Appendix 3: A review of the evidence relating to the effectiveness of technology and online service use in improving access to general practice – July to December 2017

1. Key messages

General findings

The use of technology in healthcare is constantly evolving, with the evidence base for interventions growing accordingly.

A 2015 systematic review found that the use of online services increases increased satisfaction, convenience and patient-led safety improvements, for example identification of medication discrepancies with the potential for severe harm. There was also a moderate increase of email, no change on telephone contact and variable effects on face-to-face contact (11).

A Nuffield Trust report found that there is a high degree of uncertainty regarding how health-related digital technology will impact on demand for services, clinical workload and health outcomes, and that there is a current lack of evidence in many areas (12). Additionally, access to online services will not necessarily by itself lead to patient engagement with self-management of their health conditions – this will require education and support from highly skilled staff (12).

An observational study of telephone triage by GPs has recently been shown to increase average GP consulting time with no evidence of a reduction in secondary care costs (13).

Evidence for specific technologies

A Nuffield Trust report found that the patient experience can be improved by online appointment booking and repeat prescriptions ordering, but there is little evidence for associated increased administrative efficiency (12).

A systematic review found that online access to rest results is also associated with greater patient satisfaction compared to in person or by telephone (1).

A Nuffield Trust report highlighted the lack of good quality evidence for remote consultations but found that email consultations increase communication, save patients time and increase overall satisfaction, with mixed evidence on their impact on demand (12). A 2017 observational study showed that the use of e-consultations in the UK primary care is very low (14). NHS England highlights the greater discretion and convenience (particularly for those with mobility issues) offered by online appointments, but notes the challenges regarding lack of verbal cues and the potential for excluded groups (3).

A recent Systematic Review and Thematic Synthesis showed that Telehealth interventions ("personalized care from a distance") can provide reassurance and independence for individuals living with cancer (15). The Whole System Demonstrator cluster randomised trial also showed that telehealth is associated with lower mortality and emergency admission rates (16).

A Nuffield Trust report and systematic review highlight that SMS appointment reminders have been shown to be effective in reducing rates of missed hospital appointments (12,17). However, a Scottish Randomised Control Trial showed that text message reminders sent to patients who repeatedly fail to attend primary care appointments may not significantly reduce non-attendance rates (18).

Use of online services

A systematic review demonstrated that certain groups show increased use of online access to electronic health records and other linked online services (11). The groups are:

- females
- people who are middle-aged or older
- people with much greater overall morbidity

Certain groups appear less likely to use digital service or to be potentially disadvantaged (3,11,19). These are:

- individuals with a disability (NHS England report)
- groups with no regular access to the internet such as the homeless, offenders, Gypsy, Traveller and Roma communities (NHS England report)
- people with low computer literacy (case study)
- some people in rural communities (NHS England report)
- adults over the age of 65 years living alone (NHS England report)

- people of non-white ethnicities (systematic review)
- people from lower socioeconomic groups (systematic review)

A case study in an Australian primary care clinic found reasons for the low adoption rates of an online appointment management system included (19):

- insufficient communication with patients
- lack of added value for patients who found the functionality of the system to be inadequate and were able to make phone calls instead
- removal of communication with receptionists which some patients valued
- "tradition and habit"

Evidence for methods of increasing uptake of online services comes from experience at 2 primary care clinics (one in USA and one in Australia), a Nuffield Trust report and evaluation work undertaken by AT Medics, an organisation that manages 32 practices across London, one of which has London's highest uptake and usage of online services. Evaluation indicates that the methods that have been effective in increasing online service uptake by patients in primary care (12,19 to 22) are:

- personalised communication from the Healthcare Professional to raise awareness. Endorsement by GPs and reassurance regarding safety of online services is particularly important
- actively showing patients how to use services (possibly in a patient's first language);
- demonstrating benefits of using online services clearly to patients
- online medical records may require additional resources to help patients understand what the record contains and how to interpret it and use it to aid self-management
- working with Patient Participation Groups to inspire other patients to use the service
- low complexity of the online system
- using multiple channels of digital communication such as SMS, email and the web
- provision of facilities, for example, kiosks, within practices for those with no internet access at home
- providing training to staff to remind patients that online services are available and offering them help with registration and initial usage
- a promotional video used during a face-to-face appointment resulted in significantly higher patient portal registrations and use of portal messaging

The patient perspective

There is clear evidence that many patients like online services and want to use them (23 to 25).

Online services are linked to an increase in convenience and satisfaction for patients (26). Advantages are being able to use the service out of hours and a reduction in waiting times (19).

There is evidence that the use of online services enhances access for certain groups, including individuals working full-time and those unable to take time off to see a GP (5,19).

Patient-reported experiences are generally all positive (11,20,27). For example, accessing medical records gives patients information and power – for example spotting errors with their medication and enabling them to be more autonomous with self-care with increased opportunities for prevention (11,20,26).

The clinician perspective

Clinician reported experiences of online services have been mixed. There are several concerns including workload (particularly patient access to full medical records and email), training, technology, confidentiality and governance (11, 12, 20, 28 to 31).

Comment – October 2018

This literature review was carried out between July and December 2017. Online services in general practice is a rapidly evolving area and a report detailing CQC inspections of companies offering online healthcare was published in March 2018 (32). Between November 2016 and July 2017, 35 providers of online healthcare were inspected and many of these were re-inspected in February 2018. Many providers have responded to concerns from the CQC and are making changes to improve safety of online services (33). However, as at February 2018, 43% of provider were not fully compliant with safety standards, with concerns including issues with information sharing, monitoring long-term conditions and inappropriate prescribing (32).

Overall evidence for the safety and benefit of online services is still awaited, together with evidence regarding whether these services will improve or worsen health inequalities (34).

Additionally, there has recently been a renewed focus on continuity within healthcare. The first systematic review investigating the association between continuity of care and mortality was published in 2018 and showed higher continuity of care to be associated with lower mortality rates (35).

As a GP wrote in a recent letter to the BMJ, "I urge policy makers at CCGs and NHS England… to strengthen the role of the named accountable GP… It may not be new and fancy. It is not vanguard nor blue sky. But we know it works."

2. Literature review search strategy

Searches were constructed with help from a Site and Research Engagement Librarian at the Health Services Library, University of Southampton.

Medline was searched on 18 July 2017. A comprehensive search (see appendix) returned more than 16,000 papers. Due to limited time, the Trip database was suggested as an alternative.

The Trip database was searched on 18 July 2017 for 'GP online appointments' and 623 records were returned.

One hundred and twenty-one relevant references were initially identified as relevant. Seventy-four of the 121 were ultimately selected for the study after further review.

Significant snowballing was then conducted from these references and from colleagues with knowledge of the subject area. The Cochrane Database and the World Health Organisation were also searched.

In total, 185 total references were included in the Endnote database folder.

3. Introduction

Recent national policy has focused on the provision of 7-day NHS services. The 2008 Extended Access schemes and, more recently, the 2013 Prime Minister's GP access fund have focused on increasing access by, for example, extending opening hours outside of normal working hours (5). Evidence from the 2016 annual patient survey indicated that 76% found their GP practice's opening hours satisfactory (47). Extending GP hours, however, could benefit patients who have difficulty taking time off work (5).

The bidding process for the Prime Minister's Access Fund commenced in 2013 for pioneer GP practices to pilot schemes to help improve access to general practice and develop innovative ways of providing services. 20 wave one pilots rolled out during 2014, and further funding was announced in 2014 for a second wave of 37 pilots. The key objectives of the national programme were:

- to provide additional hours of GP appointment time
- to improve patient and staff satisfaction with access to general practice
- to increase the range of contact modes

Other than extending GP opening hours, additional strategies to increase access to general practice have included the use of online and electronic tools/resources and enhancing telephony infrastructure. It is vital that new technologies are affective for the 15 million people with long term conditions who have been identified as 'high need,

high cost' patients (48). Continuity of care has also been shown to be associated with a lower level of secondary care admissions, particularly for heavy users of GP services; hence this is another consideration when increasing access to general practice (49). Relationship continuity between clinician and patient is also, in general, associated with lower costs and improved health outcomes for patients (50).

Digital services offer, amongst other benefits, opportunities to drive increased co-ordination and quality of healthcare, greater patient engagement and a reduction in ED attendances (25). With the cost of 2 emergency department visits being greater than a year's care in General Practice (47), the economic rationale is clear. Two of 6 key reasons for A&E attendances have been identified as limited access to primary care and convenience (51). It has been estimated that half to two-thirds of all consultations can be dealt with online, by email or by telephone (49,52) A key ambition of the Department of Health's Power of Information strategy (6) is the 'widespread use of modern technology to make health and care services more convenient, accessible and efficient'. The introduction of online consultations was a policy objective of the Prime Minister's GP access fund (5) supported by a £45 million national programme to stimulate uptake of online consultation systems (1). England has led the world in allowing patients online functionality such as accessing their medical record and booking appointments (29) and the aim in the UK, described by Jeremy Hunt in 2017, is for all records to be "digital, real time and interoperable by 2020" (20).

Three priority areas to achieve benefits for primary care through digital technology have been identified by The Nuffield Trust as sharing electronic health records, telehealth solutions (for example professional-to-professional and patient-to-professional) and patients tools such as online appointment booking and medical record access (53).

The purpose of this paper is to review current evidence for strategies designed to increase access to general practice to inform the work of the Surrey Heath CCG. The main focus of the report is the use of online services in general practice.

