BMJ Open Quality

Readiness for five digital technologies in general practice: perceptions of staff in one part of southern England

Matthew Hammerton,[1] Tim Benson ,[2,3] Andrew Sibley [1]

To cite: Hammerton M, Benson T, Sibley A. Readiness for five digital technologies in general practice: perceptions of staff in one part of southern England. *BMJ Open Quality* 2022;**11**:e001865. doi:10.1136/bmjoq-2022-001865

Received 14 February 2022
Accepted 3 June 2022

[1]Wessex Academic Health Science Network, Southampton, UK
[2]R-Outcomes Ltd, Newbury, UK
[3]Institute of Health Informatics, UCL, London, UK

Correspondence to
Tim Benson;
tim.benson@r-outcomes.com

ABSTRACT

Background Our aim was to understand how digital readiness within general practice varies between different technologies and to identify how demographic, workplace and external factors affect this. The technologies considered include electronic patient records, telehealth (text messaging and video consultations), patient online access, patient clinical apps and wearables, and social media.

Method A digital readiness survey tool was developed and used in one area of southern England during Spring 2020. Semistructured qualitative interviews were also carried out with some practice staff and digital technology company representatives.

Results GPs, nurses and non-clinical staff submitted 287 responses from 27 general practices (out of 33 invited). Staff digital readiness differs significantly between technologies. The mean perceived digital competency scores on 0–100 scale (high is good) were electronic patient records (75.7), telehealth (64.2), patient online access (65.8), patient clinical apps and wearables (50.8), and social media (51.2).

Younger general practice staff, those in post for 5 or less years are more digitally competent and confident than older staff. This applies to both clinical and non-clinical staff. Older patient population, rurality and smaller practice size are associated with lower digital readiness. Readiness to use digital technology may have improved since the start of the COVID-19 pandemic but barriers remain in poor IT and mobile infrastructure, software usability and interoperability, and concerns about information governance.

Conclusions Improving digital readiness in general practice is complex and multifactorial. Issues may be alleviated by using dedicated digital implementation teams and closer collaboration between stakeholders (GPs and their staff, patients, funders, technology companies and government).

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Adoption of digital technologies in general practice varies between technologies and between practices. This study set out to understand the reasons for this.

WHAT THIS STUDY ADDS

⇒ This study has shown large differences between digital technologies, staff and practices in their readiness to embrace innovations due to human factors (staff role, age and time in practice), practice demographics (rurality and older patients) and external factors including IT infrastructure, software usability, interoperability and information governance.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE AND/OR POLICY

⇒ Digital innovation adoption is complex. All stakeholders need to build a consensus, recognising that change requires effort and one-size-fits-all solutions will not work for all general practices.

BACKGROUND

The structure of the English National Health Service (NHS) is complex, with nearly 7000 independent general practices grouped into 1250 primary care networks (PCNs) plus several hundred community, mental health, ambulance and secondary care providers. Our focus here is on general practice after the start of the COVID-19 pandemic.

For several decades governments have promoted digital transformation of general practice services.[1] All general practices in the UK have used computers in their consulting rooms for over 20 years, but progress has been variable for other proven digital technologies.[2–4] The COVID-19 pandemic led to an acceleration in some but not all aspects of digital transformation.[5 6]

This project set out to understand why general practice has not continued to be in the vanguard of digital health innovation. We asked general practice staff about their views of digital readiness and assessed how this varies across technologies, practices and external variables.

Digital readiness is defined here as the motivation and competence to adopt, use and spread digital healthcare technologies effectively. Motivation and competence are different. Motivation is mainly a mind-set, which is related to confidence, while competence is mainly a skill set that can be learnt.

Digital literacy is defined as the capabilities that fit someone for living, learning, working, participating and thriving in a digital society.[7]

Digital literacy is a skill set and is a key factor in the adoption of digital health technologies to support the health and well-being of patients and carers.[8 9]

Staff acceptance helps determine whether a new technology succeeds or fails at a local level.[10] General practitioners (GPs) and other staff need the motivation, enthusiasm and ability to see the opportunities and benefits of the proposals.[11] Recognised barriers include poor information technology (IT) infrastructure, lack of interoperability and uncertainty about information governance regulations.[12]

Patient adoption is associated with digital skills, good connection/device access at home and digital confidence.[13] Negative factors are age, rurality and poverty.[14 15] Larger practice size is associated with more patient adoption of digital technologies.[16]

Study questions

The study focused on five groups of digital healthcare technologies, which may be classified as staff-facing or patient-facing.

