

Digital readiness within General Practice



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Disclaimer

The findings of this independent service evaluation are those of the authors and do not necessarily represent the views of the AHSN or HEE.

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Contents

Executive summary.....	3
Recommendations.....	6
1.0 Background.....	7
1.1 Measuring digital readiness	7
1.2 Digital Healthcare Technologies.....	8
2.0 Aim and Study Questions.....	10
3.0 Methods	11
3.1 Quantitative evidence	11
3.2 Qualitative evidence	14
3.3 Digital healthcare technology use versus digital readiness competency measures.....	15
4.0 Results.....	16
4.1 Demographics of the survey sample	16
4.2 Core results.....	17
5.0 Exploration of the findings on digital readiness.....	27
5.1 How does digital readiness vary between technologies and individual aspects?	27
5.2 How do micro (human) factors impact on digital readiness?	28
5.3 How do meso (practice situation) factors impact on digital readiness?	31
5.4 How do macro (external) factors impact on digital readiness?	38
5.5 Do practice digital readiness competency measures correspond to digital healthcare technology use?	42
6.0 Discussion.....	43
6.1 How does digital readiness vary between technologies and individual aspects?	43
6.2 How do micro (human) factors impact on digital readiness?	43
6.3 How do meso (practice situation) factors impact on digital readiness?	44
6.4 How do macro (external) factors impact on digital readiness?	45
6.5 Do practice digital readiness competency measures correspond to digital healthcare technology use?	46
7.0 Limitations	47
8.0 Conclusion	48
References.....	49
Appendix 1: List of Practices.....	52
Appendix 2: Digital readiness survey tool	53
Appendix 3: Semi-structured interview questions.....	55

Executive summary

There is a strong Government and policy push for digital transformation within the NHS. Despite this push, the digitalisation of healthcare has been slow to develop with evidence of variation in progression, causing a 'digital gap' and inevitable healthcare inequalities. Digital readiness, defined here as a **motivation and competence to effectively adopt, use and spread digital healthcare technologies**, has grown in recognition of its importance for digital transformation. This has been greatly accelerated by necessity during the Covid-19 pandemic.

Digital readiness has a greater impact on digital transformation than technology itself. However, research into factors impacting on general practice digital readiness is limited. As such, this service evaluation study set out to gain a better understanding of digital readiness by asking:

1. How does digital readiness vary between technologies and individual aspects?
2. How do micro (human) factors impact on digital readiness?
3. How do meso (practice situation) factors impact on digital readiness?
4. How do macro (external) factors impact on digital readiness?
5. Do practice digital readiness competency measures correspond to related digital healthcare technology use?

This was done via a sequential mixed methods design using both quantitative and qualitative evidence between December 2019 and September 2020. Staff at 33 practices within the North and Mid Hampshire Integrated Care Partnership and digital companies linked to innovations operating at these practices provided the study boundaries. The digital healthcare technologies considered were: electronic patient records, telehealth, patient online access, patient apps and wearables and social media.

Reliably measuring digital readiness in a complex and varied health environment is challenging. As such, a review of the literature was conducted before developing a 90-second digital readiness survey tool provided to all practices within the study. This comprised short user-reported experience measures for digital competency, contextualised digital competencies and innovation readiness. The digital competency measures looked at confidence, motivation and self-efficacy (an individual's belief in their capacity to execute behaviours necessary to produce specific performance attainments). Responses were collected pre and post-lockdown commencing on the 23rd March 2020. The results guided the qualitative semi-structured interviews with clinical and non-clinical general practice staff and digital technology company representatives. These were analysed for emerging themes before being triangulated with the quantitative findings.

52 and 287 survey responses were received pre- and post-lockdown respectively representing a post-lockdown response rate of 22.3%. The demographics of the survey sample were similar pre- and post-lockdown and when compared to current staff demographics. Nine interviews were conducted and thematically analysed; six with general practice and three with digital technology companies. The following uses the triangulated results to answer the study questions:

1. How does digital readiness vary between technologies and individual aspects?

The results demonstrated a moderate level of digital readiness in long-term (electronic patient records) technologies but low level in evolving technologies (patient apps and wearables and social media). Patient access and telehealth technologies were between the two. Given this variation, the use of a simple and contextualised digital readiness assessment tool may help practices to understand and target relevant support where needed when adopting different technologies.

When considering the individual elements of digital readiness: confidence, motivation and self-efficacy, the latter is consistently lower. While previous research highlights the importance of motivation,

perceived self-efficacy may have a greater limiting role. As such, concentrating on improving self-efficacy may result in improved digital transformation.

2. How do micro (human) factors impact on digital readiness?

Younger general practice staff (<50), those in post for five or less years and non-clinical staff were significantly more competent in several measures of digital readiness. This contrasts with the mixed interview opinions suggesting a possible problematic perception of digital readiness. While important not to stereotype and appreciating that this is more about digital skills than refined cognitive skills (both necessary), it suggests a need for targeting digital support appropriately. Furthermore, the differing digital readiness with differing general practice roles highlights the need for a supportive team approach with effective communication between staff groups. The simple heuristic 'Tool+Team+Routine' may help practices to consider digital transformation in a more service design orientated approach.

However, time and resources for supporting digital transformation is lacking. The study found a clear need for a structured, well-resourced and supported gradual iterative change process to promote improved digital readiness and subsequent successful digital transformation.

3. How do meso (practice situation) factors impact on digital readiness?

The results showed significant variation in digital readiness between practices and PCNs. This was in contrast to the interview findings suggesting a potential complacency in driving forward digital innovation.

The most significant factor reducing practice digital readiness was increasing percentage of older patients within a practice population. If practices are to lead digital transformation, they need to enhance learning about and actively supporting their older patient population digital readiness. This could be via active patient participation groups, patient co-design and use of real-time digital usage data as well as digital nurse champions, practice/PCN based digital hubs and use of expert patient digital health ambassadors.

Smaller more rural practices also demonstrate lower digital readiness scores. The qualitative data emphasised the stark difference in digital readiness between urban and rural practice due to reduced innovation readiness and rural internet connectivity barriers. Interventions to minimise the barriers and support innovation in rural small practices is likely to reduce the digital divide between large urban and small rural practices.

4. How do macro (external) factors impact on digital readiness?

Considering macro factors, previously suggested enablers, public and professional willingness and clinical endorsement, have been enhanced greatly due to the unique situation of the pandemic. In parallel, IT infrastructure, software usability and interoperability and governance issues were outlined as the main barriers, suggesting these areas, highlighted by previous research, remain unaddressed. While NHS Digital's GP IT Futures may have come at an opportune time for helping to tackle these barriers, going forward, a critical factor is the collaboration and support gap between technology companies, CCGs and practices. AccuRx's manifesto on 'Software That Works' delivers a set of principles that would be well worth pursuing to help to reduce these barriers. Reducing these barriers is critical if we want to tackle the meso and micro factors impacting on digital readiness.

5. Do practice digital readiness competency measures correspond to related digital healthcare technology use?

Practice digital readiness based on staff perceived digital readiness does not correspond to digital healthcare technology use. This highlights the complexity of the healthcare environment and the limitations of using a simple self-assessment tool for this purpose. While the tool has its uses, there is a need to consider the situation holistically, taking into account the multiple micro, meso and macro influential factors.

Based on these findings, the study has provided seven pragmatic ‘DR7’ recommendations for tackling the most pertinent issues. In summary, the *DR7 recommendations* highlight a need to:

1. Understand, acknowledge and support differences in staff digital readiness.
2. Undertake digital transformation in a well-resourced and supported gradual iterative change process that is team-based and works to understand and actively engage patients.
3. Undertake essential improvements in IT infrastructure, software usability and interoperability while improving collaboration and effective mutual digital support between technology companies, CCGs and general practice.

Digital readiness is a multifactorial concept requiring reflection and action from patients, general practice staff, technology companies, CCGs and governing bodies. As such, recommendations one to five are aimed at GPs and Practice Managers while recommendations six and seven relate more to technology companies and CCGs. All require support from governing bodies.

A collaborative, formative and realistic digital readiness checklist, that encompasses the above recommendations and provides all stakeholders with clear direction of progression while acknowledging the role each has to play, may prove useful. Redmoor Health’s current development of a Digital Journey Planner is trying to achieve this at the practice level. The AHSN is appropriately positioned to act as the vital link between the different stakeholders and could host a network that focuses on improving collaboration between general practice and industry.

While the pandemic has been hugely damaging to society, it has provided general practice with a unique opportunity to fast forward an empathetic and relevant digital transformation process. General practice staff are motivated in this common goal as long as it is done for the right reasons and appropriately resourced and supported. By providing this support for increasing motivation and competence to effectively adopt, use and spread digital healthcare technologies, we will minimise the digital gap and **all** achieve the key digitalisation milestones set out by the NHS Long Term Plan.

Recommendations

- 1** Understand staff digital readiness – developing a simple, brief digital readiness assessment tool may help practices and staff to target digital support where most needed.
- 2** Acknowledging that colleagues in a particular demographic (>50 years old, in practice for >five years, clinical roles) may experience less digital readiness for emerging technologies. This will be necessary when considering targeted support.
- 3** A supportive team-based approach combining both non-clinical and clinical staff skills is required in the adoption of new digital healthcare technologies. Undertaking a contextual assessment prior to adoption may help to emphasise this approach.
- 4** Increased emphasis needs to be placed on understanding and actively engaging patient populations in digital upskilling. This is especially so in the digitally excluded patient groups.
- 5** A structured, well-resourced and supported gradual iterative change process is necessary for successful digital transformation.
- 6** Essential improvements in IT infrastructure, software usability and interoperability and governance issues are required if general practice digital readiness is to be maximised.
- 7** Improved collaboration and effective mutual support between technology company staff, CCGs and practice staff is required for the benefit of improving digital readiness.

1.0 Background

There is a strong Government and policy push for digital transformation within the NHS¹. NHS England's Long-Term Plan, published in 2018, established a set of key digitalisation milestones for the next five years. Those specific to general practice, include access to online consultations for all patients and the ability for clinicians to access and interact with patient records and care plans wherever they are². Despite this strong policy push, the digitisation of healthcare has been slow to progress with evidence of variation in progression, causing a 'digital gap'¹³. It has taken the hugely damaging Covid-19 pandemic to demonstrate the critical requirement for digital transformation within general practice and the wider NHS. The response to the pandemic has been an impressive acceleration in digital transformation across the NHS^{4 5}.

The current focus on digital transformation, provides an ideal opportunity to explore key influential components impacting on speed and variation of transformation. While this has originally centred around technology and infrastructure, the term, digital readiness, defined here as **a motivation and competence to effectively adopt, use and spread digital healthcare technologies**, has grown in importance.

Whilst the field of digital readiness is ill defined, a growing general literature highlights the key components, motivation and competence, as having a greater impact on digital transformation than technology itself. *The Topol Review: Preparing the healthcare workforce to deliver the digital future*, strongly emphasised the need for enhanced digital literacy in the current and future workforce in order to support NHS staff to realise their full potential in a technology enabled NHS⁶. The Health Education England Digital literacy literature review highlighted a lack of workforce digital literacy development as a factor in the poor adoption of digital health technologies resulting in missed opportunities to support clients, patients and carers to self-care⁷. Health Education England's Technology Enhanced Learning Programme and the Building a Digital Ready Workforce Programme of the National Information Board, developed the Health and Care Digital Capabilities Framework. They define digital literacy as "The capabilities that fit someone for living, learning, working, participating and thriving in a digital society."⁸ Meanwhile, Greenhalgh *et al* suggested that acceptance by professional staff, of which motivation is an important part, may be the single most important determinant of whether a new technology-supported service succeeds or fails at a local level⁹. Chambers *et al*, in training digital practice nurse champions, suggests that the essential component is enthusiasm and ability to see the opportunities and benefits of digital transformation rather than confidence or prior experience with digital solutions¹⁰. Lennon *et al* in their research on readiness for delivering digital health at scale highlight IT infrastructure, information governance uncertainty and interoperability issues as key hindering factors but public and professional willingness and clinical endorsement as key enabling factors¹¹. Considering the patient population, the Good Things Foundation states the three key barriers to digital inclusion are lack of digital skills, connection/device access and digital motivation with the latter being the most significant¹².

Demographic factors associated with reduced digital readiness in the general population have been shown to be; increasing age, rurality and reduced socio-economic status^{13 14}. Size of practice has been shown to impact on greater, more meaningful use of digital healthcare technology¹⁵. However, research into factors impacting on general practice staff and practice digital readiness is limited.

As such, this service evaluation study seeks to gain an understanding of digital readiness within general practice including the impact of demographic and external factors on general practice staff and practices.

