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# Evaluating the national rollout of the NHS App in England using qualitative and quantitative methods

*Felix Greaves, Chrysanthi Papoutsis, Sukriti Kc, Salina Tewolde, Claire Reidy, Bernard Gudgin,  
Anthony A Laverty, Azeem Majeed, Ceire Costelloe and John Powell*







## Extended Research Article

# Evaluating the national rollout of the NHS App in England using qualitative and quantitative methods

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## This article

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# Abstract

**Background:** In 2019, the NHS App was launched as a 'digital front door' to England's National Health Service, aiming to improve access to primary care, enhance patient experience, save time in general practitioner practices and promote self-care.

**Aims and objectives:** This project aimed to identify and understand the use and acceptability of the NHS App, to measure the extent to which it improved patient experience and influences health service access, and to understand patterns of early take-up and participation.

**Methods:** Qualitative work explored experiences and views on the acceptability of the app through 60 hours of observation in general practices, document analysis (approximately 100 documents), and 62 interviews and four focus groups with patients, carers, members of the public and staff across five general practices, as well as commissioners and policy-makers. Our theoretical approach used the Non-adoption, Abandonment, Scale-up, Spread and Sustainability framework. Quantitative work examined the impact of the NHS App on the usage of primary and secondary care, using routinely collected data. Firstly, using monthly NHS App user data at general practice level in England, descriptive statistics and time series analysis explored monthly NHS App use from January 2019 to May 2021. Secondly, data on the sociodemographic characteristics of the general practitioner-registered population and their healthcare needs at the general practitioner level were used as covariates to explore inequalities in app usage. Finally, NHS App usage data were also compared with measures of patient experience of care and care access extracted from the General Practitioner Patient Survey database.

**Results:** The qualitative analysis guided by the Non-adoption, Abandonment, Scale-up, Spread and Sustainability framework illustrated the multiple layers of complexity when introducing a constantly shifting technology into a challenging environment such as English general practice, during and after a period of considerable societal turbulence caused by the COVID-19 pandemic. Quantitative work showed there was strong adoption of the NHS App even before the onset of the pandemic, although the introduction of the COVID-19 Pass feature was linked to a fourfold increase in downloads. Analyses by sociodemographic data found higher usage in less-deprived and less ethnically diverse practices, with a generally younger population. There were 25% lower registrations in the most deprived practices ( $p < 0.001$ ), and 44% more registrations in the largest-sized practices ( $p < 0.001$ ). Registration rates were 36% higher in practices, with the highest proportion of registered White patients ( $p < 0.001$ ), 23% higher in practices with the largest proportion of 15- to 34-year-olds ( $p < 0.001$ ) and 2% lower in practices with highest proportion of people with long-term care needs ( $p < 0.001$ ). Analyses by patient subgroup and by patient experience of care showed mixed findings.

**Limitations:** There was no opportunity to evaluate the app or the app functionality in an experimental design. The technology itself, and the context, was changing during the study, which added challenges and complexity. The quantitative analyses used aggregated data rather than individual-level linked data.

**Conclusions:** The NHS App was introduced into a complex and changing landscape. It has achieved strong uptake, with the COVID-19 Pass feature increasing adoption substantially. Overall uptake and use have followed an inverse deprivation gradient, influenced in particular by age, ethnicity and healthcare needs. Different functions of the NHS App have been used to different extents, and with different patterns over time.

**Future work:** Further evaluation as the healthcare landscape and the functions of the NHS App evolve is warranted, including longitudinal studies using person-level data and further work on inequalities in access and use.

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## List of abbreviations

AHP	allied health professional	IT	information technology
CPRD	Clinical Practice Research Datalink	ITS	interrupted time series
GP	general practitioner	ONS	Office for National Statistics
GPPS	GP Patient Survey	PPIE	patient and public involvement and engagement
IMD	Index of Multiple Deprivation	SDE	secure data environment
IRR	incidence rate ratio		

## Plain language summary

In 2019, the National Health Service in England introduced a new smartphone app for patients, called the 'NHS App'. This aims to become the 'digital front door' to the National Health Service. Over the last 5 years, an increasing number of functions have been added to the app. For example, people are able to use it to see their medical records, book appointments, order repeat prescriptions and undertake other tasks related to their health and care.

In this research study, we looked at how many people use the NHS App, what functions they use, what people think about the NHS App and whether it changes how people use the National Health Service.

To do this, we used interviews and discussions with people who use (or do not use) the app, and with doctors and other staff who work in the National Health Service. We also looked at the statistics showing how often the NHS App is used.

We found that the NHS App has been widely adopted by many millions of users. In the early days, this high uptake was helped by events related to the COVID pandemic, and especially the introduction of the COVID Pass. Usage has continued to grow since then. The use of the app appears to be more common in areas which are less poor, and where general practices have younger patients, and where the populations they serve are less ethnically diverse. Different features of the NHS App are used by different groups of patients to a greater or less extent. Patients who are most looked after in primary care may find the app more useful than those who are being looked after by hospital specialists. Healthcare staff and the organisations they work for have had to adapt their own work in order to introduce the NHS App into their practice.

# Scientific summary

## Background

The NHS App was developed as a 'digital front door' to England's NHS. The initial goals for the app were to improve access to primary care services, improve patient experience, save time in general practitioner (GP) practices and promote self-care. There was no planned national evaluation of this app, which was introduced as a policy priority and constituted a novel complex intervention with potentially wide-ranging impacts on the use of healthcare services. This project provides the only national evaluation of a major component of the central plan to digitally transform the NHS.

The roll-out of the NHS App was in line with a general political discourse and drive towards harnessing digital tools for health care and was tied in with the roll-out of the NHS login. The NHS Long Term Plan set out the ambition for all patients in England to have the right to access digital consultations from their GP, while NHS England's 'digital first' strategy, aimed to direct patients away from in-person engagements, through telephone, online or video consulting before face-to-face consultations.

Throughout roll-out, the app has been dubbed as serving to 'ease pressures on GPs', 'provide more effective, personalised care' and 'freeing up valuable clinician time'. There have been ongoing developments of the NHS App, with additional features and integrations added throughout roll-out, and it continues to be at the forefront of the digital health agenda in government policy. In the spring budget of March 2024, the Chancellor of the Exchequer announced £3.4B of funding for the NHS to invest in digital technology, including the specific aim to make the NHS App a single front door to the NHS for patients. The plans for the NHS App include greater use of messaging with healthcare providers, more preventative 'keep me healthy' content and supporting integration with third-party apps and devices.

This project aimed to identify and understand the use and acceptability of the NHS App, measure the extent to which it improves patient experience and influences health service access, and assess the impact of the app on reducing demand on NHS services. Much of the evaluation covered the period during and immediately following the COVID-19 pandemic.

## Methods

To evaluate the app, this study had two workstreams. A qualitative approach explored experiences and views on the acceptability of the NHS App through 62 semistructured and think-aloud interviews, and four focus groups with 88 participants. These participants included patients, carers, members of the public (who used the app to different degrees or not at all) and clinical/non-clinical staff in five general practices (where we also conducted over 60 hours of observations), as well as other industry, policy, commissioning and civil rights stakeholders. Document analysis of approximately 100 documents (blogs, government reports, newspaper articles, digital access documents in GP practices) also contributed to participant recruitment and data interpretation. Data were collected between June 2021 and April 2023. Our theoretical approach was based on the Non-adoption, Abandonment, Scale-up, Spread and Sustainability (NASSS) framework. A quantitative element examined the impact of the NHS App on the usage of primary and secondary care, using routinely collected statistics. Firstly, using monthly NHS App user data at general practice level in England, descriptive statistics and time series analysis explored monthly NHS App use from January 2019 to May 2021. Secondly, data on the sociodemographic characteristics of the GP-registered population and their healthcare needs at the GP level were used as covariates to explore inequalities in app usage. Finally, NHS App usage data were also compared with measures of patient experience of care and care access extracted from the GP Patient Survey (GPPS) database. This was a multimethod study using separate qualitative and quantitative approaches to study the app, with the results presented separately, rather than a mixed-methods study where such approaches would be integrated in the analysis.

## Results

### Qualitative study

Using the NASSS framework, the qualitative workstream identified the multiple layers of complexity manifesting when introducing a constantly shifting technology into a challenging environment, such as English general practice, during and after a period of considerable societal turbulence in the context of the COVID pandemic. Several interacting influences shaped the trajectory of the NHS App. These included complexity and variability in the value proposition as different features were added, removed or became more or less relevant over time, such as the COVID-19 Pass; variable infrastructure and local arrangements which meant some features were only functional in some areas or general practices; availability, interest and capacity of healthcare staff to support adoption, in the context of what was perceived as top-down implementation, as well as effort required by patients and carers to use the app meaningfully; varied motivation at organisational level to put in place the processes, staff roles and capacity required for the change effort; the influence of the wider context which shifted considerably from a 'remote-by-default' orientation to an emphasis on in-person care, as well as controversies related to specific features (such as centralised patient access to own records); and challenges with digital inclusion especially in relation to maintaining interest in an offer that would appeal to a large proportion of NHS patients and remain relevant for them over time.

### Quantitative studies

Analysis of NHS App usage data and other routine statistics for general practice in England showed that there was strong adoption of the NHS App even before the onset of the COVID-19 pandemic, although the introduction of the COVID-19 Pass feature did cause a massive surge in registrations. Before the first national lockdown in the UK was announced, there were almost 1.5 million downloads of the app. Between January 2019 and May 2021, there were 8,524,882 NHS App downloads and 4,449,869 registrations, with a fourfold increase in app downloads when the COVID-19 Pass feature was introduced. Analyses by sociodemographic data found higher usage in less-deprived and less-ethnically diverse practices, with a generally younger population. There were 25% lower registrations in the most deprived practices ( $p < 0.001$ ), and 44% more registrations in the largest-sized practices ( $p < 0.001$ ). Registration rates were 36% higher in practices with the highest proportion of registered White patients ( $p < 0.001$ ), 23% higher in practices with the largest proportion of 15- to 34-year-olds ( $p < 0.001$ ) and 2% lower in practices with highest proportion of people with long-term care needs ( $p < 0.001$ ).

In terms of specific app functions, the COVID-19 pandemic and the introduction of the COVID-19 Pass service had significant impacts on their use. Introduction of the COVID-19 Pass accounted for over a threefold increase in login sessions in May, indicating that users could have been logging into the app to retrieve their vaccination status. This pattern was also observed for the number of users using the app to access their GP health records. Appointment bookings fell substantially after the first lockdown in line with a fall in overall primary care NHS activity, but continued on the same gradient from March to May 2021. Prescriptions ordered via the NHS App also significantly increased after the first lockdown, suggesting that more users were using the app to place prescription orders rather than in person or via the phone. These findings could be related to patients and carers seeking alternative options to in-person care and may have also been influenced by changes in health service delivery due to the risk of COVID-19 transmission and due to the reliance on online prescriptions to support patients who had relocated during the national lockdown.

There were variations in the use of different features overall and across the different covariate categories. Practices with younger patients had higher appointment booking rates, but lower rates of prescription ordered. In practices with the most people with long-term healthcare needs, there were significantly higher rates of medical record views and prescriptions ordered but lower appointment booking rates, registrations and logins. For ordering prescriptions online – one of the most used features – there was a strong ethnicity gradient, with practices with a higher proportion of White patients using this function more than twice as much as practices with a lower proportion of White patients, suggesting particular opportunities for changes in design and practice to reduce inequality.

Our analysis of GP patient experience of care and care access on public engagement with the NHS App features highlighted a varied pattern of uptake and revealed a nuanced relationship between access modalities, patient experiences and the utilisation patterns of NHS App features. We might have expected that better patient experience was associated with higher NHS App use, or possibly lower use. We found a more complex and variable relationship.

Generally, practices with better-reported phone access had higher usage overall for the different app functions but had lower registration rates and a varied pattern of logins. In particular, appointment booking rates were 57.8% higher in the practices that were reported as easiest to access via phone. In terms of web access, practices with websites that were reported as easiest to access and use had a mixed pattern of NHS App feature usage. Although registrations, logins and prescription orders were generally higher among these practices, appointment booking rates were substantially lower compared to the reference group. Also, rates of medical record views were overall higher among practices with websites that were easier to access and use, with modest but non-significant increase in the highest quintile. Similarly, the use of the different NHS App features also varied by patient experience with lower rates overall for appointment bookings and prescription orders among practices with better reports of patient experience. Although registrations, logins and medical record views were generally higher among these practices, usage rates were significantly lower in the highest quintiles, suggesting that practices with the best patient experience had lower rates of use of these different functions.

### Research recommendations

We identify three priority areas for further work: longitudinal studies, which include the use of person-level data; studies which focus on inequalities, access and inclusion; and work examining how digital tools like the NHS App can be better integrated into clinical workflows to support healthcare providers.

To better understand the long-term impact of the NHS App and similar digital tools on health outcomes and healthcare utilisation, longitudinal studies are recommended. These studies should aim to track individuals' app usage patterns over time and correlate these with changes in health behaviours, access to care, service utilisation and health outcomes. This would require overcoming current barriers to person-level data linkage but would provide invaluable insights into the effectiveness of digital health interventions.

