Implementation of a web-based asynchronous consultation service in a hospital in Northeast Scotland: a multi-method multi-lens assessment

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Abstract

Background: Asynchronous outpatient patient-to-provider communication is becoming widespread in UK healthcare. It has mostly been tested in primary care but is increasingly used in secondary care outpatient services. During the pandemic, Aberdeen Royal Infirmary in Scotland expanded its outpatient asynchronous consultation system from dermatology to gastroenterology and pain management.

Objective: We conducted a multi-method study between April 2021 to July 2022 including staff, patient, and public perspectives and quantitative data from the NHS to obtain a rounded picture of innovation as it happened.

Methods: Three online and one face-to-face focus groups (n=22) on public readiness for the new service and 14 semi-structured interviews with staff on service design and delivery were conducted. The new service's effects were examined using NHS data on service usage, a patient satisfaction survey (n=66), and six follow-up semi-structured interviews. Satisfaction survey responses were analyzed descriptively. Service users' demographics, acceptability across specialties, non-attendance rates, and appointment outcomes were compared. The Scottish Index of Multiple Deprivation was used to measure health inequality. Individual interviews and focus group transcripts were thematically analyzed.

Results: Staff anticipated a simple technical system transfer from dermatology to other receptive medical specialties, but despite a favourable setting and organizational assistance, it has been complicated. Key implementation difficulties comprised technical integration delays caused by the pandemic, misalignment with existing administrative processes, and a lack of continuity in project management. The pain management clinic started offering asynchronous consultations (known as 'digital appointments') in December 2021, and the gastrointestinal followed suit shortly thereafter in February 2022. Staff rapidly learned how to explain and utilize this new service. It was thought to function better for pain management since it fitted pre-existing practices. From February through July 2022, dermatology (adult and pediatric), gastrointestinal, and pain management offered 1709 appointments to a range of people (totaling n=1417). Asynchronous consultations reduced travel by an estimated 44,712 miles compared to face-to-face mode. The deprivation profile of people who opted into the digital appointment service was very similar to that in the Grampian region, people living in the least deprived areas were most likely to not attend (?2 = 19.3, $p < 0.001$), according to NHS data analysis. People from all deprivation quintiles were equally likely to receive any of the possible four outcomes including treatment and open return (?2 = 13.6, $p > 0.05$). In the survey, only 18% (12 out of 66) of respondents were unhappy or very unhappy to be offered a digital appointment invitation. The benefits mentioned included better access, convenience, decreased travel and waiting time, information gathering/sharing, and clinical flexibility. Overall, patients, the public, and staff saw its potential as an NHS service but highlighted informed choice and flexibility, noting that it may not work for others, especially individuals with limited digital or writing abilities. Better communication - including the use of the term 'appointment' - may increase patient acceptance.

Conclusions: Asynchronous pain management and gastroenterology consultations are viable and acceptable. Transfer of this technology into new services is easiest when there is a limited disruption to existing administrative processes but regardless always needs significant and continuous support. This study can inform practical strategies for supporting staff in implementing asynchronous consultations (e.g., preparing for the process's non-linearity, and working around task issues). For potential patients, careful technical support and explanation are needed, as well as a choice of consultation routes, to ensure digital inclusion.

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Keywords: outpatient care; teleconsultation; asynchronous communication; implementation; mixed-methods research; qualitative research; hospital data

Introduction

In recent decades, healthcare organizations have adopted innovative remote patient-to-provider communication methods such as video, instant messaging, and email. The nature of the COVID-19 epidemic caused extraordinary growth in their use, which relieved health system strains by allowing patients to obtain primary and specialized care without an in-person appointment [1,2]. As these new forms of patient-to-provider communication are expected to become a part of delivering healthcare, valuable lessons can be learned from this accelerated uptake under emergency measures [3].

An asynchronous consultation, where healthcare staff and patients do not need to be available at the same time, is a potential alternative to synchronous (in real-time) methods such as traditional in-person meetings, phone calls, and video conferences. It has been widely tested in primary care [4-8] but is increasingly used in secondary care outpatient services, particularly for highly visible symptoms, such as dermatological problems [9,10] or epileptic seizures [11]. Typically, outpatient asynchronous approaches involve patients answering a number of specialty-specific questions about their health online at times to suit themselves usually within a window of about a week (response may include photographs or video footage). This completed form is then reviewed by the outpatient clinic and they can request further information over a similar time-period before deciding on the

most suitable outcome (e.g., investigations, treatments, face-to-face consultations, or outpatient discharge).

Asynchronous consultations provide a new healthcare model, unlike video conferencing. A systematic review found that outpatient asynchronous consultations may produce equivalent outcomes to in-person treatment and lower health care expenses for certain conditions [12]. The pandemic has increased the acceptability of remote consultations, but technical, educational, infrastructure, legal, and economic challenges must be solved for them to be sustainable and scalable beyond the pandemic [13]. Because of this, emphasis has been placed on determining the resources and approaches required to effectively implement the technology required to deliver asynchronous consultations (by assessing how they get adopted) and understanding their effects on staff and patients [3,12,14,15].

A nationwide case study by Wherton and colleagues (2021) [8] indicated that NHS boards in Scotland expanded video consultations before and after the epidemic. NHS Grampian board serves a population of nearly 600,000 in urban and remote and rural locations across a large geographic area. It also provides some specialist services to other boards in the North of Scotland including the island communities of Shetland and Orkney. Like other boards in Scotland, but to a greater extent, NHS Grampian substantially increased its use of video consultations [8]. The Department of Dermatology at Aberdeen Royal Infirmary introduced asynchronous appointments as part of a multi-board nationally led innovation project in May 2020. Due to the pandemic, the organization expanded this new service to the Gastroenterology and Pain Management clinics. The dermatology system provided a template and contextual insights for rolling out this new service. This study examined staff, patient, and public perspectives and NHS quantitative data to provide a complete picture of outpatient asynchronous consultation system adoption.

Methods

Study context

The list of parties involved in developing and implementing new pathways is shown in Table 1. The NHS Grampian team approached the Health Services Research Unit for help assessing this implementation's effects. An implementation researcher (MRD), an expert qualitative social science researcher (LL), a service improvement researcher (CR), NHS Grampian's Clinical Lead for Innovation (AK), a service evaluation lead (KM), and two public research partners knowledgeable in digital skills assistance (MM, AM) formed the study team. The lay partners participated in project conceptualization and all research stages as co-investigators (from design, through delivery to dissemination).

Table 1. A list of adopters of the newly implemented pathways (gastroenterology and pain management) of asynchronous consultations.

Stakeholders	Responsibilities
Asynchronous Coordinator	Supporting the admin process surrounding the onboarding of the patient and logging issues with the third-party supplier. Assisting with troubleshooting.
Clinical Leads	Defining pathway question sets associated with their specialty.
Clinic Coordinators	Booking patients into asynchronous consultations and may answer some onboarding queries (most likely done by the asynchronous coordinator, though).
Clinicians	Reviewing the information provided by the patient within the asynchronous consultations and issuing an outcome via the software to the patient.
eHealth	Involved in technical configuration of appt messaging/outcoming and onward delivery to appropriate NHS Grampian electronic patient records. Calls may also be logged on the IT Servicedesk, but these are mainly resolved by the third-party supplier, NSS or admin support teams involved in supporting the system within their departments.
Information Governance	Ensuring the project provides the appropriate assurances to enable an NHS Grampian data protection officer Caldicott guardian to approve required paperwork associated with the system.
IT Security	Ensuring the project provides the appropriate assurances to enable the IT Security officer to approve required paperwork associated with the system.

NSS/NES	Involved in technical configuration/delivery of messaging between NHS Grampian and third-party supplier systems and technical troubleshooting.
Outpatient Services Management	Overall responsibility for the patient information leaflets that give patients issues about the asynchronous consultations.
Project Team	Managing the product rollout within Pain and gastroenterology, coordinating all staff involved to ensure all prerequisites are in place to enable go live to proceed. Managing handover to business-as-usual teams.
Service Management (gastroenterology only)	Helping ensure the process is embedded within gastroenterology.
Storm ID	Supplier of the software, enhancing the software and troubleshooting issues.