- Staff-facing: (1) electronic patient records (EPR) and (2) telehealth (text messaging and video consultations).
- Patient-facing: (3) patient online access to their records, (4) patient apps and wearables, and (5) social media.

This study addressed five questions about:

1. Variation of staff digital readiness between different technologies.
2. Impact of staff factors (age, time in practice, professional group) on their digital readiness.
3. Effect of the practice population and rurality on staff digital readiness.
4. Wider factors (eg, government regulations) that impact digital readiness.
5. Relationship between the use of different digital healthcare technologies and staff digital readiness.

METHOD

A sequential mixed-methods design[17] was used to collect quantitative and qualitative evidence. The content was influenced by Greenhalgh's NASSS (reasons for Non-adoption, Abandonment and failure to Scale-up, Spread and Sustain) framework for understanding issues that impact the adoption of digital health technologies.[10] The survey was piloted in general practice in another part of England before undertaking the main study.

Setting

All 33 practices in an area of North and Mid Hampshire, England, were invited to take part. The area is relatively prosperous, with a mix of urban and rural populations and covers about 570 000 people. Five practices did not respond to emails and one practice stated that they were not able to take part due to current workload pressures, leaving 27 participating practices (82% participation).

Permission to engage practice staff was obtained via practice managers. Survey data was collected between May and June 2020 during the COVID-19 pandemic. Qualitative interviews were carried out in June and July 2020. Some data was recorded prior to the pandemic but is not reported here. (The full report includes a comparison of pre-COVID and post-COVID results).

Development

R-Outcomes developed a short survey for completion by practice staff, based on existing measures of digital innovation, adapted for the specific needs of this project.[18 19] The words, as displayed to respondents, are shown in column one of table 1.

Figure 1 shows the format of each measure. The example shown is the digital competence measure, which covers each respondent's perceived confidence, motivation and self-efficacy using all types of digital healthcare technology. Self-efficacy is an individual's belief in their capability to execute behaviours required to produce specific results.[20 21]

The main adaptation was to add a separate set of questions for each of the five technologies. For staff-facing applications, the focus was on their own use. For patient-facing applications, the focus was on whether staff would recommend that patients use them.

The process of questionnaire design was iterative among members of the project team. This took place over several weeks, and involved external pilot studies, until all team members were happy with the final survey.

The innovation readiness measure explores whether respondents feel open to and up-to-date with new ideas, and whether their organisations are receptive to and effective at making innovations work.[19 22]

Each measure shares a common look and feel, with four items and four response options each. In common with all measures developed by R-Outcomes, these measures are brief, easy to understand and with a low reading age.

Each item within each measure is scored on a scale from 0 (disagree) to 3 (strongly agree). A high score is good. Summary scores are calculated as the sum of the four items in each measure; the mean summary scores are also reported on a 0–100 scale. For reporting, the mean scores for both items and summary scores are converted to a scale from 0 (all disagree) to 100 (all strongly agree).

External data sources

The following existing external data sources were also used:

- NHS Digital General Practice Data Hub for general practice patient population size, workforce numbers and percentage of general practice patients using any online patient access service.
- NHS England general practice indicator dashboard for the rurality of each general practice.

Table 1 Mean, SD of each item and summary measure, plus Cronbach's α values for each measure