4. Surrey Heath CCG

Figure 1. Surrey Heath Clinical Commissioning Group (Surrey Heath CCG, 2017)
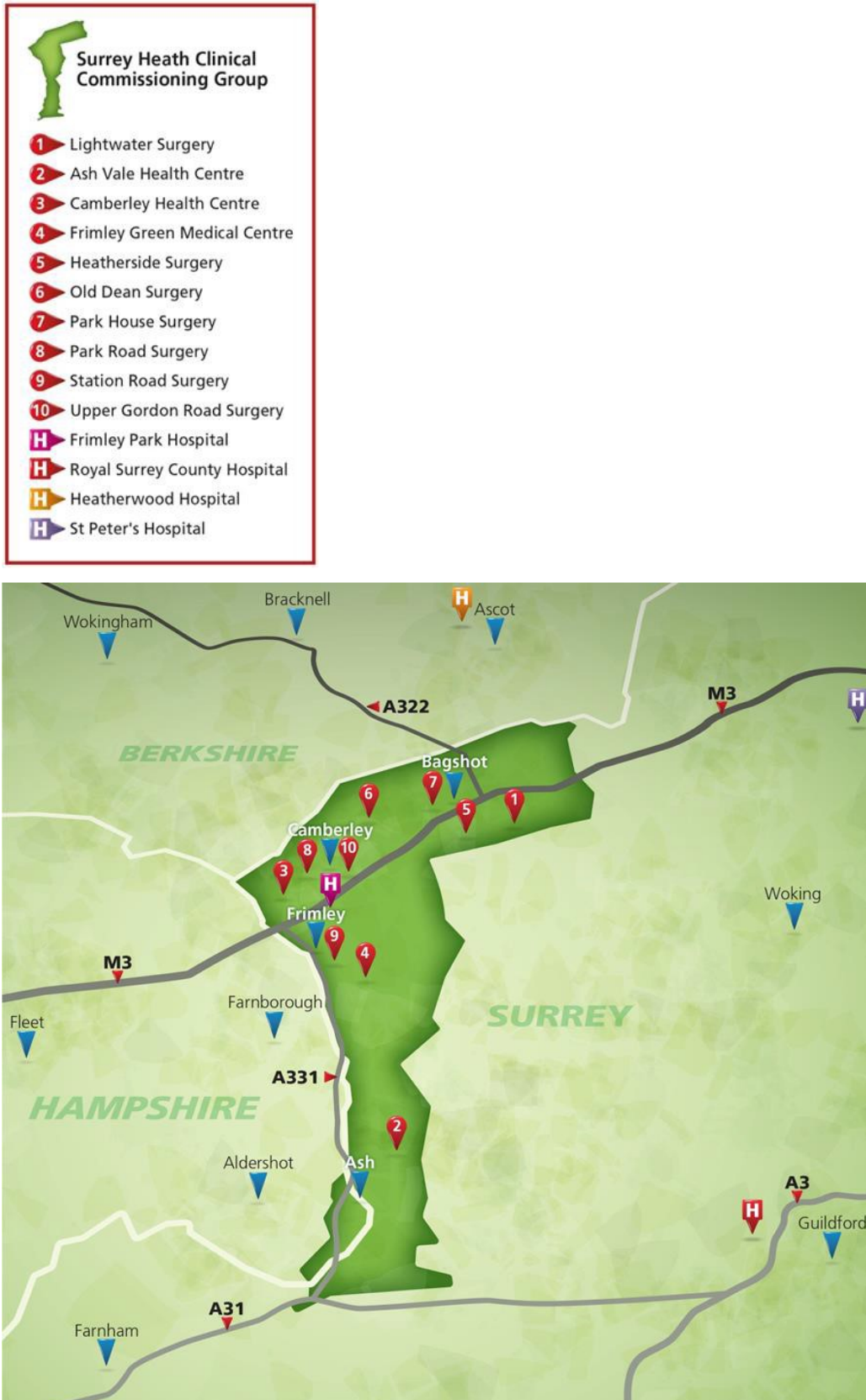
The Surrey Heath CCG population is around 95,000 with 8 GP practices (10 surgeries) within the CCG (7). Park Road Surgery incorporates Old Dean Surgery, and Frimley Green and Ash Vale are part of the Bartlett Group Practice. When inspected by the CQC in 2016 to 2017, the Park Road and Old Dean surgeries achieved an 'outstanding' rating and all others were rated as 'good' (7).

Surrey Heath is an affluent borough. The average life expectancy for women is 84 years and for men is 81 years, both significantly above the national average (7). However, small areas of deprivation do exist within the borough, for example, Old Dean where life expectancy has recently been falling (7).

Fifty-eight percent of the population are of working age (20 to 64 years old), with 24% aged 0 to 19 years and 18% aged over 65 years (7).

Improving use of technology and IT within General Practice is additionally a priority of Surrey Heath CCG's 2017 operational plan (54).

The percentage of patients enabled for general practice online services ranges from 11% to 24% and the percentage of patients enabled for access to medical records ranges from 0% to 21% (55).

A May 2017 Surrey Heath CCG Public Meeting survey indicated that 24% (7 of 29 respondents) always booked GP appointments online, 52% did so sometimes and 24% never booked appointments online. 92% (24 of 26 respondents) said that they would like to use the internet to access other GP online services, with 4% unsure and 4% saying no. Patients who answered yes to the previous questions were asked to rank in order of preference which online services they would use. The top 4 services ranked first by patients were booking and cancellation of appointments, order repeat prescriptions, consultation via video conferencing and viewing the GP record.

The range of online services currently available within Surrey Heath CCG are summarised below in Table 1.

Table 1 - Online services currently available in Surrey Heath CCG

Online Service number	Online Service description	BGP	Park House	Station Road	Park Road/ Old Dean	Upper Gordon Road	Camberley Health Centre	Lightwater	Heatherside
Type of online service									
1	Online access to DCR coded medical record	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Online access to pathology test results	Yes	No	No	Yes	Yes	Yes	Yes	Yes
3	Online prescription ordering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Online prescription cancellation	Not sure	No	Yes	Yes	No	No	Yes	Unclear answer
5	Online appointment booking – same day appointments	Yes	Yes	No	Yes	No	Yes	Yes	Yes
6	Online appointment cancellation – same day appointments	Yes	No	No	Yes	No	Yes	Yes	Yes
7	Online appointment booking – advanced appointments	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	Online appointment cancellation – advanced appointments	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Which clinics and health professionals can online appointments be booked with?									
9	GP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	Nurse	No	No	No	No	No	Yes - some	No	No
11	HCA	No	No	No	No	No	Yes	No	No
12	Physio	No	No	No	No	No	N/A	No	No
13	Midwife	No	No	No	No	No	No	No	No
Online Service number	Online Service description	BGP	Park House	Station Road	Park Road/ Old Dean	Upper Gordon Road	Camberley Health Centre	Lightwater	Heatherside
14	Health visitor	No	No	No	No	No	N/A	No	No
15	Travel clinic	No	No	No	No	No	No	No	No

16	Other (please list)	No	No	No	No	Yes - INR clinics	No	No	No
Electronic communication with practice									
17	Email	Partial	No	Yes	No	Yes	Yes - limited	No	Yes
18	SMS reminders	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
19	FaceTime	No	No	No	No	No	No	No	No
20	Skype	No	No	No	No	No	No	No	No
21	Other (please list)	No	No	No	No	No	No	Yes	No
Use of IT/online services to improve health and for self-management of conditions									
22	Telehealth	No	No	No	No	No	No	No	No
23	Online signposting to services	No	No	Yes	No	No	No	No	No
24	Use of health improvement information	No	No	Yes	No	No	No	No	No
25	Other (please provide details)	No	No	No	No	No	No	No	No

5. What are online services?

There is an ever-expanding array of digital services which are available for use in healthcare, both by patients and healthcare professionals.

Online services for patients and professionals include:

- online appointment booking
- online repeat prescription ordering
- online access to medical records, which may be one of 3 levels
- full record access (all coded information, free text, documents (third party and sensitive content excluded))
- detailed coded access (all coded information (third party and sensitive content excluded))
- summary information
- online patient networks (online location which brings together patients who have the same condition, to enable communication, support, resources sharing and so on)
- online service directories – online list of web sites/resources
- online information
- online access to clinical triage systems – an online system that signposts patients to the most appropriate care for their needs
- online audio or video meetings – connecting people in real time which allows virtual meetings, training and so on

New methods of communication include:

- web portals – websites that act as a gateway to an array of organised information; a login is required to see content
- SMS/routine secure text – short text messages between mobile devices
- e-consultations – a personal interaction between patient and clinician initiated by digital means (56)
- emails
- video conferencing – video-link between 2 or more people in different locations
- web chat – real-time transmission of online messages
- direct transmission of secondary care discharge summaries – hospitals send patient discharge summaries electronically to GPs
- 2-way communication between GPs and specialists – this may be email between GPs and consultants via a shared (generic) email address accessed by consultants on a rota basis
- teleconsultation is defined as "synchronous or asynchronous consultation using information and communication technology to omit geographical and functional distance" (57)
- telemedicine/teleconsultations – "telemedicine is the use of telecommunication and information technology to provide clinical health care from a distance" (58); this may be patients with clinicians (for example hard to reach patients) or clinicians with clinicians – "Telemedicine uses telecommunications technologies to support the delivery of all kinds of medical, diagnostic and treatment-related services usually by doctors" (59)
- telehealth ("the use of digital technologies to provide remote care") (60) "is similar to telemedicine but includes a wider variety of remote healthcare services beyond the doctor-patient relationship – it often involves services provided by nurses, pharmacists or social

workers, for example, who help with patient health education, social support and medication adherence, and troubleshooting health issues for patients and their caregivers"

- telecare – "Telecare generally refers to technology that allows consumers to stay safe and independent in their own homes" (59)
- telephone and telecoaching – telephone advice

New services available through technological advances include:

- apps (1,12,61) – an application or software programme which can be downloaded onto mobile devices
- wearables (12) – "Wearable technology, wearables, fashionable technology, wearable devices, tech togs, or fashion electronics are smart electronic devices (electronic device with micro-controllers) that can be incorporated into clothing or worn on the body as implants or accessories" (62)
- interactive symptom checkers (12) – online technology which uses algorithms to allow s patients to self-diagnose their symptoms and therefore is a means of triaging patients
- self-monitoring kiosks in practices (61), for example blood pressure monitoring in GP practice waiting rooms
- mHealth technology (63) – "mHealth (also written as m-health) is an abbreviation for mobile health, a term used for the practice of medicine and public health supported by mobile devices. The term is most commonly used in reference to using mobile communication devices, such as mobile phones, tablet computers and PDAs, and wearable devices such as smart watches, for health services, information, and data collection" (64)
- professional telemonitoring (12) – the monitoring of patients remotely using information technology
- computerised cognitive behaviour therapy (65) – CBT accessed via a patient's own computer usually with little/no direct support from a therapist

Possible future direction of travel

Looking to the future, a key aim for the NHS is the creation of the NHS.UK web site which will be a portal for online information, in addition to enabling to online appointment booking, ordering and paying for prescriptions online and to access health records (66,67). There are additionally plans for an online 111 triage service (67) and online booking and management of secondary care appointments (12).