NES: NHS Education for Scotland; NSS: National Services Scotland.

The asynchronous consultation system

This service is for routine appointments only. An outpatient team vets returning and/or new patients referred by primary care doctors to assess suitability for an asynchronous consultation (that NHS Grampian calls ‘digital appointments’). After reaching the top of the waiting list, a patient receives an information pamphlet explaining a digital appointment and a letter encouraging them to call the operational team to book. If the patient declines, the booking staff offer a synchronous alternative. An appointment is generated in TrakCare, a patient management system, which then triggers the invitation to the patient to register for the digital system. After registration, the patient gets a link to a web-based inquiry form (‘a web-based questionnaire’) with five days to complete before the scheduled date (Figure 1). Sample areas of questioning in the pain management pathway included: experience of pain, symptom descriptions and improvement level, adverse effects, pain medication, mood, ability to undertake normal work, sleep, enjoyment of life, and any other relevant experiences. Sample areas of questioning in the gastroenterology pathway included: description of symptoms, bowel movements and stool, experience of abdominal pain and bloating, weight loss, medication taken, ability to perform normal work and daily tasks, enjoyment of life, and concerns. Patients register, answer questions, check, and transmit. After analyzing information and maybe asking further questions through real-time messaging, a clinician determines whether to provide remote

advice and treatment, schedule a face-to-face visit, or discharge. The patient, outpatient clinical team, and general practitioner get a PDF appointment summary (via the NHS email address of a clinician system user), stored in a document repository (Skystore). Delivery is via Storm ID (third party), and Lenus is the platform used.

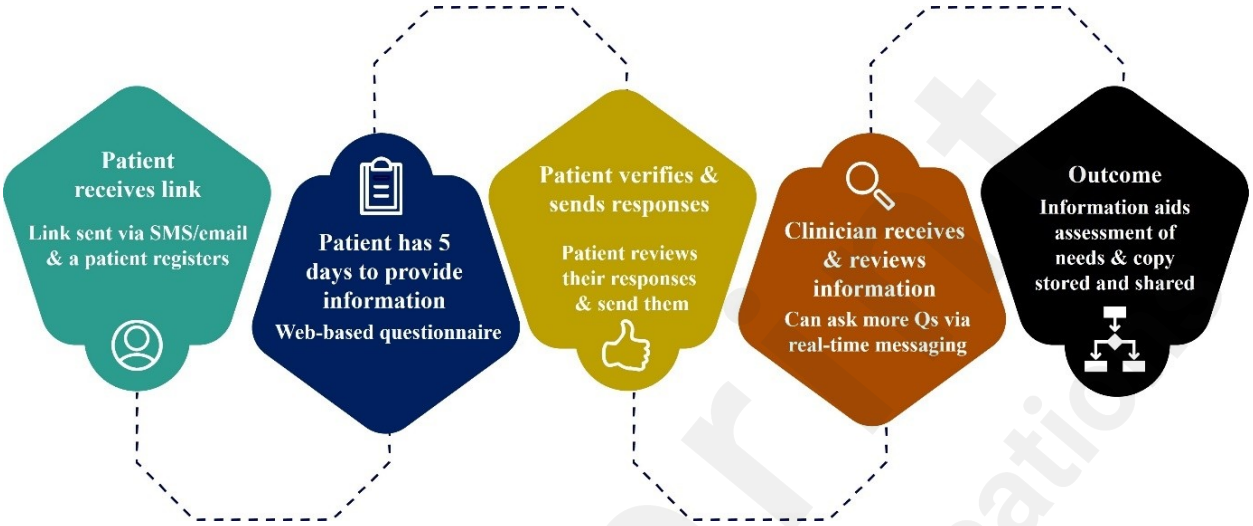

Figure 1. Asynchronous consultation process (in NHS Grampian known as ‘digital appointments’).

SMS: Short Message Service; Qs: questions

Study design

We deployed a multi-method study design with a multi-stage purposeful sampling strategy [16]. The study took place between April 2021 and July 2022 and included three online and one face-to-face public focus groups about public readiness for the new service; interviews with staff about their experiences with designing and implementing the service; and an assessment of service uptake through analysis of the service usage data collected between February and July 2022 and patient experience (including a patient satisfaction survey and follow-up patient interviews about their experiences with receiving the service).

The primary focus was on the newly implemented pathways - gastroenterology and pain management - while adult dermatology served effectively to provide context, helping to illustrate the

transferability from one medical specialty to another in a real-world scenario. Focus groups with members of the public and staff interviews covered all three specialties. The NHS Grampian data on service utilization covered four medical specialties: pain management, gastroenterology, adult and pediatric dermatology. The patient satisfaction survey, conducted by NHS Grampian, was confined by our ethical clearance to prospective evaluations of the newly implemented pathways, as dermatology was assessed independently. All participants in the satisfaction survey who were happy to be contacted by a researcher were eligible for the interviews.

Overall, the study was designed to answer six research questions:

1) How accepting and prepared is the public for asynchronous consultations?
2) What are clinical and administrative staff experiences of and attitudes towards asynchronous consultation in secondary care?
3) Is asynchronous consultation sustainable beyond the immediate context of COVID-19?
4) How do patients feel about the quality of asynchronous consultation and its effect on their relationship with healthcare professionals?
5) How does asynchronous consultation affect health inequalities in terms of access?
6) What is the impact of an asynchronous consulting model on NHS performance?

Ethical approval

The NHS service evaluation component led by the NHS Grampian did not require ethical review. Ethical approval for the qualitative study was granted by the London - Bloomsbury Research Ethics Committee (reference number 21/PR/0051). Informed verbal/written consent was taken from each study participant individually.

Focus groups about public readiness

Recruitment and data collection

We recruited members of the general public for participation in focus groups, targeting individuals at

risk of digital exclusion, including low-income people, older people, people with disabilities, and those who assist them. Our two public co-investigators (MM and AM) who work with community voluntary sector organizations contacted members of the public to invite them to participate. Three online and one face-to-face focus groups of four to seven participants were held, with 22 adult participants, eight men and 14 women (ages 20-40 (n=6), 41-64 (n=5), and 65 (n=11)). The asynchronous consultation system used by the dermatology clinic was explained and demonstrated to participants at the start of the focus group. Additionally, the group was informed about what new medical specialties this service would be expanded to, highlighting its potential applicability across various populations. The facilitator (MRD) used a semi-structured topic guide (Multimedia Appendix 2 - item A).

Data analysis

Focus groups were video/audio recorded and professionally transcribed, checked for accuracy, anonymized, and coded using the NVivo 10 software programme. The Technology Acceptance Model (TAM) [17] - one of the most influential technology acceptance models which proposes that perceived ease of use and usefulness of a technological tool determines the extent of user acceptance - informed the analysis. Analysis began alongside data collection, with ideas from early analysis informing later data collection in an iterative process. Analysis of transcripts commenced with familiarisation conducted by two experienced qualitative researchers (MRD and LL) followed by open coding using a mixture of inductive and theory-informed codes. This generated a coding framework, which then one researcher (MRD) systemically applied to all data. The themes identified from the focus groups helped inform later qualitative stages (see below).

Staff interviews about design and implementation

Recruitment and data collection

NHS Grampian partners contacted staff members who expressed interest by contacting the project researcher. Staff were interviewed online using topic guides (Multimedia Appendix 2 – item B) to

discuss retrospectively dermatology and prospectively pain and gastrointestinal routes. From the service adopters described in Table 1 (gastroenterology and pain pathways), eight people, including clinical leads, service/administration leads, and technological leads/experts (including a developer, technical integration lead, and digital health lead), were interviewed at the pre-implementation project stage (June to November 2021), five of whom had experience with either the dermatology system alone or dermatology and the newly implemented pathways. At this stage, we additionally interviewed a dermatology clinician, totalling nine individuals interviewed at the pre-implementation stage. Five adopters of the newly implemented pathways (two interviewed at the pre-implementation stage) were interviewed at the post-implementation stage (March to June 2022), including two clinical leads, one service/administration lead, and project management leads/experts (including an evaluation lead and a project manager).

