (ID P32). Some patients

374 were viewed as more isolated, lacking support from a '*team or family or carers'* to help

375 them access DHTs (ID P12).

376

377 Some DHTs placed criteria that excluded vulnerable and underserved groups. For example, a

378 HCPs also spoke about the Babylon app that has: '*excluded a ridiculous number of people*

379 *from being able to use its service (…) like no woman can become pregnant, no one with*

380 *social service needs, no one with mental health problems, so there's many exclusions for*

381 *people with the highest needs.' (ID P9)*

382

383 There were conflicting opinions about digital health accessibility for people who lived in

384 lower income areas. Some felt most people with lower incomes '*have phone access now*

385 *anyway, so they will rely on their phones and online'* to access health information and

386 support (ID P4). However, concerns were raised that the '*disadvantage of the digital stuff is*

387 *potentially exacerbating health inequalities'* (ID P8). A participant described the intersection

388 between age and deprivation being particularly problematic:

389   *'…we work in a relatively deprived area and most to our particularly*

390   *younger patients do have Internet access and you know have mobiles, but*

391   *a lot of our older patients don't' (ID P8).*

392 Although many HCPs spoke about how the elderly could be excluded from using DHTs, some

393 had their presumptions about age-related technology uptake challenged by experiences

394 with older patients being adept at using DHTs:

395   *'… a chap who was 80 years old, he came into my clinic room (…), he*

396   *opened his tablet and he logged on to his own umm… personal page on his*

397   *own practice to give me information. (…) I was like oh gosh that's really*

398   *impressive can I have a look' (ID P20).*

399 Conversely, an HCP had found that *'…a lot of young people don't want treatment digitally'*

400 *(ID 15)*, because they were concerned around inadvertent disclosure of stigmatised health

401 conditions:

402   *'…they're saying, actually, I don't want something on my phone that my*

403   *mates going to see. And it's got something about anxiety on it or it's got*

404   *something like I'm a family member of somebody with an alcohol problem'*

405   *(ID P15)*

406 *HCP's making judgements about who to use DHTs with*
407 The perception of HCPs about the appropriateness of DHTs for a specific patient group

408 influenced their decisions regarding DHT use. HCPs described how they were less likely to

409 communicate with older adults or those with *'mental disabilities'* (ID P9) using DHTs. Several

410 HCPs said they were less likely to engage in discussions about or supply DHTs to discuss or

411 older patients:

412   *'…the older generation are a little bit 'oh no, I don't want to do that', or 'it*

413   *confuses me'. So yeah, I judge who I would discuss apps with and*

414   *technology with age wise…'* (ID P32)

415

416 A participant stated that their team were targeting *'the younger ones'* in their roll out of an

417 app to support people with bowel cancer (ID P25). However, she acknowledged that the

418 majority of their *'patients are 70-89'* and were *'not going to be able to use the app'* (ID P25).

419

420 Some HCPs described how the perception that someone was lacking digital skills, resulted in

421 them being prioritised for face-to-face consultations, when *'clinically, they didn't need that*

422 *priority'* (ID P5). A participant reflected that *'the less digitally enabled person might get*

423 *more of my attention than the more digitally enabled'* (ID P11).

424

425 ***COVID 19 Survey***
426 <u>Changes in access to and use of DHTs during the pandemic</u>
427 HCPs who completed the survey about their use of DHTs during the pandemic, described a

428 dramatic shift in *'practice to almost completely remote working'* in response to government

429 implemented COVID restrictions (Survey ID 10). They described how: they adapted to this

430 shift, the barriers and facilitators to providing care almost exclusively through DHTs, and

431 their perceptions of the barriers and facilitators for patients accessing care through DHTs

432 during the pandemic.

433

How HCPs adapted to a remote-led model of care during the pandemic

435 Some of the HCPs reflected positively on the shift to the delivery of care through

436 technology. Participants described how being *'forced to engage better with digital*

437 *technology'* (Survey ID 25), made them realise *'the potential of just what you can do by*

438 *phone (and sometimes video)'* (Survey ID 9). An HCP concluded that *'It has changed the way*

439 *we work for the long term, I think in a good way.'* (Survey ID 25). However, several of the

440 HCPs cited similar concerns to pre-pandemic about practising through remote

441 appointments. They found it: *'more difficult to understand a patient's problem and support*

442 *them when you are unable to see them in person and perform certain tests'* (Survey ID 15).

443 In addition to hindering the development of an *'appropriate patient physician relationship'*

444 (Survey ID 17).