Additional aims are to enable current A&E waiting times to be accessed online (12) and the introduction of the GP connect programme which will allow enhanced sharing of medical information across different locations as well as the ability for apps to interface with patient records (67).

An NHS app library providing app endorsements is also currently running in an early beta version (67).

6. Current usage of online services in general practice

For over 15 years, patients have been expressing an interest in the ability to receive appointment reminders, to book appointments online and for virtual visits (68). Some studies indicate that patients' interest in using these services has continued to rise, with 90% wishing to use online services and 80% wishing to view medical records (25).

However, a 2015 survey of GP practices indicated that this enthusiasm was not reciprocated (28). Only 6% of practices were already using email or electronic messaging and half of practices had no plan to use this. None were currently using internet video such as Skype or FaceTime and 86% had no plan to do so (28). Reasons given for not using email included concerns about a possibly deluge of emails with the potential that these would become lost or not actioned if a GP was on leave, along with issues of confidentiality and the risk of disadvantaging certain patient groups (28). 66% of practices were, nevertheless, already frequently using bookable telephone consultations.

Ninety-four percent of GP practices in England do now allow registered patients to have access to coded medical records, laboratory reports and medication (43). Some practices also allow access to free text records and to clinical letters such as those from hospitals (43). However, in 2017, despite 88% of the population using the internet (25), only 0.9% of patients had registered for record access and 16.4% had registered for online prescription ordering services (43). Interestingly, a study found that 80% of patients went online following a medical visit (69). Forum posts were the item most commonly accessed (91%), and the most common reason for doing so being "curiosity" (68%).

There is clearly a large "intention-behaviour" gap between the number of patients who express a desire to use digital healthcare services and the much lower number who actually do so (24). Indeed, a 2017 Surrey Heath CCG survey indicated that 92% of 26 patients surveyed indicated that they would like to use the internet to access other GP online services, yet only 24% were currently always booking GP appointments online (70).

Feedback from a 2009 UK study of both patients and staff indicated that lack of awareness of the system was a major reason for low usage and that the system required greater promotion, endorsement by GPs and analysis of usage by different patient groups to increase uptake (24).

Indeed, 29 months after introducing an e-appointment scheduling service in Australia, only 'innovators' (taken from Diffusion of Innovation Theory (71), the population group who typically take up new technologies first, 4% of patients in this study) were using it (19).This was thought to be due to a lack of communication about the service, lack of

added value for patients, patient's preference to talk to receptionists and patient characteristics such as limited internet literacy (19).

Dr Amir Hannan, a British GP who decided to open medical records to regain trust with patients when he took over from the practice formerly run by Dr Harold Shipman, recently commented that "the rate of uptake of the summary care record is down to doctors" (20). Indeed, a 2015 Forbes poll of 2300 UK and US doctors showed that only 34% of doctors felt that patients should always have access to their entire medical record (37).

Telemedicine (or remote healthcare) is a rapidly growing industry. Previously, visits where examinations were required increased risk for both patients and doctors. However, new telemedicine devices are now being developed which allow vital signs to be obtained in addition to clinical auscultation and inspection of tissues, ear canals and tonsils (72).

Private providers of online appointments are expanding. The CQC has responsibility for inspection of these services and has already raised concerns about safety (73). The CQC currently does not have authority to provide ratings for providers of digital healthcare but ensures that providers are registered and inspected (73).

There is additionally a concern that private providers will threaten the coordination of primary and secondary care (12) and in the US there is an ongoing battle between access, convenience and cost versus ensuring medical standards are maintained (74).

Finally, recent technological advances mean that over 165,000 health apps are now commercially available (12) and by 2018, it is anticipated that 50% of the 3.4 billion users of mobile phones and tablets will have downloaded an MHealth app (75). The issue of how apps are regulated and approved for use by the NHS is an evolving process (76) with a Beta site of the Digital Apps Library currently live and testing 2 apps with another having been approved (77).

Experiences of the use of online services from both the patient and clinician perspectives are given below:

Patient-reported experiences include:

- improved ability to reschedule appointments (78)
- improved convenience – access at any time from any location (78)
- reduced need for visits and phone calls (78)
- ability to check medications and manage prescriptions (78)
- greater satisfaction due to increased capacity for self-care (11); patient better able to express themselves in writing as opposed to verbally – increase in sharing of psychosocial information and to communicate about difficult topics (11)

- when using electronic communication, qualitative work has shown that trust is crucial between patient and doctor (27)
- saved time, phone call and clinic visits (11)
- patient wished to be able to annotate notes from a consultation (11)
- a small minority of patients expressed 'worry, harm or offence' from viewing their notes (1% to 8% of patients) (11)
- ability to raise issues of lower importance (27)
- ability to transfer responsibility of their issue to the doctor (27)
- having the time for reflection (27)
- ability to communicate with less formal language (27)

Clinician-reported experiences include:

- relationships were strengthened, trust was enhanced and decision making was improved by online access (11)
- email useful for answering non-urgent medical questions (11)
- protected time was required to answer emails (11)
- emails too lengthy (11)
- emails contained incomplete information (11)
- increased use of preventative services was seen by online users for example flu vaccine, mammography (11)
- doctors consistently have expressed concerns about patients accessing their records and a particular example of this is with patients with mental illness – clinicians may be concerned that patients viewing their notes will cause them distress; however, a useful strategy for clinicians is to describe behaviour and not to label, much like a radiologist will describe but not diagnose (patients' strengths can also be highlighted) – additionally, it was noted that many patients have an awareness of the impact of their illness and often their perceptions of themselves are worse than those of the clinicians (79)

7. Evidence for and against the use of online services in general practice

Table 1. Evidence base for online services

Online service	Evidence for	Strength of evidence	Evidence against	Strength of evidence
Overall	A 2015 systematic review (176 studies) found (11): • patients reported increased satisfaction and convenience • patients reported improved self-care • patients reported better communication/engagement with clinicians • patient-led safety improvements through increased use of preventive service and the identification of medication errors	High (systematic review)	"The overall impact of health-related digital technology on demand and health outcomes is not clear "(12)	High (narrative review)
	Certain groups show increased use of online access to electronic health records and other linked online services (11): • females • middle aged or older • much greater overall morbidity	High (systematic review)	Reduced access by non-white ethnicities and from lower socioeconomic groups (11)	High (systematic review)
	Increased patient convenience, engagement, autonomy and safety. Also reduced burden on reception services – RCGP report (31)	High (report with references to original research)	Access to online services led to a moderate increase in the use of email. Telephone use was stable and variable effects on face-to-face consultations (11)	High (systematic review)
Appointment booking and repeat prescription ordering	Can be linked with accessing medical records, ordering prescriptions and accessing results (3)	High (NHS England report)	"Online appointment booking may encourage uptake" (12)	High (narrative review)
	Patients given access to their medication list online corrected more than twice as many medication discrepancies with potential for severe harm (11)	High (systematic review)	Can be difficult to decide how many appointments are made available in order to link effectively with clinical triage (12)	High (narrative review)
	"Booking appointments and ordering repeat prescriptions online can improve patient experience" (12)	High (narrative review)		

Online service	Evidence for	Strength of evidence	Evidence against	Strength of evidence
	"Many assume online booking will also result in administrative efficiencies, but there is little evidence of this to date; in most places uptake is too low to have any discernible impact" (12)	High (narrative review)		
Access to test results	Online access to test results led to greater patient satisfaction compared to in person or by telephone (11)	High (systematic review)	Interpretation of blood results should be discussed with patients, as, for example, results outside the normal reference range may be worrying (80)	Low (KevinMD.com blog)
Access to medical records	A 2014 UK study found that record access led to a reduction in both appointments and phone calls equivalent to a cost saving per patient per year of £44.39. (40)	Medium (London Journal of Primary Care article)	11% of doctors reported increase time writing and editing notes (20)	Medium (BMJ feature)
	Two thirds of patient s felt more in control (20)	Medium (BMJ feature)	3-36% clinicians altered the contents of medical record content in response to patient access (11)	High (systematic review)
	99% of patients and 75% doctors reported that they wished to continue using OpenNotes after the trial (20)	Medium (BMJ feature)	0-21% reported needing extra time in writing notes (11)	High (systematic review)
	Patients had increased understanding of their conditions and who were more concordant with treatment (41)	Low (BMJ opinion piece)	Help may be required for patients to understand data in their medical record(43)	Low (response to BMJ article)
	Empowering patients with access to medical records has been shown to lead to better outcomes (41)	Low (BMJ opinion piece)	Characteristics associated with decreased use of online access to medical records and linked services (11): • Medicaid (v other commercial insurance) • African-American • Other non-white ethnicities • Females with lower socioeconomic classification	High (systematic review)
	Improves communication (11)	High (systematic review)	"Has the potential to increase GP visits, telephone encounters, A&E visits and hospitalisations. No robust evidence on	High (narrative review)

Online service	Evidence for	Strength of evidence	Evidence against	Strength of evidence
			its impact on health outcomes. There are also a number of governance concerns: • granting record access to vulnerable patients • the extent to which third-party information is shared Restricting access or redacting records takes considerable resource and a new business model is required" (12)	
	Impact on patient use of face-to-face services and telephone calls unclear (11)	High (systematic review)		
	Patient with type 2 diabetes were more likely to have their medication does changed when they have access to a web-based personal health record (81)	High (RCT)		
	Providing patients with health maintenance reminders via a personal health record may be effective in improving some elements of preventive care (39)	High (RCT)		
	An opportunity to support patients and highlight their achievements (42)	Medium (JAMA commentary)		
	Increased number of medication inaccuracies with potential for severe harm (11)	High (systematic review)		
	Increased medication adherence (11)	High (systematic review)		
	Characteristics associated with increased use of online access to medical records and linked services (11): females, middle age or older, increased morbidity	High (systematic review)		