Data analysis

The approach was the same as for focus group analysis, but this time the coding framework was informed by Greenhalgh and colleagues' evidence-based conceptual model for evaluating factors affecting diffusion, dissemination, and implementation of innovations in health care delivery and organisation [18].

Assessment of service uptake by patients

Assessment of routinely collected data

The NHS Grampian team examined service use data, including demographics of new system users (age, postcode, sex), acceptance of service throughout routes (numbers completed, expressly declined, and not accepted for other reasons), non-attendance rates, and appointment results. To assess health inequality, we assessed rates distribution across the Scottish Index of Multiple Deprivation (SIMD) [19], which ranks every small area in NHS Grampian from ‘most deprived’ (lowest quintile of the SIMD) to the ‘least deprived’ (lowest quintile of the SIMD). The data was based on hospital data and an audit carried out by administrative staff between February and July

2022. When feasible, a chi-square test was performed to calculate percentage differences, setting the significance level at $p > 0.05$.

Patient experience

All gastroenterology and pain management patients offered the new service were given the chance to complete a brief online satisfaction survey (see Multimedia Appendix 2 items D-F). Collected data was analyzed descriptively. Patients who completed a survey and checked a box to be contacted by the project researcher were eligible for a follow-up interview. The NHS Grampian team research partners gave the details of consenting, eligible participants to the study researcher. The researcher (MRD) contacted participants via email and/or phone calls and sent reminders at two weeks. Semi-structured interviews were done online or by phone to better understand their experiences (see Multimedia Appendix 2 for patient interview topic guide – item C) and analyzed in the same way as the focus group transcripts. In March–July 2022, six pain management patients were interviewed, of which four completed their appointment and two did not. Table S1 describes the interview participants (Multimedia Appendix 1). Only two gastroenterology patients consented to researchers contacting them, but neither responded to the researcher.

Results

Focus groups about public readiness

COVID-19's impact on the digital revolution

Participants described how the COVID-19 pandemic significantly affected the population's digital technology habits, including remote consultations, and has sped up many valuable previously hard-to-imagine digital innovations. They aired concerns about how this may change the fabric of society, adding to the problem of technology addiction and diminishing human interactions.

Attitudes towards asynchronous consultations

Some participants described having personal, satisfactory experiences using remote

communication (emails, phone, and video calls) with healthcare providers. Most participants were very positive about the new asynchronous consultation system. Even those who expressed a clear personal preference for remote synchronous and face-to-face consultations could see how the service could be useful for some aspects of care, such as triage, monitoring the healthcare needs of people with long-term conditions or reaching people who have difficulty travelling to hospital.

Relative advantages and disadvantages of asynchronous consultations

Many possible benefits were cited regarding access, efficiency, time and travel saved, more flexibility for clinicians, and reminders that we should not make assumptions about who would find it hard to use. Downsides were also aired, particularly for those for whom English is a second language, people without a good internet connection or adequate devices, people with conditions that need physical examination or symptoms that are difficult to describe in words, people with cognitive/developmental disabilities, risks of urgent issues being missed, loss of human contact and empathy, fragmentation of care, and the potential that the length of time you must wait for a reply could create anxiety (though accepting it might still be quicker than waiting for a face-to-face appointment).

Practical barriers and facilitators to using the asynchronous service

Participants noted that the practical barriers, such as the lack of equipment and skills, could be mitigated with the help of community-funded programs or by setting up adequate and safe spaces in the community, or by providing an alternative method of communication (such as telephone). Patients' fears regarding data privacy and confidentiality would need to be allayed, the group explained, as these issues would otherwise serve as a barrier.

Compatibility with needs

As the new service might not work for everyone, participants stressed the importance of being

mindful of personal preferences (e.g., for communication format), tailoring the system to end-users' needs, and the service remaining optional. Most participants wondered whether being routed to an asynchronous system might make people feel fobbed off or less valued; another person noted that those who could not use it might feel less valued/second-class citizens. The underlying concern was that digital exclusion and opt-out could exacerbate health inequalities.

Further detail on findings under the developed themes appear in Box S1 (Multimedia Appendix 1).

Staff interviews about design and implementation

Findings from staff interviews are presented drawing on components of Greenhalgh and colleagues' [18] conceptual model for the diffusion and implementation of innovations. Further detail on findings under the developed themes appear in Table S2 and on implementation setback specifically in Table S3 (Multimedia Appendix 1).

Characteristics of the innovation itself

Staff involved in the implementation of asynchronous consultations were motivated to roll out the innovation by their assessment that the new system could give clinicians more flexibility, patients more convenience, enable access to the right care for the right people at the right time (triage/assessment) and improve information sharing (between a patient, outpatient clinic and general practice). Over time, those benefits began to manifest. For example, staff noted that at first, going over a digital appointment response was not much faster than a phone call, but later, but it became quicker, taking 15 minutes instead of 30 minutes. Digital exclusion and adding an extra step to the care pathway were among the early concerns adopters wished to evaluate. The most mentioned concern was a loss of human contact; the risk of which staff felt is reduced by using real-time messaging functions with new patients or creating a pathway where patients are already engaged with care providers. Overall, there was alignment with public opinions, particularly regarding the use for triage and main concerns about digital exclusion and the loss of human contact:

> “You know, we’ve got a better understanding of the impact of pain and their mood and their function, and how much it’s interrupting daily activities, and that’s not information that we would have had before we would have had to gained all the information during the first appointment.” (#3 clinical lead)

> “[in pain pathways] Patients are already engaged following a face-to-face appointment with the nursing teams prior to the async appointments. This provides a human touch and reassurance that patients’ issues are known and will be considered, listened to.” (#1 project management lead/expert)

It was generally accepted that the innovation might be somewhat changed to satisfy different needs, except when the product design and deployment is controlled centrally, as opposed to locally (as a part of the national pilot or scale-up project). The new pathways' clinical leads determined the type of information gathered, the questions to be asked during the consultation and the place of the digital appointment in the patient experience, which mirrors the public's expectations for the service to be tailored to the needs of the end-users. Clinical leads described how two examples of how its function evolved according to needs after the system went live (e.g., the pain clinic started to use the system to manage medication use) and continued proposing new modifications (e.g., a clinical lead in gastroenterology described plans for being able to share educational materials with patients).

The developers of the newly implemented pathways viewed practical demonstrations of the dermatology system as helpful (especially pathway design and patient booking process). For instance, adopters of the new pathway tried to draw lessons from the fact that the dermatology pathway was initially too disjointed and complex for patients. Still, there was a perceived lack of space and time to try out the new systems before they went live, but they recognized that the new process could only be tested once technically integrated with the system.

After launching the service, it became evident that the new service created additional tasks for

staff. Staff described additional work tasks related to appointment booking and management process, such as manual records keeping, chasing up dermatology patients and having to phone patients to offer an appointment. In general, clinicians' manual selection of patients from waiting lists or administrative staff's selection of patients out of order and cold calls to patients were seen as ineffective. A clinical lead explained how, initially, at their end, there was also a lot of paperwork involved. However, later staff's familiarisation with the technology and growing confidence promoted more efficient use of the system (e.g., using a filter function to search waiting lists).