Measures and items	Mean score	SD	Cronbach's α
Digital competency	**70.0**	**21.8**	0.83
I am confident using digital technologies	72.7	25.8	
I enjoy learning new digital technologies	73.6	24.8	
I can get help if I am stuck	76.0	26.4	
I can solve most problems if stuck	57.5	30.0	
EPR competency	**75.7**	**18.8**	0.79
I am confident using EPR	83.5	19.5	
I enjoy learning about new aspects of them	78.4	23.2	
I can get help if I am stuck	76.6	23.7	
I can solve most problems if stuck	64.3	28.4	
Telehealth competency	**64.2**	**25.0**	0.87
I am confident using telehealth	65.7	31.4	
I enjoy learning about new telehealth technologies	70.4	26.1	
I can get help if I am stuck	66.3	28.9	
I can solve most problems if stuck	53.9	31.2	
Patient access competency	**65.8**	**22.7**	0.82
I am confident encouraging online access	70.4	27.9	
I enjoy learning about new access technologies	71.0	25.3	
I can get help if I am stuck	68.8	28.7	
I can solve most problems if stuck	53.2	30.4	
Patient apps and wearables competency	**50.8**	**26.5**	0.86
I am confident encouraging use of apps and wearables	42.9	33.5	
I enjoy learning about new apps and wearables	61.0	29.8	
I can get help if I am stuck	55.6	32.6	
I can solve most problems if stuck	41.5	30.7	
Social media competency	**51.2**	**31.1**	0.91
I am confident encouraging social media use	48.0	36.7	
I enjoy learning about new social media platforms	52.6	33.7	
I can get help if I am stuck	56.1	33.6	
I can solve most problems if stuck	46.7	35.3	
Innovation readiness	**76.4**	**17.6**	0.76
New ideas are needed in general practice	83.6	19.7	
I keep up with new ideas	70.8	24.8	
My practice supports new ideas	78.2	23.5	
My practice makes new ideas work	73.2	23.4	

Summary scores are shown in bold. all scores on 0–100 scale where high is good (n=285).
EPR, electronic patient record.

- The Care Quality Commission (CQC) latest rating of each general practice (Outstanding, Good, Requires improvement, Inadequate).
- Public Health England Finger-tips for general practice deprivation score (IMD) and the proportion of patients greater or equal to 65 years old.
- West Hampshire Clinical Commissioning Group (CCG) data for usage of eConsult and AccuRx applications (used for remote consultations).

Statistical analysis

Statistical analysis was done using JASP.[23] The independent samples t-test (two tailed) was used to assess statistical significance for all comparisons.

- Summary scores for each measure were reported in terms of mean and SD.
- Cronbach's α was used to test whether items measure the same things. Cronbach's α should ideally be in the range 0.7–0.9.[24]

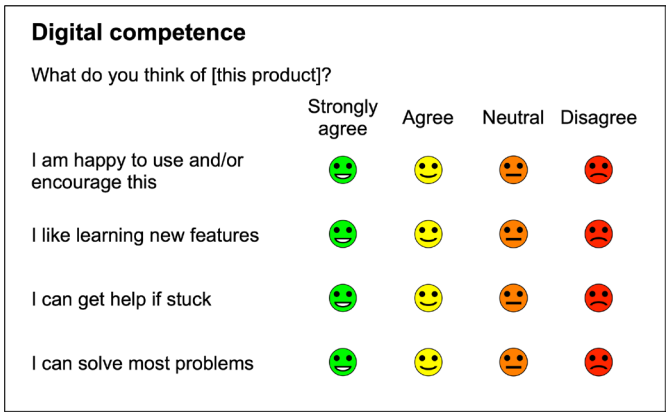

Figure 1 Digital competence measure used in the digital readiness survey.

- Individual item and summary scores were compared by demographic and practice-specific variables.

Pearson correlation was used to assess:

- The proportion of patients using online patient access against each practice's mean patient online access competency score for non-clinical staff.
- The online consultation rate per head in April 2020 against the mean patient online access competency score for all staff.
- The AccuRx video consultations rate in April and May 2020 against GPs' mean telehealth competency score.

Qualitative

Semistructured interviews were conducted with three members of staff (GP, practice and administration managers) at two contrasting practices (with high and low digital readiness scores) to investigate issues surrounding their own and patients' digital readiness.

Interviews were also conducted with staff at three digital technology companies—eConsult (telehealth), Nye Health (telehealth) and MyMhealth (patient app) to investigate their views on working with general practice.

Semistructured interview questions were based on a combination of findings from the quantitative element, the NASSS framework[10] and the findings of DALLAS assisted living project.[12]

Remote interviews were conducted via Microsoft Teams and all participants consented to being recorded. Each interview took between 40 and 60 min. Thematic analysis was used to identify themes and subthemes to address the study questions.[25]

Patient involvement

Patients were not involved.