445

Barriers and facilitators to providing care through DHTs during the COVID pandemic

447 The barriers to providing care through DHTs during the pandemic described by the HCPs

448 were similar to pre-pandemic. These included *'Internet problems'* (Survey ID 13), issues with

449 DHTs being properly approved and integrated through healthcare services, *'Issues around*

450 *consent and data sharing'* (Survey ID 25), and staff being willing or able to engage with

451 DHTs. For example, a participant described how *'some older staff didn't want to work*

452 *digitally and struggled to accept change'* (Survey ID 10).

453

454 However, HCPs described having more resources available to overcome these issues during

455 the pandemic compared to prior to the pandemic. An HCP described how their organisation

456 *'facilitated'* the use of DHTs *'more and removed any existing barriers'* (Survey ID 28):

457   *'...initially [there was] lots of confusion over how we were going to be able*

458   *to offer patient appointments and what apps etc were NHS approved etc.*

459   *The local Primary care network were fantastic in supporting local surgeries*

460   *in implementing change. Barriers also were financial, but when funding*

461   *was granted for extra equipment etc, there was a boom in embracing new*

462   *ways of working(...) there was so much change happening at once, that it*

463   *was sometimes difficult to keep up with the latest information and what*

464   *was available to use. An online network called Teamnet became the 'go to'*

465   *site for updated information and technology and government updates.'*

466   *(Survey ID 10)*

467   <u>Barriers and facilitators for patients accessing care through DHTs during the COVID</u>

468   <u>pandemic</u>

469   The HCPs felt that some patients faced challenges when they were '*forced to adapt and*

470   *resort to digital tools*' in the pandemic (Survey ID 25). However, they felt most patients were

471   able to engage with the new way of accessing health support and were more '*accepting of*

472   *the technologies as there isn't an alternative'* during lockdown periods (Survey ID 6).

473

474   For those patients who did face barriers in accessing and using DHTs, the issues described

475   by the HCPs were similar to pre-pandemic. HCPs felt that '*there is still a group of patients*

476   *and conditions for which face to face consulting is preferable'* (Survey ID 9). A participant

477   spoke about '*poorer patients not having internet or not [being] aware of how to use [the*

478   *internet]'* (Survey ID 30). An HCP described how: '*...elderly patients with no mobile phones or*

479   *laptops have felt isolated and victimized, age discrimination really. Some cannot or will not*

480 *embrace technology and want to be seen face to face or can't get phone to connect to video*

481 *call...' (Survey ID 6)*

482

483 HCPs highlighted ways in which their services adapted to improve access to health services

484 for those who faced challenges using remote consultations during the pandemic. Most of

485 the HCPs described offering phone consultations, or face-to-face consultations with '*PPE*

486 *equipment'* (Survey ID 30) '*where safety can be maintained'* (Survey ID 28). Some HCPs

487 spoke about how their services made further adjustments to the delivery of their digital

488 support, by establishing alternative people to contact if the patient did not have good digital

489 skills, or by providing equipment to access services: '*Patients who do not have access to any*

490 *digital tool (mostly elderly) we usually contacted their children etc who would be able to*

491 *assist them'* (Survey ID 15). A participant spoke about how they had '*obtained consent for*

492 *patients who don't have smartphones, to allow them to use a neighbours phone (…) to make*

493 *a video call'* (Survey ID 10). A participant described how their service provided '*mobile*

494 *phones for homeless clients'* (Survey ID 14).

495

DISCUSSION

496

497 **Principal findings**

498 In our pre-COVID-19 pandemic interviews, HCPs across different healthcare settings in

499 England generally acknowledged the potential benefit of DHTs in enhancing patient access

500 to healthcare services. However, they expressed concerns regarding the appropriateness of

501 DHTs for specific patient populations, viewing face-to-face appointments as superior in

502 certain situations. The HCPs described three levels where decisions were made which

503 determined who would have access to what DHTs. These were: the health organisation,

HCP, and patient levels. At the organisation level, HCPs described a lack of cohesive strategy

across healthcare services and traditional incentive structures targeting digital health, which

resulted in disparities in DHT adoption. At the HCP level, a wide variation in digital skills and

knowledge of DHTs created barriers to HCPs using these tools in their practice and

recommending them to patients. HCPs described a lack of high-quality centralised

information and formal training, and inconsistencies in provision of support across practices

or organisations. At the patient level, HCPs held beliefs about groups of patients they felt

would benefit from DHTs (e.g., young and fit). These preconceptions influenced HCP's

decisions on whether to introduce DHTs to patients and whether to use these tools for

patient communication.