The availability of tailored technical support was viewed as needed and important, and there was appreciation for the support provided through eHealth colleagues. The newly implemented pathways, shortly after being launched, experienced technical issues from the service side that prevented patients from accessing links. Staff worked around this problem by sending new appointments and ultimately offering an in-person appointment. Eventually, the eHealth team resolved the problem's source, but a few patients could not join despite trying multiple times. Initially, clinical leads also reported a problem with creating user accounts with the system using their NHS email addresses, which was promptly resolved. When at work, for improved efficiency, clinicians used one monitor for viewing digital appointments and another for the patient appointment booking system. However, this dual-monitor setup was not accessible when working from home.

> "So, when we're trying to test something, we've got to get everyone involved in the test process, we have to get everyone to change everything at the same time, and then if the test doesn't work then we need to go back up through the chain to find out whereabouts it failed." (#2 technical expert/lead)

Outer environmental context

Staff believed that the pandemic created a favourable environment for telemedicine in general, a perspective that was in line with the experiences of the public. It acted as the catalyst for thinking about it on a larger scale. Yet it instigated an increased demand and competition for resources.

Participants mentioned the video consultation service used in Grampian called ‘Near Me’. Even before the pandemic, they said, it was viewed as an effective new method of teleconsultation, which paved the way for teleconsultation innovation and served as a benchmark with which adopters compared the asynchronous consultations system:

> “Although we had been looking at it prior to Covid because we thought this was a way of working anyway, but Covid was the catalyst that got us thinking about it on a larger scale” (#1 technical expert/lead)

> “In the backdrop of dealing with Covid, it’s difficult in terms of the pressure within the system to try and deliver something which was new and maybe something that people were just trying to learn and implement” (#1 project management lead/expert)

System antecedents and organizational readiness

NHS Grampian was generally viewed as a receptive context to telemedicine and innovations, characterized by a recognized need to introduce a new care model and technical expert/leadership and innovation high on its agenda. Staff can, and do, exchange knowledge internally and externally, which is conducive to innovating. However, the receptiveness of the environment for innovation would be further strengthened by a more clearly articulated strategic vision for priorities, more clearly defined roles and responsibilities of innovation and transformation teams and streamlined processes (such as information governance):

> "I mean I think the main things I would say are that I think NHS Grampian has been very supportive of this." (#2 technical expert/lead)

> “The reality is there’s a lot of things that are urgent and need to be done, so I think that it’s more from an innovative perspective creating a kind of culture of innovation and getting agreement that this is how we work for innovative things and understanding that process and really encouraging” (#2 project management lead/expert)

At the time of implementation, pain and gastroenterology systems were perceived as more likely to succeed than the dermatology system due to the belief that there were more staff supporters of the innovation in those clinics.

The importance of staff and patients as adopters of the new service

The innovation was developed and implemented by motivated and keen innovative clinicians and facilitated by the staff's ability to work across traditional professional and disciplinary boundaries, working around setbacks and task issues. Good uptake of the innovation by patients was viewed as critical to maintaining staff motivation:

> "The clinicians themselves are very motivated to changing how they operate and engage with new digital tools, so they're highly motivated to do that and they know their domain very, very well." (#1 technical expert/lead)

Efforts were made to select and target the right group of patients, considering a condition type, demographic characteristics, psychological factors, and lifestyle. They initially expected it to work better for some patients (returning patients, working people, those needing continuous low-level input) and less for others (digitally excluded - no internet/email, with preference/need for human contact). This belief persisted over time, although subsequently, the notion that it functions best for medical conditions for which treatment is highly standardized arose:

> "[A clinical lead] felt was suitable for, as the first try at this and she also thought she'd have a high uptake because of the demographic, because of the age range and the working nature of the folk with the condition she felt that they were ones who were likely to not want to come into clinic." (#1 technical expert/lead)

> “I do not see why in a properly selected group of patients or conditions it could not be adopted in other areas. Like, it would be really good for patients with endocrine problems because the majority of their management is pretty standardised” (#1 clinical lead)

Patients' understanding was considered critical to managing patients' expectations and, subsequently, a good uptake. For example, patients were observed to refuse digital appointments when contacted ad hoc, due to lack of prior knowledge of the purpose of the call. The term 'appointment' was viewed as a misnomer causing a lack of understanding with the patients, who viewed the term 'appointment' as an arrangement to meet someone at a particular time and date. Concerns were also expressed that patients may rely only on information from an invitation letter (rather than an information booklet) or may not have understood all details (e.g., what information exchanged during consultation gets saved).

Staff quickly learned how to effectively communicate the new service to patients to improve their acceptance of the new service. At the time of conducting the interviews, administrative leads expressed their plans to further revise the information leaflets and update the external website. Patients' preferences affected initial product specification through admin staff's experiences with patients' preferences (indirectly) and exploring patient opinions earlier in the new pathways' specification process (directly), although some staff felt that greater patient input might have been beneficial:

> "We've done a lot of work in what the patient information leaflets were like, letters were like, when we're phoning the patients how we're explaining it to them. I think feedback from when patients did onboard, feedback on the reasons why they didn't onboard. We took that into consideration and changed our information leaflets to change... simple things such as changing the wording." (#3 service/admin lead)

Assimilation by the system

The adult dermatology system went live in May 2020 relatively smoothly, attributable to the project being driven centrally as a part of the national pilot project, thus having more momentum and being ready to go live by the time the pandemic hit. A major issue was observed during the initial

implementation phase when adopters noted and worked around an initially significantly high 'did not attend' (DNA) rate. It was not until February-March 2022 that uptake rates increased, which was attributed to appointing an admin operational support that 'pushed' and monitored the system to ensure patients identified for digital appointments had been offered them and supported where required; improved clinical buy-in (with more dermatologists offering the digital appointments); and service management supporting and driving digital appointments' use within the service:

> “I think they could all relate to this story of it being given a task and trying to implement it by a date and not hitting that date, and then feeling that you’re constantly trying to push something up a hill just to try and get it done. I don’t think this is necessarily exclusive to this particular bit of work; it just happened to be the focus of the evaluation for us.” (#2 project management lead/expert)

There were several setbacks to the implementation of the gastroenterology and pain management pathways, leading to delays in the system going live. First, a 4-months delay in procurement (attributed to suboptimal coordination of efforts between innovation and transformation teams); then a 6-months delay in technical integration caused by capacity issues (loss of technical personnel by NHS Grampian eHealth team and availability of the external technical resource (National Services Scotland (NSS)) to undertake the development); and finally, a one-month delay due to technical issues (e.g., information governance).

> "I think NHS Grampian didn't act upon the emergency procurement process rapidly enough for us to get the window with NSS [National Service Scotland] when they had the capacity to do it, as I look back." (#1 technical expert/lead)

> “It’s really been the bottleneck at NSS that’s caused a lot of delays, and then also some personnel changes at NSS which have resulted in the people who’ve got knowledge of how that integration works moving on to new positions” (#2 technical expert/lead)

Over time, the reality of these setbacks caused staff to grow tired and frustrated, with some losing their confidence in this specific innovation. Contrary to expectations, the groundwork made through the adoption of the dermatology asynchronous consultation system was not easily transferable to pain and gastroenterology systems, despite involving the same developer and product “the reality turned into that it was an absolute uphill battle to even get it live" (#2 project management lead/expert):

> “I think the area that frustrated us more was the integration side of things because we already had integration up and running with dermatology and from our perspective it should’ve been a relatively simple process” (#2 technical expert/lead)

Overall, almost all adopters described feeling surprised by the complexity and non-linear nature of the process and implementation effort involved. Initially, that provoked reflections on the timing of technical integration, sequencing of steps, timing of stakeholder involvement and lack of guidance on core and optional steps. After the implementation, this prompted recognition of the "need to have those champions and people that are pushing for it and really taking it through" (#2 project management lead/expert):

> “If you integrate it too early, you might end up with something that won't scale very well. If you integrate it too late, you might end up with lots of messy ways of working with lots of different workarounds that people don't want to change from. I think there is definitely a sweet point of when's the right sweet spot to integrate and I don't think we got that right with this one" (#1 technical expert/lead)