RESULTS

A total of 285 survey responses were analysed from practice staff. Response rates in different practices varied considerably. In 15 practices, more than 15% of staff provided valid responses.

The mean and SD of for each item, the measure summary scores and Cronbach's α values are shown in table 1.

Table 2 shows the mean summary score for each measure (each comprising four items), categorised by independent variables. The measures cover each respondent's perception of their competence in terms of IT in general, EPRs, telehealth (text messages and remote consultations), patient access to their own records and systems, patient-used applications, social media groups and innovation readiness. The independent variables include staff age (over or under 50 years old), time employed in that practice (over or under 6 years), job type (GP or other), whether the practice is urban or rural, practice size (over or under 13 000 patient population), level of online patient access (over or under 40%), CQC rating (good or other), patients' age (more or less than 20% over 65) and deprivation level (over or under Index of Multiple Deprivation (IMD) of 11).

Variation between technologies

Differences between technologies are substantial. Staff show moderate competence for digital healthcare technologies generally (mean 70.0). The mean summary scores for each technology are: EPRs (75.7), telehealth (64.2), patient access (65.8), patient apps and wearables (50.8) and social media (51.2).

Staff factors

Age of staff

Younger staff (<50 years old) have higher digital competence (confidence and self-efficacy) and telehealth competence (confidence, motivation and self-efficacy) than older staff. This is highly significant for telehealth. Younger staff are more motivated to learn about patient apps and wearables and social media.

Differences for the other competencies are not significant. Both younger and older staff have similar mean competence for EPRs, patient access and innovative readiness. Qualitative analysis reported a nuanced picture for age being a factor for digital readiness.

> It's tempting to think that part of it is to do with age, isn't it? But I'm not sure that that's true, actually. (GP Partner)

Time in general practice

Staff, who have been in post for over 5 years, are less digitally competent specifically for EPR, patient access and social media. This is associated with lower self-efficacy, particularly solving problems if stuck. Qualitative analysis emphasises the importance of continuous upskilling in digital healthcare technologies.

> Most people, who have been here for more than five years, have been here almost 20 years and they really struggle picking up digital. People who come in new and they're taught it from the beginning don't know any difference. All they know is those systems and

Table 2 Summary scores for independent variables

Variable	Responses (n)	Digital	EPR	Telehealth	Pat access	Pat apps	Social med	Innovation readiness
Overall	285	70	76	64	66	51	51	76
Staff over 50	134	67	76	60	65	50	49	76
Staff under 50	151	72	75	68*	67	51	53	77
Service 0–5 years	137	76*	79*	67	71*	55*	62*	79*
Service 6+ years	148	64	72	62	61	47	41	74
General Practitioner (GP)	101	67	73	71*	63	50	43	79
Other staff	178	72	78*	61	68	51	57*	75
Rural practice	67	69	76	68	64	53	48	72
Urban practice	218	70	76	63	66	50	52	78*
>13 k patients	209	70	76	63	66	50	52	77
<13 k patients	76	70	76	68	64	54	49	74
>40% online access	183	73*	77	64	68*	52	53	78*
<40% online access	102	65	74	65	62	48	48	74
CQC rated good	263	70	76	64	66	51	51	76
CQC rated other	21	65	77	62	59	51	49	81
Under 20% over 65	102	79*	82*	67	70	56*	59*	81*
Over 20% over 65	164	65	72	63	65	47	46	73
Dependency low	117	68	73	62	63	52	48	73
Dependency high	149	72	78	66	69*	50	54	78*

All scores on 0–100 scale, where high is good.
*Indicates significantly higher score (t-test, p<0.05).
CQC, Care Quality Commission; EPR, electronic patient record.

how they work, so that is a good thing about a new starter coming in. (Operations Manager)

Professional groups

General practitioners (GPs) see themselves as less digitally competent than do most other staff, specifically for EPR, Patient access and Social media. This is mainly linked to self-efficacy (ability to get help if stuck and/or solve most problems if stuck).

However, GPs are more confident in using telehealth and learning about new patient apps and wearables (although not for other aspects of Patient apps). GPs are also more open to new ideas being needed in general practice.