Our findings suggest that the roll-out of the NHS App has not been equitable across all populations, potentially exacerbating existing health inequalities. Future research should focus on identifying the specific barriers to app adoption and use among marginalised and underserved communities. This includes qualitative research to understand the unique needs and preferences of these populations and developing targeted interventions to increase accessibility and usability of digital health tools and long-term engagement with them.

Research is also needed to explore how digital tools like the NHS App can be better integrated into clinical workflows to support healthcare providers. This includes understanding the barriers and facilitators to the adoption of digital tools by healthcare professionals and investigating how these tools impact clinical practices, patient-provider interactions and overall healthcare delivery efficiency.

### Conclusions

Our study contributes to the growing body of evidence on engagement with novel digital health solutions and the complexity inherent in their adoption. It was clear that the NHS App has achieved strong uptake. While initial uptake was good, the COVID-19 pandemic, and especially the introduction of the COVID-19 Pass feature, drove a significant increase in adoption. The extent to which this uptake has translated to sustained and meaningful use is less clear. But the landscape is complex and changing. Overall uptake and use has followed a deprivation gradient and influenced in particular by patient age, ethnicity and healthcare needs. Different functions of the NHS App have been used to different extents, and with different patterns over time, with varying degrees of experience and use by patients and practices. While many patients report the app has been able to address some of their needs, there is now a need to focus more on understanding and meeting practitioner needs with further development of the NHS App. There is an unresolved question about whether the NHS App represents *an* app for the NHS or *the* app for the NHS. A single NHS login, with linked data, presents real opportunities for tailoring patient offers, and for research, but cannot yet be fully realised.

## Study registration

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# Chapter 1 Introduction

The NHS App was developed as a 'digital front door' to England's NHS. This project aimed to identify and understand the use and acceptability of the NHS App, to measure the extent to which it improves patient experience and influences health service access, and to understand patterns of early take-up and participation.

The NHS App was rolled out in 2019 across the NHS in England at the direction of the Secretary of State for Health and Social Care. The app was launched with core features, including prescription ordering, access to test results and people's own health records, general practitioner (GP) appointment booking, organ donation preference setting and display of the user's NHS number and GP surgery details.<sup>1</sup> It is also linked to a symptom checker and the NHS 111 service, and over time, it has integrated with further services, such as the COVID-19 vaccine pass, accessing vaccination and other health records, receiving messages regarding care, managing secondary care appointments, viewing hospital waiting times and receiving online consultations. Modifications within the app have been informed by user research.<sup>2,3</sup> As of December 2023, there have been over 33 million downloads of the app,<sup>4</sup> representing 75% of UK adults.

National Health Service England's initial goals for the app were to improve access to primary care services, improve patient experience, save time in GP practices and promote self-care. There was no planned national evaluation of this app, which was introduced as a policy priority and constituted a novel complex intervention with potentially wide-ranging impacts on the use of healthcare services. This project is therefore important and timely as it provides the only national evaluation of a major component of the central plan to digitally transform the NHS.

The roll-out of the NHS App was in line with a general political discourse and drive towards harnessing digital tools for health care and was tied in with the roll-out of the NHS login. The NHS Long Term Plan<sup>5</sup> set out the ambition for all patients in England to have the right to access digital consultations from their GP, while NHS England's 'digital first' strategy, aimed to direct patients away from in-person engagements, through telephone, online or video consulting before face-to-face consultations.

The introduction of the NHS App also needs to be seen in the wider context of access to primary care services. Strategies to improve access to primary care services include several national initiatives, such as the Modern General Practice model in England, which focuses on ensuring equitable and easy access to care across multiple channels using optimised telephone systems, well-designed practice websites, as well as using digital tools such as the app. These approaches align with a global commitment to prioritise primary care access, as outlined in the WHO Declaration of Astana, which emphasises the significance of primary health care in achieving universal health coverage and supports the use of technologies to improve access to care and to involve individuals in their healthcare decisions.<sup>6</sup> They also reflect on patient and public views regarding priorities for improving the NHS, with ease of access to GP appointments highlighted as one of the top two concerns.<sup>7</sup>

The delivery of the NHS App was led by NHS England and built by NHS Digital.<sup>8</sup> Responsibility for the NHS App was taken on by NHSX, with NHS Digital remaining the main delivery partner. There was a rapid roll-out plan, with full national usability for all practices by July 2019 in England,<sup>1</sup> and all patients with a long-term condition to have access to their care plan through the NHS App by 2020, through the Summary Care Record. However, by February 2020, a political shift from an app with 'huge functionality' to a 'thin app' as a platform for industry to integrate with (in the context of other apps from the digital health industry offering some similar features),<sup>9</sup> and followed by the COVID-19 pandemic, which had some impact on this national roll-out. Over time, other competing apps (such as the NHS COVID-19 App) were at the forefront of NHSX's delivery campaign. There was also an introduction of 'total triage' for patients in primary care in March 2020, where all care, wherever possible, was to be initially undertaken by remote means.<sup>10</sup>

Throughout roll-out, the app has been dubbed as serving to 'ease pressures on GPs', 'provide more effective, personalised care' and 'freeing up valuable clinician time'.<sup>11</sup> There have been ongoing developments of the NHS App, with additional features and integrations added throughout roll-out (including a vaccination certificate, linked profiles, GP messaging and authentication infrastructure), and it continues to be at the forefront of the digital health agenda in government policy. In the spring budget of March 2024, the Chancellor of the Exchequer announced £3.4B of

funding for the NHS to invest in digital technology, including the specific aim to make the NHS App a single front door for patients. The future plans for the NHS App include greater use of messaging with healthcare providers, more preventative 'keep me healthy' content, and supporting integration with third-party apps and devices.

The NHS App is, in essence, a patient portal. Patient portals provide the potential for improved patient-provider communication via electronic messaging, direct appointment booking, prescription ordering, and provide users a platform to be more informed about their health.<sup>12</sup> Research exploring patient access to electronic health records using patient portals underscores their potential to improve care co-ordination, enables self-management and supports empowerment by actively engaging patients in their healthcare decisions.<sup>7,12,13</sup> While benefits of such technologies have been reported on several aspects of care, such as disease awareness, medication adherence and patient safety, issues around patient confidentiality, security and trust remain.<sup>13,14</sup> There are also reports of unintended consequences of online access to health records with impacts on patient autonomy, documentation practices and increased workload, which affect patients and healthcare staff.<sup>15</sup> Impacts on inequalities are also not well understood.<sup>16,17</sup> Evidence suggests inequality patterns not only relate to patient portal adoption, which is generally lower in those who are elderly,<sup>18,19</sup> ethnic minorities<sup>18,20</sup> and from a lower socioeconomic status,<sup>19</sup> but they are also reflected on sustained engagement trends and the use of different portal functionalities.<sup>20</sup> Research highlights that users may show preferences for specific patient portal features, and their ability to engage with certain functions are influenced by factors such as age, digital literacy, health conditions and personal healthcare needs.<sup>21-23</sup>

To evaluate the app, this study had two workstreams. A qualitative approach used comparative case studies in five general practices to explore experiences and views on the acceptability of the NHS App through observations in general practices, document analysis, interviews and focus groups with patients, GPs, practice staff, commissioners and policy-makers. Our theoretical approach was based on the NASSS framework.<sup>24</sup> Secondly, a quantitative element examined patterns of uptake and adoption of the app, and its various functions, and changes in use across different population groups. We also explored whether patients' experience of access to their general practices and their overall practice experience influences engagement with the NHS App. Alongside analysis of aggregated NHS App usage, we had originally aimed to use bespoke data linkage of individual patient data, but this was not possible as discussed later in the monograph and this change was agreed with NIHR.

In this monograph, we first (see [Chapter 2](#)) describe the qualitative study (see [Methods](#) and [Results](#)), then in [Chapters 3-5](#), we will describe the three quantitative studies (see [Methods](#) and [Results](#)). These empirical chapters reproduce work which has been published in, or is currently under review, with academic journals (with appropriate attribution and copyright permission). We discuss all the findings in the subsequent chapters, and also provide details of how we involved patients and the public in this work. We conclude with sections on the impact of the work, implications for policy-makers, and our recommendations for future research.

# Chapter 2 Qualitative study

## Introduction

The qualitative study examined how the NHS App has been used and experienced over time by patients, carers, members of the public, healthcare staff, delivery teams, industry and other stakeholders, and whether and how the app has met varying needs in accessing and organising health care. Parts of this chapter have been reproduced with permission from Reidy *et al.*<sup>25</sup> This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) licence, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: <https://creativecommons.org/licenses/by/4.0/>. The text below includes minor additions and formatting changes to the original text.

Our research questions were:

1. How did multiple interacting influences shape NHS App use, implementation and roll-out in general practice (and beyond)?
2. How did patients, carers and healthcare staff experience the integration of the NHS App in the health service? What were the perceived implications for access, efficiency and safety in general practice?
3. What transferable learning can we draw from the example of the NHS App to inform the implementation, national roll-out and routine use of health technologies?

Ethical approval for this study was granted by the National Research Ethics Service and Health Research Authority (Reference 21/WS/0031).

## Methods

This was a longitudinal qualitative study which employed a range of methods, including interviews, focus groups, observation and document analysis. Technology implementation, roll-out and transferability were explored as nonlinear processes across different settings. We compared and contrasted findings between general practice sites. Data collection were carried out over 2 years between June 2021 and April 2023. This longitudinal approach facilitated investigation of the NHS App as an evolving technology in a policy and public health environment which was changing rapidly. It also allowed exploration of sociotechnical processes over time, such as administrative processes, professional roles, norms around primary care access and patient expectations.

The sites were five GP practices across England. We used a staged approach to site identification and recruitment to achieve maximum variation in characteristics such as geographical location, ethnicity mix, patient list size, deprivation levels and digital maturity status. Digital maturity was assessed using the Greenhalgh *et al.*<sup>26</sup> digital maturity five-point scale, which considers the organisation's readiness to plan and deliver a digital service (including measures to address digital inequalities), its capability (based on what level of digital measures are already present and running), and the organisational infrastructure (the underpinning material, regulatory, and human resource frameworks) that are in place to support further development of digital services. The characteristics of the five sites are shown in [Table 1](#). Sites were identified via NIHR Local Clinical Research Networks and professional networks. The functionality offered through the NHS App to patients differed by practice (and over time). These are summarised in [Box 1](#) for clarification on the functionality offered to patients in each site.

**TABLE 1** Case site characteristics

	Case site 1	Case site 2	Case site 3	Case site 4	Case site 5
Location	South East England	East Midlands	North West England	North England	South East England
Urban/rural	Urban	Rural	Urban	Urban	Urban
Population served <sup>a</sup>	Mixed ethnic population; 3.5% mixed, 13.6% Asian, 4.5% Black, 1.3% Other non-White ethnic groups	Mostly White British; 1.3% non-White ethnic groups	Majority south Asian; 1.5% Mixed, 66.9% Asian, 1.8% other non-White ethnic groups	Mixed ethnic population; 6.7% Mixed, 20.2% Asian, 17.9% Black, 1.9% other non-White ethnic groups	Mixed ethnic population; 7.3% Mixed, 10.9% Asian, 20.1% Black, 10.9% Other non-White ethnic groups
Practice patient population size <sup>b</sup>	Large: 18,998	Average: 13,098	Average: 10,847	Small: 7385	Small: 3032
Deprivation level <sup>c</sup>	7	4	2	3	2
Information technology (IT) system used	EMIS	SystemOne	EMIS	SystemOne	EMIS
Digital maturity <sup>d</sup>	Level 4: (learning and improving)	Level 2: traditional with lone innovator (ad hoc, demonstration)	Level 2: traditional with lone innovator (ad hoc, demonstration)	Level 3: digitally curious (experimenting)	Level 2: traditional with lone innovator (ad hoc, demonstration)

a Estimated proportion of non-White ethnic groups in the practice population (weighted average over the contributing LSOAs) – Data source: Census 2011 (Ethnicity by LSOA); HSCIC: Numbers of Patients Registered at a GP Practice – April 2015 (Patients by LSOA) (Office for Health Improvement and Disparities, 2023).

b 9544 England average (Office for Health Improvement and Disparities, 2023).

c Deprivation score (Index of Multiple Deprivation 2019) of the area, 1 = most deprived, 10 = least deprived (Office for Health Improvement and Disparities, 2023).

d Assessed using the Greenhalgh *et al.*<sup>26</sup> digital maturity scale, from level 1: traditional (reactive) to level 5: system-oriented (extending and spreading).

#### Source

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**BOX 1** Functionality offered to patients through the NHS App according to each case site<sup>a</sup>**All practices**

All users were able to access their NHS number and GP surgery details, organ donation preference setting, and were able to link to a symptom checker and the NHS 111 service. These features did not require practices to enable access.

All practices provided access to patients' own health records and test results when patients requested this access or already had their own health record access digitally enabled through their practice previously. Practices had different protocols as to how access was given, and whether records would be assessed by staff to have data redacted.