In the survey conducted during the pandemic, the HCPs described an almost complete shift

to remote delivery of care. While many barriers to DHT use persisted, HCPs reported

receiving significant support to overcome these challenges during the pandemic. This

included support from the local Primary Care Networks to implement the shift to digital

services, funding for extra equipment, and an online network (e.g., Teamnet) that provided

the most up to date information about what DHTs were available.

HCPs felt that the majority of their patients were able to adapt to the change in the delivery

of services, mostly due to the lack of alternatives during the pandemic. However, similar

concerns regarding digital exclusion persisted. To address these issues, HCPs implemented

strategies to enhance access to healthcare services for patients facing difficulties with DHTs.

This often included offering face-to-face appointments with the HCP wearing full personal

protective equipment (PPE) or providing additional support for accessing digital services.

528

Strengths and limitations

530 To the authors knowledge, this is the first study to explore the impact of decision making

531 around the use of DHTs by HCPs on access to DHTs for patients, before and during the

532 COVID-19 pandemic in England. In addition to our planned qualitative study, we developed

533 and disseminated a questionnaire that explored whether COVID-19 had changed the way

534 that healthcare professionals used DHTs. By doing this, we were able to ensure that our

535 earlier 'pre-COVID' work was still relevant to inform future research and policymaking.

536

537 Complete audio data was recorded for all interviews, and there were no issues with lost

538 data. Double coding of a subset of interviews by five members of the team and ongoing

539 discussion about coding structure ensured the coding scheme was robust. Multiple views of

540 the data promoted confidence in the credibility of the findings (28). A diverse range of

541 experiences and opposing sides of arguments were identified and presented.

542

543 There were challenges recruiting the sample of healthcare professionals, meaning both

544 survey and interviews had (relatively) small samples. However considering both datasets

545 using principles of information power (27), suggests that the findings are still relevant and

546 valuable, although some experiences related to DHT access and use may not have captured.

547 As patients were not included in this study, reflections about the barriers patients

548 experience accessing DHTs are from the HCP's perspective. Consequently, this may not

549 accurately reflect the barriers and facilitators patients experienced accessing DHTs prior to

550 and during the pandemic.

551

Interpretations in the Context of Existing Literature

Our study agrees with previous qualitative research conducted in the United States, that

emphasised the influence of organisational context on DHT access (2, 29). Puckett et al.

(2020) found that inequality in access to diabetes pumps was related to whether the clinic

distributed resources equally as standard policy, or whether they provided patients with

access dependent on their pre-determined policy/eligibility (e.g. interaction with the health

service) (29).

Concerns about the quality and reliability of DHTs cited by the HCPs in the interviews in this

study, reflect previous review findings that the majority of commercially available health

apps are not evidence based or do not reflect public health guidelines (30). The same review

reported that in surveys from Germany and (31) the United States (32, 33) agreed with the

HCP views in this study that those who used health apps were more likely to be younger, in

good health, higher income, education and health literacy (30). Although some HCPs in our

interviews described how their presumptions about age-related technology uptake was

challenged when older patients were highly engaged with DHTs, and younger patients were

disinterested in technology.

Our study found that during and prior to the pandemic, HCPs had concerns about

accessibility of online consultations, and made adaptations to support patients who were

less digitally literate or did not have internet access. These findings are similar to those of

recent qualitative studies conducted before (21), and during the pandemic (34), where HCPs

reported that remote consultations could improve access for some groups (e.g. those with

caring responsibilities, not able to leave their homes) (21, 34). However, they also had

576   concerns about digital exclusion and accessibility for some patients (21, 34), and described

577   providing face-to-face appointments for those who they perceived to be less able to use the

578   digital services (e.g. older adults)(21). A multinational survey found that ophthalmologists

579   felt clinical Artificial Intelligence would improve accessibility of eye care services, but were

580   less convinced about whether it would result in improvements in quality or affordability (2).

581   They were unsure about whether the COVID-19 pandemic would increase adoption of

582   digital technology in the health system, or result in the increased in implementation of the

583   technology through investment, training healthcare workers or educating the public (2).

584

585   Two YouGov surveys of NHS staff and patients found that while the majority of patients and

586   NHS staff responded positively to the increased use of technology in healthcare during the

587   pandemic, certain groups, including those over 55, individuals with caregivers, or those

588   unemployed, reported negative experiences with DHTs more frequently than the general

589   population (6). This corresponds with the perceptions of the HCPs in our study, that the

590   majority of patients adapted well to delivery of care through technology. But those who

591   were older and had lower incomes faced greater barriers accessing DHTs before and during

592   the pandemic.

593

594   In our study, some HCPs described having limited knowledge of what DHTs were available

595   and what to recommend to their patients. This corresponds with the findings from a

596   qualitative study exploring digital access for patients with T2D, where participants felt HCPs

597   were not knowledgeable about self-care DHTs (20).