Qualitative evidence highlights that GP partners are the key enablers of digital transformation, particularly motivation and engagement of practice staff. They also have the most responsibility and autonomy for making changes. Other staff are vital for patient engagement and troubleshooting.

Really important is actually your reception and admin - getting them on board. If they see the benefits, they drive it, they really do, they're fantastic. (Technology company representative)

Patient online access is seen as a non-clinical function but Telehealth and encouraging the use of Patient apps and wearables are seen as clinical. The need to join up clinical and non-clinical staff collaboration for digital transformation was expressed. All part-time staff (GPs and others) find it hard to get digital training and maintain skills.

Non-clinical staff have most interaction with patient access technology but seldom encounter patient apps and wearables.

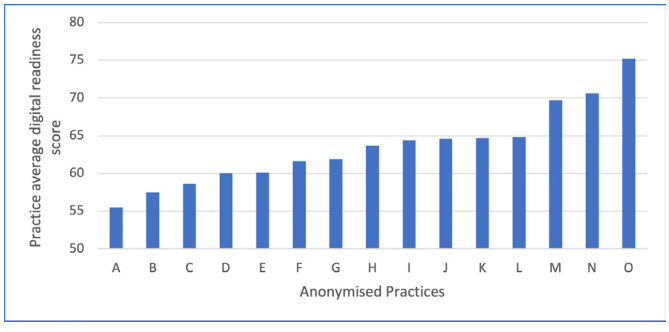

Figure 2 Practice average digital readiness score based on the average of all survey measure scores for anonymised practices with a response rate ≥15%.

Practice situation

Figure 2 demonstrates wide variability between practices in mean digital readiness score, with a large difference between the practice A (mean digital readiness score=55) and practice O (mean digital readiness score=75).

Practice A is a small rural practice with poor internet and mobile signals. It is a late adopter with many elderly patients. There are few digital champions, low motivation to change and staff are mostly sceptical of new technology.

Practice O is a large urban practice with good internet and mobile signals. It is an early adopter with fewer elderly patients. There are multiple digital champions who actively look to adopt, test and spread new innovations.

These two practices are at opposite ends of the innovativeness spectrum.[22]

> As a practice we haven't waited for proven benefit. We have done things first, and then the CCG [payer] has agreed to fund it. (GP Partner in Practice O)

> I think we're quite sceptical of lots of things. I think some practices seem to think just because it's new it means it's better and we don't agree with that philosophy. We think, well, it might be new, but actually it may be worse. So, analyse things a bit more and see what happens before making a change to see whether it will benefit us or our patients. (GP Partner in Practice A)

Deprivation

Practices with more deprived patient populations have a higher mean innovation readiness score than those with more affluent patient populations. When asked about digital exclusion and inequalities, interviewees focused more on age than on other aspects of social deprivation, such as poverty or housing.

Population age

Practices with fewer than 20% of patients over 65 are more competent than practices with 20% or more for: general digital competency, EPR, patient access, social media and innovation readiness. This strongly supports the notion that the lower digital confidence of an older population affects the digital readiness in practice staff.

> We've quite an elderly demographic. Quite a few of our patients don't have mobile phones or they won't use them because they'll say 'I get no signal in my house' so it is their land line or nothing, which can be a challenge. Even if the staff have been willing and able, sometimes it's just been impossible due to the patients. (GP Partner)

Practice staff report that they drive change not patients. However, technology suppliers suggest that practices' enthusiasm for change is impacted by perceived resistance from less digitally confident patients and less by requests from more digitally confident patients. Our results support this view.

External factors

Procurement and support

> The idea of many new solutions is often appealing, but implementation is frequently not supported sufficiently with the necessary IT infrastructure, funding or time. (GP)

Practices need engagement and choice in the procurement of digital technology. Practices complain that externally procured one-size-fits-all technology solutions reduce practice input into procurement decisions, exacerbated by low financial incentives. Practices felt being forced to transform, but were not given enough time to understand the digital technology being adopted nor to engage staff and patients.

Technology barriers

User frustration is created by various barriers to digital transformation. Lack of interoperability, including lack of links between practice sites, practices, PCNs, across healthcare organisations and between software platforms, remains a major problem.