Online service	Evidence for	Strength of evidence	Evidence against	Strength of evidence
	"Engages patients, often leading to improved communication, adherence to lifestyle advice and shared decision-making. It also tends to be highly valued by patients" (12)	High (narrative review)		
Patient networks	Patients Like Me® allows patients with similar diagnoses to compare treatments and share experiences and provides other members with a wealth of data (82)	Medium (Nuffield Trust blog based on a report)	No evidence identified	
Information	POWeR web-based programme with face-to face nurse support led to 5% sustained weight loss for 12 months (83)	Medium (NIHR study)	No evidence identified	
	Online information could lead to a reduction in use for non-urgent conditions and increased safety for urgent conditions (84)	Medium (BMJ article)		
	Computerised CBT for depression and anxiety in adolescents and young people has some evidence (85)	High (systematic and meta-review)		
	Evidence for internet self-managed CBT (86) and targeted hypertension management online spaced education for clinicians (87)	High (randomised, controlled proof-of-concept trial) and RCT		
	"Online information can help patients manage their condition and have more productive conversations with their health care team" (12)	High (narrative review)		
Access to clinical triage systems (e-consultations)	Online consultation systems could be developed to improve efficiency for staff and patients (14)	Medium (journal article)	Use in the UK is very low, particularly at weekends. Unless this is improved, impact on staff workload and patient waiting times is likely to be negligible (14)	Medium (journal article)

Online service	Evidence for	Strength of evidence	Evidence against	Strength of evidence
	E-consultations resolve '40-60%' of GP consultations without attendance (88)	Low (Pulse article)	Possible that the use of e-consultations increases primary care workload and costs(14)	Medium (journal article)
	GPs using the online consultation systems have said there is 'no doubt' that practices are more efficient after implementing e-consultations(88)	Low (Pulse article)	Median face-to-face appointment time resulting from an e-consultation tended to be longer than the national average (14)	Medium (journal article)
Audio and video meetings	"Video consultations are also generally well received by those that use them, but they tend to appeal to those who struggle to access their health care team in person. Various results showing they increase workload permanently or temporarily, or decrease workload. Much depends on the context and the type of patient" (12)	High (narrative review)	No evidence identified	

Table 2. Evidence base for communication channels

Communication channel	Evidence for	Strength of evidence	Evidence against	Strength of evidence
SMS/secure text	Appointment reminders improve patient follow up (89)	High (Cochrane Database Systematic Review)	A Scottish RCT published in 2007 showed no significant reduction in primary care DNA rates for repeat non-attenders using text appointment reminders (18)	High (RCT)
	"Text message reminders are a quick win" (12)	High (narrative review)		
	It is strongly recommended that electronic reminders are used to reduce outpatient DNA rates, improve medication adherence and facilitate behaviour change (90)	High (US National Guidance)		
	May be appropriate for adolescent parents (91)	Medium (journal article)		
E-consultations/ Online consultations	"Patient choice and experience is improved and may decrease DNA rate" (12)	High (narrative review)	Non-verbal cues cannot be assessed (3)	High (NHS England report)
	Offer discretion for example for sexual health and mental health advice (3)	High (NHS England report)	Not suitable for those with learning disabilities (3)	High (NHS England report)
	Convenience, especially for those with reduced mobility (3)	High (NHS England report)	Excluded groups may not have regular access to computer or handheld devices (3)	High (NHS England report)
	Can help to improve health (3)	High (NHS England report)	Older people may not have access to or may not be able to utilise technology because of age related impairments (3)	High (NHS England report)
	Integrated appointment booking and patient record (3)	High (NHS England report)		
	May be appropriate for adolescent parents (91)	Medium (journal article)		
	Where patients type agendas into electronic medical records, both doctors and patient reported an improvement in communication (92)	Medium (journal article)		

Communication channel	Evidence for	Strength of evidence	Evidence against	Strength of evidence
	The biggest proportion of e-visits were requested by women (for themselves, children and parents) during core hours, most frequently on Mondays (93)	Medium (journal article)		
	40% of e-visits were resolved without a face-to-face visit (93)	Medium (journal article)		
	The 3 most common conditions for e-visits were sinusitis, depression and back pain (93)	Medium (journal article)		
	"Email consultations improve communication with professionals, save patients time and increase overall satisfaction" (12)	High (narrative review)		
Email	Associated with a reduction in office visits and a high level of patient satisfaction (US study) (23)	Medium (journal article)	Increased use of clinical services for patients with email and medical record access compared with group members who did not (96)	Medium (journal article)
	Use of a secure messaging system improved patient satisfaction with care (11)	High (systematic review)	Access to secure messaging in Norway resulted in a lower number of office visits but there was no reduction in telephone calls (97)	Medium (journal article)
	A triage email system promoted to patients resulted in an increase in e-mails but doctors' views of the use of email became more favourable (94)	High (RCT)	A triage email system promoted to patients resulted in an increase in e-mails but doctors' views of the use of email became more favourable (94)	High (RCT)
	Email content and tone were generally appropriate with medically focused content. Patients avoided urgent requests and issues of a sensitive nature (95)	High (systematic review)		
Web portals	Can be used to include a screening survey to identify chronic conditions (98)	Medium (journal article)	No evidence identified	
	Patients who use portals are higher users of internet generally – this is good because they are experienced with the technology, but they may also have higher functional expectations. Patient	Medium (journal article)		

Communication channel	Evidence for	Strength of evidence	Evidence against	Strength of evidence
	who enrolled and went on to use the portal were older, female, with higher levels of income or education, or were more likely to have a chronic disease (99)			
Telehealth	Telehealth for patients with long term conditions has been linked to decreased mortality rates and a reduction in both elective and emergency hospital admissions (100)	High (report referencing Cluster RCT)	No evidence identified	
	Telehealth has been used to provide reassurance to patients with cancer and to promote their independence (15)	High (Systematic Review and Thematic Synthesis)		
Telemedicine/ teleconsultations	A Systematic Review and Thematic Synthesis showed that Telehealth interventions ("personalized care from a distance") can provide reassurance and independence for individuals living with cancer (15)	High (Systematic Review and Thematic Synthesis)	"Can lead to increased initial demand" (12)	High (narrative review)
	The Whole System Demonstrator cluster randomised trial also showed that telehealth is associated with lower mortality and emergency admission rates (16)	High (Cluster randomised trial)		
	Strong agreement between diagnosis and surgical management decisions made by paediatric ENT surgeons between face-to-face or by teleconference assessments (101)	Medium (journal article)		
	"There is little good quality evidence on clinical outcomes from remote consultations" (12)	High (narrative review)		
	"Should be offered to those who can benefit most" (12)	High (narrative review)		
	"Skype appointments are superior to telephone calls, usually quicker than face-to-face visits and provide flexibility for patients" (12)	High (narrative review)		
	A 2016 systematic review found that there is currently insufficient evidence to determine whether telephone or internet reviews for asthma reviews are a safe alternative to in-person consultations (102)	High (Cochrane Database Systematic Review)		

Communication channel	Evidence for	Strength of evidence	Evidence against	Strength of evidence
	Evidence in favour of the use of telemedicine to support the parents of high-risk newborn infants receiving intensive care is currently inconclusive (103)	High (Cochrane Database Systematic Review)		
	"Evidence is inconclusive for the use of remote consultations" (12)	High (narrative review)		
	The use of telepsychiatry for the treatment of depression in low-income Hispanic patients has shown good acceptability but possible issues regarding feasibility (104)	Medium (journal article)		
	A CPAP telemedicine-based education programme increased clinic attendance but did not improve adherence (105)	Medium (journal article)		
Telephone and telecoaching	A 2016 systematic review found that there is currently insufficient evidence to determine whether telephone or internet reviews for asthma reviews are a safe alternative to in-person consultations (102)	High (Cochrane Database Systematic Review)	No evidence identified	
Video conferencing	No evidence identified		No evidence identified	
Web chat	No evidence identified		No evidence identified	
Direct transmission of discharge summaries	No evidence identified		No evidence identified	
Online communities	"Where patients belong to a patient network, they often feel better socially supported and have improved behavioural and clinical outcomes. There are also positive results from targeted web-based interventions, particularly for mental and sexual health, but they must be effectively targeted to the appropriate audience to be successful"(12)	High (narrative review)	No evidence identified	
Two-way communication	Electronic Clinician-to-Clinician Advice Service (E-consultations) - Yorkshire and the Humber.	Medium (NHS networks)	No evidence identified	

Communication channel	Evidence for	Strength of evidence	Evidence against	Strength of evidence
between GPs and specialists	Enables primary care clinicians to seek advice from specialists in secondary care by sending an electronic message through a shared system. This allows more patient care to be managed in the primary care setting and can remove the need for outpatient appointments. The shared view of the patient record provides the secondary care clinician with information on interventions, tests and care planning and so on. The original pilot has highlighted significant benefit to patient care and as a result, a number of other specialties have now launched similar e-consultation services (106)			

Table 3. Evidence base for new technologies

New technologies	Evidence for	Strength of evidence	Evidence against	Strength of evidence
Apps	Digital technology allows patients to self-manage their health, as demonstrated by the effectiveness of a number of apps which have been evaluated (82)	Medium (Nuffield Trust blog based on a report)	Risk of long-term disengagement (82)	Medium (Nuffield Trust blog based on a report)
	May be appropriate for adolescent parents (91)	Medium (journal article)	Lack of apps targeted to a range of different conditions (82)	Medium (Nuffield Trust blog based on a report)
	"Emerging body of evidence suggesting that apps can have a positive impact on diet monitoring; physical activity; adherence to medication and chronic condition management, particularly for multiple sclerosis, Parkinson's disease and cardiovascular disease" (12)	High (narrative review)		
	"The efficacy of the majority of apps is unknown. More robust evidence on what works and in which contexts is required" (12)	High (narrative review)		
MHealth	Has been trialled for substance use disorders (63)	Medium (journal article)	No evidence identified	
Professional telemonitoring	Digitally mediated physician presence has been shown to be feasible for alcohol reduction (107)	High (RCT study)	No evidence identified	
Monitoring and wearable technology	"Some evidence that monitoring can improve people's diet, exercise and medication adherence, but sustained engagement can prove challenging and not all of the studies were positive in their findings. Professional monitoring interventions for chronic conditions, whereby data is sent to the health care team, have had very positive results on health outcomes and resource use" (12)	High (narrative review)	Not all of the studies had positive results(12)	High (narrative review)
Interactive symptom checkers	"Have the potential to reduce demand, although evidence of this is weak to date. At present, interactive symptom checkers are risk averse and may drive unnecessary demand to the health care system. Advancements in artificial intelligence mean there are opportunities to make them much more accurate. More research on how patients engage with these tools alongside rigorous testing	High (narrative review)	"At present, interactive symptom checkers are risk averse and may drive unnecessary demand to the health care system" (12)	High (narrative review)

	and evaluation of the technology itself is needed" (12)			
Self-monitoring kiosks	No evidence identified		No evidence identified	

8. The potential challenges with the use of online services in general practice

Support from GPs will be crucial to the widespread adoption of digital technologies. Interviews with Scottish GPs have revealed that GPs were prepared to consider using new technologies in their clinical practice, particularly for administrative or less complex tasks in order to increase practice efficiency and patient convenience (30).