All practices offered proxy access (available from July 2021) which was assessed on a case-by-case basis and access provided according to local protocols, and whether records would be assessed by staff to have data redacted. All practices provided access to the COVID Pass from May 2021.

**Functions available per case site**

Case site 1: a digital triage and online consultation service (additional add-on to the NHS App), online prescriptions (most prescriptions were encouraged to come through to this practice electronically, through the NHS App, another app or through the practice website). Initially provided appointment booking early on, but soon disabled this function, with no intention to reinstate.

Case site 2: add-on personal health record functionality through a commercial provider (which allows access to secondary care health records and messaging, including photo messaging and questionnaires related to long-term conditions<sup>b</sup>), and online prescriptions (although most prescriptions to the practice came through telephone).

Case site 3: online prescriptions. Initially used appointment booking early on, but disabled this function, with no intention to reinstate.

Case site 4: a digital triage and online consultation service, online prescriptions (most prescriptions were encouraged to come through to this practice electronically, through the NHS App, another app or through the practice website).

Case site 5: online prescriptions (but patients were encouraged to continue using another app for this), appointment booking never used, but there were intentions to use this for nurse appointments in the future.

<sup>a</sup> At the time of data collection.

<sup>b</sup> This was commissioned at a local level by the local Clinical Commissioning Group (CCG).

**Participant recruitment**

Patients and carers were primarily identified through GP practice screening and selection or through invitation via practice patient groups in the five study sites (2–6 patients per site). We used theoretical and maximum variation sampling: as data collection progressed, patients and carers were selected based on views that were either missing, or views that we wanted to explore in more depth, for example, patients who had attempted to gain proxy access, or patients who had supported a member of their family to access the app. We also recruited some patient and public participants directly through voluntary and community organisations (such as groups representing different health conditions) or social media [Facebook groups (Facebook, Inc., Menlo Park, CA, USA) and Twitter (Twitter, Inc., San Francisco, CA, USA)], for example, those using the #NHS App or using condition-specific groups.

Interviews and focus groups involved people living with a range of health conditions ([Table 2](#)), including those living with, or carers of people living with, conditions such as HIV, long COVID (and those with comorbidities relating to long COVID), type 1 and type 2 diabetes, Parkinson's, colitis, epilepsy, arthritis, skin conditions, cancer, asthma, amputations, high blood pressure, high cholesterol, fibromyalgia, Crohn's disease, immune compromised, kidney failure, allergies, severe intolerances, sight loss, mental health conditions and those having investigations done for yet undetermined conditions (e.g. spinal stroke, eye conditions).

We used purposive sampling to recruit NHS staff (selecting participants from different professional roles to ensure a varied sample). NHS staff participants were identified and invited to participate through the case study sites as staff working within the site.

TABLE 2 Participant characteristics

<b>Patient participants (n = 49)</b>		
Age (years), mean (SD); range	53 (13.26), 20–79	
Gender, n (%)	Female	30 (61%)
	Male	19 (39%)
Ethnicity, <sup>a</sup> n (%)	White British	33 (67%)
	Indian or British Indian	5 (10%)
	Pakistani or British Pakistani	2 (4%)
	Black British	3 (6%)
	Black Caribbean	2 (4%)
	Black African	1 (2%)
	British Bengali	1 (2%)
	White European	1 (2%)
	Turkish	1 (2%)
	Location in England, n (%)	South East
North West		11 (22%)
East Midlands		8 (16%)
North East		6 (12%)
South West		4 (8%)
West Midlands		1 (2%)
Caring responsibilities, n (%)	Yes	11 (22%)
	No	38 (78%)
<b>NHS staff (n = 23)</b>		
Roles, n (%)	Admin role	8 (35%)
	Practice manager	5 (22%)
	GP	4 (17%)
	GP partner	4 (17%)
	Nurse	1 (4%)
	Healthcare assistant	1 (4%)
Gender, n (%)	Female	17 (74%)
	Male	6 (26%)
Ethnicity, <sup>a</sup> n (%)	White British	9 (39%)
	Indian or British Indian	8 (35%)
	Pakistani or British Pakistani	2 (9%)
	Black Caribbean	1 (4%)
	Other Arabic	1 (4%)
	White European	1 (4%)
	Filipino	1 (4%)

TABLE 2 Participant characteristics (continued)

<b>Patient participants (n = 49)</b>		
Location n (%)	North West	7 (30%)
	South East	7 (30%)
	North East	6 (26%)
	East Midlands	3 (13%)
<b>Stakeholders (n = 16)</b>		
Stakeholder number	Organisation	Role
SH1	CCG	Project lead
SH2	CCG	Management
SH3	NHS App development and implementation teams	User researcher
SH4	CCG	Management
SH5	CCG	Department head
SH6	Data privacy organisation	Co-ordinator
SH7	NHS App development and implementation team	Department head
SH8	Industry	Management
SH9	Industry	Director
SH10	Health tech support company	Implementation role
SH11	NHS App development and implementation teams	Director
SH12	CCG	Management
SH13	CCG	Implementation role
SH14	CCG	Implementation role
SH15	Professional body	Stakeholder
SH16	Industry	CEO
Organisations, n (%)	CCG	7 (44%)
	NHS App development and implementation teams	3 (19%)
	Industry	3 (19%)
	Data privacy organisation	1 (6%)
	Professional body	1 (6%)
	Health tech support company	1 (6%)
Roles, n (%)	Management	4 (25%)
	Implementation role	3 (19%)
	Director	2 (13%)
	Department head	2 (13%)
	CEO	1 (6%)
	Project lead	1 (6%)
	User researcher	1 (6%)

continued

TABLE 2 Participant characteristics (continued)

Patient participants (n = 49)		
	Co-ordinator	1 (6%)
	Policy officer	1 (6%)
Gender, n (%)	Female	12 (75%)
	Male	4 (25%)
Ethnicity, <sup>a</sup> n (%)	White British	15 (94%)
	Indian or British Indian	1 (6%)
Location, n (%)	South East	9 (56%)
	North West	5 (31%)
	East Midlands	2 (13%)

a Ethnicity data self-reported from participants.

**Source**

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Policy, commissioning, industry and other stakeholders were recruited using purposive and snowball sampling, considering relevant expertise in their professional role and involvement in the introduction and roll-out of the NHS App. We contacted participants across a range of relevant organisations, drawing on authors' professional networks and publicly available information.

**Data collection**

We recruited 88 participants to 62 semistructured and think-aloud interviews, and 4 focus groups (Box 2). These 88 participants included patients, carers and members of the public (who used the app to different degrees or not at all), clinical and non-clinical NHS staff, and other stakeholders from the digital health industry, policy and commissioning, other public bodies, and civil rights organisations. Some of the participants discussed their experiences with the NHS App in a dual capacity, in terms of professional involvement but also personal use.

**BOX 2** Summary of data sources

- Interviews:
  - 62 interviews with 66 participants comprising
  - semistructured interviews (some involving more than one participant) with
- 23 patients, carers and members of the public
- 23 healthcare staff (practice managers, GPs, nurses, healthcare assistants, admin and finance)
- 16 stakeholders (from commissioning, NHS agencies, policy, data privacy organisations, public bodies, industry)
  - Think-aloud interviews with four patients
- Four condition-specific focus groups with 22 patients/carers living with diabetes, long COVID, Parkinson's, HIV
- Observations in five GP surgeries (60 hours)
- Fieldnotes (notes, photos, videos, screenshots)
- Document analysis of approximately 100 documents (policy blogs, GP documents/forms, government reports, social media discussions)

Department head	2 (13%)
CEO	1 (6%)
Project lead	1 (6%)
User researcher	1 (6%)
Co-ordinator	1 (6%)
Policy officer	1 (6%)

All interviews and focus groups were conducted by Claire Reidy (CR) (PhD, experienced qualitative researcher), and CP (PhD, experienced qualitative researcher). Neither CR nor CP had any prior relationship with study participants. Semistructured interviews explored individual experiences, while focus groups (conducted with patients and carers only) allowed participants to collectively debate their views and perceptions. We followed a flexible topic guide adapted for different participant groups to gain an understanding of experiences with and perceptions of the app, how people used it, as well as background design and development processes, and the role the app played in organising care in general practice. Think-aloud interviews with four patients enabled direct in-depth observation of interaction with the app (e.g. viewing or using features on the app), facilitating articulation of how tasks were accomplished and challenges encountered. We captured these interactions in field-notes, photos (of participants' use of the NHS App), screenshots, and videos, with participant permission. Interviews and focus groups took place on Microsoft Teams, over telephone or face-to-face at different stages of the pandemic and lasted between 16–72 minutes (average = 41 minutes) and 59–87 minutes (average = 73 minutes), respectively. All interviews and focus groups were digitally recorded and transcribed verbatim for analysis (with written or digitally recorded consent from participants).

Claire Reidy conducted focused observations (face-to-face, totalling ≈ 60 hours) within each GP surgery, to better understand the back-end operational and technical processes required to integrate the app in the service (e.g. managing digital appointment booking or prescription ordering). Observations facilitated assessment of digital maturity within each practice site, the context of the practice, collection of NHS App-related and digital health promotion documents in GP surgeries and supported participant recruitment.

We collected a range of documents (e.g. policy blogs, Twitter discussions, government reports and plans, newspaper articles, documents in GP surgeries – e.g. forms for patient digital health access, and GP survey examples) which helped inform recruitment but also contributed to data interpretation and context setting.

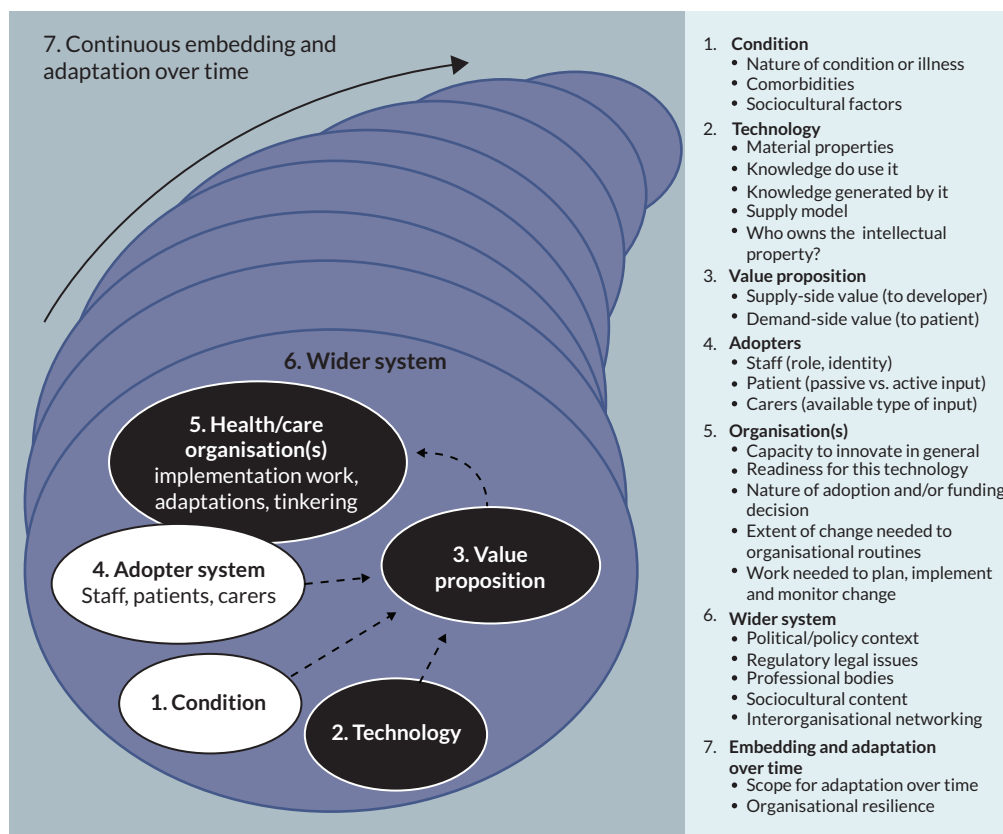
## Data analysis

### Theoretical framework

Data collection and analysis was informed by Greenhalgh *et al.*'s NASSS (*Figure 1*) an evidence-based framework developed to guide thinking on the implementation, roll-out and routine use of technology in health care.<sup>24,26</sup> By drawing on NASSS, we have taken a complexity-informed approach<sup>27</sup> to embrace rich theorising, generative learning, as well as pragmatic adaptation to changing contexts. In this sense, we acknowledge the dynamic, interconnected, and adaptive nature of healthcare systems, and the implementation and roll-out of a complex app in a complex system. For example, we used NASSS to explore multiple interacting influences to NHS App implementation and use, including differences in engagement with the NHS App depending on clinical needs and service configuration, the complexity of the technology itself and modifications to it over time, the value generated for different stakeholders, the role of NHS staff in its introduction, the underlying organisational structures in place and the complexity of wider NHS service provision.