Another barrier is a lack of laptops and webcams and poor network connections in GP practices and for use by patients at home.

Information governance

Practices need clearer information governance guidance and they have concerns about missed communications.

> There is confusion about what we are allowed to send to patients regarding what is advertising and what is allowed. The system feels really complicated. (Practice Manager)

DISCUSSION

Digital technologies

We found wide variation in digital readiness between different digital healthcare technologies. EPRs have been around for a long time in general practice and they are used every day. Patient apps and wearables and Social media are newer, and the roles and risks are not clear.

Social media was not widely encouraged due to a general feeling that the technology does not add extra benefits over other digital options with the added risk of negative or inappropriate externally facing comments.

The item, ability to solve problems if stuck, has poor scores across all measures suggesting it is perceived competence rather than motivation which impacts digital readiness, as suggested by previous research.[9–11] This highlights the need for more and better training and support.

Standard deviations (table 1) illustrate the range of scores among staff. Assuming a normal distribution, 31% of responses are more than 1 SD above or below the mean. Given this variation, a simple digital readiness assessment tool could help practices to understand staff needs and target support where needed. Only by understanding the

practice digital readiness culture, is it likely that bespoke digital transformation can occur that is empathetic to both the practice staff and the population they serve.

Human factors

Anyone can struggle with digital literacy.[26] Younger digital natives, have better digital skills, but older staff have better and more refined cognitive skills. Both are needed. GPs and other staff have different digital readiness scores.

Practices and policy-makers need to consider how clinical staff, in particular, can be supported to solve problems when stuck, while maximising the confidence of reception and administration staff to improve patient engagement in digital transformation. GPs and other staff need better internal IT support and allocated time for education and training to continually improve their competence with current and emerging digital healthcare technology.[27]

A particular problem was identified for longer-serving staff, who may become set in their ways. The scores for staff who have been at the practice for less than 6 years is significantly higher on six out of seven measures (table 2).

A supportive team approach with effective communication between staff groups can benefit everyone. The Tool+Team+Routine heuristic can help practices consider digital transformation in terms of service design.[28] Tool refers to the benefits of the tool proposed. Team refers to all the people that are expected to use the tool (not just the enthusiasts). Routine refers to the importance of adapting workflows to use the tool as part of the care process.

The value proposition for any new digital technology (tool) should be clearly stated for all users who interact with the technology or the information it generates. The team can use the technology to establish new routines involved in providing care and ultimately reconfigure the service.

Local factors

Large urban practices are more confident in recommending patient access and social media and supporting new ideas. Qualitative data emphasise the stark difference in digital readiness caused by poor rural internet connectivity as well as lack of innovation readiness. These factors are reflected in the literature.[2 13–15]

Older patient populations are associated with lower staff digital competency, patient access, social media competency, innovation readiness and EPR competency.[14] There is always a risk of a new type of inverse care law, with care most available to the digitally competent.[29]

Practices can support their patient population in several ways. Real-time data can help understand patient use and to encourage patient codesign of digital healthcare technologies.[6] Digital nurse champions can actively seek and support technology enabled care.[30 31] Practice or locality-based (PCN) digital hubs could help resolve software and hardware issues.[32] Expert patients could act as digital health ambassadors.

GP practices do not have the time and resources to undertake digital transformation without extra help.[33] However, they are the local leaders. They need to understand staff digital readiness better, repeat training to drive and maintain changes, use peer and personal learning and endorsement, explain reasons for change to improve motivation, scale up slowly with appropriate internal IT support and encourage digital champions (particularly GPs) to engage with staff and support change.

Wider factors

Technology companies and funders are critical to maintain progress. Poor information technology infrastructure, software usability, interoperability and information governance issues remain pressing issues.