Implementation and routinisation

While decision-making was devolved locally to pain and gastroenterology clinical leads (whereas in practice, dermatology was centrally led as a part of national pilot project), its adopters expressed regrets over missed opportunities to make implementation smoother by taking admin staff's concerns

more seriously early on, especially in terms of system readiness and how to improve patients' uptake:

> “Involvement of the stakeholders, as I say, the secretarial staff would have been absolutely brilliant at pointing out where the omissions might happen, or kind of documentation issues might happen that we would never foresee.“ (#4 clinical lead)

The organization and delivery of the innovation were human resource-intensive, requiring a high level of staff buy-in and administrative input. Allocated time was perceived as needed for clinicians, operational staff, clinic coordinator, project manager, evaluation lead and eHealth team. Appointment of admin operational support was perceived as directly responsible for an increase in take-up. A need for continued funding and dedicated resources was stressed, but this was against extreme pressure on NHS resources generally:

> “If it was funded appropriately that would have maybe improved things as in funding for NHS staff and for NSS involvement. There was very little funding available within the NHS“(#2 technical expert/lead)

> “There was a new appointment made a number of months ago, which has... actually, you can see it’s paid dividends now in terms of the take-up of the figures in terms of the digital appointments as well, but that’s kind of an admin support.” (#1 project management lead/expert)

Delays with technical integration prompted reflections on the role of the NSS integration hub as a national-level NHS stakeholder. The NSS appeared to have limited capacity for this project. The innovation was intended as proof of concept rather than a fully operational system, so it needed more time commitment and a clear description of roles and contractual agreements on escalation routes. The delays in technical integration caused the technical leads to wonder if an IT system at the proof-of-concept stage should be fully integrated with the host organization's IT system immediately or only after it has undergone functional testing.

Incompatibilities with the current ways of working did not surface until after implementation,

leaving adopters unsure if it "translates practically into the real world" (#1 service/admin lead). The main issue was the so-called ‘lifetime of an appointment’ in the patient booking system. While in-person appointments are acted upon the same day of the appointment, asynchronous consultations would appear still booked, which was "kind of alien to [admin staff]" (#2 service/admin lead). Another issue concerned how clinicians plan their time, imposing limits and how flexibly the new system can be used (i.e., managed by allocating time slots two afternoons a week or ad hoc, but ultimately depending on patients' timing). At the time the interviews were conducted, a solution for this issue had not been established:

> “I think the notion behind the asynchronous appointments or assessments, or the process is good. I don’t know that it translates practically into the real world if that makes sense. So, I think the idea behind it around you don’t need to have dedicated clinical sessions, you can spread these appointments out throughout the week and the clinicians can deal with them at any time, that doesn’t fit with the world we live in in terms of job planning and service planning and things.” (#1 service/admin lead)

From early on, there was a perceived need for better two-way communication between the project manager and adopters, including relevant people from the start (importantly admin staff) and keeping them informed throughout, keeping records of communication, and clearly outlining roles (knowing whom to contact). Concerns about a perceived lack of a formal project board were aired - essential for acting on staff feedback brought up by a project manager. Transition/loss of personnel, especially project manager changes, significantly disturbed stakeholders' involvement, and communication continuity. Later, a new acting project manager addressed this by ensuring a two-way communication line with the operational staff, which they felt helped restore trust.

Perceived consequences

Initial low confidence in the success of the dermatology system improved with time following a

"quite a dramatic increase in Dermatology take-up in terms of the number of appointments that have gone through" (#1 project management lead/expert).

As the new pathways went live, it was felt that some of the new pathways were better accepted by patients than others and that the new system would be more successful overall if the new system fitted better the existing process flow. For example, it was considered to work well for pain management because patients were scheduled in a sequence (when they reached the top of the list, as opposed to being chosen by hand) and clinicians introduce patients to the service during their initial appointment:

> “Pain Management it works very well with them because they already used a similar system. The patients are being onboarded by the clinicians at the time, or the care providers at the time of their initial appointment so it’s been explained to them what it is and how it works.”. (#3 service/admin lead)

Overall, the new system was viewed as useful to many patients, but " there needs to be an alternative option because it's not for everybody" (#3 clinical lead). As for the implementation success, they seemed to agree that - "in the face of all the adversity and challenges that the work has faced, the fact that that still is getting used and patients are still buying into shows that, I guess, as an attempt to introduce this and upscale it, it can be done. " (#2 project management lead/expert)

Assessment of service uptake by patients

Assessment of routinely collected data

The adult dermatology service was the first in NHS Grampian to offer digital asynchronous appointments to their patients, in May 2020, followed by the paediatric dermatology service in January 2021. The gastroenterology and pain management departments started offering digital appointments in December 2021 (10 months later than originally planned). There were a total of

1709 appointments offered to 1417 people across the four medical specialties. The total outcomes (N=2416) were greater than the number of appointments (N=1709) because there could be more than one outcome per consultation. The responses of people offered digital appointments are based on an audit carried out by administrative staff between February and July 2022 (N=832). Below are reported key findings.

41% (n=341 out of 832) accepted and received digital appointments, only 17% (n=141) explicitly declined, and 31% (n=258) did not respond to the clinic letter offers or believed they no longer required a consultation. The remaining 11% (n=92) consisted of people whom services had already seen, people who had already booked a different type of consultation and a small number of people classified as “other”.

The overall mean age of service users (N=1709) was 38.7 years (SD=22.7), ranging from 1 to 90 years. 55.6% (n=950) of people were women, and 79.4% (n=1357) were white British. The deprivation profile of people who opted into the digital appointment service was very similar to that in the Grampian region, e.g., 5% of asynchronous system users were from the most deprived quintile which is the same percentage as found in Grampian as a whole (see Figure 2). This discovery is important, as both public and staff groups were concerned with assessing whether the system could potentially worsen health inequalities, a consideration that would be a major disadvantage.

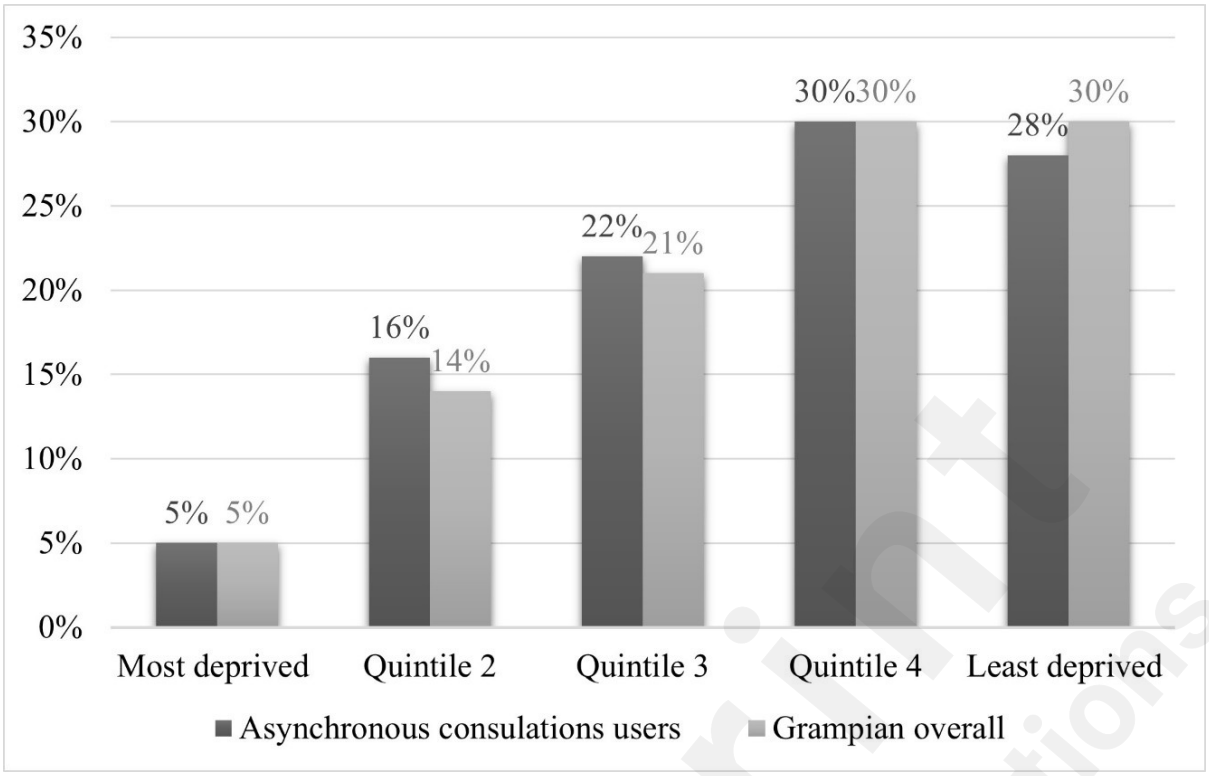

Figure 2. Comparison of the distribution of deprivation in the Grampian region and those who took up the offer of 'digital appointments'.