### Analysis

Analysis took place in parallel to data collection, enabling us to refocus our methods over time, to account for a range of experiences and emergent themes until we were able to build a sufficient understanding.<sup>28</sup> It enabled us to consider changes as the app was rolled out, and who we needed to speak to and what data we would need to capture to build on



**FIGURE 1** NASSS framework. Reproduced with permission from Greenhalgh *et al.*<sup>24</sup> This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) licence, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: <https://creativecommons.org/licenses/by/4.0/>. The figure above includes minor additions and formatting changes to the original text.

our evaluation of the NHS App roll-out, for example, the development of the COVID-19 Pass. Braun and Clarke's<sup>29</sup> six-step framework guided our thematic analysis, which began with data familiarisation, generation and iterative refinement of initial ideas and codes from transcripts and fieldnotes. This was followed by inductive and deductive development of broader themes within and across NASSS domains, including comparing and contrasting similarities, differences, and connections in the data (especially across sites). Combining an inductive and deductive approach allowed us to pay attention to emergent as well as anticipated themes and to identify cross-cutting areas of complexity. We used NVivo 12 (QSR International, Warrington, UK) for data management.

Our patient public involvement group was involved in the process of data analysis and sense-making. We held six patient public involvement and engagement (PPIE) workshops at project initiation and set-up, through recruitment, and as data emerged. The workshops enabled a space for sharing, discussing and challenging insights gained, and considering and prioritising approaches and directions for continuing data collection. Further, weekly team meetings with the PPIE lead facilitated continued engagement throughout the study.

## Results

The analysis draws on the NASSS framework to identify the various ways in which complexity manifested as part of implementation, use and roll-out of the NHS App, including how multiple interacting influences shaped its trajectory. We categorised these against the seven domains of the framework, as described below. Illustrative quotes are provided under each NASSS domain.

### Domain 1: clinical condition

Participants with health conditions described different care pathways for the management of their health and shared different ways of engaging with the NHS App. For example, those with conditions primarily managed in general practice found more useful functionality through the app (following up on investigations and test results from within the GP Practice, and letters between GP practice and secondary care). Many of those primarily receiving care in hospital or community settings (e.g. patients living with Parkinson's, HIV or type 1 diabetes) found the app less useful in their self-management as they were unable to access the majority of their test results or health records (unless their practice included a personal health record function add-on in the app through a commercial provider). This led some patients to express frustration with the app which they saw as reflecting system fragmentation and a lack of joined-up care;

*I've got now a multidisciplinary team behind me ... [so] using those different authorities in the NHS, my medical records are not too complete ... if I look at my [GP] medical record, I would be very surprised if it even says I've got Parkinson's because I don't interact with my GP surgery at all with Parkinson's ... I think [the NHS App] is great to have, [but] it's gotta be able to interface with all the other potential medical people I use.*

*R5, Parkinson's Focus Group, 57, male, White British*

While the NHS App was designed to be used by anyone registered for NHS care (aged 13 or over), some patients and staff posited that it would be less relevant for those not managing long-term conditions (e.g. it was suggested young people were more likely to belong to this category) as they may not need to use its features, or the health service, as regularly.

*Yeah I use like a health app on my phone like for my steps ... I think my dad told me about it [the NHS App] ... I'll do it later ... I just don't feel like I need it at the minute ... I don't wanna do it ... [it's] for everyone and also for patients that might want to track anything on there ... it can be for me, I just, I don't know ... I just don't feel like I would use it very often that's why ...*

*P12, site 3, 20, female, British Indian*

### Domain 2: the technology

#### The app and its features, over time and in different settings

Compared to alternative patient portals already in use by GP practices, the NHS App required a more elaborate registration and authentication process (e.g. filling in an online or, usually, a physical form), plus requirement to provide identity documents (see [Appendix 1, Figure 20](#), take a photo or video, facial recognition, and for the practice to enable a digital 'linkage key') which in many cases made the app initially appear complex and difficult to navigate for patient users.

Apart from core functionality provided directly through the app, the rest of its features relied on background systems and infrastructures (e.g. GP IT systems, access to the Spine, Electronic Prescription Service data, Summary Care Record) with the NHS App only functioning as gateway. This increased complexity as not all features were available by default and consistently to all users. For example, GP practices made decisions independently on whether they would enable appointment booking (including what types of appointments and how these would be displayed) through the app which resulted in significant variability in whether and how this feature became available to patients;

*... nobody understands how complicated booking practice nurse appointments are ... and so we would never let them [patients] do that [online booking] ... Because they would get it wrong ... it depends on the nurses skill set if she's the right nurse and how long it needs depends on certain things ... there's well over a 100 different types of [Practice Nurse] appointments ... if [patients] speak to our staff they can signpost you ...*

*S17, site 4, practice manager*

Appointment booking was in fact disabled by most surgeries given triage protocols during the pandemic and demand pressures following consecutive lockdown periods (see [Appendix 1, Figure 21](#)). There were some accounts of patients being able to use appointment booking on the app, especially before the pandemic, although this was not the case for most people we interviewed (who reported they would benefit from such a feature):

*pre-COVID you had to put 75% of appointments available online for booking ... Now the trouble with that is that goes against all sign posting practice ... we spend our life trying to triage ... to get things to the right clinician in the right time frame ... [booking] straight into appointments online goes completely against all of that ... While booking an appointment that they don't need, you know, for a hay fever medication which they should just go and get from the chemist. There's no way of filtering that.*

*S1, site 1, practice manager*

Own record access was controlled by local protocols and procedures which in some cases differed (at least in terms of their interpretation) between, and sometimes even within, GP practices [especially in relation to limiting access due to General Data Protection Regulation (GDPR) concerns];

*there's certain things in your records where it says ... you don't have access to this or you don't have permission so I've actually gone into the surgery three or four times and said I want access to this part and quite often they say oh we don't know how to do that ... and for some reason my husband he's got access to more sections on his than I have.*

*R6, Long COVID focus group, 48, female, White British*

Even in cases where patients were provided with access to their own records, sometimes these were in a coded format, rather than designed for sharing with patients. Therefore, some patients found them to be lacking in meaning and relevance;

*not that I can understand this [coded entry on the app].*

*P24, site 4, 62, female, British Indian*

Over time the app became integrated with external commercial platforms, such as a personal health record platform, a digital triage and online consultation service (where patients submitted symptoms or requests to their GP practice), and other communication solutions. Again, these options were only available in GP practices or secondary care services using such external providers through local contracts and arrangements (e.g. independently or through their CCG). This increased variability in the features on the app, with additional options available for some patients and practices, but not others. It also complicated our interviews with patients as it was often unclear to us (and to them) what features were available to each of them and at what point.

### **Knowledge required to access and use the app**

Our data indicated a certain level of knowledge was needed to be able to request access to the app in the first place and make good use of available features. Yet, awareness of resources and guidance available to support use of the app varied among staff and patients. Some suggested that the app should facilitate access in a more patient-facing way that does not assume advanced health literacy to interpret, for example, normal ranges for blood test results (something that was addressed in a later version of the app);

*... having an app like this does assume a level of health literacy that I don't think the general population had, I mean again even somebody who has some medical awareness there's some bits of it that I kind of look at and I go 'what does that mean?' ... [so] what is a blood test what is a normal range just having some access to some of those sort of information.*

*R2, Long COVID Focus Group, 42, female, White British*

In interviews and focus groups, there was confusion over what the NHS App was in the first place. Some patients thought it was the same as the COVID track and trace app used for contact tracing at the time. There was general lack of awareness of what other features (other than NHS COVID Pass) were available on the app and so patients and staff often articulated that more publicity and promotion was required.

Complexity emerged not just because practices had different processes and protocols in terms of enabling or disabling specific features on the app. Staff also needed to know how to interpret and activate these protocols (e.g. enabling proxy access or access to own records) so that features of the app would become usable for patients.

### Domain 3: the value proposition

#### Should this be the only app that practices use or one of many?

By designating the NHS App as the digital 'front door' to the NHS, policy-makers aimed to promote access to services and support self-management, enabling patients to 'be more equal partners' in managing their health care. Members of the NHS App development teams saw it as a way to address inefficiencies, generate better (and less) use of appointments, and reduce burden on services, such as through patients ordering prescriptions, monitoring test results or checking on referral progress. It was publicly pronounced as a 'thin' platform on which other services and third-party suppliers would connect to, perhaps due to push-back from industry about the NHS App's potential to 'stifle the market':

*Yes but if you've seen the App you will see that, so we got so much push back from third party suppliers about the NHS trying to stifle the market and Matthew [Gould]'s blog was very much the NHS App would remain very thin but nobody ever really kind of said what that meant ... I think he meant it would be a platform that other services would connect to etc. ... people would choose whatever, whatever kind of user interfacing they preferred.*

*SH7, Development team 2, Communications and stakeholder engagement*

However, the strategy or concept of a 'thin' app was not clearly characterised or explained to practices. Over time, and with integration of popular features such as the COVID Pass, value was articulated in different ways to meet different needs and interests, given broader policy intentions and targets for widespread use.

#### Demand-side value: 'empowerment' and 'control' for patients, reduced workload for practices?

For most patient participants, value is often derived from relatively simple features, such as ordering prescriptions on the app (compared to calling or visiting the surgery). Security features, such as fingerprint scanning and face id to access the app, were considered appealing to many users we spoke with and was especially important for those with health diagnoses they did not want shared outside the health service:

*I'm really worried about my HIV status coming out but I would rather have my results on my phone, I don't pass my phone to anybody so nobody can go onto it, you can't go onto the App without your fingerprint so they can't just see that App and think oh I've have a look and see what that is because they can't get on it.*

*R4, HIV Focus Group, 47, female, White British*

Having features such as security codes for accessing the app sent through text message provided reassurance (see [Appendix 1, Figure 20](#)).

When patients could access their own (or where they had proxy access rights to others') health records, they reported an increased sense of control, for example, knowing what information was held about them, what consultations had occurred when, and what record was kept regarding those consultations. Some patients also saw such access to records as providing the ability to hold the service to account:

*Well I suppose the purpose of the App should be for me to be able to know what information is kept about me, you know, with regards to whatever interaction I've had with the NHS ... [if] the medical institution has any information about me, you know, I want to know what that information is.*

*P16, 56, male, Black British*

However, given the availability of different features varied between settings, what patients expected as added value from the app often did not materialise. This included quick and easy access to booking appointments through the app, viewing own health records or providing a history of encounters across the health service, rather than just in general practice.

With promised features not always realised, some patients were reluctant to shift to using the NHS App as they compared its value to other apps or portals with similar features they had already been using (e.g. pharmacy apps). They suggested added value would be generated if the NHS App could provide more interactive features, such as

pop-up notifications when prescriptions were ready to collect, or when new test results, letters or referrals were issued. However, when pop-up notifications were enabled in newer versions of the app, technical issues meant some notifications appeared without any content.

From the perspective of general practice staff, the app did not always appear to have a clear and sustained value proposition in terms of supporting their practice, workload or engagement with patients, apart from the prescription ordering feature. They did not always perceive the app as having substantial clinical need or utility (at the time), for example, not tracking referrals, or messaging patients, or other ways for the app benefiting patients directly, although general practice staff recognised it held significant potential in the future (and in some cases awareness about current app features was limited).

With the announcement of the COVID Pass being added to the NHS App in April 2021, the value proposition became quickly associated with this feature and resulted in rapid increase of downloads as well as increased awareness by practice staff. In addition, many patients that we spoke to had only heard about the NHS App in terms of the COVID Pass, and some patient participants described being unsure what value the NHS App would hold for them when they were no longer required to use the COVID Pass.

#### **Domain 4: the adopter system**

##### **Tensions between top-down implementation and staff capacity in general practice**

At first, introduction of the NHS App and its basic functions did not seem to require significant effort by GP staff. Yet, over time it became apparent that patients saw their surgery as the first point of contact, for example, how to register on the app, use it and request access to different features (such as proxy access, personal health records), also correcting personal details for travel purposes using the COVID Pass. This meant surgery staff needed to become increasingly familiar with the app (and its various iterations) from a user and IT infrastructure perspective so they could answer such queries, demonstrate to patients how to use the app or identify sources of external guidance for them, even on matters unrelated to the practice such as the COVID Pass. Staff perceived a lack of technical support being available, and some proposed the development of a toolkit to resolve issues, such as app error codes, or a central team or helpline to support troubleshooting. Without a clear value proposition in terms of addressing workflow and demand pressures, and with little training or support to take on new roles and responsibilities related to the NHS App, some staff, especially practice managers, expressed frustration that the onus had been placed on them in a top-down way without meaningful consultation:

*[M]y staff haven't had any help, haven't had any training in how to support people [with the NHS App], most of them only know about it because they set it up for themselves ... Or because they're interested in NHS stuff and they do it out of the goodness of their hearts so they can help patients ... And giving themselves a tutorial.*

*S17, site 4, practice manager*

Staff also wanted to ensure the NHS App did not signal a complete move away from face-to-face engagement and digital approaches were used in the context of already established, trusted relationships with patients. This was particularly relevant for specific patient groups (e.g. those with language barriers or from particular cultural backgrounds) and those who needed more support to navigate the system through face-to-face contact rather than through complex online tools:

*I think a lot of us are quite pro integrating technology into our systems it's just integrating it in a way that doesn't advantage the people that are already good at getting access to healthcare ... So [digital triage tool]s are great, I would say a lot of the time they are used by people that already receive good healthcare ... [unless] English isn't your first language and you don't have family support around you.*

*S14, site 4, GP partner*

Some functions (e.g. own record access) engendered more complexities than others, including fears that patients may be affected negatively by viewing their records in a system-facing rather than patient-facing format, leading to misunderstandings, additional appointments, as well as safeguarding concerns.