1.1 Measuring digital readiness

Reliably measuring digital readiness in a complex and varied health environment is tricky. The Timmus 2019 investigation¹⁶ reviewed the use of digital tools that could evaluate NHS staff digital capabilities. Their analysis suggested the need for a lightweight digital diagnostic tool to reduce the non-responder

bias and engage and capture the digital capabilities of the majority of NHS staff, not just the digitally ready. They focussed on digital confidence, experience and motivation due to their previous work highlighting the independence of these factors within the healthcare literature. They found the measurement of digital confidence and motivation were largely successful. However, measuring digital experience was unreliable due to the concept of 'digital technologies' being so nebulous limiting real meaning. They suggested reliably measuring digital experience requires a focus on the local environmental context and professional role. Furthermore, their questions represented each of HEE Digital Capability Framework areas. Yet, this work suggested that the framework may be better used as a way to reflect on the workforce at a strategic level, rather than being used as a tool with staff. However, a self-assessment diagnostic tool underpinned by the Digital Capability Framework is being developed and it will be interesting to see how customisable and holistic this is to the needs of general practice¹⁷.

Work by Chamber *et al.* 'Making digital healthcare happen in practice' highlights the need for a holistic understanding of digital transformation¹⁸. In their practical guide, they promote the assessment of the seven 'Cs' relating to technology enhanced care delivery: Competence, Capability, Capacity, Confidence, Creativity, Communication and Continuity. However, widespread implementation of their digital quality mark for practices and the production of an easily implementable and comprehensive digital readiness survey tool is yet to be seen. Other research on measuring digital readiness looking at digital readiness gaps in the American public¹³ detail three measurable elements of digital readiness; digital skills, trust in and use of digital technology. Using these measures, they identified five groups from the unprepared to the digitally ready.

An alternative approach involves the use of pick and mix person-reported experience measures developed by R-Outcomes Ltd. These short simple evaluation tools, specifically 'innovation readiness' and 'digital literacy' measures have been influenced by and mapped to Greenhalgh's NASSS (non-adoption, abandonment, scale-up, spread and sustainability) framework for understanding the adoption or non-adoption of digital health technologies. They have been developed following a lack of suitable evaluation tools for measuring digital innovation and readiness^{19 20}.

1.2 Digital Healthcare Technologies

In considering digital readiness within general practice, and reflecting on the need to provide local context, we need to consider the core groups of general practice digital healthcare technologies on which digital readiness is based. We focused on five main groups of technologies – two healthcare-facing and three patient-facing which will be discussed below. Whilst this excludes the fields of artificial intelligence and data analytics, these technologies represent the solid foundations on which other digital healthcare technologies can flourish.

Electronic Patient Records (EPR): Electronic patient records have been widely used within GP surgeries since the late 1980s. Their success ahead of secondary care counterparts is largely down to the profession working with government to provide incentives and remove barriers²¹. Two systems largely dominate; EMIS Web and TPP SystmOne²². Key current and future developments include improved connectivity between systems with GP Connect and local health and care record exemplars, widespread adoption of SNOMED CT for improved clinical coding and increasing access for patients²³.

Telehealth: Telehealth or telemedicine, while these terms can be ambiguous, they ultimately involve remote clinical consultations via text, audio and video telecommunication replacing face to face consultations where appropriate²⁴. While telephone triage is well established in general practice, other methods of telehealth have been slow to achieve widespread adoption⁶. The 2019/20 GP Contract stipulated a requirement for all patients to have the right to undertake online consultations by April 2020²⁵. Despite this, it has required the Covid-19 pandemic to cause a dramatic and rapid increase in the use of telehealth. AccuRx Chain SMS and eConsult are two companies that have seen significant increases in widespread adoption²⁶.

Patient online access: Patient online access, once registered, gives patients remote access to multiple healthcare resources including GP appointments, repeat prescriptions and securely viewing their GP medical record. This can be done through multiple providers, including the NHS app, using the secure NHS login. The 2019/20 GP Contract stipulated a requirement for 25% of appointments to be offered online by April 2019²⁵. As with telehealth, patient online access has seen dramatic increases in online access during the pandemic. This has been especially vital for shielded patients in order to retain access to health services.

Patient apps and wearables: Patient apps and wearables are becoming increasingly prescribed as digital therapeutics for self-monitoring and self-management as well as remote monitoring and diagnostics⁶. The NHS Apps library acts as a trusted source of information for over 90 apps currently²⁷. In addition to this, there are over 300 000 consumer health and wellbeing apps available along with a rapidly evolving wearable market of smartwatches and fitness trackers. The concept of silent hypoxia in Covid-19 has also seen a rise in the use of pulse oximetry within the home environment²⁸. The challenge for general practice is how to effectively and appropriately integrate these strands of digital health into day-to-day practice⁶.

Social media groups: Social media, particularly closed peer groups, are widely used both professionally and personally yet use by general practice remains relatively low due to concerns of risks being greater than benefits. Nevertheless, there are positive examples of effective social media use for practice communication and peer-support for patients with long term conditions²⁹.

2.0 Aim and Study Questions

This service evaluation study seeks to gain an understanding of digital readiness within general practice.

- 1. How does digital readiness vary between technologies and individual aspects?**
 - Between different digital healthcare technologies
 - Between confidence, motivation and self-efficacy
- 2. How do micro (human) factors impact on digital readiness?**
 - Age of staff
 - Time in practice
 - Job role
- 3. How do meso (practice situation) factors impact on digital readiness?**
 - Rurality
 - Size
 - CQC Rating
 - Proportion of older patients
 - Deprivation score of patients
 - Intra- versus inter-PCN variation
- 4. How do macro (external) factors impact on digital readiness?**
 - COVID-19 lockdown
 - Digital technology companies
- 5. Do practice digital readiness competency measures correspond to related digital healthcare technology use?**

3.0 Methods

To address the aims of this service evaluation, a sequential mixed methods design³⁰ was used to collect both quantitative and qualitative evidence. The quantitative arm of the evaluation was conducted first and involved a survey of primary care staff and analyses of external data sources. This guided the qualitative arm of the evaluation, in particular the interview questions with practice staff and digital technology company representatives. All data sources were triangulated to address all study questions.

Staff at 33 practices within the North and Mid Hampshire Integrated Care Partnership and digital company staff linked to digital innovations operating at these practices provided the study boundaries of this service evaluation. A broad range of staff views from general practice, both clinical and non-clinical, were sought to provide a realistic assessment of digital readiness. These practices were chosen as they correspond best to the current and future grouping of practices within the region. The 33 practices make up ten Primary Care Networks (see appendix 1 for list of Practices). The study ran from December 2019 to September 2020 with quantitative evidence collected between February and June 2020 and qualitative evidence collected between June and July 2020.

Information about the service evaluation was disseminated via the North and West Hampshire Integrated Care Partnership and via attendance at the mid-Hampshire Locality meeting and North Hampshire Clinical Directors meeting. As this evaluation is largely focused on existing digital readiness, it is classed as service evaluation and does not require NHS ethical approval. This was confirmed through the use of the Healthcare Research Authority decision tool.

3.1 Quantitative evidence

3.1.1 Development of a new digital readiness assessment tool

The R-outcomes set of short generic user-reported experience measures²⁰ were adopted and customised in the development of a 90-second online digital readiness survey tool, the brevity of the tool being important for minimising non-responder bias. The tool was tested with members of Wessex AHSN and Northgate Medical Centre, Chester for usability and relevance prior to the main service evaluation. Feedback confirmed that it was reasonable to undertake the survey within 90 seconds and the questions were unambiguous and relevant.

The survey tool contains non-identifiable demographic questions including current general practice, profession type, time in current practice and 10-year age groupings as well as seven measures related to digital readiness. (See appendix 2 for the digital readiness survey tool). The measures include:

- The digital competence measure (see figure 1) exploring respondents' perceived confidence, intrinsic motivation and self-efficacy with digital healthcare technologies. Self-efficacy is an individual's belief in their capacity to execute behaviours necessary to produce specific performance attainments³¹. Accurate perceived self-efficacy is regarded as the most important ability for future lifelong learning³².
- Two contextualised competency measures exploring digital competence in using two of the five digital healthcare technologies: Electronic Patient Records (e.g. EMIS, SystmOne) and Telehealth (e.g. text messaging, video consultations).
- Three contextualised competency measures exploring digital competence in recommending patients to access the remaining three of the five digital healthcare technologies: patient online access (NHS app), patient apps and wearables (e.g. Alivecor for AF detection, MyCOPD for improved self-care) and social media (e.g. closed Facebook groups for long term conditions).
- The innovation readiness measure exploring respondents' perceptions of how much they are open to and up-to-date with new ideas, and whether their organisations are receptive to and capable of innovation. They are based on Rogers' diffusion of innovations³³.



Figure 1: Digital competence measure of digital readiness survey

Figure 1 provides an example of the measure. These measures share a common look and feel, with 4 items and 4 responses each. They have been designed to be clear and brief with a low reading age. Each item is scored on a scale from 0 (disagree) to 3 (strongly agree). For reporting, the scores are converted to a scale from 0 (all disagree) to 100 (all strongly agree). A high score is always good. The summary score identifying competence and innovation readiness is also calculated as the sum of the four items in each measure. This is also reported on a 0–100 scale. R-outcomes have developed mean score thresholds based on several years of experience of 0 - <40, 40 - <60, 60 - <80 and 80 - 100 corresponding to very low, low, moderate and high respectively for each measure.

3.1.2 External data sources

In order to analyse the impact of demographic and external factors on digital readiness, a number of external data sources have been used to obtain the following data:

- NHS Digital General Practice Data Hub <https://digital.nhs.uk/data-and-information/data-tools-and-services/data-services/general-practice-data-hub> accessed 26th May 2020
 - Size of general practice patient population (February 2020)
 - General practice workforce numbers (December 2019)
 - Percentage of general practice patients using at least one online patient access service (April 2020)
- NHS England general practice indicator dashboard <https://tabanalytics.data.england.nhs.uk/> accessed 26th May 2020
 - Rurality of general practice
- Care Quality Commission GP Services <https://www.cqc.org.uk/> accessed 26th May 2020
 - Latest General Practice CQC rating
- PHE Finger tips National General Practice Profiles: <https://fingertips.phe.org.uk/profile/general-practice/> accessed 26th May 2020
 - General practice patient community deprivation score (IMD 2019)
 - Proportion of patients greater or equal to 65 years old (2019)
- Provided via secure email transfer from West Hampshire CCG via Wessex AHSN
 - General practice April 2020 Econsult usage
 - General practice April-May 2020 accuRx video usage

3.1.3 Data collection and Covid-19

Permission to engage and access to the survey tool for all practice staff was via a disseminated email from the practice managers within each practice in March 2020. This was followed-up by reminder emails encouraging the support of the Practice Manager where Practice survey response rates were

low. Participants completion of the survey tool for this evaluation was considered consent. One Practice stated that they were unable to take part due to current workload pressures and 5 out of 33 Practices did not respond to emails or provide any survey responses.

Face to face practice visits were planned in April to maximise survey uptake. However, following the initial dissemination of the survey, general practice and the wider healthcare landscape changed significantly with the Covid-19 pandemic. This changing landscape presented a challenge for:

1. **Capturing data:** With the inability to visit practices face to face and the curtailment of many areas of everyday work, in order to concentrate on tackling the spread of the virus, this impacted on how staff could be recruited. While this was partly mitigated by the increased use of email and social media to endorse the study, it likely impacted on the number of staff completing the survey.
2. **Obtaining consistent and comparative data:** The way care was provided within and between practices significantly changed pre- and post-lockdown (23rd March 2020), including a transition to total remote triage and the reduction in many routine services. As such survey responses obtained pre-lockdown needed to be separated from post-lockdown responses to allow for direct practice comparisons. Yet, this also presented a unique opportunity for assessing changes in digital readiness pre and post-lockdown. This included a second set of responses from three practices that provided the majority of the responses prior to lockdown.

3.1.4 Statistical analysis

Once the survey was closed, on the 11th May 2020, the response data was collated and descriptively and statistically analysed by the evaluation team to firstly guide the development of interview questions in the qualitative arm of the evaluation and secondly provide evidence against the outcome measures detailed above. Statistical analysis was undertaken using the JASP package.

The following sets of tests were done:

1. Psychometric assessment of the R-outcomes measures. As six of the measures used were significant adaptations on existing measures, the psychometric properties of the measure summary scores have been described in terms of mean, standard deviation and Cronbach's α thereby providing an assessment of reliability (see table 5). This has been undertaken using all survey responses.
2. Comparison of the individual question and measure summary scores of the study population post-lockdown responses according to demographic and practice specific variables (outlined by the study questions). Comparisons considering practice specific variables excluded practices with a response rate less than 15% to improve reliability of the findings. Where variables were derived from continuous data, the value closest to both the mean and median of the data was chosen as the comparator value (see table 1).
3. Comparison of the individual question and measure summary scores of the study population pre-lockdown responses with the post-lockdown responses.

Comparator	Mean	Median	Value chosen
Practice size (number of patients)	13 701	13 018	13 000
Proportion of patients over 65 years old (%)	20.2	20.9	20
Deprivation score	11.1	9.9	11

Table 1: Comparator values chosen for assessment of practice specific variables

The parametric independent samples t Test was used to assess statistical significance for all comparators apart from intra-PCN variation where an anova test was used.

3.2 Qualitative evidence

The qualitative assessment involved interviews with:

1. General practice staff in two contrasting practices to investigate the context and issues surrounding their digital readiness and that of their patients.
2. Digital technology company staff to investigate their views on working with general practice to introduce and support the digital readiness of general practice staff and their patients.