However, research additionally indicates that GPs still have concerns which will need to be addressed (12). These are discussed below.

Increased workload

There are concerns amongst GPs that digital technologies will lead to an increased workload and are sceptical about the potential health benefits for patients (11,29). Indeed, there is evidence that access to online services can lead to variable effects on face-to-face consultations (11) and there is also no clear evidence currently that online services improve efficiency (12).

Doctors reported increase time writing and editing notes when patients have access to their medical record (11,20) and help may also be required for patients to understand data within the record (43).

Training

GPs highlighted training and IT support as key considerations when implementing new technologies (30) and the Royal College of GPs have echoed these concerns with the possible resulting increased workload (31).

Safety

Telemedicine is cheap. Online appointments, however, currently do not allow physical examinations, will miss non-verbal cues and may not be suitable for patients with learning disabilities (3). There is also concern regarding the use of telemedicine for children and in consultations where a detailed physical examination is required.

Additionally, in the US, a lack of records being sent from telemedicine consultations to primary care doctors has been identified (108).

Confidentiality

Confidentiality and information governance are, rightly, key concerns for patients (53,109). In one study, approximately one-third of patients accessing online medical records had concerns regarding privacy (44).

The Nuffield Trust recently highlighted a tension between the 2012 Health and Social Care Act which aims to have central management of personal information and the 1998 Data Protection Act which puts patients in control of their data and how it is used (12).

The GMC and medical indemnity bodies have expressed concerns regarding possible confidentiality issues and possible patient safety issues due to the lack of face-to-face contact (110,111). The GMC are currently developing further guidance regarding remote consultations (111).

Regulation and governance

Governance issues raised by digital technologies include:

- identity checks (31)
- third–party data, proxy issues and coercion (31,112)
- data custodianship and liability issues (109)
- medico-legal guidance when implementing new technologies (30)
- evaluation of new technologies (12)

Clear governance can provide support within the new and constantly developing digital environment (12). For example, a 2013 qualitative study looking at the use of email in General Practice identified the need to consider how a GP's responsibility can be upheld in the context of a new consultation method and that guidance from the BMA and RCGP was urgently required (113). Guidance on protecting electronic patient information does exist (114).

There are currently concerns regarding the regulation of MHealth technologies and whether they should be classified as medical devices. Evaluation of these interventions will also be challenging due to the short time-scales involved (60).

The NHS apps library is currently in a beta version and will approve apps in a 4 stage process. However, more evidence is needed for most apps and approvals will need to be effectively communicated (12).

Digital exclusion

It is vital that patients who are not online are not excluded from access to primary care (3, 12).

Groups who have been identified to be at risk of digital exclusion are (3):

- individuals with a disability
- groups with no regular access to the internet such as the homeless, offenders, Gypsy, Traveller and Roma communities
- some people in rural communities
- adults over the age of 65 years due to lack of skills and high costs

In a Polish study of the use of e-health services among patients over the age of 60 years, 87% had a chronic disease and 62% used a mobile phone, but only 22% of responders used the internet at least occasionally (115).

Additionally, in the US, reduced access to medical records was observed in patients with Medicaid insurance, African-Americans, other non-white ethnicities and in females from lower socioeconomic groups (11).

Patients as customers

Treating patients as customers is fraught with difficulties in the realm of healthcare. For example, doctors who prescribe antibiotics are given better reviews than those who do not, but the problem of inappropriate antibiotics prescriptions is a very serious one (116). Patients and doctors may also hold differing views on flexible access to physicians (109).

Technology

Technology issues may slow down the adoption of digital services. Issues such as outdated hardware and multiple providers of general practice software may cause complexity in implementation of digital initiatives. Primary and secondary systems also do not work together (53).

In the US, research has shown that poor communication between primary and specialist care may be improved by upgrading the single shared electronic medical records to allow for 'special cases'. However, collaboration and personal interaction is still highly valued at the interface between primary and specialist care (117).

9. Examples of UK innovative practice

Table 4. Example of UK innovative practice

Technology	Examples
Online appointment booking	Granta Medical Practices in Cambridgeshire - Patients can book appointments online up to 6 weeks in advance (118)
	'MyHealthcare' Birmingham – patients can book appointments online (1)
	AT Medics – limited company operating 24 practices, a walk-in centre, minor injuries unit and 2 urgent care centres (12) 100% of appointments are available to book online and 20% are done in this way which is far above the national average. Patients are constantly reminded of online services, demonstrations are available and tablets are located in waiting rooms (12)
	Peverell Park Surgery (12), 60% of appointments are available to book online. Same day cannot be booked online because it was found that half of appointments were booked by patients who did not need a same day appointment
	South Somerset Symphony – Integrated primary and acute care system. Uses the 'Patients Know best' web platform where care plans and escalation plans are accessible (53)
	Hulme Hall Medical Group (Manchester) – almost 50% of patients now carry out online transactions (46)
Online prescription ordering	'MyHealthcare' Birmingham – patients can book prescriptions online (1)
Online peer support networks	Online peer support networks (Patients Like Me®) (53)
	Big White Wall – online community for mental health problems – is available online and via an app – recovery rates of 58% (12, 45)
Electronic messaging	West Wakefield – GP federation with 6 GP practices. Video consultations and electronic messaging are due to be launched soon (3)
	AT Medics – 'Message my GP' secure message service (53)
	South Somerset Symphony – online messaging available (53)
	'Florence Simple Telehealth' text messaging system to monitor a range of conditions provided by Stoke-on-Trent CCG and Mediaburst Limited (61)
	Prime Minister's challenge evaluation - 5 pilots (265 practices) have developed texting services (119)
Electronic records	Haughton Thornley Medical Centres, Manchester – 50% patients have access to their records. Dedicated time during consultations, questionnaire with clinicians re common scenarios, signposting to educational resources Lab Tests Online for interpreting blood results and practices' web site. Any mistakes in notes have been corrected. The practice monitors who accesses and have targeted unengaged groups. Positive outcomes – enables patients to self-manage and allows patients to prepare for consultations. Records can be shared with other individuals such as those in secondary care (12)

Technology	Examples
	In Dumfries and Galloway hospital all paper records have been scanned and uploaded to electronic records (120). There is now no need to store or move paper records thus saving money (120). All new information is added in a paperless way such as by scanning or entering directly into the record (120)
	Manor House – Manchester – allow full access to medical records routinely – reduced calls and appointments (45)
	South Somerset Symphony – online test results (53)
	Street Lane Practice, Leeds - patients can access records, book appointments, order prescriptions and view results online. This has saved both the practice and patients time and money (46)
	Integrated Digital Care Record in Bradford and Airedale – reduced administration time and medication errors (46)
	Maldon Integrated Care Team in Mid-Essex use of Summary Care Record has improved medication safety and has made assessments more efficient (46)
	Hulme Hall Medical Group (Manchester) – jargon has been removed from medical records. Patients are more engaged with their care (46)
E-consultations	Electronic Clinician-to-Clinician Advice Service (E-consultations) - Yorkshire and the Humber. E-consultation service enables primary care clinicians to seek advice from specialists in secondary care by sending an electronic message through a shared system. This allows more patient care to be managed in the primary care setting and can remove the need for outpatient appointments. The shared view of the patient record provides the secondary care clinician with information on interventions, tests and care planning and so on. The original pilot in Bradford 's Chronic Kidney Disease Service has highlighted significant benefit to patient care and as a result, a number of other specialties have now launched similar e-consultation services (106)
	AskmyGP (12, 121) and WebGP e-consultation services (45, 121)
	Modality, Birmingham – group of GP practices with a 24/7 single point of access. On average 700 calls per day. 65% health concerns resolved without visiting a surgery. Skype consultations and e consulting is available (1), Single IT systems for each of 15 member practices. 72% reduction in DNAs. In future GPs may be able to offer consultations from home or other sites (53)
Technology	Examples
E-consultations	AT Medics – 'Message my GP' e-consultation service (53)
	Prime Minister's Challenge Fund evaluation (122): • Seven pilots introduced online patient diagnostic tools and/or e-consultation with mixed reception • Bristol 81% satisfied or very satisfied, 60% would otherwise have requested face-to-face consultation, 20% would have sought telephone discussion • Brighton and Hove and Southwark – GPs apprehensive about being inundated with e-consultations request • Care UK – identified limited appeal for e-consultations