### Variability in patient and carer experiences depending on features available

Patients, especially those living with long-term conditions, used the app to navigate the service and support self-care. In interviews they discussed ordering prescriptions, checking symptoms, viewing test results, and (where available) booking appointments. However, many patients described app usage as occasional rather than regular, in contrast to banking, shopping or neighbourhood apps (where people can connect with, communicate and exchange information or buy and sell items based on their geographical area). Users with access to additional features (e.g. being able to view appointments and secondary care letters) appeared to have an enhanced experience of the app, as they perceived their care as more joined up (see [Appendix 1](#), [Figures 23 and 24](#)).

Those with proxy access on the NHS App (e.g. for family members) described being able to view health records more easily and conveniently 'on the go', ordering prescriptions simply, which supported managing other responsibilities (including employment and caring for others). Yet the process of acquiring access was depicted as long and complex requiring persistence (taking more than 6 months or resulting in failure), as not all GP practices were familiar with protocols and technical processes (e.g. which boxes to select in IT systems) or carers were not always able to procure necessary identification documents. Proxy rights were also an issue when access requirements changed (e.g. COVID Pass age restriction).

### Disparities around equitable use and access

While the NHS App was deemed by some to be more relevant to those living with and managing health conditions, some older adults who were managing (potentially multiple) health needs, or those with some specific cultural needs, described not being able to easily use the NHS App, or the NHS App not being something they wanted to use. Personal social support networks (such as volunteers in the surgery, or family members) were deemed especially valuable for those needing specific support to hear about, access and use the NHS App (such as those with language barriers), and a distinct barrier for those who did not have such assistance:

*I would say it is a barrier, so when you've got patients that can't speak that can't read English it's no good for them really ... We still offer the services to them, [we] just ask them to have family or friends to help them with ordering their prescriptions online.*

*S11, site 3, admin lead*

Some staff also expressed fear around digital access more generally, or around add-on app features (such as a digital triage tool) that could potentially mask coercion and control efforts being exercised over patients accessing the health service, and prevent practices from being able to distinguish such cases.

### Domain 5: the organisation

In the context of increasing demand pressures within practices during and following the pandemic, organisational capacity from general practices to innovate varied between case sites and was not always at the forefront of their efforts (see [Table 1](#) for case study site characteristics, and digital maturity rating). In one of the large practices already championing active engagement in digital innovations before the pandemic (site 1), there appeared to be more organic and unified processes for integration of new ways of working including dedicated practice staff with experience introducing new technologies.

*... because of our involvement in that [working with industry] and other tools when COVID hit we were in quite a good position to be able to manage that ... our patients were used to us communicating with them in that way [SMS messaging] we also I think because of my University background ... where everything was very digital ... I'd already been working over the previous year to try and get ... people set up with things like VPN's with remote access ... And so actually and using more digital tools.*

*S1, site 1, practice manager*

In other practices, there was apprehension from practice managers that introduction of digital innovations would conflict with a more 'traditional' organisational culture prioritising patients telephoning or attending face-to-face (site 2 and site 5).

*... I know some practices have tried to introduce, not a barrier as such, but they have tried to really direct people sort of to, to remove the telephone option to some degree ... I think because of our traditional approach, that would be something where I definitely will get resistance from the GPs ... I don't think they would want that as, as part of their practice.*

*S5, site 2, practice manager*

There were also fears expressed from some staff around a lack of capacity to take in, organise and act on potential extra engagement or data as a result of digital innovations and augmented access to test results and health records. Organisational capacity and willingness to innovate, including leadership focus on innovation, led to varying levels of readiness for the NHS App and impacted on NHS App use and promotion within practices. Yet, when the app (or its add-on services) offered clear value by resolving or improving workflow, such as patients sending in photos in a secure and confidential way, it enabled organisational willingness to promote use of the app even in the context of more 'traditional' organisational cultures (site 2):

*[S]o particularly sort of dermatology type things, we'll encourage them [patients] to send photos and that's, that's where we've tried to use the [NHS] App, because that's a secure way and the patient has had to prove who they are to gain access to the app etc. and so that's the one we favour.*

*S5, site 2, practice manager*

### **Nature of adoption and/or funding decisions**

The introduction of the NHS App appeared to generate tension, confusion or conflict in practices already using products (apps or patient portals) with similar or additional (e.g. messaging or video consultations early on) functionality, with little support over how to navigate the digital landscape or reach a decision to switch to the NHS App. Integration of the COVID Pass became a deciding factor as it increased awareness of the NHS App for patients and staff, yet some NHS App functions were still not promoted by practices with a history of using commercial apps or portals.

While the NHS App, in its basic form, does not require funding to use it, some add-on features, (which could potentially add unique or more valuable functions for the practice) do require funding. Yet, there was often a lack of dedicated income stream for practices, and so more innovative add-on features were seen as 'out of reach', even for practices who were more digitally focused. As a result, there were tensions between the value of the app set against funding, as well as infrastructure, organisational capacity, and staff roles.

### **Extent of change needed to organisational routines**

Introduction of the NHS App required co-ordination between staff members to enable patient access to the app, respond to queries, and integrate processes within IT systems. Yet, at organisational level, allocation of staff roles and relevant training was inconsistent between practices; some provided staff with training or information on the practice intranet while others relied on staff own initiative to train themselves out of interest in technology or 'out of the goodness of their own hearts so they can help patients' (S27). Some practices emphasised the unexpected responsibility on the organisation to support change suggesting that 'as usual GPs are the sponges that soak up all the, everything that drips out of all the cracks elsewhere' (S27) and advocated for further commissioning support.

### **Domain 6: the wider context**

The NHS App follows a long history of more or less successful initiatives to digitise care in the NHS. This includes attempts to at a policy level provide all patients with access to their own health records which has been one of the most contested features at policy level.

*I think this the, the patient, patient access programme has been a very challenging piece of work and, and it has yeah it's become, become sort of fairly fraught ... a lot of tension of kind of ways to make it happen but also to consider, consider all of the eventualities to consider safety.*

*SH15, stakeholder from professional body*

Controversy around this feature continued as the popularity of the NHS App was growing, with policy-makers and professional bodies engaging in lengthy and difficult negotiations on how appropriate access would be enabled and how safeguarding issues would be avoided:

*They [practices] think it's massive safeguarding issues ... they should be enabling patients to access their full records but the majority have not done that. This was in the GP contract way before the pandemic ... policy wise ... we're leaving the burden of you [practices] having to do that by us doing it, they're saying ... [it] will increase burden because people will start seeing things that they didn't see before and phoning up ... and GP's feeling like the clinical software to redact isn't strong enough.*

*SH7, Development Team 2, Communications and Stakeholder Engagement*

National mass roll-out of access to prospective records was stalled and replaced by a less centralised approach with practices required to switch on access locally (including as part of new contractual requirements). Yet professional bodies continued to express concern and practice managers and professional bodies highlighted issues such as the range of considerations required to provide access while also protecting information that was not originally intended for sharing with patients:

*We did have concerns about how well the programme had been communicated and practices, had some of them given enough time to prepare ... and ... checking the records for vulnerable patients who might need to have that ... you can't just drop a kind of a new piece of technology in the laps of extraordinary busy practices and expect them to be able to pick it up and make the best use of it ... there's a real need for the change management support ... to see technology adopted but also ... make sure that that it provides the outcomes and the benefits that it's designed to.*

*SH15, stakeholder from professional body*

While a rapid shift towards digital solutions was observed early on in the pandemic, increased demand pressures on practices impacted their ability to take on new technology-mediated ways of working post COVID lockdowns:

*So to be honest our main focus at the moment is to, after COVID ... I think it's probably across the whole of England we're, GP practices are just absolutely bombarded with telephone calls ... Patients trying to get through so at the moment our priority is to get everyone on board with the phone calls ... Trying to answer as many calls as they can ... Take each call as it is but that's our priority at the moment ...*

*SS16, site 3, admin lead*

The idea of 'cross-selling' (as mentioned by one of the interviewees) also surfaced as one of the principles applied in the context of roll-out meaning that users registering on the NHS App for one purpose were then expected to find value in other functionality provided, such as organ donation and online prescriptions. In this respect, the COVID Pass was seen as a major draw by some interviewees:

*And we were hearing at the start of our work that people wanted it to be in the COVID-19 App because, well we're already using [it] ... people still might say that that's the best place but for the app it's had a huge amount of unintended consequences in terms of like organ donation registrations have gone through the roof.*

*SH3, Development Team 1, User Researcher*

However, others described the integration of the COVID Pass on to the NHS App as 'manipulative' and setting a 'terrible resonance' (Data privacy organisation Co-ordinator). Their concerns centred primarily around data privacy and security when presenting the COVID Pass (and subsequently the NHS App) in settings outside health care:

*Rather than having a COVID passport App they kludged it onto the NHS App, clearly they wanna force more people or encourage more people to, depending on your perspective, to use the NHS App. That's a long-term win for them ... [but] you're talking about handing a, or showing a, a logged in device that's having access to at least part of your medical records to a third party.*

*SH6, data privacy organisation, co-ordinator*

From the perspective of the patients interviewed, there appeared to be less concern around data privacy, security and advertising compared to commercial products, given the NHS branding.

Wider context influencing roll-out of the app included efforts at inter-organisational networking to support learning. In some instances, clinical commissioning groups became invested in the NHS App which they saw as a 'nation asset' they did not need to procure for, and provided dedicated support for roll-out, including GP staff training, discussion forums between practices, and as point of contact for queries. At early stages of implementation, some areas even became designated 'beacon sites' which received additional assistance such as extra support and coaching but only over a limited time period. In other areas, commissioners did not perceive they had a mandate for the NHS App and engaged less in supporting roll-out.

### **Domain 7: embedding and adaptation over time**

Given the NHS App primarily provides a gateway to different services and platforms, there is significant scope (and policy will) to add or remove functionality so the app remains relevant over time. This has been demonstrated already with integration of the COVID Pass, and subsequently with the addition of popular commercial services (at least in some areas) such as those facilitating online consultations and access to personal health records. This brings an inherent risk, however, in that the NHS App may end up incorporating too many features, making it difficult to sustain a coherent identity.

There is significant policy interest in maintaining interest and regular use of the NHS App, increasing functionality for purposes such as 'day-to-day health management' and securing engagement from patients and practices alike, beyond the COVID Pass. Improvements and adaptations are being made over time, such as with the symptom checker (e.g. relevance for dermatological questions and different skin colours), increased security features, direct booking of vaccine appointments, and the addition of notifications to the app, although not all additions were perceived as useful by patient users:

*Sometimes I get an email or notification saying my app has updated, like blood tests ... and I go to check and sometimes the, where it tells me it has updated, are not on there ... it doesn't clarify what it means ... I have to guess.*

*P26, site 5, 34, male, Black British*

Issues with digital inclusion will have to be considered, especially around embedding different languages and increasing patient-facing terminology as the user base grows.

## **Discussion**

### **Summary of findings**

Using the NASSS framework, this article highlights the multiple layers of complexity manifesting when introducing a constantly shifting technology into a challenging environment such as English general practice, during and after a period of considerable societal turbulence because of the COVID-19 pandemic. Several interacting influences shaped the trajectory of the NHS App and we reflect on these below.

Roll-out of the NHS App reflects and illuminates the complexity and fragmentation of the NHS. For example, when patients questioned why their information on the app appeared so disjointed across primary and secondary care. The app appeared to be less able to support those accessing ongoing health care outside of general practice (e.g. patients we spoke to who were living with Parkinson's, HIV and diabetes) to manage their condition(s), yet useful for those with conditions primarily managed in primary care (for access to prescription ordering, NHS number, GP-related letters, records of GP consultations, test results). The app was also perceived by some staff and patients as being less useful for those without long-term conditions.

There was a level of health system literacy required to comprehend how to access, or request support to access, the app, and understand what the NHS app was, and what functions it encompassed (in addition to being the COVID Pass).

To a certain extent, adoption relied on general practice and its staff, who assumed responsibility in supporting patients to access the app but also in safeguarding patients, by restricting access to health records where needed. The app also required integration and access to several background systems and IT infrastructures, which meant that not all features were available by default by all users (e.g. own health records). Further, practices made decisions about what features would be available, for example, appointment booking, so this function, which was desired by many patients, was not available for all. The app design offered a transactional, mechanistic approach to functionality such as appointment booking, which did not translate well into complex practice processes that often relied on relationships with patients. This was also the case for patient access to own records, which were controlled by practices, and for which procedures for access was variable and not understood by all staff, or where staff were concerned about GDPR (and requirements for redaction).