In order to obtain insight into differing levels of digital readiness between practices based on the survey tool responses, a summary score (using the 4 individual questions) was calculated for each of the measures and averaged across the seven measures to provide a total average summary score for all responses from each practice. Only practices with a response rate greater than or equal to 20% of the total practice staff were included in this analysis. This analysis informed decisions about which practices to involve in the qualitative component of this study by providing a group of 'high readiness' practices and a group of 'low readiness' practices. Individual practices within each group were approached and asked if they would be willing to take part in the qualitative arm to the evaluation. One practice in each group kindly gave permission to proceed. Three interviews were undertaken with one or more members of the clinical team, the practice manager and a member of the administration team from each practice.

Four digital technology companies were approached and three consented to participating in the evaluation. These were:

- **eConsult (Telehealth)** – offer online consultations allowing patients to submit their symptoms or requests to their own GP electronically and access NHS self-help information, signposting to services, and a symptom checker.
- **Nye Health (Telehealth)** – provides a simple, NHS-compliant tool, that allows NHS staff to make secure telephone or video calls to any patient, from any device from anywhere.
- **Mymhealth (Patient Apps)** – provides evidence-based digital therapeutics that support clinical teams and patients to manage over 70% of long-term conditions.

The interviews sought to investigate if and how the two different contexts (GP staff and digital technology companies) were influencing digital readiness in general practice and address the study questions.

All interviews were semi-structured and promoted open-ended responses to allow room for divergence to expand on topics that were not pre-judged to be relevant. The semi-structured questions were partly based on Lennon et al recommendations and the NASSS framework^{9 11}. (See appendix 3 for the semi-structured interview questions). All participants were informed of the purpose of the evaluation, provided with participant information sheets and provided written consent. The interviews took place remotely via Microsoft Teams and all participants consented to being video-recorded during the interview so their views could be thematically analysed. All interviews were conducted at one time-point only and took between 40 and 60 minutes each. The interviews were conducted between the 30th June and the 28th July.

The video-recordings were auto-transcribed. The auto-transcripts were checked back against the original video recordings for accuracy, anonymisation and enhanced familiarisation. A recognised process of thematic analysis³⁴ was used to identify themes and sub-themes to address the study questions using Microsoft Excel. The thematic analysis was undertaken by one member of the evaluation team (MH) before being reviewed and refined by a second member (AS).

3.3 Digital healthcare technology use versus digital readiness competency measures

The evaluation team were given permission to access a summary of all practice usage data for eConsult online consultations, accuRx video consultations and the percentage of practice patients using at least one online patient access resource. This allowed for comparison against the related digital healthcare technology competence measure for the most relevant staff group. The data provided was for April to May 2020 therefore providing a direct comparison with the survey responses. The accuRx video consultation data was especially relevant as no practices had access to this telehealth digital technology prior to covid-19 lockdown and so it provided a unique opportunity to assess uptake of a new digital healthcare technology and compare this against clinical staff self-perceived telehealth competence for each practice. The comparisons are as follows:



The percentage of patients in a practice accessing at least one online patient access resource against the practice specific, non-clinical staff, patient online access competency score average.



The number of online consultations submitted to a practice in April 2020 (measured as a percentage of the total practice population) against the practice specific, all staff, patient online access competency score average.



The number of accuRx video consultations undertaken by a practice in April and May 2020 (measured as a percentage of the total practice population) against the practice specific, GP staff, telehealth competency score average.

Pearson correlation coefficient was used to measure the strength of the linear association between the variables for each of the comparisons. A p value was calculated for each comparison.

4.0 Results

The survey was open from the 10th March to the 11th June. 52 responses were received pre lockdown (10th March to 20th March) and 287 responses were received post lockdown (14th April to 11th May). The response rate post lockdown was 22.3% (287/1287) of total practice staff in the evaluation.

4.1 Demographics of the survey sample

4.1.1 Frequencies for age range

Age range	Pre-lockdown		Post-lockdown	
	Respondents	Percent (%)	Respondents	Percent (%)
Under 20	0	0.0	2	0.7
20-29	5	9.6	26	9.1
30-39	7	13.5	66	23.0
40-49	10	19.2	59	20.6
50-59	22	42.3	96	33.4
60-69	8	15.4	37	12.9
Over 70	0	0	1	0.3
Total	52	100.0	287	100.0

Table 2: Frequencies for age range of the survey responses pre- and post-lockdown

Table 2 shows that the proportion of participants in each age bracket was largely similar when comparing pre and post lockdown participants, despite the large difference in total number of participants in these groups. The majority of participants were in the 50-59 age bracket: 42.3% of the pre lockdown and 33.4% of the post lockdown participants. Based on this and the median point being closest to 50 for both pre- and post-lockdown respondents, the comparison of 'older' versus 'younger' staff used 50 years old as a suitable value for comparing digital readiness against staff age.

4.1.2 Frequencies for time in practice

Time in current general practice	Pre-lockdown		Post-lockdown	
	Respondents	Percent (%)	Respondents	Percent (%)
0-5 years	25	48.1	134	46.7
6 or more years	27	51.9	153	53.3
Total	52	100.0	287	100.0

Table 3: Frequencies for time in practice of the survey responses pre- and post-lockdown

Table 3 shows similar frequencies of time in practice for both pre-lockdown and post-lockdown and justified 6 years in practice as the separation point to create two variables for later analysis.

4.1.3 Frequencies for professional groups survey responses versus total staff number

Professional Group	Pre-lockdown		Post-lockdown		Actual staff total ³⁵	
	Respondents	Percent	Respondents	Percent	Staff	Percent
GP	15	28.8	101	35.1	332	25.8
Nurse	6	11.5	36	12.5	161	12.5
Other clinical	2	3.8	13	4.5	131	10.2
Non-clinical	29	55.8	137	47.7	663	51.5
Total	52	100.0	287	100.0	1287	100.0

Table 4: Frequencies for professional groups of the survey responses pre- and post-lockdown as well as actual staff total

The frequencies for professional groups completing survey responses in table 4 can be seen to broadly reflect total practice staff numbers provided by the NHS Digital General Practice Data Hub³⁵. The proportions of different staff were largely similar in both pre and post-lockdown data sets. Frequencies for professional groups show a roughly even split between the clinical and non-clinical staff.

4.2 Core results

4.2.1 Digital readiness scores for all questions (mean score, SD and Cronbach's α , n=287)

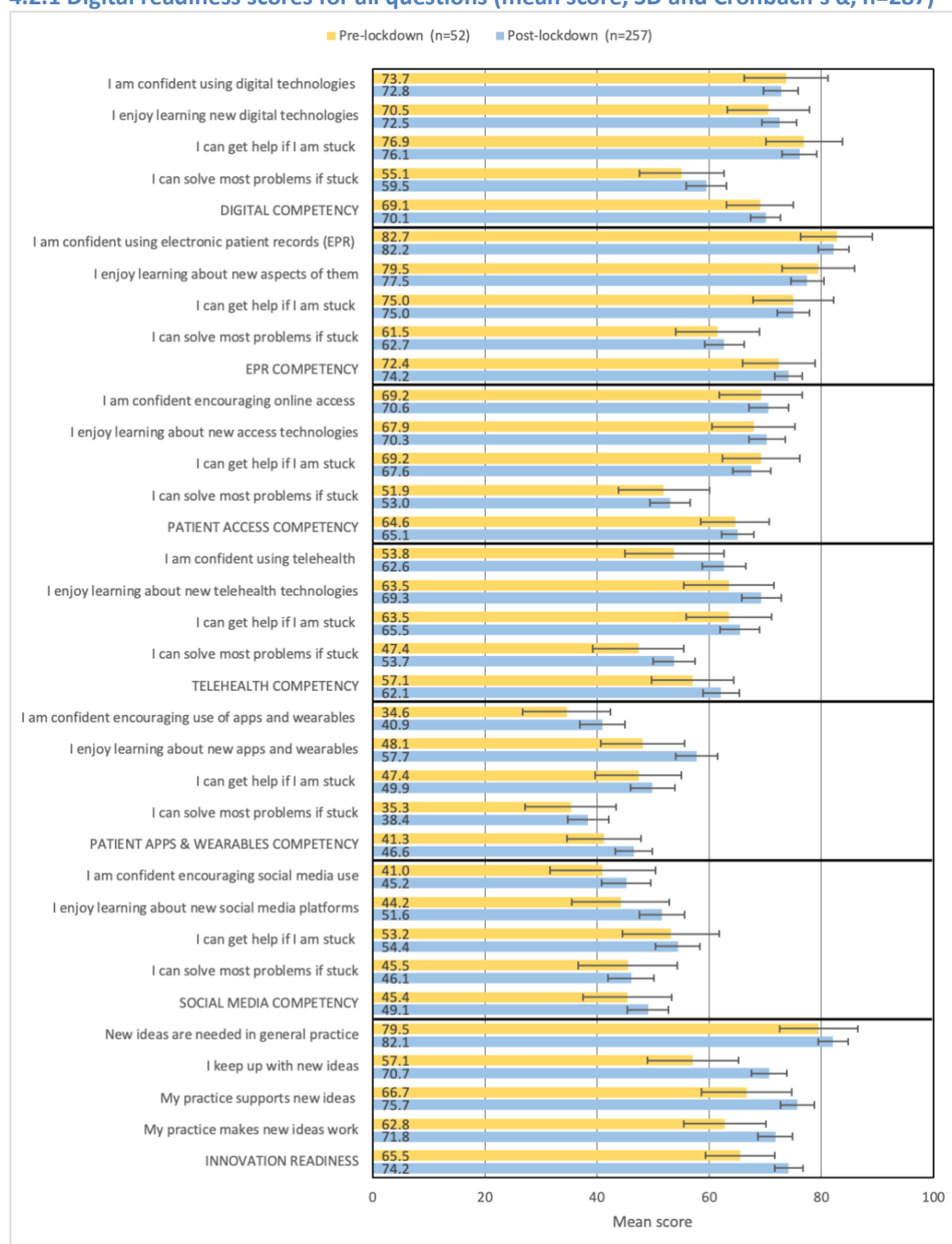


Figure 2: Mean, standard deviation of the survey responses pre- and post-lockdown for all survey responses

When reviewing the mean scores for post-lockdown response in figure 2, the results highlight a moderate level of competence (60-80) when considering digital healthcare technologies generally. When considering individual groups, there is an upper moderate level of competence (70-80) for EPRs, a lower moderate level of competence (60-70) for patient access and telehealth and a low level of competence (40-60) for patient apps and wearables and social media. There is an upper moderate readiness (70-80) for innovation at individual and practice levels. Pre-lockdown responses follow a

similar relative trend although there is a greater difference between EPR and patient access competence and telehealth, patient apps and wearables and social media competence.

Inability to solve problems if stuck have lower scores across the measures for pre- and post- lockdown responses, suggesting it is perceived ability rather than motivation that is impacting on reduced digital readiness.

R-O measures	Cronbach's α
Digital competency	0.82
EPR competency	0.81
Patient access competency	0.82
Telehealth competency	0.87
Patient apps and wearables competency	0.88
Social media competency	0.91
Innovation readiness	0.76

Table 5: Cronbach α values for all survey responses

Cronbach's alpha is a widely used measure of item reliability, which tests whether items in a measure are measuring the same things. In this type of survey, it should be in the range 0.7 to 0.9³⁶. As such, table 5 shows that the questions within each measure are a reliable measure of that measure.