'Did not attend' (DNA) rates were high in the first two months that digital appointments were used in the pain (33.4%; n=7 out of 21) and gastroenterology services (44.7%; n=17 out of 38). The overall DNA rate between January and September 2022 was 13.8% (n=134 out of 965), which is approximately 5% higher than the national face-to-face appointment DNA rates for gastroenterology and adult dermatology. There were apparent differences across medical specialties and time (Table 2), yet there was no apparent impact based on the duration the specialty had been offering the new service. This would be evident if DNA in the dermatology pathways were generally lower.

Table 2. 'Did not attend rates' across medical specialties using digital appointments in the first three quarters of 2022 (N=910).

	Jan-Mar	Apr-June	July-Sept
Gastroenterology (n=235)	14%	4%	16%
Pain (n=83)	18%	17%	19%
Adult dermatology (n=385)	19%	18%	12%
Paediatric dermatology (n=207)	6%	10%	14%

We also looked at DNA rates for all appointments across five SIMD deprivation quintiles (N=1709). We found that DNA rates were similar across four of the five deprivation quintiles (Table 3): most deprived = 25.0% (n=20/80), quintile 2 = 24.7% (n=69 out of 279), quintile 3 = 21.6% (n=79 out of 366), and quintile 4 = 23.5% (n=121 out 514). The least deprived were the most likely to not attend (χ^2 = 19.3, p < 0.001) with a DNA rate of 15.4% (n=72/470).

Table 3. 'Did not attend rates' for all appointments across SIMD deprivation quintiles.

SIMD Quintile				
Most Deprived	**2**	**3**	**4**	**Least Deprived**
24.6%	24.9%	21.5%	23.2%	15.4%

The most common (50.0%; n=1208) outcome was open returns (i.e., a patient can request another appointment), followed by treatment (37.0%; n=894), discharged (10.0%; n=242) and lastly referred on (3.0%; n=72) (based on N=2416 outcomes).

There is no evidence that those from the most deprived communities using digital appointments were disadvantaged. People from all deprivation quintiles were equally likely to receive any of the possible four outcomes including treatment and open return (χ^2 = 13.6, p > 0.05).

In terms of the estimated environmental impact, assuming people would travel from their home

address (area spread across 3000 square miles) to where the Aberdeen Royal Infirmary is located, digital appointments resulted in 44,712 fewer miles (around 71,956.81 kilometres) travelled than traditional face-to-face approaches.

Patient experience

All the patients from gastroenterology and pain clinics offered to complete the online survey, but only 66 completed it (which is approximately 4.0% of all appointments delivered), the vast majority (86.4%) of which were completed by people attending the pain management service. 10.0% of them agreed to follow-up interviews (n=6). Table 4 illustrates the survey results. Only 18.2% of respondents were unhappy or very unhappy to be offered a digital appointment, and the same proportion was unhappy or very unhappy with the service post-consultation. While as many as 89.4% of respondents felt it mattered to be involved in their care decisions, only 34.9% felt involved to a large or very large extent. Still, as many as two-thirds of respondents said the quality of the care they received was excellent or good.

Table 4. Results of the satisfaction survey with a digital appointment, from those who completed their appointment (N=66).

	Very Happy	**Happy**	**Neutral**	**Unhappy**	**Very Unhappy**
How did you feel about being offered a digital appointment?	16.7%	33.3%	31.8%	10.6%	7.6%
How do you feel about using digital appointments for this type of healthcare service now that you have tried it?	12.1%	39.4%	27.3%	12.1%	9.1%
	To a Very Large Extent	**To a Large Extent**	**Moderately**	**To Some Extent**	**Not at All**
How involved did you feel in the outcome of your digital appointments?	9.1%	25.8%	28.8%	15,2%	21.2%
How important is it to you to	71.2%	18.2%	7.6%	1.5%	1.5%

be involved in decisions about your health care?					
	Excellent	**Good**	**Fair**	**Poor**	**Very Poor**
Overall, how would you rate the quality of health care you received?	34.8%	31.8%	12.1%	7.6%	13.6%

Follow-up interviews suggested that people saw a role for it in the NHS, viewing it as an additional, optional method alongside other forms of consultation, consistent with public opinions. Key specific benefits experienced included the time saved on travel and improved information collection and sharing, which both the public and staff anticipated:

> "I think that there are huge amounts of benefits in having this kind of system, but somewhere in it you have to include the ability to have a face-to-face" (P3, male)

> "It saves you having appointments with Tom, Dick, and Harry where you can have it with Harry, and he can pass the information on to Tom and Dick" (P5, female)

Some felt apprehensive about the offered service, fearing that it might eventually replace human connections, and overall preferred in-person communication. This sentiment is in line with the distinct preference for this type of contact expressed by some public focus groups participants. They believed that teleconsultations distanced patients and healthcare professionals, emphasizing the significance of being physically present in creating a trusting doctor-patient connection. Losing meaning when writing or even suppressing their answers were also mentioned. They acknowledged, however, that the written format offers advantages, such as an opportunity to review a response and writing in one's own words in a free text box:

> “You’re being offered primarily video sessions and telephone sessions from your surgery. There has been a barrier created between the medical profession and Joe punter [a user].” (P3, male)

> “I think if you’ve got to write things, yeah, that looks bad if I’m saying, “No, this isn’t what I want.” (P2, female)

> “It’s like a survey, you can ask certain questions but there may not actually be a response available that matches what you want to say. There are benefits to it because you have time to think through… so if for example, it’s a free text box, you have the opportunity to construct what you’re saying and then review your response” (P2, female)

Those who were happy to be offered the service, on the other hand, stated that rushed in-person consultations lack the 'human factor' anyway and saw digital appointments as an opportunity to improve relationships because the doctors have a better understanding of their needs. They liked having time to think about and reconsider their comments, and they thought they covered things quite well and described the questions set as straightforward and straight to the point and more personal, and they see it as an unavoidable change:

> “I had time to sit down and actually read the question and properly kind of, not prepare answers, but kind of rethink what my answers would be. Honestly, I think that would probably better the relationship because the doctors have a better understanding of the answers for the questions that they gave.” (P6, female)

> “I think these people have got to get up-to-date with the times. [..] if that’s how it’s going to be, you’re going to have to change with the times or get someone to help you to change with the times.” (P4, male)

Four types of influences on the ease of use of the new service have been mentioned: difficulty getting timely care, condition, abilities, and technical issues. More specifically, some patients had previously had difficulty getting timely care. For some, this resulted in a preference for in-personal contact, whilst for others, it enhanced appreciation for having faster access:

> "You’ve got to jump through so many hoops [..] By the time you get to say something,

you’ve become incoherent as well” (P2, female)

"I was really looking forward to it, and I believed it would be useful." (P1, female)

One of the four participants who completed their appointment did so without assistance and felt the direction provided (an email with instructions) to be extremely clear. The remaining three people expressed doubt in their abilities to complete it without assistance, so "to be sure that [they] knew what to do," (P2, female) they sought assistance from a family member/carer/employee. Consistent with the public views, patients thought that those with limited digital literacy, certain cognitive impairments, and those who did not speak English as their first language would be least likely to use this service.