While policy-makers saw the app as a 'front door' to the NHS for patients, the purpose and utility of the app, or how this shifted over time, was perceived as not being satisfactorily communicated or fully co-designed in collaboration with practices. Although, the COVID Pass made the presence and value of the app to practices and the wider public more prominent, and coincided with a drive to increase the user base. This was despite development teams having carried out substantive user research, including on accessibility, that remained focused, however, on use by patients rather than the complex work of other implicated groups such as healthcare staff. There was also heterogeneous support provided to, and by, CCGs, which created inconsistent experiences and approaches to roll-out.

For patients, features such as ordering prescriptions online held a strong value proposition. Security features, for example, fingerprint scanning and face recognition were appreciated, especially by those with health diagnosis they did not want shared. Accessing own health records (including proxy access), engendered an increased sense of control over health for many patients, as well as enabling a sense of ensuring accountability of the health service. However, there was complexity and variability in the value proposition of the NHS App, as different features were added, removed or became more or less relevant over time (e.g. COVID pass). NHS App use has been fundamentally influenced by external events such as the COVID-19 pandemic. However, events of such magnitude are rare, which means part of the learning around how the app was received may not be directly transferable, yet most of the lessons still apply beyond the pandemic context.

### Comparison with other literature

Despite interest in patient access to their own records through the NHS App, finding a balance between providing access and safeguarding, without imposing additional workload on practices, has been challenging. Related issues have been highlighted in previous research. For example, Louch *et al.*,<sup>30</sup> discuss how clinical and non-clinical staff in primary care supported patient access but also voiced concerns around the type of historical information that would become available and how this might be interpreted or used by those accessing this information. Along similar lines, Nøst *et al.* found healthcare professionals feared that increased access could increase workload due to additional need for patient follow-up.<sup>31</sup> From a patient perspective, McMillan *et al.*<sup>32</sup> report the need to better promote availability of access, as well as introduce joined up records with community and secondary care. However, complexity is exhibited when providing access to features such as health records, which does not automatically lead to patient 'empowerment' (as shown elsewhere<sup>33</sup>) especially when considerable work is required from patients to access such features.

From an organisational perspective, several studies have identified barriers and facilitators related to the implementation of patient portals.<sup>34,35</sup> Our study further exemplifies how multiple interacting influences shape the trajectory of a complex technology with evolving components reaching various parts of the healthcare service, particularly so in a crisis context. Involvement of health professionals in the design and implementation of patient portals plays an important role in mediating their experiences.<sup>36</sup> GPs have previously expressed that they want to feel more supported with digital change (in procurement or implementation) and that innovation focused practice leadership (as found in this study), and support from the PCN or commissioning body around implementation has enhanced implementation.<sup>7</sup> Finding an optimal balance between top-down and bottom-up implementation remains challenging but is necessary to enable alignment with local care processes and priorities.<sup>37</sup>

The motivation at organisational level to put in place the processes, staff roles and capacity required for the change effort changed in the context of increasing demand and work pressures during and following on from the pandemic.

The availability, interest and capacity of healthcare staff to support adoption also varied in the context of what was perceived as top-down implementation, and in terms of the cultural context of practices, for example, apprehension from practices with a more 'traditional' organisational culture, as opposed to those practices who were more innovation focused and digitally strategic (according to Greenhalgh's digital maturity scale<sup>26</sup>).

There were considerable influences from the wider context on NHS App roll-out, which shifted from a 'remote-by-default' orientation to an emphasis on in-person care, as well as controversies related to specific features (such as centralised patient access to own records). Where inter-organisational working, for example, between practices and commissioning groups occurred, the additional support encouraged roll-out in practices. In this landscape, the NHS App offered a means of extending previous efforts to introduce online access to services in the UK. Improvements and adaptations informed by user research were being made to the app throughout data collection, although there were challenges with digital inclusion as well as maintaining user interest in an offer that would remain relevant over time.

Issues of health equity have also been debated in previous literature which explains some of our findings, that disproportionate emphasis is placed on individual responsibility to access and use patient portals, without sufficient acknowledgment of system-level barriers and support for underserved populations.<sup>16</sup> This transcended through patient participant's experiences of requiring support to log in to and access the NHS App and its various features. Further, those from more affluent, White and middle-aged backgrounds with high health literacy appear to be more likely to use digital tools such as patient portal.<sup>16</sup> Such trends of inequalities implicate a real risk of a new digital Inverse Care Law whereby attempts at digital transformation directly or indirectly compromise health equity.<sup>38,39</sup> With primary care being the access point for many to the health service, there is a pronounced need to consider the complex factors influencing adoption and roll-out and to ensure that the adoption of digital health tools do not create or exacerbate inequities in health service access or use.

### **Strengths and limitations**

The strengths of this study include the diverse sample of research participants in terms of patients, carers, healthcare staff and stakeholders from a range of environments. Participants varied in terms of age, ethnicity, health conditions, location (in terms of urban/rural and across England), health and digital literacy. Study sites covered a wide range of characteristics and patterns of technology engagement across the country. We ensured that we specifically engaged with individuals and practices that were more likely to be affected by issues such as health inequalities and the 'digital divide'. The heterogeneous sample meant that we were able to garner a wide range of experiences and perceptions to explore how the app had been deployed and used in depth. We also worked closely with the PPIE lead for the study and held a number of workshops with the study PPIE lead and group to develop the research questions, recruitment literature and recruitment practices and case study sites over time, as well as synthesise and evaluate or validate findings as they emerged. The study utilised several qualitative research methods to collect findings, which enabled exploring the roll-out of the NHS App in different contexts and for different users, and to consider societal events in which the roll-out occurred. This led to rich data which could consider the layers of complexity surrounding the roll-out of the NHS App. Collecting data over time also meant that we were able to capture many different aspects of roll-out.

Limitations of this study include the fact that due to collecting data over time, and during many changes at macro, meso and micro levels, the technology itself was also changing. This meant it was difficult at times for those we interviewed, and the researchers, to ascertain exactly what research participants did have access to, either directly in the app, or in the practice settings (in terms of integration or support available). However, capturing this experience of patients also gave more emphasis to the complexity of this app, the app's integration with practices, the presentation to patients, and the lack of comprehension, at times, about what the app's functions and purpose were. Further to this, we also held regular discussions with the research team throughout the study, collection of data from different sources (including the media), and analysis of data as it emerged helped to catalogue and consider the different contexts and experiences of users, staff and stakeholders over time to avoid any narrow interpretation of the findings, and to consider the wider context of the app and what was occurring at a higher level.

It also became evident that there were a number of people who were excluded from using the NHS App and that there were important cultural considerations that we were not able to explore in more depth, such as language barriers (with the app only available in English) some functions being less relevant for non-White skin, and around the promotion of

digital access to the health service potentially excluding some minority and vulnerable populations where relationships and trust need to be built up with healthcare staff. Future research should focus on the specific needs of defined ethnic groups to explore culturally appropriate ways to support access to primary care through the NHS App.

## Conclusions

In this qualitative study, we aimed to unpack the complexity underpinning implementation, use and roll-out of the NHS App, learning from the experiences of patients (users and non-users), healthcare staff and other relevant stakeholders. We found that patients had diverse (positive and negative) user experiences as the app evolved, with some of its features described as more useful (e.g. prescription ordering or access to records). Yet the app was primarily a gateway to general practice systems and infrastructures, therefore, not all features were available by default and consistently to all users, with information often appearing fragmented or presented in a system-facing way (e.g. coded). Using the app as a 'front door' to the health service also assumed a certain level of system literacy which was not always realised. For practices, although the app did not initially appear to have a clear value proposition in terms of supporting their work or engagement with patients, scope for potential future development as core NHS infrastructure made it appealing. Thus the NHS App remains a complex intervention in a complex landscape, it is clear ongoing work is needed to ensure the app can achieve its potential, and will continue to be developed to meet patient, service and policy needs.

# Chapter 3 Early uptake and adoption of the NHS App (quantitative study 1)

## Introduction

This chapter describes the first study of the quantitative workstream which used observational data from the NHS App dashboard to examine the uptake and adoption of the NHS App in England. The majority of this text have been reproduced and/or adapted with permission from the journal article describing this work. Reproduced with permission from Kc *et al.*<sup>40</sup> This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) licence, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: <https://creativecommons.org/licenses/by/4.0/>. The text below includes minor additions and formatting changes to the original text.

This study aimed to evaluate the effectiveness of the NHS App by exploring the trends of uptake by using data metrics from the NHS App dashboard, and routinely available General Practice data to examine early patterns of app adoption across different population groups and in relation to recent time-trends.

## Methods

### Data

Data from the NHS App were analysed using data metrics from the NHS App dashboard.<sup>41</sup> The NHS App dashboard was jointly developed by NHS England and Improvement team and NHS Digital under England's National Healthcare system. Metrics currently available through the dashboard include aggregate counts of the number of registrations, downloads, appointment bookings and cancellations, GP health records viewed, prescription requests, visits to NHS 111 online, organ donation registrations and withdrawals, visits to the health A-Z page, and to the national data opt-out page. The research team received monthly aggregated data from the NHS App team at NHS Digital and did not have access to any personal or personally identifiable information.

Covariates data mapping sociodemographic profile of patients at the GP practice level were obtained from verifiable public health data sources. Socio-demographic data on the age and gender of all GP registered population were obtained from the NHS digital website.<sup>42</sup> Data on ethnic composition and deprivation were obtained from Fingertips public health profile,<sup>43</sup> and data on long-term health conditions were extracted from the GP Patient Survey (GPPS) database.<sup>44</sup>

### Analysis

#### Descriptive statistics

The study period for this analysis was from January 2019 to May 2021. Descriptive statistics were used to summarise monthly NHS App metrics at a GP practice level nationally. Absolute monthly counts were presented from January 2019 to May 2021 of total app downloads, registrations, login sessions, appointments booked, GP health records viewed, and prescriptions ordered.

#### Time series analysis

An ecological interrupted time series (ITS) analysis was used to analyse the impact of the first UK national lockdown due to COVID-19 that occurred on 26 March 2020. The time series analysis was used to evaluate changes in uptake and the longitudinal impact of the pandemic on different functionalities of the app.<sup>45</sup> An interruption was added to the time series on 1 April 2020, to estimate changes in uptake before and after announcement of the first lockdown. The ITS explored changes in level and trend for national app logins, appointment bookings, GP health records viewed, and prescriptions ordered between January 2019 and May 2021.

The ITS model was then used to assess if there was a change in app usage immediately after the first lockdown and if a change in trend occurred over the whole study period. Absolute and relative changes of the post intervention trend were also estimated, had the first lockdown not taken place. The absolute change in trend was calculated by taking the difference between the predicted pre-lockdown trend of the outcome and the post-lockdown trend at the end of the study period. The relative change was calculated as the absolute change as a relative proportion. To analyse app usage and uptake before the NHS COVID Pass was introduced, a separate ITS analysis was conducted excluding the month of May 2021. Autocorrelation was assessed by analysing the residuals of the ITS models.<sup>45</sup>

### Cross-sectional analysis

A cross-sectional analysis of the differences in NHS App registration rates at February 2021 across categories of age, sex, ethnicity, Index of Multiple Deprivation (IMD), size of the GP practice and long-term physical or mental health conditions, disabilities or illness was conducted. A negative binomial regression model using incidence rate ratios (IRRs) was applied to explore variations in NHS App registrations across these groups.

For analysis, the sociodemographic covariates were ranked into four quartiles using the following identifiers: age (per cent 15- to 34-year-olds), gender (per cent males), ethnicity (per cent White), chronic care needs (per cent with long-term healthcare needs) and practice size (total number of GP registered patients over 15 years). Quartile 1 included the lowest ranked practice and quartile 4 the highest. The only exception to this was the IMD rank which followed the Office for National Statistics (ONS) method of grouping into quintiles.<sup>46</sup> Quintile 1 included the most deprived practices and quintile 5 included the least deprived practices. Cumulative total NHS App registration rate per 1000 GP registered population at February 2021 was considered as the outcome variable.