4.2.2 Findings from multiple independent samples t tests and anova to investigate demographic, practice and temporal impacts on digital readiness

*Significantly more digitally ready in direction of first value (i.e. younger in younger versus older staff)

**Significantly more digitally ready in direction of second value (i.e. older in younger versus older staff)

R-O measures and questions / analyses	Demographic factors: independent t test p values, all responses after lockdown (n=287)				Practice factors: independent t test and anova p values, all responses after lockdown excluding practice response rate <15% (n=255)						Temporal factors: all responses (n=339)	
	Younger vs older staff	Shorter vs longer serving staff	Clinical vs Non-Clinical staff	GP vs other staff	Urban vs rural practice	Large vs small practices	CQC good vs requires improvement	Younger vs older patients	More vs less deprived	Difference within PCN vs between PCNs	Pre vs post lockdown all staff	Pre vs post lockdown GPs
I am confident using digital technologies	0.032 *	0.003 *	0.437	0.983	0.187	0.187	0.349	0.003 *	0.410	0.196	0.817	0.180
I enjoy learning new digital technologies	0.197	0.071	0.266	0.026 **	0.091	0.091	0.810	0.003 *	0.715	0.030 **	0.613	0.122
I can get help if I am stuck	0.662	0.114	0.001 **	0.298	0.096	0.096	<0.001 *	0.008 *	0.124	0.093	0.824	0.399
I can solve most problems if stuck	0.003 *	<0.001 *	0.014 **	0.003 **	0.229	0.229	0.164	0.005 *	0.325	0.134	0.321	0.189
Measure: Digital competency	0.023 *	<0.001 *	0.015 **	0.047 **	0.090	0.090	0.035 *	<0.001 *	0.259	0.068	0.761	0.124
I am confident using electronic patient records (EPR)	0.662	0.662	0.727	0.485	0.267	0.267	0.490	0.482	0.339	0.025 **	0.890	0.654
I enjoy learning about new aspects of them	0.381	0.061	0.437	0.905	0.176	0.176	0.408	0.003 *	0.334	0.098	0.582	0.404
I can get help if I am stuck	0.819	0.120	0.001 **	0.307	0.069	0.069	0.340	0.012 *	0.110	0.080	0.994	0.384
I can solve most problems if stuck	0.568	0.004 *	0.016 **	0.007 **	0.928	0.928	0.723	0.102	0.420	0.792	0.782	0.326
Measure: EPR competency	0.849	0.037 *	0.043 **	0.218	0.558	0.558	0.937	0.027 *	0.512	0.317	0.560	0.323
I am confident encouraging online access	0.333	0.671	0.034 **	0.105	0.023 *	0.023 *	0.216	0.159	0.103	0.050 **	0.749	0.937
I enjoy learning about new access technologies	0.711	0.084	0.515	0.083	0.044 *	0.044 *	0.927	0.157	0.177	0.243	0.561	0.216
I can get help if I am stuck	0.060	0.243	<0.001 **	0.001 **	0.026 *	0.026 *	0.003 *	0.004 *	0.177	0.005 **	0.694	0.928
I can solve most problems if stuck	0.295	<0.001 *	0.003 **	0.002 **	0.131	0.131	0.137	0.026 *	0.197	0.273	0.817	0.310
Measure: Patient access competency	0.542	0.022 *	0.002 **	0.001 **	0.020 *	0.020 *	0.087	0.010 *	0.054	0.029 **	0.881	0.521

R-O measures and questions / analyses	Demographic factors: independent t test p values, all responses after lockdown (n=287)				Practice factors: independent t test and anova p values, all responses after lockdown excluding practice response rate <15% (n=255)						Temporal factors: all responses (n=339)	
	Younger vs older staff	Shorter vs longer serving staff	Clinical vs Non-Clinical staff	GP vs other staff	Urban vs rural practice	Large vs small practices	CQC good vs requires improvement	Younger vs older patients	More vs less deprived	Difference within PCN vs between PCNs	Pre vs post lockdown all staff	Pre vs post lockdown GPs
I am confident using telehealth	0.003 *	0.366	0.008 *	<0.001 *	0.922	0.922	0.996	0.842	0.664	0.061	0.071	0.002 **
I enjoy learning about new telehealth technologies	<0.001 *	0.470	0.002 *	<0.001 *	0.134	0.134	0.935	0.254	0.449	0.126	0.177	0.028 **
I can get help if I am stuck	0.024 *	0.522	0.693	0.090	0.223	0.223	0.109	0.163	0.600	0.005 **	0.636	0.621
I can solve most problems if stuck	0.001 *	0.004 *	0.738	0.709	0.735	0.735	0.347	0.286	0.634	0.037 **	0.177	0.045 **
Measure: Telehealth competency	<0.001 *	0.086	0.214	0.008 *	0.572	0.572	0.620	0.237	0.504	0.037 **	0.213	0.040 **
I am confident encouraging use of apps and wearables	0.967	0.360	0.484	0.381	0.077	0.077	0.177	0.737	0.216	0.827	0.199	0.047 **
I enjoy learning about new apps and wearables	0.001 *	0.802	<0.001 *	<0.001 *	0.230	0.230	0.548	0.052	0.349	0.366	0.034 **	0.002 **
I can get help if I am stuck	0.735	0.522	0.400	0.929	0.315	0.315	0.025 *	0.277	0.483	0.173	0.599	0.376
I can solve most problems if stuck	0.164	0.014 *	0.861	0.289	0.825	0.825	0.094	0.326	0.535	0.937	0.472	0.135
Measure: Patient apps and wearables	0.193	0.275	0.245	0.643	0.982	0.982	0.098	0.184	0.543	0.700	0.195	0.023 **
I am confident encouraging social media use	0.341	<0.001 *	0.008 **	0.002 **	0.032 *	0.032 *	0.769	0.002 *	0.429	0.037 **	0.438	0.108
I enjoy learning about new social media platforms	0.011 *	<0.001 *	0.437	0.085	0.144	0.144	0.484	0.003 *	0.621	0.096	0.141	0.087
I can get help if I am stuck	0.669	0.008 *	0.022 **	0.056	0.043 *	0.043 *	0.179	0.018 *	0.950	0.020 **	0.813	0.065
I can solve most problems if stuck	0.006 *	<0.001 *	0.174	0.025 **	0.026 *	0.026 *	0.302	0.001 *	0.658	0.071	0.905	0.054
Measure: Social media competency	0.060	<0.001 *	0.048 **	0.01 **	0.024 *	0.024 *	0.379	<0.001 *	0.769	0.015 **	0.407	0.018 **

R-O measures and questions / analyses	Demographic factors: independent t test p values, all responses after lockdown (n=287)				Practice factors: independent t test and anova p values, all responses after lockdown excluding practice response rate <15% (n=255)						Temporal factors: all responses (n=339)	
	Younger vs older staff	Shorter vs longer serving staff	Clinical vs Non-Clinical staff	GP vs other staff	Urban vs rural practice	Large vs small practices	CQC good vs requires improvement	Younger vs older patients	More vs less deprived	Difference within PCN vs between PCNs	Pre vs post lockdown all staff	Pre vs post lockdown GPs
New ideas are needed in general practice	0.599	0.730	<0.001 *	0.04 *	0.373	0.373	0.304	0.210	0.072	0.038 **	0.436	0.524
I keep up with new ideas	0.499	0.069	0.714	0.359	0.205	0.205	0.479	0.003 *	0.260	0.058	<0.001 **	0.002 **
My practice supports new ideas	0.947	0.565	0.550	0.498	0.036 *	0.036 *	0.577	0.004 *	0.032 *	0.002 **	0.018 **	0.202
My practice makes new ideas work	0.933	0.316	0.665	0.168	0.119	0.119	0.651	0.003 *	0.024 *	0.036 **	0.021 **	0.419
Measure: Innovation readiness	0.374	0.275	0.054	0.150	0.056	0.056	0.280	<0.001 *	0.032 *	0.001 **	0.006 **	0.050 **

Table 6: Findings from multiple independent samples t tests and anova to investigate demographic, practice and temporal impacts on digital readiness

Considering demographic factors; **younger staff (<50)**, **those in post for 5 or less years**, **non-clinical and non-GP staff** are significantly more competent in general digital competency. **Younger staff and GPs** are specifically more competent in telehealth. Whereas, those **in post for 5 or less years and non-clinical** are specifically more competent in patient access, social media and EPR competency. GPs are significantly less competent in patient access and social media.

Considering practice factors; **urban, large practices** are significantly more competent in patient access and social media competencies. Whereas the greater differences can be seen in **those practices with less patients over 65** who are significantly more competent in all measures of digital readiness apart from telehealth and patient apps and wearables. There are no significant measure differences based on CQC rating or deprivation scores. Significantly different digital readiness levels **between PCNs** are seen in telehealth, patient access and social media competencies and innovation readiness. Considering temporal factors (COVID-19 lockdown); innovation readiness significantly increased for **all staff post-lockdown** although additional improvements were seen with **GPs** with significant increases in telehealth and apps and wearables competencies.

4.2.3 Thematic analysis of staff views

Higher order theme	Theme	Sub-themes
How do micro (human) factors impact on digital readiness	There is mixed opinion on digital readiness of older, longer standing staff	
	Frequency of exposure to digital technology impacts on digital readiness	
	Personal attributes important (including perception and knowledge)	
	The need to understand difference in staff group roles	(i) Clinical staff, particularly GP Partners motivation critical for digital readiness (ii) Non-clinical staff critical for patient engagement (iii) Clinical working with non-clinical staff is important to the successful adoption of new technology

Higher order theme	Theme	Sub-themes
Meso (practice situation) factors impacting on digital readiness	Minimal variation between practices in the same region	
	There are differences in adoption between practices that may be driven by pressure to change	(i) Early adopters are confident, motivated and able (ii) Late adopters are not motivated to change (iii) Adoption driven by need to change
	Internet and mobile connections still an issue in rural practices	
	Understanding and acting on your patients' variable digital readiness	(i) Older patients generally willing but less able (ii) Homeless patients able (iii) Digital transformation driven by practice not patients (iv) Importance of actively helping patients to become digitally ready minimising digital exclusion (v) Need for communicating with and learning about patients
	Supporting and engaging your staff	(i) Peer and personal learning and endorsement helps digital readiness (ii) Time for formal and informal training required (iii) Communicating beneficial reasons for change increases motivation (iv) Scaling up slowly important for any change (v) Reducing unintended negative consequences important (vi) Internal IT support essential to maintain use of technology (vii) Repetition of individualised and audited training necessary to maintain use of technology (vii) Understanding staff digital readiness improves effectiveness of training (ix) Digital champions important for engaging staff and supporting digital readiness

Higher order theme	Theme	Sub-themes
Macro (external) factors impacting on digital readiness	Lack of resources and support	(i) Lack of time and resources for undertaking digital transformation (ii) CCG and technology company support needed to provide better support for practices
	Software and hardware variation	(i) Variation in use/experience with different digital healthcare technology impacts on digital readiness (ii) Usability of technology is key for adoption (iii) Lack of interoperability hinders digital readiness (iv) Lack of hardware and central procurement issues (v) Poor internet and mobile signal make new digital healthcare technology frustrating
	Governance issues	(i) Need for improvement in information governance clarity (ii) Impact on clinical governance can be a barrier
	Social media perceived or real risks outweighing benefits impacting motivation to use	
	Covid-19 has impacted positively on digital readiness	(i) Drive on practices and practice staff to adopt digital technology (ii) Change in staff perception once used digital technology (iii) Removal of barriers
	Covid-19 has impacted negatively on digital readiness	

Table 7: Thematic analysis of clinical and non-clinical staff views from two practices with differing digital readiness levels

4.2.4 Thematic analysis of technology company views

Higher order theme	Theme	Sub-themes
How do micro (human) factors impact on digital readiness	There is mixed opinion on digital readiness of older, longer standing staff	
	The need to understand difference in staff group roles	(i) Clinical staff, particularly GP Partners motivation critical for digital readiness (ii) Non-clinical staff critical for patient engagement
Meso (practice situation) factors impacting on digital readiness	Understanding and supporting patients' digital readiness	(i) Patient resistance or perceived resistance has a greater impact on digital transformation and digital readiness than patient requests. (ii) Expert patients as digital champions are important for supporting peers
	Larger practices are more digitally ready due to necessity	
	Previous positive or negative experiences are important when considering current digital readiness	
	Unclear if rurality of practice is still an important issue for digital readiness	
	Ethos of practice is important for digital readiness	
	Supporting and engaging your staff	(i) Digital champions important for engaging staff and supporting digital readiness

Higher order theme	Theme	Sub-themes
Macro (external) factors impacting on digital readiness	Understanding and improving usability of technology critical	
	Support for digital readiness should be shared between technology companies and practices	
	Technology adoption follows an ad hoc pathway	
	Governance issues	(i) Need for improvement in information governance clarity (ii) Digital technology makes clinical risk more transparent
	Lack of resources and support	(i) CCG support and engagement of practices vital for digital readiness (ii) Lack of time is a barrier to adoption
	Covid-19 has impacted positively on digital readiness	(i) Drive on practices and practice staff to adopt digital technology (ii) Forced change in patients to adopt digital technology (iii) Change in staff perception once used digital technology
	Covid-19 has caused technology companies to change strategy	

Table 8: Thematic analysis of staff views from 3 different digital healthcare technology companies

The thematic analyses for both practice and technology companies, split into macro (external), meso (practice) and micro (human) factors, highlights a number of similarities including:

- Macro factors: The importance of technology usability and interoperability, the lack of resources and support hindering progress and the positive impact of the covid-19 pandemic on digital transformation.
- Meso: The importance of supporting both staff and patients and an uncertainty around digital readiness variation between practices.
- Micro: The need for greater understanding of staff digital readiness and the uncertainty around which factors impact on readiness.

5.0 Exploration of the findings on digital readiness

5.1 How does digital readiness vary between technologies and individual aspects?

This section considers both variation between the different areas of competency (confidence, motivation and self-efficacy) and between the measures (different technology groups and innovation readiness) for all post-lockdown responses. Note micro, meso and macro factors impacting on this variation are outlined later in the report.

When reviewing the mean scores for all post-lockdown responses, **the results highlight a moderate level of competence for digital healthcare technologies generally (Mean 70.1, SD 21.6)**. For individual digital healthcare technology groups, there is an upper moderate level of competence for EPRs (Mean 74.2, SD 20.0), a lower moderate level of competence for patient access (Mean 65.1, SD 23.0) and telehealth (Mean 62.1, SD 26.5) and a low level of competence for patient apps and wearables (Mean 46.6, SD 27.1) and social media (Mean 49.1, SD 30.1). There is an upper moderate readiness for innovation at individual and practice levels (Mean 74.2, SD 20.4).