Telecare	'MyHealthcare' Birmingham – patients can book video consultations (1)
Technology	**Examples**
Telecare	Dumfries and Galloway hospital also uses telecare for some diabetes consultations (120)
	West Wakefield – GP federation with 6 GP practices. video consultations and electronic messaging are due to be launched soon (3)
	Florence, or 'Flo', is a simple telehealth intervention originally developed within Stoke-on-Trent CCG. It works by patients monitoring their condition and texting readings directly to the Flo system. Protocols exist for a variety of conditions, including diabetes, COPD and respiratory failure (12)
	AT Medics – WebEx technology is used for training (12)
	Moss Side Health Centre – using Skype since 2013 – driven by one dedicated individual. Has been found to be very useful for patients with mobility problems or for parents of an autistic child and students who are not local (12)
	South Somerset Symphony - Skype services available (53)
	Prime Minister's Challenge Fund evaluation: 6 pilots have introduced video consultation tools with several challenges identified: intensive marketing required, lack of demand, issues with broadband in care homes (119)
	Babylon Health - GP at Hand launched in November 2017. Patients book appointments via an app and have a video consultation with an NHS GP. Users are required to leave their GP and must live within 40 minutes of one of 5 surgery catchment areas in London. Babylon's artificial intelligence (AI) system scored 81% in a Membership of the Royal College of General Practitioners (MRCGP) exam in 2018 (123)
	Hurley Group – eConsult. From a patient's own practice website, patients can use a symptom checker, self-help, signpost to pharmacy and 111 or other services relevant to their condition and send an eConsult to their own GP (124)
Triaging	West Wakefield - 'Pharmacy First' and 'Physio First' schemes. Care navigation app used to access the most appropriate care. Also initiatives for self-care (53)
	St Levan – GP Access - phone call from GP for all appointments. Practice has decided that clinically led triage is the best method to avoid unnecessary use of appointments (12)
Apps and online tools	Sense.Ly® – virtual nurse avatar (12)
	VitruCare – tailored online care management tool. Can be prescribed by a GP. Allows patients to be more autonomous and to work together with their GP to manage their health (53). Patient can send messages to their GP and other professionals can also be contacted. (53)
Digital technology enabled monitoring	Wearable vital signs monitor for patients in general wards and Accident and Emergency waiting areas at the Spire Health Montefiore Hospital, Brighton provided by Sensium Healthcare (61)
	Patient Self-Testing for patients on warfarin at County Durham and Darlington FT provided by Inhealthcare using Roche CoaguChek® X (61)

	Northampton General Hospital – use of electronic vital signs monitors led to a reduction in errors of 300%. Staff alerted as soon as vital signs deteriorate (46)
Technology	**Examples**
Telephone triage	A 2017 observational study of the "telephone first" approach found a 38% fall in face to face consultations, a 1204% rise in telephone consultations and an 8% mean rise in time spent consulting (13)
	A 2004 Cochrane review found that phone consultations reduce the number of doctor visits without increasing the number of A&E attendances. However, it also highlighted the need for 'further rigorous evaluation' (125)

10. Evidence of international innovative practice

Table 5. Example of international innovative practice

Technology	Examples
Online appointment booking	US - 2016 survey of 30000 patients and 600 physicians, 27% provided online appointments (126)
	US - most family physician web sites did not have a patient portal or allow online appointment booking (127)
	US – Kaiser Permanente (23) - patients can make and cancel appointments
Online prescription ordering	US – Kaiser Permanente (23) - patients can order prescription refills
Online peer support networks	No examples identified
Electronic messaging	US - 30% allowed communication by secure email (126)
	US – Kaiser Permanente (23) – patients can communicate with physicians using secure messaging. Messages and replies are automatically incorporated into the patient's electronic record
	US - Increased use of email in primary was not associated with increase efficiency of clinical care (94)
Electronic records	Sweden - The international leader for access to medical records with patients able to insert their own data/comments. Physicians were concerned that complete access might prove distressing to patients. A decrease in activity at the weekends was noted (20)
	US - OpenNotes study "two thirds of patients reported a better understanding of their health and medical conditions and that they were taking better care of themselves, doing better with taking their medications, and feeling more in control of their care"(46) For clinicians, only 3% spent more time answering patient questions outside visits and 11% spent more time writing or editing notes
	US - 50% of doctors allowed patients to see imaging and lab results (126)
	US - Commercial health plans encourage the use of some digital services such as electronic health records (128)
	US – Kaiser Permanente (23) – electronic health records used with the ability for proxy access
	US – Veterans Health Administration - Flexible electronic records could help facilitate communication between primary and secondary care (117)
	Australia - a PCEHR (personally controlled electronic health record) was introduced in 2012 This facilitates data sharing and enables patients to enter their own data via a 'consumer portal' (129)
E-consultations	US - Commercial health plans in the US encourage the use of online self-assessment and online personalised responses (128)

Technology	Examples
Telecare	US - Commercial health plans in the US encourage the use of online counselling (128)
Triaging	No examples identified
Apps and online tools	No examples identified
Digital technology enabled monitoring	No examples identified
Telephone triage	Southcentral Foundation in Alaska, "moved from 4-week waits to same-day appointments in primary care, halved A&E attendance, and dramatically reduced hospital referrals and admissions" through a system redesign focusing on telephone triage and same-day access (130)

11. Lessons learned to date

The Nuffield Trust report 'Delivering the benefits of digital health care' has identified 7 lessons for success (25) which are:

- transformation before technology
- culture change
- user-centred design
- investing in analytics
- iterations and continuous learning
- support interoperability
- strong information governance

A number of these lessons are borne out in several research studies. For example, a study looking at the attitudes of practice managers to digital technologies (131) found a wide variation in the attitudes of practice managers towards new technologies . The individual circumstances of the practice were a very important consideration. Practice managers are likely to have a critical role in the adoption of new technologies (131).

Additionally, the skills of individuals such as health coaches, public health nurses, practices' patient participation groups and volunteers could be used to advocate the initiative and encourage others to sign up (12,21,82). It has been shown that support from professionals leads to patients using self-care resources more effectively (12) and the use of a promotional video has been shown to increase patient portal registrations and use in the US (22). Incentives and training may be required to change attitudes and develop culture change with general practice (12).

User-centred design can be enhanced by using the ability the 'think like a patient' to fully appreciate the 'patient experience' in order to increase uptake of online services (21).

Continuous learning will include using data and patient feedback to sustain use (12). Further research is also required into the relationship between different appointment types (11).

Information governance issues, such as proxy access, need to be carefully considered. A US study sets out a structure whereby for children less than 13 years of age all medical information should be accessed by the parent with a re-registration process taking place at age 13 to discuss consent and confidentiality issues (112). However, in the UK, RCGP guidelines state that on a child's 11th birthday access for the parents will be automatically restricted so past appointments and clinical record cannot be seen (132).

Patient Online offers advice and support for practices, and recommends actions including (78):

- training staff
- having a practice champion for day-to-day enquiries
- reviewing how many appointments are available for online booking
- optimising appointment lengths
- considering adding specialist clinics online such as flu
- considering pilots when making changes
- being familiar with proxy access and coercion guidance
- promoting services to patients
- asking local organisations to help
- asking for feedback from patients
- monitoring the percentage of patients with access and breaking this down by demographics

12. References

1. NHS England. General Practice Forward View. 2016
2. National Audit Office. Improving patient access to general practice. Department of Health and NHS England; 2017
3. NHS England. Improving access for all: reducing inequalities in access to general practice services. 2017
4. Smith J, Holder H, Edwards N, Maybin J, Parker H, Rosen, R, Walsh, N. Securing the future of general practice. The Kings' Fund, Nuffield Trust; 2013
5. Cowling T, Harris M, Majeed A. Extended opening hours and patient experience of general practice in England: multilevel regression analysis of a national patient survey. British Medical Journal Quality and Safety 2017. 26(5): p. 360-371
6. Department of Health. The power of information: Putting all of us in control of the health and care information we need. 2012
7. Surrey Heath CCG. Annual Report and Accounts 2016 to 2017. 2017
8. Surrey Heath CCG. Primary Care Operating Plan 2017 to 2019. 2018
9. Healthwatch Surrey. GP online: Even better if...People's experiences of GP online services. 2017
10. Healthwatch Surrey. Get Online Week 2018. Increasing awareness of GP online services. 2018
11. Mold F, de Lusignan, Sheikh A, Majeed A., Wyatt J, Quinn T, Cavill M, Franco C, Chauhan U, Blakey H, Kataria N, Arvanitis T, Ellis B. Patients' online access to their electronic health records and linked online services: a systematic review in primary care. British Journal of General Practice 2015;65(632):e141-e51
12. Castle-Clarke S, Imison C. The digital patient: transforming primary care? Nuffield Trust; 2016
13. Newbould J, Abel G, Ball S, Corbett J, Elliott M, Exley J, Martin A, Saunders C, Wilson E, Winpenny E, Yang M, Roland M. Evaluation of telephone first approach to demand management in English general practice: observational study. British Medical Journal (Clinical research edition). 2017;358:j4197
14. Edwards HB, Marques E, Hollingworth W, Horwood J, Farr M, Bernard E, Salisbury C, Northstone K. Use of a primary care online consultation system, by whom, when and why: evaluation of a pilot observational study in 36 general practices in South West England. British Medical Journal Open. 2017;7(11):e016901
15. Cox A, Lucas G, Marcu A, Piano M, Grosvenor W, Mold F, Maguire R, Ream E. Cancer Survivors' Experience With Telehealth: A Systematic Review and Thematic Synthesis. J Journal of Medical Internet Research 2017;19(1):e11
16. Steventon A, Bardsley M, Billings J, Dixon J, Doll H, Hirani S, Cartwright M, Rixon L, Knapp M, Henderson C, Rogers A, Fitzpatrick R, Hendy J, Newman S. Effect of telehealth on use of secondary care and mortality: findings from the Whole System Demonstrator cluster randomised trial. British Medical Journal (Clinical research edition). 2012;344:e3874
17. Hasvold PE, Wootton R. Use of telephone and SMS reminders to improve attendance at hospital appointments: a systematic review. Journal of telemedicine and telecare. 2011;17(7):358-64
18. Fairhurst K, Sheikh A. Texting appointment reminders to repeated non-attenders in primary care: randomised controlled study. Quality and Safety in Health Care. 2008;17(5):373-6