The Strengthening the Reporting of Observational Studies in Epidemiology guidelines were used for the reporting and analysis of this study.<sup>47</sup>

## Results

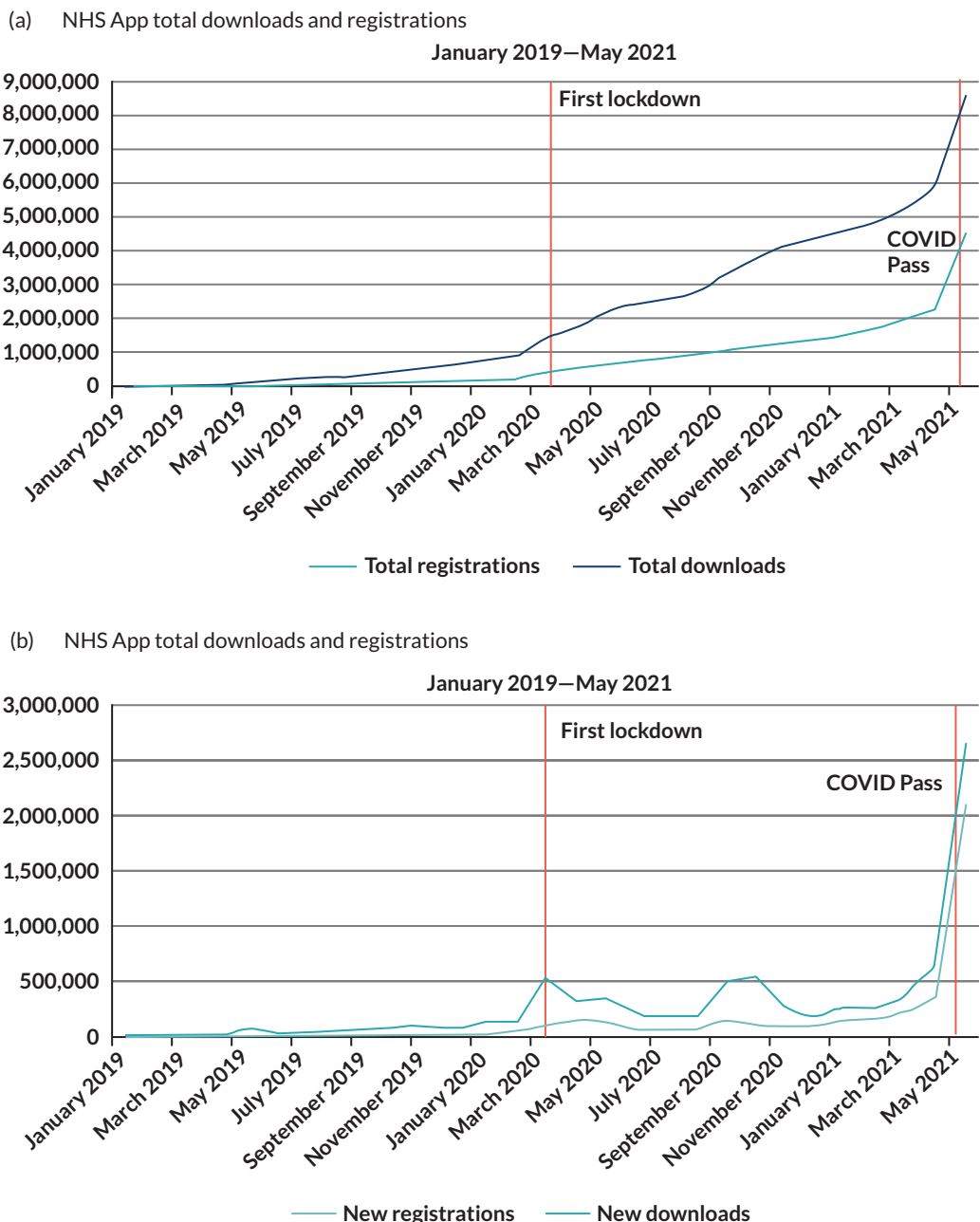
### NHS App registrations and downloads

There were 8,524,882 NHS App downloads and 4,449,869 registrations from January 2019 to May 2021 ([Figure 2](#)). At the start of the study period, there were 31,633 downloads and 1279 registrations. At the onset of the first UK lockdown in March 2020, there was a spike of 532,275 app downloads. The highest number of downloads occurred after the announcement and launch of the COVID Pass in May 2021, with a total of 2,668,535 downloads. During this month, 2,099,234 users registered for the app. At the end of May 2021, there were 51,956,423 GP registered patients in England. Of these registered patients, 8.56% of the population aged 13 + were registered for the NHS App.

### Subgroup differences in app registration

The negative binomial regression model measured a difference in the NHS App registration rate, measured for each of the covariates with others held constant. The IRR comparing the practices in the highest versus the lowest quartile for each variable found 25% lower registrations in the most deprived practices [IRR 0.75;  $p < 0.001$ , 95% confidence interval (CI) 0.74 to 0.75], and 44% higher registrations in the largest-sized practices (1.44;  $p < 0.001$ , 95% CI 1.42 to 1.45).

App registration was 36% higher in practices with the highest percentage of White patients (1.36;  $p < 0.001$ , 95% CI 1.34 to 1.38) and 23% higher in practices with the highest percentage of 15- to 34-year-olds (1.23;  $p < 0.001$ , 95% CI 1.21 to 1.25). Practices with the highest percentage of males had 13% lower registrations (0.87;  $p < 0.001$ , 95% CI 0.87 to 0.88), which was also 2% lower in practices with the highest percentage of people with long-term care needs (0.98;  $p < 0.001$ , 95% CI 0.97 to 0.99), when compared to the reference groups ([Table 3](#)).



**FIGURE 2** Monthly cumulative and new NHS App registrations and downloads. Reproduced with permission from Kc *et al.*<sup>40</sup> This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) licence, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: <https://creativecommons.org/licenses/by/4.0/>. The figure above includes minor additions and formatting changes to the original text.

### NHS App metrics

#### Login sessions

National NHS App login sessions per month ranged from 5157 to 16,730,430 from January 2019 to May 2021. There was a steady increase of login sessions from January 2019 to April 2021, with the highest number of logins occurring after introduction of the COVID Pass in May 2021 (16,730,430 login sessions) (Figure 3). The ITS showed that before implementation of the first lockdown, the number of NHS App login sessions was increasing over time at a rate of 52,093 logins a month and decreased immediately after implementation of the first lockdown. However, only the change in trend over time was found to be positive and significant, indicating an average slope change of 602,124

**TABLE 3** Negative binomial regression table showing unit change in the NHS App registration rate per 1000 GP registered population, with other variables held constant calculated using a negative binomial regression model

Registration rate/1000	% difference <sup>a</sup>	IRR	p-value	95% CI
<b>IMD quintile (reference group 1 = least deprived practices)</b>				
2	-6%	0.94	< 0.001	0.93 to 0.95
3	-8%	0.92	< 0.001	0.91 to 0.93
4	-9%	0.91	< 0.001	0.90 to 0.92
(Most deprived practices) 5	-25%	0.75	< 0.001	0.74 to 0.75
<b>% males (reference group 1 = practices with the lowest percentage of males)</b>				
2	-11	0.89	< 0.001	0.89 to 0.90
3	-10	0.90	< 0.001	0.89 to 0.91
(Practices with the highest percentage of males) 4	-13	0.87	< 0.001	0.87 to 0.88
<b>% White (reference group 1 = more ethnically diverse practices)</b>				
2	24	1.24	< 0.001	1.23 to 1.25
3	42	1.42	< 0.001	1.41 to 1.44
(Least ethnically diverse practices) 4	36	1.36	< 0.001	1.34 to 1.38
<b>% youngest age group (reference group 1 = practices with the lowest percentage of 15- to 34-year-olds)</b>				
2	7	1.07	< 0.001	1.06 to 1.08
3	12	1.12	< 0.001	1.10 to 1.12
(Practices with the highest percentage of 15- to 34-year-olds) 4	23	1.23	< 0.001	1.21 to 1.25
<b>Practice size (reference group 1 = practices with the lowest number of GP registered patients)</b>				
2	13	1.13	< 0.001	1.12 to 1.14
3	26	1.26	< 0.001	1.25 to 1.27
(Practices with the highest number of GP registered patients) 4	44	1.44	< 0.001	1.42 to 1.45
<b>% with chronic health illness or disability (reference group 1 = practices with the lowest percentage of people with chronic health illness or disability)</b>				
2	-1	0.99	< 0.001	0.98 to 0.10
3	-2	0.98	< 0.001	0.97 to 0.99
(Practices with the highest percentage of people with chronic health illness or disability) 4	-2	0.98	< 0.001	0.97 to 0.99

a Percentage difference calculated using IRR obtained from the negative binomial regression model. For the IMD, the percentage difference represents change across the IMD quintiles in comparison to the reference group IMD Q1 (i.e. least deprived practices). For all other variables, the percentage difference represents change across the variable quartiles in comparison to reference group 1 (i.e. practices with the lowest population percentage for the given variable).

#### Source

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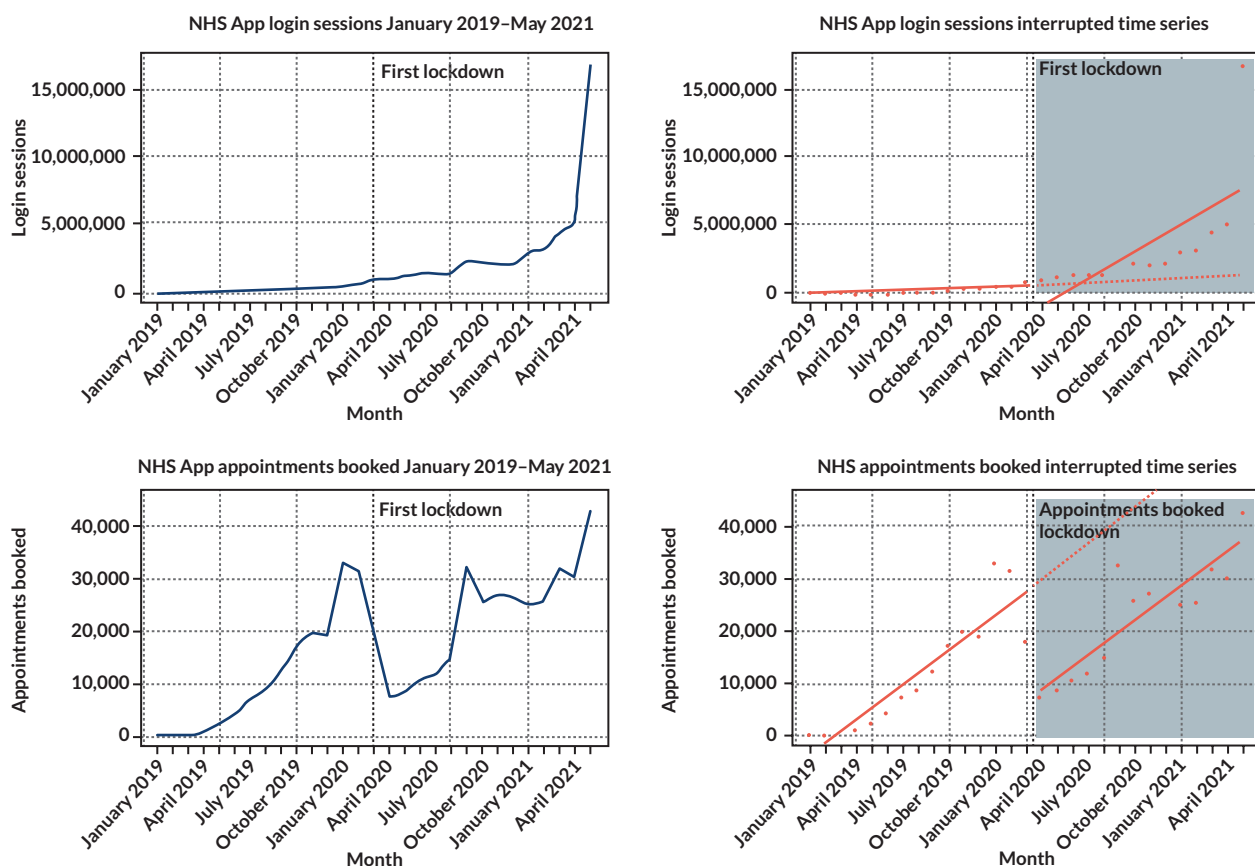
( $p = 0.004$ ) logins a month. Twelve months after the first lockdown, the average number of NHS App logins was 5,663,224 more than would have been expected if lockdown did not occur. This represented a 441% increase (Table 4).

### Appointments booked

Appointments booked using the NHS App ranged from 298 to 42,664 per month during the study period (see Table 4 and Figure 3). There was a surge of appointment bookings in January 2020 (33,003 appointments booked), September 2020 (32,335 appointments booked), and in May 2021 (42,644 appointments booked). There was a significant drop in appointment bookings after the first lockdown was announced in April 2020 (7674 appointments booked). The ITS showed that before the first lockdown, there was significant evidence of an increase in the average number of appointment bookings 2247 ( $p < 0.001$ ), followed by an immediate decrease in bookings after the lockdown was announced  $-21,315$  ( $p < 0.001$ ). Twelve months after the first lockdown, the average number of appointments booked using the NHS App was 21,601 fewer than would have been expected if lockdown did not occur. This represented an overall 38% decrease in appointment bookings.

### GP health records viewed

GP health records viewed in the NHS App ranged from 2212 to 9,324,546 per month from January 2019 to May 2021. There was a steady increase in records viewed up until April 2021 and a threefold increase from April 2021 (3,309,586 records viewed) and May 2021 (9,324,546 records viewed) (Figure 4). The ITS showed a non-significant decline in the average number of health records viewed right after lockdown  $-1,441,297$  ( $p = 0.11$ ). The sustained effect over time was significant ( $p = 0.001$ ) indicating that the number of records viewed increased on average by 371,656 views per month post lockdown (Table 5). Twelve months after the first lockdown, the average number of GP health records viewed was 3,390,234 more than would have been expected if lockdown did not occur. This represented a 548% increase.