Qualitative evidence highlights that clinical staff are competent with EPRs and to a lesser extent, telehealth. However, evidence highlights that they are less competent with patient apps and wearables and social media.

"certainly electronic patient records we've had around for years. You have to be familiar with those to work as a GP." (GP Partner)

Furthermore, considering who uses the technology, clinical or non-clinical; non-clinical staff tend to have most interaction with patient online access technology whereas patient apps and wearables are rarely encountered by them. Social media is not used widely due to the 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.

"it's hard to see a great benefit [with social media], that you can't achieve by other means. I get that it's a way of communicating with people, but you can communicate the same kinds of things by emailing people or newsletter or those kinds of things which don't invite quite the same negative online comments." (GP Partner)

Inability to solve problems if stuck have lower scores across the measures for post-lockdown responses, suggesting it is perceived ability rather than motivation that is impacting on reduced digital readiness. These findings highlight that implementing solutions from different digital healthcare technology groups will be impacted by differing levels of digital readiness to that technology. For instance, staff implementation of a closed Facebook group for patients with a long-term condition will be far harder than staff use of new templates in their EPR. Furthermore, the findings highlight lower levels of self-efficacy compared to confidence and motivation. As such, concentrating on improving self-efficacy may result in improved implementation of technology solutions.

5.2 How do micro (human) factors impact on digital readiness?

5.2.1 Digital readiness versus age (equal/greater than or less than 50):

Younger staff (<50) are statistically more competent than older staff with digital competence (confidence and self-efficacy) and telehealth competence (confidence, motivation and self-efficacy). This is strongly significant with telehealth. Younger staff are also significantly more motivated to learn about patient apps and wearables and social media. There is no significant difference for the other competencies. Competence for EPRs, patient access and innovative readiness appear equivalent between younger and older staff. The qualitative analysis reported a mixed picture for age being a factor impacting on digital readiness.

"I would say that age is a huge factor. A massive factor. We've got GPs here, well one for example that's in his 60s and he really struggles with technology...He's not very good with new things coming in or setting things up." (Operations Manager)

"I think unfortunately, some of it is to do with age. We've seen in some smaller practices where all the clinicians are of an older age where they don't use tech so much in their outside lives, it can seem a bit more of a hurdle. Having said that, there are exceptions to those rules, and sometimes it's the older clinicians in the practice who become the ambassadors for these types of things, so that's not exclusive by any means. But that can be an issue." (Technology company representative)

"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)

These findings demonstrate no difference in competencies with established technologies or readiness to innovate based on age. However, they do highlight confusion, or unwillingness to admit, that age can be a predictor of reduced digital readiness with evolving technologies. Alerting general practice to this finding and offering targeted individual support may help here. Inequality in access to and use of evolving digital solutions for patients and staff may widen if targeted support is not available.

5.2.2 Digital readiness versus time in general practice (less than/equal or greater than 5 years)

Staff who have been in their post for more than 5 years are statistically less competent with general digital competencies, and specifically EPR, patient access and social media. Interestingly, this result is largely related to the perceived self-efficacy of these staff, particularly solving problems if stuck, which is significantly less in all measures. The qualitative analysis provides some evidence for length of time being a factor with digital readiness.

"Just thinking in general for those specific practices where they've got older team members that have been in the NHS for years and at the same practice, they're not engaged in bringing in new technologies." (Technology company representative)

"People that have been here for more than five years have been here almost 20 years, if not a little bit more in my staff, and they really struggle picking up digital...I would say 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 how they work, so that is a good thing about a new starter coming in." (Operations Manager)

The findings demonstrate that, while the inability to solve problems if stuck is shown to be a factor for all staff, it is particularly so for staff who have been in post for some time. This emphasises the importance of continuous and repeated upskilling in digital healthcare technologies rather than relying on past solution knowledge and skills.

5.2.3 Digital readiness versus professional group (clinical versus non-clinical and GP versus other)

Non-clinical staff are statistically more competent with general digital competencies and specifically EPR, patient access and social media. There is a strong link to statistically better self-efficacy (ability to get help if stuck and/or solve most problems if stuck) in these measures for non-clinical staff. Clinical staff, while not having evidence for improved competencies, are statistically more confident with telehealth technologies and enjoy learning about new telehealth technologies and new patient apps and wearables. Clinical staff are also significantly more open to new ideas being needed in general practice.

When comparing GPs versus others, the picture is very similar with other (non-GP) staff being statistically more competent with digital competence, patient access competence and social media competence but not EPR competence. **GPs** are statistically more competent with telehealth competence due to the strong significance of confidence and enjoying learning about new telehealth technologies.

Thematic analysis of the qualitative evidence highlights the importance of understanding the different roles played in digital transformation. GP Partners are critical for digital transformation particularly motivation and engagement of practice staff. They have the most to lose and have the most autonomy for making changes.

"The partners own the business and they have to be a driving force, otherwise things won't happen irrespective of how persuasive the managers or anybody else might be." (Practice Manager)

"I think GPs had a huge hand in the fact of whether the practice would take eConsult on board." (Technology company representative)

While non-clinical staff have less autonomy to guide transformation but are critical for patient engagement and troubleshooting.

"We do have patients, pre-covid, they will just rock up in the waiting room with their iPad and say to you 'can you help me' because they are completely stuck. Because you are the main port of call, obviously they can come through to myself, but it's the ladies on the phone, so they've got to know what they're talking about. And even if it sounds really ridiculously simple but it's a step by step instruction of guiding a patient where to go and what to look for." (Operations Manager)

"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)

When considering the individual tools, encouraging online access is felt to be solely a non-clinical function whereas telehealth and encouraging the use of apps and wearables are felt to be more clinical. This would fit with the increased confidence seen in the telehealth and apps and wearables survey measures for clinical staff.

Finally, the benefits of joined up clinical and non-clinical staff collaboration for digital transformation was expressed.

"We are pushing for it [cross-practice group working] a lot more. The doctors will work alongside the non-clinical staff and vice versa...If we were unsure they would help us and if they were unsure we would help them. We're all quite open and honest about systems that come in. We might sit down and go, actually I have not got a scooby how that works and it might be explained by somebody

clinical or non-clinical so we are all on the same wavelength. We all know how each other's systems work, which is great." (Operations Manager)

These findings highlight differences in staff digital readiness and roles that different staff groups play. As with longer-term staff, it highlights clinical staff have reduced perceived self-efficacy. Clinical staff autonomy to decide whether or not to use a particular tool when struggling may be a factor here as reduced use will result in further reduced self-efficacy. Lack of time or access to resources for seeking solutions may also be a barrier. This finding implies the need for practices to consider how clinical staff, in particular, can be supported to solve problems when stuck. It also implies the need for maximising the confidence of reception and administration staff in order to maximise the engagement of patients with the changes. A supportive team approach with improved communication between groups may help. By not providing this, it is likely the clinical staff will continue to struggle with technology when problems occur and patient facing non-clinical staff will not promote new technology and processes effectively.

5.2.4 Other human factors impacting on digital readiness

The thematic analysis highlighted experience through frequency and amount of exposure to digital technology impacted on digital readiness. It was suggested that part-time staff (clinical and non-clinical) find it more difficult to undertake digital training and maintain skills.

"So I think some of it is to do more with the frequency with which they do things or they're exposed to things than actually to be able to do it." (Practice Manager)

The impact of personal attributes and perception of risk was also highlighted as impacting of staff's motivation and competencies.

"I think it's probably much more to do with people's appetite for change and appetite for risk. It's a bit like new medicines isn't it? Some people will always be the first people to be prescribing new medicines and other people will wait until you know all the safety data and things have been worked out and tried and tested, and I think it's the same with digital stuff really." (GP Partner)

"Some people [admin staff] are like me that just get it. Get it sorted, get it filed, get it where it needs to be. Other people will read into it, they will then try to solve it or they will try to get it to the right channel and when it's too busy like that you just need to get things filed away." (Operations Manager)

These findings demonstrate the need to find a way to mitigate against reduced training and use of digital technology by part time staff as well as the need to consider individual's personal attributes in support and training.

5.3 How do meso (practice situation) factors impact on digital readiness?

5.3.1 Practice variability in digital readiness

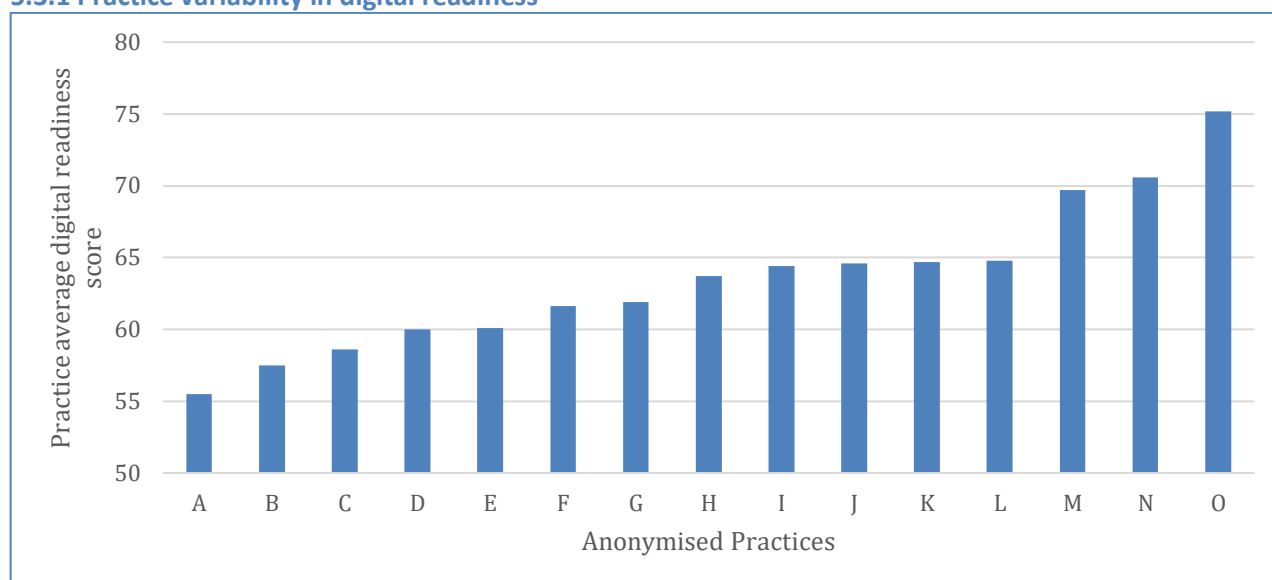


Figure 3: Bar chart showing practice average digital readiness score (based on the average of all survey measure scores) for anonymised practices with a response rate $\geq 15\%$

Practice A	Practice O
<ul style="list-style-type: none"> • Small rural practice • Internet and mobile signals problematic • High percentage of elderly patients • Late adopter • Sceptical about new technology – see how others get on first • Reticent about trialling new technology • Lack of motivation to change - patients and staff happy with current situation • Limited use of real-time data to guide training and support needs • Few digital champions 	<ul style="list-style-type: none"> • Large urban practice • No problem with internet or mobile signals • Low percentage of elderly patients • Early adopter • Actively looking to adopt, use and spread new innovations • Confident in trying things out and failing • Need to change to maintain efficiency of processes • Significant use of real time data to guide training and support needs • Multiple digital champions

Table 9: Key characteristics of the two practices (A and O shown in figure 3) with the greatest difference in digital readiness levels

Figure 3 demonstrates a wide variability in average digital readiness. There is almost a 20-point difference in scores between the practices A and O. Table 9 highlights some of the key characteristics of these practices that may explain the difference in staff digital readiness levels. The qualitative interviews highlight that there is a perceived minimal digital readiness variation in practices within the same region. Differences between PCNs is explored later. However, the analysis provides evidence for differences in innovation between practices. It suggests that traditional practices, where both patient and staff are happy with the current situation and lack a motivation to change have a lower perceived innovation readiness. Whereas, bigger practices needing to change out of necessity to maintain efficiency, and having previously embraced change successfully, have higher levels of innovation readiness. Equally, early adopters have the confidence to try things out and fail and are actively looking to adopt, use and spread new innovations.

"As a practice we haven't tended to wait for proven benefit. I think we've tended to do things first, so we did the same with GP teamnet - we used that fairly early on and then the CCG agreed to fund it. "
(GP Partner)

Late adopters are sceptical about new technology and reticent about trialling it. They are worried about the time and resources required as well as the risks on the practice. They are happy to let others take on that risk.

"I think we're quite sceptical of lots of things and analyse it and I think some practices seem to think just because it's new it means it's better and I think 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)

This can be due to previous negative experiences impacting on digital readiness, specifically motivation to undertake digital transformation.

"Sometimes it's having had bad experiences with tech before, it's failed and it just creates more problems. " (Technology company representative)

These findings highlight significant differences in practice digital readiness with several contributing factors. The implication is that if the underlying factors are not understood, forcing a digital solution on a practice, that they may not want or perceive to need, is unlikely to succeed. By understanding the practice digital readiness and situation, it is likely that bespoke digital transformation can occur that is empathetic to both the practice and practice population needs.