The NHSX Information Governance Portal has simplified information governance.[34] GP IT Futures may improve procurement, interoperability and the usability of clinical IT systems.[35] However, more collaboration and mutual support is needed between all stakeholders (practices, technology companies, CCGs, patient groups, etc). Economies of scale need to be balanced against practice autonomy.[36]

COVID pandemic

The pandemic has improved public and professional willingness to adopt digital.[11] COVID-19 provided an opportunity to change the perception of those reticent to adopt and use digital healthcare technologies. Future progress requires continued and improved resource allocation and support for both patients and healthcare staff. Other observers have said similar things.[37]

The pandemic has been hugely damaging to society but has provided an opportunity to fast-forward digital transformation. General practice staff are motivated in this common goal if it is done for the right reasons, appropriately resourced and supported. Support for increasing motivation and competence to effectively adopt, use and spread digital healthcare technologies, could reduce the digital gap and help achieve the milestones set out in the NHS Long Term Plan.[3]

Limitations

This study is limited to practices in one part of Hampshire. Although a broad mix of urban and rural practices were included, the results may not be representative of inner cities or more deprived areas. Six practices (18%) chose not to be involved and may have a different view.

The survey was limited to four aspects of staff perceptions of five different digital technologies as implemented locally. Further research is needed to assess whether or not this agrees with patients' own perceptions of each technology and what alternative arrangements might be made.

Reported use of digital healthcare technologies does not correlate well with staff digital competency. This suggests that actual use of digital healthcare technologies is determined by multiple factors (eg, leadership, incentives and procurement) and that staff digital competency is only one factor. However, staff digital competency is relatively easy to fix; it has a simple solution—more and better education and training.

We have used parametric statistics (such as mean, t-test and Pearson correlation), rather than non-parametric statistics (such as median, Mann-Whitney U test and Spearman correlation) because they are more widely taught and understood. None of the conclusions would differ, had we used non-parametric statistics.

CONCLUSIONS

This study demonstrates wide variation in digital readiness in general practice between technologies, staff and individual practices. These relate to human factors, such as staff staff roles, age and time in practice, practice factors (practice rurality and older patients) and external factors including IT infrastructure, software usability, interoperability and information governance.

Digital innovation progress in general practice is complex. It requires reflection, consensus and action from GPs, practice managers and staff, patients, technology companies, funders and government. In particular, more education and training are needed to improve staff digital competency for all digital technologies used in general practice.

Twitter Matthew Hammerton @matthammerton and Tim Benson @timbenson

Contributors MH conceived the study, led the data collection and analysis work and wrote the original report and the first draft of this paper. TB designed the data collection survey, undertook detailed quantitative analysis, is guarantor and wrote subsequent drafts of this paper. AS advised the project throughout and helped in particular with qualitative research.

Funding Funding for the study and the original report was received from Health Education England.

Competing interests TB is founder and director of R-Outcomes, which provides services to enable feedback of patient-reported information to those providing health and care services, for evaluation and routine monitoring.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study was service evaluation and did not require NHS ethics approval.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request from the authors.

ORCID iDs
Tim Benson http://orcid.org/0000-0002-2101-1353
Andrew Sibley http://orcid.org/0000-0002-2503-5432