Some people's ability to go to in-person appointments, stay seated, and even respond to the questionnaire was reported to be affected by their condition. In line with public perception of possible disadvantages, some people found it difficult to convey their health status, particularly pain, into words, necessitating physical contact with a clinician:

“Because I’m in pain, I mean, I can’t sit in the same place. I’m afraid you just stop listening.” (P1, female)

“When I filled in that, I could quite well be contradicting myself by what I’m saying now. You’re not well, things change.” (P2, female)

Two people reported experiencing technical issues (the link to the appointment not working, poor broadband connection and a "device that refused to work" (P3, male)). One person thought that was normal and resulted from “a lack of experience on both sides” (P3, male). Another person felt confused and “not being taken seriously” (P2, female). Those patients sought assistance from the clinic, which eventually provided options for in-person and telephone consultations. This approach is in line with public opinions on the necessity of providing alternative forms of consultation and aligns with staff reports on actions taken to sidestep technical issues.

Consistent with staff views, we noted that the primary area for improvement was participants' comprehension of the service. All but one patient had trouble memorizing and naming specific phases in their treatment pathway, indicating difficulties with eHealth terminology and the complexity of the pathway. Patients did not consider 'digital appointment' as an appointment, but rather as an exchange of information/assessment to determine "whether [they] actually need an appointment" (P2, female). The majority of respondents who completed consultations did not recall receiving a consultation copy, which indicates that this information was not effectively communicated. In addition, there was no clear connection perceived between the outcome of the consultation and the responses made, indicating a lack of knowledge of how information obtained from consultations influenced treatment decisions.

Discussion

Principal findings

A range of patients decided to use the asynchronous consultation service of dermatology, gastroenterology, and pain management departments, with a total of 1709 appointments offered to 1417 people from February to July 2022. The public has been overall receptive to the service and 80% of real users felt neutral to very happy about being offered the service. Improved access, ease, information collecting and sharing, and more physician flexibility were among the benefits highlighted. The main concerns expressed by both the public and staff was the fear of digital exclusion, potentially worsening health inequalities, and the loss of human contact. However, NHS data showed no evidence that people from the most deprived areas are less likely to accept digital appointments, get treatment, or be given open return appointments. Regarding human contact, some patients preferred direct interaction, while others noted that face-to-face encounters did not always enhance connection and found written communication to be more effective for clinician understanding. Recognizing that it may not work for certain individuals, especially those with limited digital resources or writing abilities, and that other people would prefer in-person interaction,

informed choice and flexibility are required. The administrative processes could be improved, starting with better communication to promote patient acceptability by changing the term ‘digital appointment’ to ‘assessment’.

The adopters (staff) expected a relatively straightforward technical system transfer from dermatology to other receptive specialties, with generally positive support from clinical and admin staff tasked with implementing it. Despite a favourable context and organizational support, the reality has proved immensely complex. Nonetheless, staff understanding of the asynchronous system, how to describe it to patients, and how to use it to the best effect evolved rapidly. They perceived variances in adoption amongst specialties, with pain management being regarded to ‘function better’ (easier to use) since the new approach suited present practices, but numerical data did not show that the approach functioned any differently for pain clinics. The sustainability of this new system was seen as linked to its transferability across many specialties and the availability of funds to afford allocated continuous time for clinicians, operational staff, clinic coordinator, project manager, evaluation lead, and eHealth team.

Limitations

There was a substantial unanticipated delay in implementing the system, which is a finding in itself. The NHS is a system under constant pressure with limited support for innovation available, so the risk of delays seems difficult to eliminate. We used this chance to capture and report on implementation challenges, and the NHS Grampian partner's commitment to transparency in reporting the implementation process made this feasible. However, the implementation delay meant there was less time than we had hoped to recruit patients to interview who had completed the appointment processes, and as a result, our sample of patient interviews was smaller than we planned to recruit. The number of people who were able to complete the NHS satisfaction survey was also small and limited to gastroenterology and pain clinics (due to permission restrictions). The NHS Grampian data has limitations as well; we were unable to collect any data on patient

outcomes, however, our focus was on assessing the implementation approach across specialties, rather than on specific patient outcomes within individual pathways.

Comparison with prior work

In accordance with a global agenda [20], the UK Department of Health and Social Care [21] and Scotland's Digital Health and Care Strategy [22] aspire to expand the range of digital clinical and care services and ensure staff can work remotely and flexibly. Asynchronous patient-to-doctor communication offers that. Prior studies revealed that teleconsultations were generally acceptable to NHS patients [23]. We found that the public is receptive to NHS outpatient asynchronous consultations if individual preferences are respected, the system is suited to end-users' needs, and the service is optional. Most outpatient asynchronous consultations involve submitting a response to a set of key questions about a condition and to upload photos or videos (for example in, dermatology [9] or epileptic seizures [11]) but overall has a variety of uses across countries [6]. An asynchronous consultations service for pain management and gastroenterology care involving a set of key questions only is a viable and acceptable option.

Consistent with what we know already from the wider implementation literature [18], future implementation efforts around digital innovations should consider assessing ahead of implementation key organization-wide factors identified by our staff participants as desirable, including a degree of consensus on broader innovation priorities and protocols; clearly defined roles and responsibilities of innovation and transformation teams; adequate resources and involvement of stakeholders; and strong and continuous project management. Further research is needed to help organizations to build and implement evidence-informed strategies to prioritize and manage innovation.

The non-linear and complex nature of the implementation process has been previously reported [18]. This study resonates with that and further suggests it can be expected even when the same product is scaled up in the same setting. The reality of staff’s frustrations with the complexity of that process however is less documented. It is widely recognised that scaling innovation takes

space, time and resources, so organizations need to consciously and strategically drive scaling efforts [24]. We noted the critical importance of numerous influences on clinicians' motivation to adopt and continue engaging with the innovation - e.g., uptake by patients, competing priorities and time pressures, exposure to the innovation work and continuous two-way communication with a project manager. In the primary care setting, the importance of compatibility with existing workflow and patient satisfaction with asynchronous consultations was also noted [6]. It is crucial to include administrative staff issues early on, since they may anticipate patient ease of use and compatibility with the existing workflow.

The importance of the involvement of end-users is reported in the eHealth literature in general [25] and in chronic disease management [26] specifically, emphasising the need for user-centered design. The importance of providing user-friendly, role-appropriate information and resources to support the individual being cared for [27] and patient involvement in digital service design from the outset have been noted [6,28]. This can be done with the help of one of many frameworks for gathering insights from patients and the public [29]. This study echoes it and emphasize the need to understand and tackle digital exclusion and provide informed ‘digital choice’ via system co-specification and effective communication regarding outpatient asynchronous consultations.

The current body of research points to a rising interest in patient safety within telemedicine, although there is a lack of detailed studies on this topic [30]. Consistent with this trend, this perspective warrants attention in this research. In this study, the team responsible for implementation assessed and monitored the new service, worked on their communication with patients, ensured data security and system resilience, and maintained follow-up protocols, all key elements of patient safety [31]. We have reported issues concerning whether patients fully comprehend the nature and content of the communication process, which is vital for patient safety [31]. Overall, this study supports the relevance of establishing technical standards and guidelines to guarantee the safety and quality in

asynchronous consultations as a form of telemedicine.

Conclusions

The research shows the viability and great potential for asynchronous consultations and wider digital solutions in the NHS to be a key part of meeting increased demands on the NHS. Recognizing that it may not work for everyone, flexibility and informed choice are key. For potential patients, careful technical support and explanation are needed, as well as a choice of consultation routes, to ensure digital inclusion. These findings also highlight how essential effective patient and public involvement is for the success of any digital technology developments in the NHS, especially as the use of digital technology in health continues to rapidly advance. Our results on implementation effort complexity the delays that occurred, the characteristics of the innovation and its reception by hospital staff may help staff deploy and sustain asynchronous consultations.