5.3.2 Digital readiness versus rurality and size of practice

On attempting to assess urban versus rural practices and small versus large practices, the two variables corresponded with each other so that all the small practices were rural and the urban practices were large. As such the following assesses urban large practices against rural small practices for impact on digital readiness.

Urban large practices are statistically more capable than small rural practices with patient access competency and social media competency as well as supporting new ideas. However, there is no statistical differences for all other aspects of digital readiness. In considering the above, the qualitative evidence highlights some important contrasts between practices and technology companies. Internet and mobile signals are still seen as a barrier within rural regions for digital readiness.

"I've never worked in a rural practice until I came here and I used to attend all the practice meetings and all of the time, without exception, the rural practices would say the speed of the connections to branch premises is a major barrier. I now know that personally and in reality it's a bit shocking...this should be taken seriously. " (Practice Manager)

Yet, interviews with the technology companies asking specifically about rurality, was met with ambivalence on whether rurality is still an important factor.

These findings highlight a lack of insight into the current issues facing rural practices. This may be leading to a widening digital divide between urban and rural practices.

5.3.3 Digital readiness versus CQC rating

Practices rated good are statistically more capable than practices rated require improvement with digital competency, in particular self-efficacy; I can get help if I am stuck. There are no other statistical differences.

While a worse CQC rating would be thought to be associated with a worse digital readiness, this does not seem to be the case from the study findings.

5.3.4 Digital readiness versus deprivation score

Practices with a more deprived patient population have statistically greater innovation readiness than practices with a less deprived patient population. There are no other statistical differences. When asked specifically about digital exclusion, interviewees focused much more on the age (see below) rather than other elements of social deprivation. The small amount of qualitative evidence suggested that the deprived populations are not digitally excluded.

“actually homeless people is less of an issue [for digital readiness] because maybe surprisingly, a lot of homeless people, well, all homeless people have mobile phones, so, it's actually not so much of an issue with them.” (GP Partner)

It would be dangerous to draw concrete findings from the above evidence although it provides a glimmer of hope that digital transformation may help to reduce inequalities in certain groups with high levels of social deprivation.

5.3.5 Digital readiness versus percentage of population above 65

Practices with less than 20% of patients over 65 are statistically more competent than practices with 20% or more for general digital competency and specifically EPR, patient access and social media competency and innovation readiness. This is strongly significant (≤ 0.01) in all but the EPR competence. This provides evidence for the bigger notion that patients' populations that are less digitally ready have a direct impact on practice digital readiness. A large amount of qualitative evidence supports the notion that digital exclusion is greater in the elderly population and this can have an impact on staff digital readiness.

“We've quite an elderly demographic...so quite a few of our patients don't have mobile phones on their notes and they won't use them because they'll say I get no signal in my house so their land lines 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)

“The people it [digital exclusion] is more of an issue with, probably is some of the frail elderly, and I say some because some of them are very IT savvy, but some not.” (GP Partner)

“There are many elderly patients who do not have access to this [Digital technology]. Eg mobile smart phone. All new stuff will be IN ADDITION to what currently exists as we cannot simply ignore and stop services for the technologically illiterate or inaccessible patients.” (GP Partner)

The following provides an unfortunate example of care being impacted through digital exclusion.

“So I had an elderly lady who pitched up at the surgery to have an injury looked at and the staff sent her away to go and have a telephone call and they sent her a text saying ‘please can you send a picture in?’ Of course she's in her late 80s, early 90s and she tried as hard as she could but she just

couldn't work out how to attach the picture. So in the end I had to call her back in. So she's driven all the way home and then came all the way back in again poor thing. So I think it is all very good having all the digital readiness, but if we're not able to think slightly laterally, is this appropriate for this person, then it can actually impact on the patient care as well." (Salaried GP)

When considering innovation and change, practice interviewees consistently reported that they drive change rather than patients:

"...most of it [practice change] is driven by us. Which I think is actually often the way, not just in the area of digital, but in most of how we run our practices, isn't it? I mean, a lot of people talk about things being patient centred, but the truth is normally they're organized around what's convenient for us." (GP Partner)

Themes from technology suppliers suggest that, practices' drive for change is impacted more by resistance or perceived resistance from less digitally ready patients rather than requests from more digitally ready patients:

"Where you've got older populations, you might have less uptake of the app. A lot of feedback that I've got recently from people not liking the app...they have a lower uptake of usage of the app. You get a lot of comments 'I'm too old for this nonsense.' That tends to be particularly so where you get an older population." (Technology company representative)

"Clinicians have this view that patients perhaps won't like this, or won't like that, and they prefer a more traditional system, or prefer dealing face to face or whatever. I think sometimes patients can surprise us in terms of what they actually most want. So it's the preconceptions about patients, or the types of patients that might struggle with tech." (Technology company representative)

"It's interesting, I've got a University practice that have got a very young population and a demographic that you think would be that [suited for digital tools] but the practice are holding onto the reigns of not allowing the digital door to open fully because they're scared of the flood gates." (Technology company representative)

Linked qualitative themes included understanding and acting on your patients' variable digital readiness. The themes highlight a clear need for practices to learn about and communicate with patients including the use of an active patient participation group, proactive responses to complaints and the use of patient usage data to guide support. Support can include actively helping patients and carers with one to one face to face support for software and hardware issues as well as making use of expert patients as digital health ambassadors. It is felt that the time and resources spent here pay off in improved patient confidence and engagement with digital transformation and reduced digital exclusion:

"it will take longer to help this patient over the telephone or face to face. But if they want to know how to fill in an eConsult and you're confident in knowing how to do it then next time they'll know for themselves and they won't need to call in and question. It will save time in the long run. You may spend 5 minutes helping this patient with an eConsult today, but for the next 10 times they contact the surgery, they're not going to pick up the phone, they're going to fill in an eConsult." (Operations Manager).

"it's all very well as the clinician saying yes you need to use this, but actually if you've got somebody there who's using it, who is a patient, it's looked at in a very different way." (Technology company representative)

These findings highlight the importance of involving patients in digital transformation as their level of readiness or practice-perceived digital readiness does impact on practice digital readiness directly. This is clearly seen with the older patient group. The implication of actively including and helping willing patients in digital transformation will be an improved digital readiness for the practice. Ignoring patients or thinking you know what patients need will result in reduced successes and greater frustration for practices.

5.3.6 Similarity of digital readiness of practices within PCNs versus between PCNs

The one-way anova analysis of 8 PCNs demonstrates that the digital readiness levels between PCNs is significantly different in several measures. These include patient access, telehealth and social media competency as well as innovation readiness (strongly significant).

Qualitative evidence pointed at similarities between practices within the same PCN as well as those within the same (urban) region but differences between regions.

While this doesn't explicitly demonstrate similarity of digital readiness levels of practices within a PCN compared to practices from different PCNs, it is highly likely that this would be found. The formation of PCNs are generally based on geography and similar values and as such, factors such as rurality will have an impact.

5.3.7 The importance of supporting and engaging your staff for digital readiness

The qualitative evidence, particularly from the practices, highlighted the importance of supporting and engaging both clinical and non-clinical staff digital readiness through a variety of methods described below.

Peer and personal learning and endorsement helps digital readiness

Endorsement from colleagues or other practices is felt to be a powerful method of promoting engagement in digital transformation. Even staff that are initially reticent will adopt solutions if they see colleagues benefitting. There is a strong learning process from both peer and personal experiences.

"it was hugely reassuring for the staff to hear colleagues telling them honestly, what if any problems they experienced, how they overcame them and actually to tell them a couple of weeks after implementation that actually they're happy with it. So that does build confidence if staff know that their peers have mastered it then they know they will as well." (Practice manager)

"When it first became available, we had one partner who kind of trialled it essentially on behalf of the rest of us. And he came back and said; yeah, it works really well, you should all do it. So we just did, it was much more reactive." (GP Partner)

Time for formal and informal training required

There is an abundance of evidence highlighting the need for training and support with dedicated time both within and external to the day-to-day job role. Examples included; ad-hoc conversations to promote conformity and improved ways of using technology solutions and dedicated time for role play with simulated patients to obtain a full understanding of the impact of the changes both for the practice staff and patient.

"I have monthly meetings with my staff and anything that they are unsure about, they ask and it's usually around how do I do this on EMIS or how do I do this on Docman or I have a patient calling in with this scenario, what would we do? So we do a lot of role play and the best thing about it is, using dummy patients, you can act as if you're that patient and if we are ever unsure, we can then talk that patient through step by step." (Operations Manager)

"IT knowledge and ability to solve problems as they occur are simply not there. In the absence of training I have to pick it up as I go along- making IT work for me is the most frustrating part of my job." (GP)

Communicating beneficial reasons for change increases motivation

Increasing motivation in digital readiness requires a clear communication of the benefits of the change.

"Anything that improves efficiency for medical staff, and frees up time for looking after patients better is likely to be of benefit. If it does this whilst being easy for patients to use and accessible and "enjoyable" then even more so. Convincing staff to get past the time and monetary outlay costs might be the hurdle and the inertia that we often experience in our roles. So I think to motivate staff to take on these changes we need to offer and be offered really motivating goals as to what these new approaches could offer us on a day to day basis in concrete terms." (GP)

Scaling up slowly and internal IT support essential for digital transformation

Changing too fast and too much in one go is seen as a barrier. Instead, a gradual iterative change process with limited synchronous changes, trialled within a small group before scaling up should be adopted. Furthermore, the need for regular and just in time in-house IT support was strongly emphasised. The evidence highlighted that when the technology is not working, it needs to be fixed as quickly and efficiently as possible. Internal IT support is viewed as essential here although Healthcare Computing™ was praised for its fast response to IT problems. The inability of staff to fix technology when not working was felt to make this an essential requirement. This is particularly so with GPs as highlighted in section 5.2.3.

"I'm not confident with anything IT so I expect to be given a laptop with everything already on it, ready to go and running smoothly and then when it doesn't run smoothly I literally don't know what to do, I just have to put the laptop away and not do whatever I'm doing. I don't know how to fix it." (Salaried GP)

Repetition of training necessary for driving and maintaining changes

Repetition of training and a progression from general group to specific individual training was highlighted as important for learning and continuing to use new digital healthcare technologies. Clarity Teamnet™ was highlighted as a useful tool for auditing the training process and providing the ability to undertake repeated training using customised resources including video tutorials.

"We will go back over with the team about what they need to do and how it works, and so there's repetition, isn't it? Just remind, remind, remind." (Practice Manager)

Understanding staff digital readiness improves effectiveness of training

There is a need to use data to assess effectiveness of training in order to provide training that staff really need rather than training that they are perceived to need.

"I know there is a case that what we've got to do is recognize that we have moved quite quickly with different technologies and changing methods of communication with patients and we are leaving some of our people behind in terms of the training that we think we've given them versus the training that they really need." (Practice Manager)

Digital champions important for engaging staff and supporting digital readiness

The importance of digital champions, particularly GP Partners, was highlighted for enthusing and supporting staff and driving change. Their role includes horizon scanning and trialling new technologies before promoting those where the benefits outweigh the risks.

"If we think it's going to be useful for either us or the patients, I would say we go for it. I don't know if that's my view on it. Maybe that's because we've got this enthusiastic young Partner who comes in and bounces around these ideas." (Salaried GP)

"It often takes an ambassador within a practice who's very interested in tech and the potential benefits of it. If you don't have that person keeping up to date with an eye on the latest things and also a bit driven, it's quite difficult for practice to get over the hump." (Technology company representative)

The findings are not necessarily surprising. They highlight the need for a structured, well-resourced and supported gradual iterative change process to promote improved digital readiness and subsequent successful digital transformation.

5.4 How do macro (external) factors impact on digital readiness?

5.4.1 COVID-19 pandemic and lockdown

When looking at all staff, there is a strong significant increase in perceived innovation readiness post-lockdown, both for the individual and the practice. There is also a significant increase for enjoying learning about new apps and wearables. When looking at only GPs, there is a significant increase in digital readiness post-lockdown for telehealth, patient apps and wearables, social media competencies as well as innovation readiness. In keeping with other findings for digital readiness in GPs, the significant changes are seen in confidence and motivation but not self-efficacy.

The majority of the qualitative evidence highlights positive aspects of covid-19 for digital transformation. A removal of barriers (IT resources, reduced patient demand, reduced bureaucracy) and particularly a drive on practices, practice staff and patients to adopt digital technology (particularly telehealth) with a resulting largely positive change in perception. The following quote highlights this change process when considering the transition between forced-reluctant and active-engaged adoption of online consultations:

"Well, it [online consultation] was enforced, wasn't it? So by the 1st of April we had to have it, and then we have to decide whether it's going to be visible or hidden on the website and how hard we were going to promote it or not. And then we were initially going to just have it on the website, but it's going to be quite hidden and we're not really going to promote this and probably just expect one or two dribbling in every day. And then just because of the way we changed working with Covid and everything. If Covid hadn't happened, we would still be very reluctant and just be having one or two coming in a day and really just trying to push it to the side. But actually because of the remote consultations, I think then we just realized it seemed to make our lives easier." (GP Partner)

This view was mirrored by a technology company representative:

"Yeah, if I suppose they've got to use it [online consultations] and because of Covid, a lot did. It's like, oh, this is really actually good, I didn't know it did that. Because they haven't allowed themselves to explore the opportunities of digital consultations prior to Covid because they had the option to turn it down. Now they haven't." (Technology company representative)

It also forced technology companies to change strategies offering their digital solutions more widely and moving to remote training and support:

"I think if it hadn't been for Covid, we would have approached those who were using a lot of telephone already, so sort of telephone first style practices. But in the context of Covid, because everyone was thrown into the same position, our particular tool became relevant to everyone." (Technology company representative)

In considering intra and inter-practice variation in innovation readiness, covid-19 was considered to be a great leveller helping all practices to move in the same direction with a common goal:

"So now we've got a group of GPs who are all engaged in going in the same direction, maybe not quite as quickly, but at least we're all going in the same direction as opposed to being at different ends of the scales." (Practice Manager)

Yet, the impact of the pandemic on digital readiness has not been universally positive. There were concerns around the benefit of digital transformation once the lockdown honeymoon period is over and some normality returns. A loss in confidence was reported with information governance concerns and the ability to fix problems was made harder by a lack of face to face IT support.