19. Zhang X, Yu P, Yan J, Spil I. Using diffusion of innovation theory to understand the factors impacting patient acceptance and use of consumer e-health innovations: a case study in a primary care clinic. BioMed Central Health Services Research. 2015;15:71
20. Armstrong S. Patient access to health records: striving for the Swedish ideal. British Medical Journal (Clinical research edition). 2017;357:j2069
21. Tahir A. How 'thinking like a patient' helped us get our patients online. Nuffield Trust blog; 2016
22. North F, Hanna B, Crane S, Smith S, Tulledge-Scheitel S, Stroebel R. Patient portal doldrums: does an exam room promotional video during an office visit increase patient portal registrations and portal use? Journal of the American Medical Informatics Association : JAMIA. 2011;18 Suppl 1:i24-7
23. Baer D. Patient-physician e-mail communication: the kaiser permanente experience. Journal of oncology practice. 2011;7(4):230-3
24. Flynn D, Gregory P, Makki H, Gabbay M. Expectations and experiences of eHealth in primary care: a qualitative practice-based investigation. International Journal of Medical Informatics. 2009;78(9):588-604
25. Imison C, Castle-Clarke S, Watson R, Edwards N. Delivering the benefits of digital health care – research summary. Nuffield Trust; 2016
26. de Lusignan S, Mold F, Sheikh A, Majeed A, Wyatt J, Quinn T, Cavill M, Gronlund T, Franco C, Chauhan U, Blakey H, Kataria N, Barker F, Ellis B, Koczan P, Arvanitis T, McCarthy M, Jones S, Rafi I.. Patients' online access to their electronic health records and linked online services: a systematic interpretative review. British Medical Journal Open. 2014;4(9):e006021
27. Andreassen H, Trondsen M, Kummervold P, Gammon D, Hjortdahl P. Patients who use e-mediated communication with their doctor: new constructions of trust in the patient-doctor relationship. Qualitative health research. 2006;16(2):238-48
28. Brant H, Atherton H, Ziebland S, McKinstry B, Campbell J, Salisbury C. Using alternatives to face-to-face consultations: a survey of prevalence and attitudes in general practice. The British journal of general practice : the journal of the Royal College of General Practitioners. 2016;66(648):e460-6
29. Darzi A. Ara Darzi: Workload fears over online patient records. The British Medical Journal Blog; 2016
30. Hanna L, May C, Fairhurst K. The place of information and communication technology-mediated consultations in primary care: GPs' perspectives. Family Practice. 2012;29(3):361-6
31. Royal College of General Practitioners. Online services: an overview of online access. 2015.
32. Care Quality Commission. The state of care in independent online primary health services. Findings from CQC's programme of comprehensive inspections in England. Care Quality Commission; 2018
33. Renaud-Komiya N. How online GP services are tackling safety concerns. British Medical Journal (Clinical research edition). 2018;362:k3058
34. McCartney M. Margaret McCartney: Health technology and the modern inverse care law. British Medical Journal (Clinical research edition). 2018;362:k3118
35. Pereira Gray D, Sidaway-Lee K, White E, Thorne A, Evans P. Continuity of care with doctors-a matter of life and death? A systematic review of continuity of care and mortality. British Medical Journal Open. 2018;8(6):e021161
36. Sayers L. Policy makers need to strengthen continuity of care. British Medical Journal (Clinical research edition). 2017;356:j1133

37. Open Notes. Forbes: New Poll Shows Two–Thirds Of Doctors Reluctant To Share Health Data With Patients. 2015

38. Grant R, Wald J, Schnipper J, Gandhi T, Poon E, Orav E, Williams D, Volk L, Middleton B. Practice-linked online personal health records for type 2 diabetes mellitus: a randomized controlled trial. Archives of Internal Medicine. 2008;168(16):1776-82

39. Wright A, Poon E, Wald J, Feblowitz J, Pang J, Schnipper J, Grant R, Gandhi T, Volk L, Bloom A, Williams D, Gardner K, Epstein M, Nelson L, Businger A, Li Q, Bates D, Middleton B. Randomized controlled trial of health maintenance reminders provided directly to patients through an electronic PHR. Journal of General Internal Medicine. 2012;27(1):85-92.

40. Fitton C, Fitton R, Hannan A, Fisher B, Morgan L, Halsall D. The impact of patient record access on appointments and telephone calls in two English general practices: a population-based study. London Journal of Primary Care (Abingdon). 2014;6(1):8-15

41. Batte J. Jemma Batte: The positive power of transparency. The British Medical Journal Blog; 2017

42. Klein J, Jackson S, Bell S, Anselmo M, Walker J, Delbanco T, Elmore J. Your Patient Is Now Reading Your Note: Opportunities, Problems, and Prospects. The American journal of medicine. 2016;129(10):1018-21.

43. Sullivan R. Reply to "100% access to records: if Sweden can do it for patients why can't we". British Medical Journal [Internet]. 2017

44. Vodicka E, Mejilla R, Leveille S, Ralston J, Darer J, Delbanco T, Walker J, Elmore J. Online access to doctors' notes: patient concerns about privacy. Journal of Medical Internet Research. 2013;15(9):e208

45. Clay H, Stern R. Making Time In General Practice. Primary Care Foundation, NHS Alliance; 2015

46. National Information Board. National Information Board Annual Report 2016. National Information Board; 2016

47. Marshall M. Seven day access to routine care in general practice. British Medical Journal (Clinical research edition). 2017;357:j2142

48. Coulter A. What can e-health do for patients? Nuffield Trust blog; 2016

49. Barker I, Steventon A, Deeny S. Association between continuity of care in general practice and hospital admissions for ambulatory care sensitive conditions: cross sectional study of routinely collected, person level data. British Medical Journal (Clinical research edition). 2017;356:j84

50. Freeman G, Hughes J. Continuity of care and the patient experience. The King's Fund; 2010

51. Coster J, Turner J, Bradbury D, Cantrell A. Why do people choose Emergency and Urgent care services? A rapid review utilizing a systematic literature search and narrative synthesis. Academic Emergency Medicine. 2017

52. Smith R. Richard Smith: Time for GPs to be leaders not victims. The British Medical Journal Blog; 2015

53. Castle-Clarke S, Kumpunen S, Machaqueiro S, Curry N, Imison C. Digital requirements for new primary care models: a briefing for clinicians and managers. Nuffield Trust; 2016

54. Surrey Heath Clinical Commissioning Group. Delivering the Forward View. Planning for 2017-2019. Operational Plan. 2016

55. NHS Digital. Patient Online Management Information (POMI), 2017 to 2018. 2017

56. GPAccess. So what is an e-consultation? 2018

57. Deldar K, Bahaadinbeigy, K, Seyed Mahmood, T. Teleconsultation and Clinical Decision Making: a Systematic Review. Acta Informatica Medica. 2016;24(4):286-92

58. Wikipedia. Telemedicine. 2018

59. Federal Communications Commission. Telehealth, Telemedicine and Telecare: What's What? 2018
60. University of Birmingham. New and emerging mobile health interventions that promote behavioural change. NHS National Insitute for Health Research Horizon, Scanning Research and Intelligence Centre; 2015
61. NHS Commissioning Assembly. Technology Enabled Care Services. Resource for Commissioners. 2015
62. Wikipedia. Wearable technology. 2018
63. Mares M-L, Gustafson D, Glass J, Quanbeck A, McDowell H, McTavish F, Atwood A, Marsch L, Thomas C, Shah D, Brown R, Isham A, Nealon M, Ward, V. Implementing an mHealth system for substance use disorders in primary care: a mixed methods study of clinicians' initial expectations and first year experiences. Medical Informatics and Decision Making. 2016;16(1):126
64. Wikipedia. mHealth. 2018
65. Salisbury C, O'Cathain A, Edwards L, Thomas C, Gaunt D, Hollinghurst S, Nicholl J, Large S, Yardley L, Lewis G, Foster A, Garner K, Horspool K, Man M, Rogers A, Pope C, Dixon P, Montgomery A. Effectiveness of an integrated telehealth service for patients with depression: a pragmatic randomised controlled trial of a complex intervention. The Lancet Psychiatry. 2016;3(6):515-25
66. Higgott J. Will NHS.UK be the next GOV.UK? King's Fund blog; 2015
67. Honeyman M. Wachter watch: where next for the NHS's digital strategy? King's Fund blog; 2016
68. Grover F Jr, Wu H, Blanford C, Holcomb S, Tidler D. Computer-using patients want Internet services from family physicians. The Journal of family practice. 2002;51(6):570-2
69. Li N, Orrange S, Kravitz R, Bell R. Reasons for and predictors of patients' online health information seeking following a medical appointment. Family Practice. 2014;31(5):550
70. Surrey Heath CCG. Surrey Heath Public Meeting. Shaping the Future of Local Health and Social Care Services in Surrey Heath. 2017.
71. Rogers E. Diffusion of Innovations. New York: Free Press; 1983
72. Qamar S. The $30 billion telemedicine industry: What's missing? KevinMD blog; 2015
73. Care Quality Commission. Clarification of regulatory methodology: PMS digital healthcare providers. 2017
74. Reidbord S. The tension between traditional medical values and expanding commercialism is real. KevinMD blog; 2015
75. Dufour B. Health Technology Update – Issue 17. Canadian Agency for Drugs and Technologies in Health; 2016
76. Imison C, Castle-Clarke S, Watson R, Edwards N. Delivering the benefits of digital health care. Nuffield Trust; 2016
77. NHS. NHS Apps Library. 2017
78. NHS England. Patient Online: Making the most of online appointments and repeat prescriptions. 2015
79. Kahn MW, Bell SK, Walker J, Delbanco T. A piece of my mind. Let's show patients their mental health records. Jama. 2014;311(13):1291-2
80. Ejnes Y. Why physicians need to interpret your lab results. KevinMD blog; 2016
81. Grant R, Wald J, Schnipper J, Gandhi T, Poon E, Orav E, Williams D, Volk L, Middleton B. Practice-linked online personal health records for type 2 diabetes mellitus: a randomized controlled trial. Archives of internal medicine. 2008;168(16):1776
82. Castle-Clarke S. Is patient technology just what the doctor ordered? Nuffield Trust blog; 2016