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Data Availability

All relevant data are within the paper and Multimedia Appendix 1.

Conflicts of Interest

None declared.

Multimedia Appendix 1: Supplementary data.

Multimedia Appendix 2: Study tools.

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Abbreviations

DNA: Did not attend

NES: NHS Education for Scotland

NHS: National Health Service

NSS: National Services Scotland

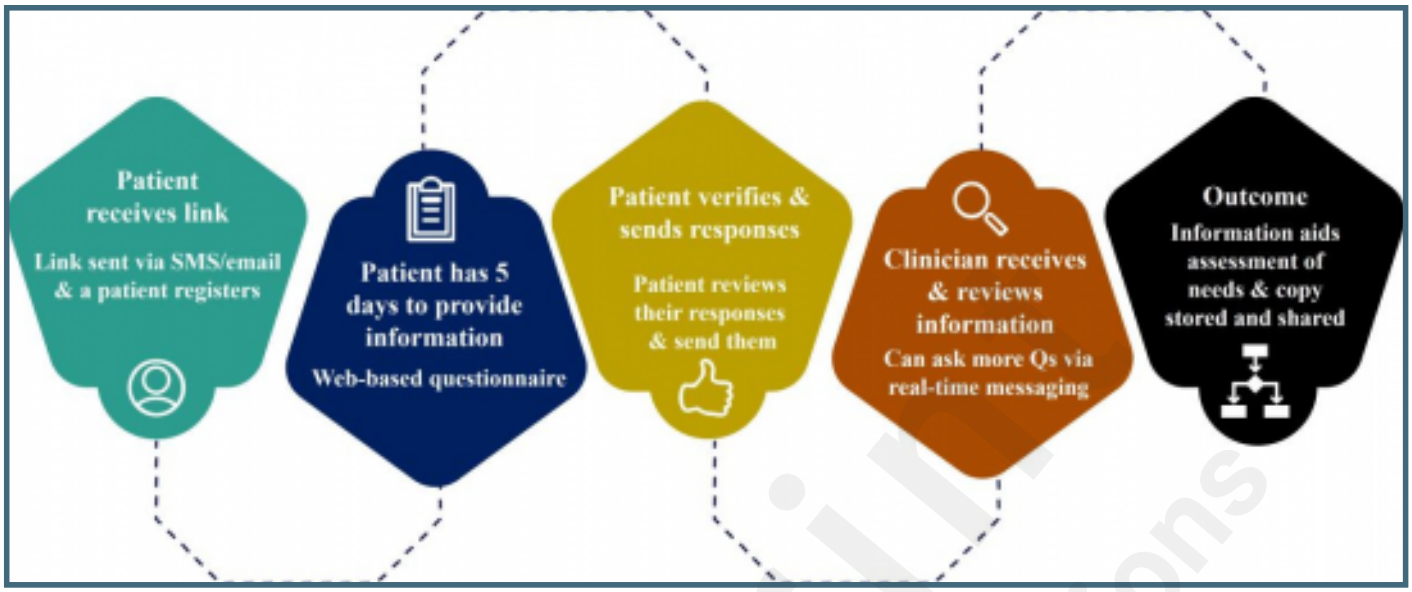
SIMD: Scottish Index of Multiple Deprivation

TAM: Technology Acceptance Model

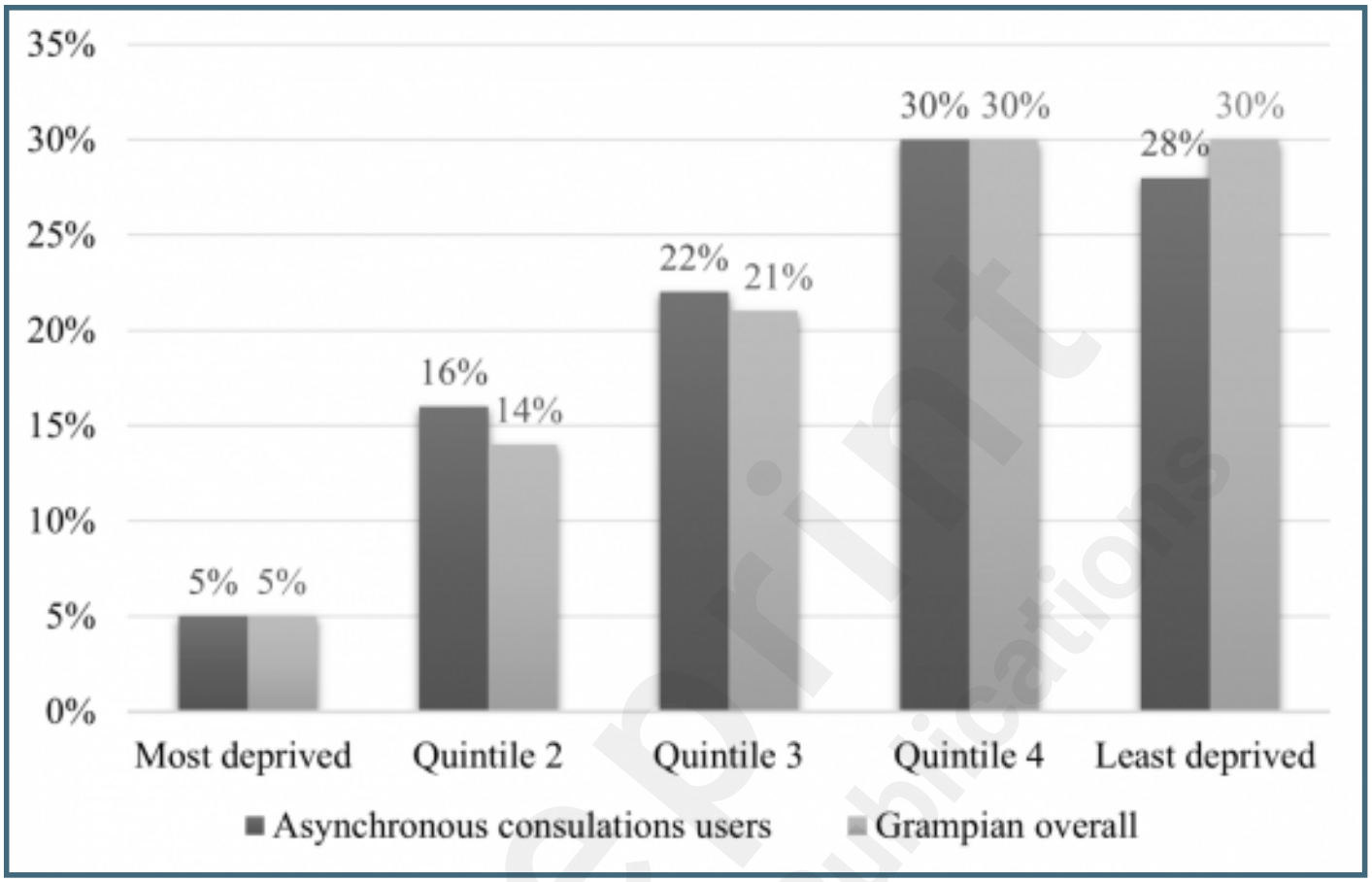
Supplementary Files

Figures

Asynchronous consultation process (in NHS Grampian known as ‘digital appointments’). SMS: Short Message Service; Qs: questions.



Comparison of the distribution of deprivation in the Grampian region and those who took up the offer of 'digital appointments'.



Multimedia Appendixes

Supplementary data.
URL: http://asset.jmir.pub/assets/3ce3d50174aed909d1ea697f21358037.docx

Study tools.
URL: http://asset.jmir.pub/assets/5540f7726a7864be199b7dad04c26554.docx