These findings demonstrate a levelling of digital readiness between practices reflecting the necessity for all to adopt new ways of working, particularly GPs. However, the honeymoon period is over with winter demands, routine work returning to normal levels and a continuing pandemic. This unique situation provided an opportunity to change the perception of those reticent to adopting and using digital healthcare technologies. Continued progress requires continued and improved resource allocation and support for both patients and healthcare staff as seen below. The implication of not providing the necessary support will be an increased reluctance in continued digital transformation.

5.4.2 IT infrastructure, procurement and support

GP Practice interviews highlighted resources, procurement and support as important to progressing digital readiness forward.

IT infrastructure

Resource issues included a lack of hardware highlighted by many, particularly laptops and webcams.

"What I don't want the outcome to be is a complete misrepresentation that digital readiness is being held up because general practice isn't capable because of skills when because you're assuming that it is that rather than hardware availability that is the barrier which is actually the reality." (Practice Manager).

Network connections, both in practice and at home, was also highlighted as a barrier to digital readiness.

"All of the above depends on a fast, reliable and consistent internet connection, which is by no means universal. If the NHS is going to encourage all of this and particularly the ability to work from home if needed then this has to be addressed" (GP)

Procurement

There was a need for improved engagement and choice for practices with external procurement of digital technology. Reticence in adopting well-meaning externally procured technology solutions arises due to; lack of autonomy for continuing or curtailing procurement, lack of practice inputs in procurement decisions, lack of financial motivation or perceived cost savings, a lack of consideration for individual practice needs and with the feeling of being forced to transform. Further to this, time to understand the digital technology being adopted and engage staff and patients in the changes is lacking.

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

Support

While companies should provide easy access customer support including local face to face support (digital health advisors and specialist digital health clinics) and resources for communicating and troubleshooting, practices also need time, training and resources to understand the digital technology and support staff and patients in its use.

"I think we've got to make it as easy as possible for general practice to be ready and able to take it on board. I think there's a joint ownership to this responsibility. There's no point of having a clunky solution that makes their lives harder." (Technology company representative)

"There's not enough between them and us, or just general practice in general. We don't get enough instructions. It's just this is what you can do, the rest of it leave to us. But we need to be able to explain to patients as well what it is that they're going to be doing." (Operations Manager)

These findings demonstrate a balance between supporting practices by centrally procuring new digital technology solutions making use of economies of scale and adopting a one size fits all approach with limited input from the practice and patients who are expected to use the solution. Furthermore, time, resources and support are needed to increase the chance of success in this adoption process. The solution here, may be the provision of two or three potential digital solutions with relevant guidance, support and resources for practices to adopt and use their preferred option. The implication of not going down this route is a continued reticence by some practices for what is perceived to be a top-down enforced digital healthcare technology solution.

5.4.3 Software usability and interoperability

Usability and interoperability were highlighted as barriers to the effective adoption and use of technology. The importance of usability was highlighted by reflecting on the variation between two commonly used digital healthcare technologies.

"AccuRx is a lot easier. It's just a simple: make sure you're in the patient record, send the text message, off it goes. Whereas eConsult, it comes into an email, they then have to file that away onto the patients notes, add it onto an appointment book. So although the actual program is simple and there's nothing that the reception admin team have to do with it, once it reaches us, a lot of process is to make sure it reaches a GP or the correct person, and I think that's where a lot of people lack confidence and it is where mistakes are made and we do end up sometimes missing off eConsults because they've either been filed away and they've not been assigned to a GP or they've been assigned to a GP and they haven't been filed onto the notes or they've just been filed away in completed items on email so there is that risk of something not being done with it." (Operations Manager)

To be fair to the company, eConsult and others, they are aware of this and are working tirelessly to make their digital technology as easy as possible to use with improved interoperability.

"Ideally you should be able to just pick up the app, you shouldn't really need to be taught how to use it." (Technology company representative)

"What we're really focusing on is the real-world data, we want real-world evidence. To do that, we're going to extract from the app and that's how we're going to address usage" (Technology company representative)

Interoperability was repeatedly highlighted as a significant frustration. Difficulties were encountered between practice sites, practices, PCNs and cross-organisational as well as between software platforms:

"It is extremely frustrating that these systems don't always interact with each other particularly problematic if you are a locum and working across sites" (GP)

"There is a significant problem with sharing EMIS databases between PCNs, whilst allowing allied health care prescribers to prescribe on different networks. I do not want to merge but we may be forced down that route because of this. We have set up a 4th database on EMIS just to address this issue." (GP)

These findings demonstrate unresolved barriers to digital transformation that cause significant frustrations for the users. Technology that is usable and interoperable promotes digital readiness.

5.4.4 Governance issues

There were emerging themes around both information governance and clinical governance issues. This included clearer information governance guidance around patient communication using newer digital healthcare technologies.

"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)

Clinical governance issues centred around concerns about missed communication.

"It would technically be quite straightforward for us to email things from an NHS.net email address but because we haven't got it set up in such a way that other people can check them when we're on holiday, we worry that there's a risk that we'll get some reply when someone's on holiday and won't see it for two weeks. So those kind of issues have made us wary of some things." (GP Partner)

However, technology companies highlighted that digital technology can actually make clinical risk more apparent compared to hidden risks in traditional appointment systems. This can then highlight where improvements can be made.

The findings demonstrate the need for clearer information governance and careful consideration of clinical governance when implementing new technologies.

5.5 Do practice digital readiness competency measures correspond to digital healthcare technology use?

Comparisons	Number of practices with $\geq 15\%$ staff response rate	r (Pearson correlation coefficient)	P value
The percentage of patients in a practice accessing at least one online patient access resource against the practice specific, non-clinical staff, patient online access competency score average.	15	-.05	.85
The number of online consultations submitted to a practice in April 2020 (measured as a percentage of the total practice population) against the practice specific, all staff, patient online access competency score average.	18	.03	.90
The number of accuRx video consultations undertaken by a practice in April and May 2020 (measured as a percentage of the total practice population) against the practice specific, GP staff, telehealth competency score average.	22	.10	.67

Table 10: The correlation between practice digital healthcare technology use (accuRx video, eConsult online consultations and patient online access) and the related practice averaged digital readiness competency measure.

The table shows no significant positive or negative correlation for all three comparisons. This highlights that the variation in practice averaged digital competency measures do not correlate with variation in use of digital healthcare technologies. While it would have been satisfying to show a positive correlation for all 3 comparisons, this was unlikely. This demonstrates that variation in use of digital healthcare technologies is likely multifactorial and cannot be measured with a simple tool assessing staff related experience measures.

6.0 Discussion

6.1 How does digital readiness vary between technologies and individual aspects?

In the survey findings for all post-lockdown responses there was a wide variation between competencies for different digital healthcare technologies. This varies from EPRs which have been around for a long time and are used everyday to patient apps and wearables and social media that are emerging digital healthcare technologies with associated risks and unclear roles. Given this variation, the use of a simple and contextualised digital readiness assessment tool may help practices to understand and target relevant support where needed.

When considering the individual elements of each measure, confidence, motivation and self-efficacy, self-efficacy has lower scores across the measures for post-lockdown responses. This suggests it is perceived ability rather than motivation that is impacting on reduced digital readiness. While previous research^{9 10 11} suggests that motivation, defined as staff acceptance, willingness and enthusiasm, is the most important aspect of digital readiness and subsequent transformation, this work highlights that poor perceived self-efficacy may play a greater limiting role. As such, concentrating on improving self-efficacy through methods highlighted in section 5.3.7, may result in improved implementation of technology solutions.

Recommendation 1: Understand staff digital readiness – developing a simple, brief digital readiness assessment tool may help practices and staff to target digital support where most needed.

6.2 How do micro (human) factors impact on digital readiness?

In the survey findings, younger general practice staff (<50), those in post for 5 or less years and non-clinical staff were significantly more competent in several measures of digital readiness. For younger staff, this was general digital competency and telehealth. For those in post for 5 or less years and non-clinical staff, this was general digital competency, EPRs, patient access and social media competencies. While similar for non-GPs, there was a lack of significant difference with EPRs. GPs were also significantly more competent with telehealth than non-GPs.

However, these distinctions were contrary to the views shared in the primary care staff interviews, where there was mixed opinion on digital readiness of older, longer standing staff. While personal attributes will come into play, this suggests a potentially problematic perception of digital competence of older and longer standing staff, which is likely to manifest itself at the point of digital innovation. It's possible older and longer standing staff digital readiness is over-estimated by other practice staff due to their potential seniority and experience within the practice. This is important to recognise but at the same time, not stereotype based on age and time in practice. Becker in his 2018 paper on myths and principles of digital literacies³⁷ highlights that, everyone may struggle with digital literacy. While younger generations, digital natives, may have better digital skills, older generations may have better and more refined cognitive skills. Both are needed and recognising that fact is important in considering **targeted digital support**.

The difference in digital readiness between clinical and non-clinical staff is another key finding. Given the different roles and uses of technology, there is a need for practices to consider how clinical staff, in particular, can be supported to solve problems when stuck while maximising the confidence of reception and administration staff in order to maximise patient engagement in digital transformation. For the former, this is likely to be through **improved internal IT support** and **allocated time** for improving self-efficacy with current and emerging digital healthcare technology. A view promoted in the literature³⁸. For the latter, a **supportive team approach** with effective communication between staff groups may benefit all. Furthermore, this highlights the need for a **contextual assessment** prior to implementation of digital innovations. This may be as simple as the use of the heuristic 'Tool+Team+Routine'³⁹ or more comprehensive with the use of the 'NASSS-CAT' tool based on the

NASSS framework⁴⁰ for example. This will help practices consider digital transformation in a more service design orientated approach while highlighting the importance of spending time in considering implementation. This may also help to consider other roles in the implementation of a new tool resulting in better collaboration and support between clinical and non-clinical staff groups.

Recommendation 2: Acknowledging that colleagues in a particular demographic (>50 years old, in practice for >five years, clinical roles) may experience less digital readiness for emerging technologies. This will be necessary when considering targeted support.

Recommendation 3: A supportive team-based approach combining both non-clinical and clinical staff skills is required in the adoption of new digital healthcare technologies. Undertaking a contextual assessment prior to adoption may help to emphasise this approach.

6.3 How do meso (practice situation) factors impact on digital readiness?

In the primary care staff interviews, minimal variation between practices within the same region was reported, however, the quantitative findings demonstrate a different story with almost a 20-point difference in digital readiness between practices. The question is whether this uninformed view of digital readiness variation between practices may lead to complacency in driving forward digital innovation and a lack of understanding by commissioners. This may be further emphasised by practices concentrating on other practices within the PCN rather than further afield where the study has demonstrated a significant difference in inter-PCN digital readiness. By acknowledging these differences, bespoke digital transformation can occur that is empathetic to both the practice and practice population needs.

The quantitative data on practice factors highlights significant differences based on size and rurality with improved competency for large urban practices in patient access and social media as well as supporting new ideas. However, it is the qualitative data that really emphasises the stark difference in digital readiness based on lack of innovation readiness and rural internet connectivity barriers. The impact of size and rurality on readiness are reflected in the literature^{1 13 14 15}. **Interventions to minimise the barriers and support innovation in rural small practices** is likely to reduce the digital divide between large urban and small rural practices.

The most important factor impacting on digital readiness of practice staff is a greater percentage of older patients within a practice population. This is strongly significant for general digital competency, patient access and social media competency and innovation readiness and significant for EPR competency. Research on the age-based digital divide highlights that it is capability rather than motivation that is driving this divide¹⁴. It is highly likely that patient populations digital readiness impacts on practice digital readiness. If practices are to lead digital transformation, they need to find ways of **learning about and actively supporting their patient population**. This may include:

- Active patient participation groups, use of real-time data to better understand patient use and patient co-design of digital healthcare technologies⁶
- Widespread adoption of digital nurse champions to actively seek and support technology enabled care^{41 42}
- Practice/PCN based digital hubs providing supported exploration of digital healthcare technology and face to face support for software and hardware issues⁴³
- Use of expert patients as digital health ambassadors

Finally, in the primary care staff interviews, **lack of time and resources** for undertaking digital transformation was reported. This suggests more investment in reflection upon digital transformation

is required at practice level, particularly with general practice making more use of online and remote methods of care where clinically appropriate. The interviews identified a need for:

- Understanding staff digital readiness
- Repetition of training to drive and maintain changes
- Peer and personal learning and endorsement
- Communicating beneficial reasons for change to improve motivation
- Scaling up slowly with appropriate internal IT support
- Digital champions (particularly GPs) for engaging staff and supporting change

As such, a structured, well-resourced and supported gradual iterative change process is necessary to promote improved digital readiness and subsequent successful digital transformation. Redmoor Health's current development of a Primary Care Digital Journey Planner may help in this area⁴⁴. The planner will incorporate a practice self-assessment digital checklist, offering targeted and practical information on using and improving digital solutions and then provide a bespoke action plan for practices.