REFERENCES

1 Benson T. Why general practitioners use computers and hospital doctors do not--Part 1: incentives. *BMJ* 2002;325:1086–9.
2 Asthana S, Jones R, Sheaff R. Why does the NHS struggle to adopt eHealth innovations? A review of macro, meso and micro factors. *BMC Health Serv Res* 2019;19:984.
3 NHS England. *NHS long term plan*, 2019.
4 Deloitte Centre for Health Solutions. *Closing the digital gap: shaping the future of UK healthcare*. Deloitte, 2019.
5 Peek N, Sujan M, Scott P. Digital health and care in pandemic times: impact of COVID-19. *BMJ Health Care Inform* 2020;27:e100166.
6 Hutchings R. *The impact of Covid-19 on the use of digital technology in the NHS*. Nuffield Trust Briefing, 2020.
7 Health Education England. Building a digital ready workforce. health education England, n.d. Available: www.hee.nhs.uk/our-work/building-digital-ready-workforce [Accessed 15 Dec 2019].
8 Health Education England. *Literature review: examining the extent to which digital literacy is seen as a challenge for trainers, learners and employees in the workplace*. Health Education England, 2015.
9 Topol E. *The Topol review: preparing the healthcare workforce to deliver the digital future*. Health Education England, 2019.
10 Greenhalgh T, Wherton J, Papoutsi C, *et al*. Beyond adoption: a new framework for theorizing and evaluating nonadoption, abandonment, and challenges to the scale-up, spread, and sustainability of health and care technologies. *J Med Internet Res* 2017;19:e367.
11 Chambers R, Hughes A, Beaney P. You too can be a digital practice nurse champion. *Practice Nurse* 2018:11–15.
12 Lennon MR, Bouamrane M-M, Devlin AM, *et al*. Readiness for delivering digital health at scale: lessons from a longitudinal qualitative evaluation of a national digital health innovation program in the United Kingdom. *J Med Internet Res* 2017;19:e42.
13 French T, Quinn L, Yates S. *Digital motivation: exploring the reasons people are offline*. Good Things Foundation, 2018.
14 Pew Research Center. *Horringan J digital readiness gaps*, 2016.
15 Antonio A, Tuffley D. Bridging the Age-based digital divide. *International Journal of Digital Literacy and Digital Competence* 2015;6:1–15.
16 Shea CM, Reiter KL, Weaver MA, *et al*. Associations between practice characteristics and demonstration of stage 1 meaningful use for the electronic health record incentive program. *N C Med J* 2015;76:280–5.
17 Tashakkori A, Teddlie C, eds. *Handbook of Mixed Methods in Social & Behavioral Research*. 2nd ed. Sage: Thousand Oaks, 2010.
18 Benson T. Digital innovation evaluation: user perceptions of innovation readiness, digital confidence, innovation adoption, user experience and behaviour change. *BMJ Health Care Inform* 2019;26:e000018.
19 Benson T. Measure what we want: a taxonomy of short generic person-reported outcome and experience measures (PROMs and PREMs). *BMJ Open Qual* 2020;9:e000789.
20 Bandura A. Self-Efficacy: toward a unifying theory of behavioral change. *Psychol Rev* 1977;84:191–215.
21 Lurkin R, Learning M. *Human intelligence: the future of education for the 21st century*. London: Institute of Education Press, 2018.
22 Rogers E. *Diffusion of innovations*. 5th edn. The Free Press, 2003.
23 JASP Team. JASP (version 0.14.1) 2020.
24 Streiner D, Norman G, Cairney J. *Health measurement scales: a practical guide to their development and use*. 5th edn. Oxford University Press, 2014.
25 Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;3:77–101.
26 Becker BW. Information literacy in the digital age: myths and principles of digital literacy. *School of Information Student Research Journal* 2018;7:2.
27 Sau N, Jaggi A, Cairns M. Clinicians' Views On The Uptake Of Technology In Health Care. *Int J Ther Rehabil* 2019;26:11.
28 Shaw J, Agarwal P, Desveaux L, *et al*. Beyond "implementation": digital health innovation and service design. *NPJ Digit Med* 2018;1:48.
29 Iacobucci G. Digital health: GPs aren't "Luddites" but want safe, equitable care. *BMJ* 2019;364:l1258.
30 Chambers R, Schmid M. Making technology-enabled health care work in general practice. *British Journal of General Practice* 2018;68:108–9.
31 Beaney P, Hatfield R, Hughes A, *et al*. Creating digitally ready nurses in general practice. *Nurs Manage* 2019;26:27–35.
32 Baird A, Nowak S. Why primary care practices should become digital health information hubs for their patients. *BMC Fam Pract* 2014;15:190.
33 Gosling J, Mays N, Erens B, *et al*. Quality improvement in general practice: what do GPs and practice managers think? results from a nationally representative survey of UK GPs and practice managers. *BMJ Open Qual* 2021;10:e001309.
34 NHSX. Information governance, 2020. Available: https://www.nhsx.nhs.uk/information-governance/guidance/ [Accessed 27 July 2021].
35 NHS Digital. GP IT futures systems and services, 2021. Available: https://digital.nhs.uk/services/gp-it-futures-systems [Accessed 27 July 2021].
36 Liebe JD, Hüsers J, Hübner U. Investigating the roots of successful IT adoption processes - an empirical study exploring the shared

awareness-knowledge of Directors of Nursing and Chief Information Officers. *BMC Med Inform Decis Mak* 2015;16:10.

37 van Hattem NE, Silven AV, Bonten TN, *et al*. COVID-19's impact on the future of digital health technology in primary care. *Fam Pract* 2021;6:cmab081.