598

Implications for Research, practice and policy

Improving digital infrastructure and training of HCPs

601 The centralised response to the pandemic and the way in which barriers to accessing DHTs

602 were universally addressed in healthcare services across the United Kingdom described by

603 HCPs in our survey, can be seen as an illustration of good practice in tackling inequalities in

604 access to DHTs at the organisational and HCP level. A recent white paper the Department of

605 Health and Social Care laid out the aim to make the innovations that the COVID pandemic

606 accelerated permanent (35). However, it is unclear what support will remain to reduce

607 barriers to accessing and using DHTs, and whether this will be universally provided. Future

608 support could consist of government funding and incentives, ensuring HCPs have access to

609 and are aware of central repositories that provide up-to-date information about evidence-

610 based DHTs that they could recommend to their patients (e.g. ORCHA), and support for

611 health services to adopt innovations (e.g. Adopting Innovation programme (6)).

612

Reducing inequalities in access to DHTs for patients

614 The HCPs in this study did not describe any centralised provision of support to ensure less

615 digitally engaged patients had access to DHTs during the pandemic. Instead, individual HCPs

616 and health organisations made decisions about who could benefit from DHTs, and what

617 support would be offered to reduce barriers to accessing DHTs. By making judgements

618 about who can benefit from DHTs, HCPs are potentially preventing some patients from

619 being able to benefit from these services, which has implications for inequalities in access to

620 healthcare. This is particularly poignant as we move towards the 'digital first' service as laid

621 out in the NHS Long Term plan (1). To avoid digital exclusion, through the lack of provision

622 of information about DHTs, it could become standard policy that all patients should be

623 signposted to evidence based DHTs. This could be sent to patients utilising existing systems

624   (e.g., accuRx) so as not to add additional burden on to HCP, and to circumvent HCPs acting

625   as gatekeepers to DHTs. HCPs could also be provided with information about where to

626   signpost patients for support to access or use DHTs. Digital participation schemes piloted by

627   NHS digital have been successful in reducing inequalities in access to DHTs, by providing

628   people with low digital literacy with support from digital champions (36, 37). Although there

629   are plans to roll these out more widely following the success of the pilots (36), current

630   unequal provision of these services across the UK risks widening digital inequities in areas

631   not served by these schemes. Speeding up the availability of this support could involve the

632   development and roll out of engaging accessible training for digital health champions and

633   access to up-to-date resources these digital champions could refer to. Such an approach is

634   in line with recent recommendations to recognise variation in user needs to improve

635   technology adoption and acceptance (38).

636

637   **Conclusions**
638   This research has highlighted how decision-making at the health organisation, HCP, and

639   patient levels influence inequalities in access to DHTs for HCPs and patients. The pandemic

640   prompted the centralised mobilisation of resources for health organisation and HCPs to

641   access and implement of DHTs. However, the patients still faced uneven access to DHTs,

642   determined by decisions made by individual health services and HCPs. Attention must be

643   paid to ensuring all patients have access to information about what DHTs could support

644   them. There is also a need to increase access to support for less digitally engaged patients

645   so they can benefit from the 'digital first' health service.

646 *List of abbreviations*

DHT	Digital Health Technologies
NHS	National Health Service
UK	United Kingdom
IMD	Indices of Multiple Deprivation
GP	General Practitioner
HCP	Health Care Practitioner

647

648 *Declarations*

649 *Ethics approval and consent to participate*

650 All activities were approved by and conducted in accordance with the University of Bath
651 Psychology Research Ethics Committee (PREC reference number: 19-211 and 20-142
652 respectively) and the Declaration of Helsinki for both the interviews and online survey. The
653 participants received both written and verbal information about the research. Informed
654 consent was collected from all participants. Interview participants provided written consent
655 before the interview was arranged and which was confirmed with verbal consent
656 immediately prior the interview. Those who completed the survey provided informed
657 consent ahead of data collection.

658

659 *Consent for publication*

660 Not Applicable.

661

662 *Availability of data and materials*

663 Anonymised datasets used and/or analysed during the current study are available from the
664 corresponding author on reasonable request.

665

666 *Competing interests*

667 None

668

669 *Funding*

670 This project was funded by the GW4 Digital Crucible seedcorn funding grant. GL was funded
671 by the NIHR Health Protection Research Unit in Behavioural Science and Evaluation at
672 University of Bristol, in partnership with UK Health Security Agency (UKHSA). The views
673 expressed are those of the authors and not necessarily those of the NIHR, the Department
674 of Health and Social Care, or UKHSA.

675

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