Recommendation 4: Increased emphasis needs to be placed on understanding and actively engaging patient populations in digital upskilling. This is especially so in the digitally excluded patient groups.

Recommendation 5: A structured, well-resourced and supported gradual iterative change process is necessary for successful digital transformation.

6.4 How do macro (external) factors impact on digital readiness?

In both the general practice staff and the technology company staff interviews, IT infrastructure, software usability and interoperability and governance issues were prevalent. This indicated these barriers, identified in previous literature¹¹, remain unaddressed. However, previously suggested enablers, public and professional willingness and clinical endorsement¹¹, have been enhanced due to the unique situation of the pandemic. Support from technology companies and CCGs will be critical for continuing the recent progress over the next few years. The NHSX Information Governance Portal⁴⁵ and NHS Digital's GP IT Futures⁴⁶ has come at an opportune time. The portal aims to simplify information governance providing guidance across a range of digital areas. The GP IT Future aims to improve procurement, interoperability and usability of clinical IT systems for the benefit of general practice staff and patient needs.

Both sets of interviews reported the need for **more collaboration and effective mutual support between technology company staff, CCGs and practice staff** when embarking on new digital solutions for practice. This needs to balance the benefits of economies of scale with practice autonomy. This would suggest a clear '**collaboration and support gap**' for all stakeholders to invest in and benefit from. Reducing this gap is critical for creating the necessary trust for digital transformation⁴⁷. Given the fragmentation of the healthcare environment, this may be a critical factor to support many other challenges identified in this study including targeted digital readiness support for individuals and practices.

In considering this collaboration and support gap and the unaddressed barriers, accuRx has produced an extremely useful manifesto for developing 'software that works'⁴⁸. Their set of principles outlined in the manifesto provide a blueprint for other digital healthcare companies to follow and improve upon for the good of the NHS and ultimately patient care.

Recommendation 6: Essential improvements in IT infrastructure, software usability and interoperability and governance issues are required if general practice digital readiness is to be maximised.

Recommendation 7: Improved collaboration and effective mutual support between technology company staff, CCGs and practice staff is required for the benefit of improving digital readiness.

6.5 Do practice digital readiness competency measures correspond to digital healthcare technology use?

Looking at two different digital healthcare technology groups and two different digital readiness measures, the results show that variation in staff perceived digital competency, averaged across a practice, does not correlate positively or negatively with variation in practice use of related digital healthcare technologies. While digital readiness in terms of staff perceived digital competency will ultimately play a part, it highlights the complexity of the healthcare environment with the need to consider multiple influencing micro, meso and macro factors.

Quantitative measures of digital readiness in the public have been shown to correlate with level of use of technology by the public¹³. However, this has not been shown within healthcare. This study highlights that, while a quantitative brief survey tool has potential merits (insight into individual staff digital readiness, general average digital readiness for a practice) it cannot be used on its own to guide practice digital transformation.

As such, this study hopes to provide evidence for the development of more holistic tools including the self-assessment diagnostic tool being developed by the Building the Digital Ready Workforce programme¹⁷.

7.0 Limitations

The survey tool used for assessing digital readiness within general practice is not peer reviewed or independently assessed. However, the style of survey along with the context has been evidence based and the tool has been guided by previous research on the evaluation of digital readiness. When considering the individual survey measures, the measures are not normally distributed. As such, it is theoretically more appropriate to use non-parametric tests such as Wilcoxon Signed Rank Test. However, in practice the results differ very little.

Given the time available for the fellowship (34 days) and the impact of the pandemic, the number of qualitative interviews had to be limited, especially those of external organisations. It would have been useful to obtain a broader range of technology companies staff views with examples from each of the five different digital healthcare technologies.

8.0 Conclusion

This service evaluation study sought to gain an understanding of digital readiness within general practice. To achieve this goal, it has provided insights into variation in digital readiness including an analysis of factors impacting at a micro (human), meso (practice) and macro (external) level. It has done this through the development of a viable tool for measuring staff reported experiences as well as harnessing and analysing the views of several key practice and technology company stakeholders.

It has demonstrated variation in digital readiness between technologies, staff and practices and linked these to the most relevant factors. These include micro factors; staff role, age and time in practice, meso factors; practice rurality and percentage of patients over 65 and macro factors; IT infrastructure, software usability and interoperability. Based on these findings, it has provided seven pragmatic 'DR7' recommendations for tackling the most pertinent issues. In summary, the *DR7 recommendations* highlight a need to:

1. Understand, acknowledge and support differences in staff digital readiness.
2. Undertake digital transformation in a well-resourced and supported gradual iterative change process that is team-based and works to understand and actively engage patients.
3. Undertake essential improvements in IT infrastructure, software usability and interoperability while improving collaboration and effective mutual digital support between technology companies, CCGs and General Practice.

Digital readiness is a multifactorial concept requiring reflection and action from patients, general practice staff, technology companies, CCGs and governing bodies. As such, recommendations one to five are aimed at GPs and Practice Managers while recommendations six and seven relate more to technology companies and CCGs. All require support from governing bodies.

A collaborative, formative and realistic digital readiness checklist, that encompasses the above recommendations and provides all stakeholders with clear direction of progression while acknowledging the role each has to play, may prove useful. Redmoor Health's current development of a Digital Journey Planner is trying to achieve this at the practice level. The AHSNs are appropriately positioned to act as the vital link between the different stakeholders and could host a network that focuses on improving collaboration between general practice and industry.

While the pandemic has been hugely damaging to society, it has provided general practice with a unique opportunity to fast forward an empathetic and relevant digital transformation process. General practice staff are motivated in this common goal as long as it is done for the right reasons and appropriately resourced and supported. By providing this support for increasing motivation and competence to effectively adopt, use and spread digital healthcare technologies, we will minimise the digital gap and **all** achieve the key digitalisation milestones set out by the NHS Long Term Plan.

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Appendix 1: List of Practices

Practices	Primary Care Network
The Friarsgate Practice	Winchester City
St Clements Partnership	Winchester City
St Paul's Surgery	Winchester City
Alresford Surgery	Rural North
Gratton Surgery	Rural North
Stockbridge Surgery	Rural North
Mansfield Park Surgery	Rural North
West Meon Surgery	Rural North
Two Rivers Medical Partnership	Rural North
Bishops Waltham Surgery	Rural South
Stokewood Surgery	Rural South
Twyford Surgery	Rural South
Wickham Surgery	Rural South
Adelaide Medical Centre	Andover
Andover Health Centre	Andover
Charlton Hill Surgery	Andover
Shepherds Spring Medical Centre	Andover
St Mary's Surgery	Andover
Bentley Village Surgery	A31
Boundaries Surgery	A31
Chawton Park Surgery	A31
The Wilson Practice	A31
Camrose, Gilles & Hackwood Partnership	Camrose, Gilles & Hackwood
Bermuda and Marlowe Practice	B-Connected Care
Bramblys Grange Medical Practice	B-Connected Care
Beggarwood Practice	B-Connected Care
Crown Heights Medical Centre	Mosaic
Odiham Health Centre	Mosaic
Tadley Medical Partnership	Rural West
Watership Down Health	Rural West
The Chineham Medical Practice	Whitewater Loddon
Clift Surgery	Whitewater Loddon
Whitewater Health	Whitewater Loddon

Appendix 2: Digital readiness survey tool

Introduction

This 90 second micro-survey aims to improve our understanding of digital readiness within primary care to better support GPs and their teams in delivering care. The readiness of GPs and their teams is critical to the successful adoption of the right digital health technologies in the right way, to improve care for our patients and our wellbeing. Your input will remain strictly confidential.

Digital health technology examples include: electronic patient records (EMIS, systemOne), online patient access (eConsult, NHS App), telehealth (text messaging/video consultations), patient apps (MyCOPD for improved self-care) and social media (closed FaceBook groups for long term conditions).

Demographics

Practice – drop down (33 practices)

Profession type – drop down (GP partner, GP salaried, GP locum, GP trainee, Advanced nurse practitioner, Practice Nurse, HCA, Allied health professional, Care navigator, Reception staff, Administrative staff, IT support, Management, Other - with single line free text box)

Age range – (20-29, 30-39, 40-49, 50-59, 60-69, 70+)

Time in current general practice (years) – (0-5, 6+)

Digital Confidence <i>Considering digital technology</i>	Strongly agree	Agree	Neutral	Disagree
I am confident using digital technologies				
I enjoy learning about digital technologies				
I can get help if I am stuck				
I can solve most problems, if stuck				
Electronic Patient Records <i>(e.g. EMIS, systemOne)</i>	Strongly agree	Agree	Neutral	Disagree
I am confident using electronic patient records				
I enjoy learning about new aspects about them				
I can get help if I am stuck				
I can solve most problems, if stuck				
Patient Online Access <i>(e.g. NHS App)</i>	Strongly agree	Agree	Neutral	Disagree
I am confident using and encouraging online access				
I enjoy learning about new access technologies				
I can get help if I am stuck				
I can solve most problems, if stuck				
Telehealth <i>(e.g. text messaging/video consultations)</i>	Strongly agree	Agree	Neutral	Disagree
I am confident using and encouraging telehealth				
I enjoy learning about new telehealth technologies				
I can get help if I am stuck				
I can solve most problems, if stuck				

Patient Apps <i>(e.g. MyCOPD for improved self care)</i>	Strongly agree	Agree	Neutral	Disagree
I am confident using and encouraging apps				
I enjoy learning about new apps				
I can get help if I am stuck				
I can solve most problems, if stuck				

Social Media <i>(e.g. Closed Facebook groups for long term conditions)</i>	Strongly agree	Agree	Neutral	Disagree
I am confident using and encouraging social media				
I enjoy learning about new social media platforms				
I can get help if I am stuck				
I can solve most problems, if stuck				

Innovation Readiness <i>Considering new digital health technology ideas in primary care</i>	Strongly agree	Agree	Neutral	Disagree
New ideas are needed in primary care				
I keep up with new ideas				
My practice supports new ideas				
My practice makes new ideas work				

Please provide any further thoughts about digital readiness in general practice.

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Appendix 3: Semi-structured interview questions

For general practice staff

Differences in digital readiness

1. Are there **differences in digital readiness** amongst your **colleagues**? (In what way and why)
2. Are you aware of **differences in digital readiness** between **practices** in your region? (In what way and why)
3. Are there **differences in digital readiness** for using **digital healthcare technologies**? (In what way and why)

Development of staff

4. Does your practice **help staff** to become more digitally able? (Lennon. Rec 6) (In what way and why)
5. How does your practice **build trust and confidence** in using digital health technologies? (Lennon Rec 3)

Patients and digital inclusion

6. How does your practice help patients to become more digitally ready, especially those who are at risk of digital exclusion? (Lennon Rec 5)
7. How does your practice gain an understanding of **patient use and views** of digital healthcare technologies (current and future)?
8. How much are you driven by your **patient expectations** for the use of digital healthcare technologies?

Barriers and solutions

9. Can you think of any **groups or individuals within the practice** who specifically help or hinder digital readiness?
10. Can you think of any **groups external to the practice** that help or hinder digital readiness?
11. Finally, what has been the impact of COVID-19 on digital readiness?

For digital technology company representatives

Considered digital innovation aspects and defining digital readiness

1. How does [company] **decide to introduce** digital innovations into specific practices or areas?
2. How does [company] **define digital readiness**?

Development of staff

3. Does [company] **support** general practice staff to become more **digitally able** when providing a current/new digital innovation? (In what way, to what extent, which staff groups)
4. Whose **responsibility is it to ensure digital readiness**; technology suppliers or general practice? (To what extent and why)
5. Does [company] plan to support digital readiness in primary care in any way in the future?

Patients and digital inclusion

6. Does [company] support practices to help patients to become more digitally ready, especially those who are at risk of digital exclusion? (How) (Lennon Rec 5)
7. How does [company] gain an understanding of **patient use and views** of your digital healthcare technology?
8. How much are you driven by **patient expectations** for the use of your digital healthcare technology?

Barriers and solutions

9. From [company] point of view, what are the **barriers** of introducing digital readiness into primary care?
10. From [company] point of view, what are the **enablers** of introducing digital readiness into primary care?
11. Can these barriers and enablers be explained by **differences in digital readiness** within practices or between practices? (In what way)
12. How has COVID-19 impacted on digital readiness from the [company] viewpoint?