83. National Institute for Health Research (NIHR). A supported web-based programme helps people lose weight in the short term. NIHR Dissemination Centre; 2017
84. Giesen M-J, Keizer E, Julia van de Pol J, Knoben J, Wensing M, Giesen P. The impact of demand management strategies on parents' decision-making for out-of-hours primary care: findings from a survey in The Netherlands. British Medical Journal open. 2017;7(5):014605
85. Hollis C, Falconer CJ, Martin JL, Whittington C, Stockton S, Glazebrook C, Davies B. Annual Research Review: Digital health interventions for children and young people with mental health problems – a systematic and meta-review. Journal of child psychology and psychiatry, and allied disciplines. 2017;58(4):474-503
86. Litz B, Engel C, Bryant R, Papa A. A randomized, controlled proof-of-concept trial of an Internet-based, therapist-assisted self-management treatment for posttraumatic stress disorder. The American journal of psychiatry. 2007;164(11):1676-83
87. Kerfoot B, Turchin A, Breydo E, Gagnon D, Conlin P. An online spaced-education game among clinicians improves their patients' time to blood pressure control: a randomized controlled trial. Circulation Cardiovascular quality and outcomes. 2014;7(3):468-74
88. Wickware C. E-consultations resolve '40-60%' of GP consultations without attendance. 2018
89. Fahey T, Schroeder K, Ebrahim S. Interventions used to improve control of blood pressure in patients with hypertension. The Cochrane database of systematic reviews; 2006(4):Cd005182
90. National Guideline Clearinghouse. Guideline Summary: Best evidence statement (BESt). Electronic reminders to address adherence. [Cincinnati Children's Hospital Medical Center]. National Guideline Clearinghouse; 2012
91. Thompson G. Meeting the needs of adolescent parents and their children. Canadian Paediatric Society; 2016
92. Anderson M, Jackson S, Oster N, Peacock S, Walker J, Chen G, Elmore J. Patients Typing Their Own Visit Agendas Into an Electronic Medical Record: Pilot in a Safety-Net Clinic. Annals of family medicine. 2017;15(2):158-61
93. Adamson S, Bachman J. Pilot Study of Providing Online Care in a Primary Care Setting. Mayo Clinic Proceedings. 2010;85(8):704
94. Katz S, Moyer C, Cox D, Stern D. Effect of a triage-based E-mail system on clinic resource use and patient and physician satisfaction in primary care: a randomized controlled trial. Journal of General Internal Medicine. 2003;18(9):736-44
95. Ye J, Rust G, Fry-Johnson Y, Strothers H. E-mail in patient-provider communication: a systematic review. Patient education and counseling. 2010;80(2):266-73
96. Palen T, Ross C, Powers J, Xu S. Association of online patient access to clinicians and medical records with use of clinical services. Jama. 2012;308(19):2012-9
97. Bergmo T, Kummervold P, Gammon D, Dahl L. Electronic patient-provider communication: will it offset office visits and telephone consultations in primary care? International journal of medical informatics. 2005;74(9):705
98. Leveille S, Huang A, Tsai S, Weingart S, Iezzoni L. Screening for chronic conditions using a patient internet portal: recruitment for an internet-based primary care intervention. Journal of General Internal Medicine. 2008;23(4):472
99. Wakefield D, Kruse R, Wakefield B, Koopman R, Keplinger L, Canfield S, Mehr D. Consistency of Patient Preferences About a Secure Internet-Based Patient Communications Portal: Contemplating, Enrolling, and Using. American Journal of Medical Quality. 2012;27(6):494
100. Coventry City Council. Annual Report of the Director of Public Health. 2014

101. Smith A, Dowthwaite S, Agnew J, Wootton R. Concordance between real-time telemedicine assessments and face-to-face consultations in paediatric otolaryngology. Medical Journal of Australia. 2008;188(8):457

102. Kew K, Cates C. Remote versus face-to-face check-ups for asthma. The Cochrane database of systematic reviews. 2016;4:Cd011715

103. Tan K, Lai N. Telemedicine for the support of parents of high-risk newborn infants. The Cochrane database of systematic reviews. 2012(6):Cd006818

104. Chong J, Moreno F. Feasibility and acceptability of clinic-based telepsychiatry for low-income Hispanic primary care patients. Telemedicine journal and e-health : the official journal of the American Telemedicine Association. 2012;18(4):297

105. Hwang D, Chang J, Benjafield A, Crocker M, Kelly C, Becker K, Kim J, Woodrum R, Liang J Derose S. Effect of Telemedicine Education and Telemonitoring on CPAP Adherence: The Tele-OSA Randomized Trial. American journal of respiratory and critical care medicine. 2017

106. nhsnetworks. E-Consultations (NHS Yorkshire and the Humber). 2018

107. Lygidakis C, Wallace P, Tersar C, Marcatto F, Ferrante D, Della Vedova R, Scafuri F, Scafato E, Struzzo P. Risky Drinkers and the Web: a RCT Study in Region Friuli-Venezia Giulia. Clinical Trials. 2012

108. Benaroch R. Telemedicine: What could go wrong? A lot. KevinMD blog; 2016

109. Beard L, Schein R, Morra D, Wilson K, Keelan J. The challenges in making electronic health records accessible to patients. Journal of the American Medical Informatics Association: JAMIA. 2012;19(1):116-20

110. Tidy C, Kavanagh S. Email Consultations in Healthcare. Mentor; 2008

111. General Medical Council (GMC). Good Medical Practice. General Medical Council; 2017

112. Bourgeois F, Taylor P, Emans S, Nigrin D, Mandl K. Whose personal control? Creating private, personally controlled health records for pediatric and adolescent patients. Journal of the American Medical Informatics Association: JAMIA. 2008;15(6):737-43

113. Atherton H, Pappas Y, Heneghan C, Murray E. Experiences of using email for general practice consultations: a qualitative study. The British journal of general practice: the journal of the Royal College of General Practitioners. 2013;63(616):e760-7

114. British Medical Association / NHS Connecting for Health. Joint guidance on protecting electronic patient information. Publication 1083. 2008

115. Bujnowska-Fedak M, Pirogowicz I. Support for e-Health Services Among Elderly Primary Care Patients. Telemedicine Journal and e-Health. 2014;20(8):696

116. Feke T. This is why patients cannot be customers. KevinMD blog; 2016

117. Zuchowski J, Rose D, Hamilton A, Stockdale S, Meredith L, Yano E, Rubenstein L, Cordasco K. Challenges in Referral Communication Between VHA Primary Care and Specialty Care. Journal of General Internal Medicine. 2014;30(3):305

118. Smith R. Richard Smith: Where general practice is flourishing. The British Medical Journal Blog; 2017

119. SQW / Mott MacDonald. Prime Minister's Challenge Fund: Improving Access to General Practice First Evaluation Report: October 2015. 2015

120. Smith R. Richard Smith: Dumfries and Galloway NHS 9: Information technology – from black hole to the best in Scotland. The British Medical Journal Blog; 2017

121. GP Access Ltd. Comparing webGP and askmyGP

122. SQW / Mott MacDonald. Prime Minister's Challenge Fund: Improving Access to General Practice Second Evaluation Report to September 2015. 2015

123. Babylon. GP at hand. 2018

124. Hurley Group. eConsult. 2018   .

125. Bunn F, Byrne G, Kendall S. Telephone consultation and triage: effects on health care use and patient satisfaction. Cochrane Database of Systematic Reviews. 2004(3)
126. Pearl R. Until the gap between doctors and patients is fixed, the nation will suffer. KevinMD blog; 2016
127. Alpert J. Evaluating the Content of Family Physician Websites in the United States. Journal for Healthcare Quality. 2014;37(5):311
128. Quinn A, Reif S, Evans B, Creedon T, Stewart M, Garnick D, Horgan C. How health plans promote health IT to improve behavioral health care. American Journal Of Managed Care. 2016;22(12):810
129. Pearce C, Bainbridge M. A personally controlled electronic health record for Australia. Journal of the American Medical Informatics Association : JAMIA. 2014;21(4):707-13
130. Collins B. NHS vanguards: redesigning the aeroplane in flight. King's Fund blog; 2015
131. Hanna L, May C, Fairhurst K. Non-face-to-face consultations and communications in primary care: the role and perspective of general practice managers in Scotland. Informatics in Primary Care. 2011;19(1):17-24
132. Royal College of General Practitioners. Online services: Proxy Access on behalf of Children and Young People. Guidance for general practice. 2015

13. Appendix

Medline detailed search strategy 18 July 2017

		Results
1	exp Telemedicine/	21990
2	exp Internet/	67152
3	exp electronic health records/ or exp medical records systems, computerized/	34067
4	(online or telehealth or telemedicine or portal or electronic or techno* or mobile).tw.	760183
5	1 or 2 or 3 or 4	826833
6	exp General Practice/	71565
7	Primary Health Care/	66517
8	(primary care or general prac* or GP).tw.	182160
9	6 or 7 or 8	242861
10	5 and 9	16559
11	1 or 2	85957
12	9 and 11	3421
13	exp "Appointments and Schedules"/	18008
14	exp Prescriptions/	30851
15	exp Medical Records/	132407
16	13 or 14 or 15	179332
17	11 and 16	4405
18	exp Patients/	55884
19	exp Patient Satisfaction/	77385
20	18 or 19	131229
21	11 and 20	3012
22	mold f.au.	17
23	21 and 22	1
24	12 and 22	1
25	10 and 22	4
26	limit 25 to (english language and yr="1945 - 2017")	4
27	limit 21 to (english language and yr="2017")	137
28	limit 21 to (english language and yr="1946 - 2017")	2874

Trip database search strategy 18 July 2017

The Trip database was searched on 18.07.2017 for 'GP online appointments' and 623 records were returned.

121 relevant references were initially identified as relevant. 74 of the 121 were ultimately selected for the study after further review.

Snowballing and colleague recommendations identified further references.

In total, 168 total references were included in my December 2017 Endnote database folder.

Ten further references identified through general reading were added in October and November 2018.