**FIGURE 3** Login sessions and appointments booked time series and ITS (January 2019–May 2021). Reproduced with permission from Kc *et al.*<sup>40</sup> This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) licence, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: <https://creativecommons.org/licenses/by/4.0/>. The figure above includes minor additions and formatting changes to the original text.

TABLE 4 Login sessions and appointments booked interrupted times series output

NHS App metric	Regression intercept (p-value)	Pre-intervention monthly trend (p-value)	Immediate change in trend after COVID lockdown (p-value)	Change in trend over study period (p-value)	1 year after first lockdown	
					Absolute change (count)	Relative change (%)
Login sessions <sup>a</sup>	-175,074 (p = 0.88)	52,093 (p = 0.68)	-2,164,386 (p = 0.19)	602,124 (p = 0.004)	5,663,224	441
Login sessions <sup>b</sup>	-175,074 (p = 0.36)	52,093 (p = 0.02)	-408,723 (p = 0.1419)	250,991 (p < 0.001)	2,954,162	222
Appointments booked <sup>a</sup>	-6196 (p = 0.02)	2247 (p < 0.001)	-21,315 (p < 0.001)	-22 (p = 0.95)	-21,601	-38
Appointments booked <sup>b</sup>	-6196 (p = 0.02)	2247 (p < 0.001)	-20,294 (p < 0.001)	-226 (p = 0.62)	-23,236	-41

a January 2019–May 2021.

b January 2019–April 2022.

**Source**

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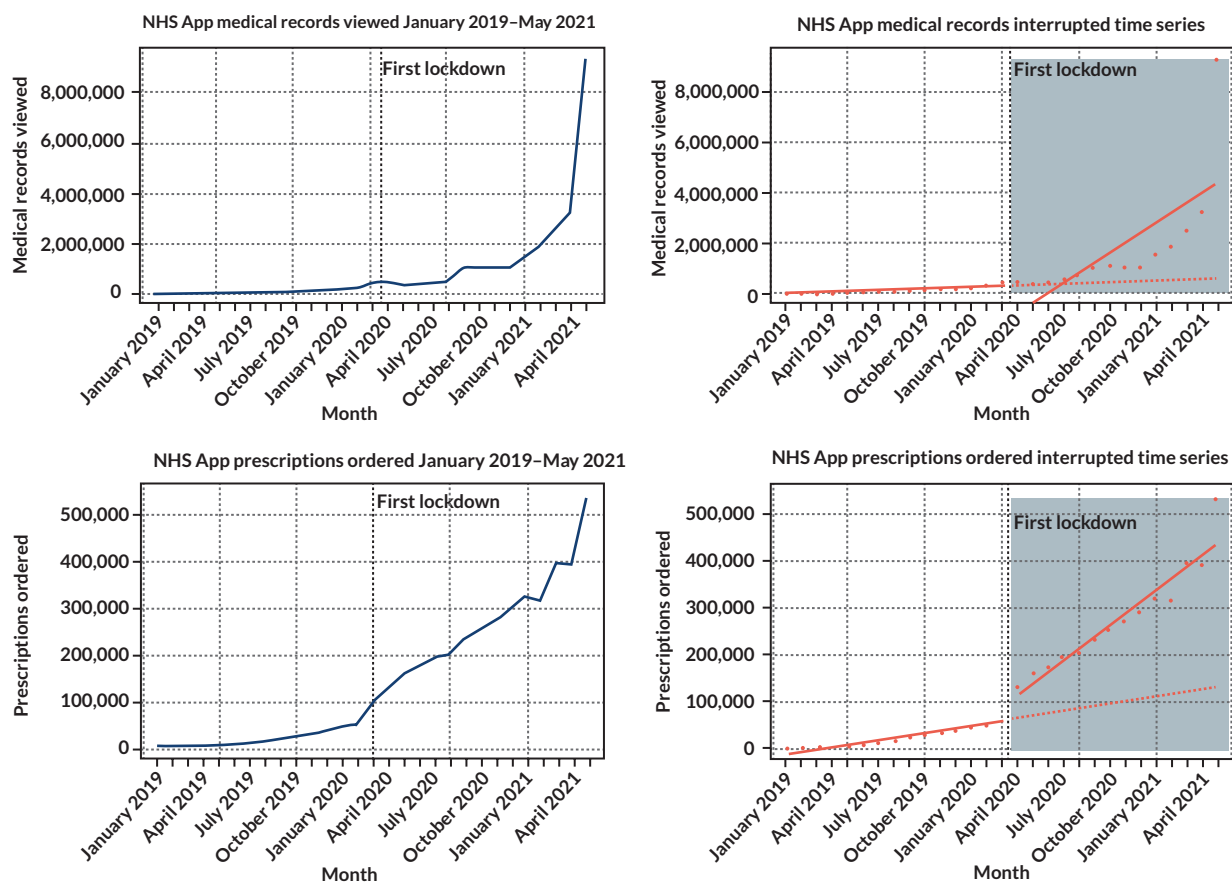
TABLE 5 General practitioner health records viewed and prescriptions ordered interrupted times series output

NHS App metric	Regression intercept (p-value)	Pre-intervention monthly trend (p-value)	Immediate change in trend after COVID lockdown (p-value)	Change in trend over study period (p-value)	1 year after first lockdown	
					Absolute change (count)	Relative change (%)
GP health records viewed <sup>a</sup>	-86,104 (p = 0.89)	25,159 (p = 0.72251)	-1,441,297 (p = 0.11)	371,656 (p = 0.001)	3,390,234	548
GP health records viewed <sup>b</sup>	-86,104 (p = 0.56)	25,159 (p = 0.1349)	-495,304 (p = 0.02)	182,458 (p < 0.001)	1,876,645	303
Prescriptions ordered <sup>a</sup>	-18,935 (p = 0.17)	5225 (p = 0.001)	27,494 (p = 0.15)	19,934 (p < 0.001)	286,630	225
Prescriptions ordered <sup>b</sup>	-18,935 (p = 0.01)	5225 (p < 0.001)	45,036 (p < 0.001)	16,425 (p < 0.001)	258,563	202

a January 2019–May 2021.

b January 2019–April 2021.

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**FIGURE 4** GP health records viewed and prescriptions ordered time series and ITS (January 2019–May 2021). Reproduced with permission from Kc *et al.*<sup>40</sup> This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) licence, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: <https://creativecommons.org/licenses/by/4.0/>. The figure above includes minor additions and formatting changes to the original text.

## Prescriptions ordered

Repeat prescriptions ordered using the NHS App ranged from 655 to 530,382 per month from January 2019 to May 2021. There was 1.3 times increase in prescriptions ordered after announcement of the first lockdown, March 2020 (98,692 prescriptions ordered) and April 2020 (128,028 prescriptions ordered) (see [Figure 4](#)). The ITS showed that pre lockdown, there was significant evidence that the number of prescriptions ordered was increasing at an average rate of 5255 ( $p = 0.001$ ) a month (see [Table 5](#)). Post lockdown, there was a positive and significant increase in trend of 19,934 ( $p < 0.001$ ) prescription orders per month (see [Table 5](#)). Twelve months after the first lockdown, the average number of NHS App prescription orders was 286,630 more than would have been expected if lockdown did not occur. This represented a 225% increase.

## Discussion

### Summary

We found that there was strong adoption of the NHS App even before the onset of the COVID-19 pandemic. Before the first national lockdown in the UK was announced, there were almost 1.5 million downloads of the app. From April 2021 to May 2021, there was a fourfold increase in app downloads, showing the significant impact the introduction of the COVID-19 Pass had on app uptake. However, a disparity between app downloads and registrations exists. At the end of the study period, there were 8,524,882 downloads and 4,446,286 registrations. There are also differences in the

NHS App registration rates across the different sociodemographic groups highlighting unequal trends of adoption, with higher usage in less deprived and less ethnically diverse practices, with a generally younger population.

In terms of app functions, COVID-19 and the introduction of the COVID-19 Pass service had significant impacts on their use. Introduction of the COVID-19 Pass accounted for over a threefold increase in login sessions in May, indicating that users could have been logging into the app to retrieve their vaccination status. This pattern was also observed for the number of users using the app to access their GP health records. Appointment bookings fell substantially after the first lockdown in line with a fall in overall primary care NHS activity,<sup>48</sup> but continued on the same gradient from March to May 2021. In person GP appointments fell in March 2020 due to the pandemic, and some GPs switched off the ability for patients to book appointments via the NHS App at this time. Prescriptions ordered via the NHS App also significantly increased after the first lockdown, suggesting that more users were using the app to place prescription orders rather than in person or via the phone. These findings could be related to patients and carers seeking alternative options to in person care (e.g. digital prescription ordering).<sup>49</sup> They may have also been influenced by changes in health service delivery due to the risk of COVID-19 transmission and due to the reliance on online prescriptions to support patients who had relocated during the national lockdown.<sup>50</sup>

### **Strengths and limitations**

Our ecological analysis was only able to analyse the NHS App at the GP practice level. As person-level data are currently unavailable, these preliminary results indicate an inequality in adoption, which may be influenced by patient and provider-related factors. Furthermore, this study also presents limitations in the use of ecological data to understand subgroup differences in the uptake of and engagement with an app rolled out at a national level. Even though data linking allows us to overcome some of these challenges, differences in the format, structure and content of different data sources influence biases due to linkage errors. These differences, although potentially negligible, can still result in overestimation or underestimation of results.<sup>51</sup> Availability of person-level data would overcome some of these challenges by allowing us to understand the interactions between sociodemographic factors and app use patterns more directly.

Also, the ITS analysis also does not account for other confounding factors, or control for the rapid changes in healthcare delivery during COVID, which may have contributed to the results seen in this study. This could include changes in seasonality, other existing cointerventions and changes in healthcare delivery model that may have occurred in tandem during the study period.

### **Comparison with existing literature**

The public health impact of digital health interventions is dependent upon real-world uptake, and engagement.<sup>52</sup> Although our analysis showed a strong interest in the NHS App, variations in the adoption rates and differences in the use of functionalities may not reflect high levels of engagement. A recent study looking at uptake and engagement of health and well-being apps found that one of most important factors for engagement were apps coupled with health practitioner support.<sup>52</sup> At the time of this analysis, the NHS App does not directly incorporate any health practitioner support. This may be an important consideration as research highlights the importance of provider endorsement and support, along with technical training and usage assistance as effective digital facilitation strategies in primary care, particularly to support those from marginalised groups.<sup>53</sup>

There are also concerns about sustained app use as highlighted by the differences in app downloads and registrations, which corroborates the findings of a recent study which showed that 25% of all mobile apps were only accessed once after download.<sup>54</sup> The barriers for sustained app use could be for several reasons, from users not being able to successfully register for the app, or never using the app once it is downloaded, which need to be further explored. Furthermore, the differences in the NHS App registration rates support earlier research findings and they indicate that use of the NHS App, as with other digital health technology differs according to gender, ethnicity, socioeconomic status and healthcare needs.<sup>50,55</sup>

### ***Implications for research and/or practice***

Further research is needed to identify whether the NHS App is an effective digital health tool and the extent to which it has met the goals set out by NHS England. The existing literature on technology adoption and diffusion of innovation tells us that this process is difficult and complex. Adoption is not just based on the technology, but a complex mixture of how the public and staff interact with it, what they see as the benefits, organisational culture and wider influences on the system including the policy and regulatory context.<sup>56</sup> Also, the evidence of usage inequalities warrants facilitation efforts to promote equitable use of digital services in primary care settings. Provider support, patient assistance and training are identified as useful strategies,<sup>53</sup> but a more comprehensive understanding of the impact of these initiatives within the broader organisational context, including technology usability and provider burden is essential.

Our analysis showed that there has been strong adoption of the app, and that COVID has significantly expedited uptake, but further research is needed to evaluate continuous usage of the app over time across different population groups and if it yields any benefits.

### **Conclusion**

This is the first ecological study that has analysed a nationwide intervention rolled out by NHS England. This analysis has shown that the uptake of the NHS App has significantly increased post lockdown, driven by COVID-related events. Usage trends for the different app functions varied and the patterns of app registration was unequal between different subsets of the population. Further research is needed to measure the extent to which it influences inequities in health and whether it impacts care outcomes.

# Chapter 4 Inequalities and the NHS App (quantitative study 2)

## Introduction

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As we highlighted in the introduction to this monograph, the impacts of patient portal adoption and use on inequalities are not well understood.<sup>16,17</sup> Inequality patterns not only relate to patient portal adoption, which is generally lower in those who are elderly,<sup>18,19</sup> ethnic minorities<sup>18,20</sup> and from a lower socioeconomic group.<sup>19</sup> They are also reflected on sustained engagement trends and the use of different portal functionalities.<sup>20</sup> User preferences for specific patient portal features, and their ability to engage with certain functions, is influenced by factors such as age, digital literacy, health conditions and personal healthcare needs.<sup>21-23</sup> For example, a study looking at patient portal adoption by older adults revealed a notable interest among this group to use functions enabling access to their health information and appointment booking. However, there were also reported issues surrounding usability of the technology itself and a need for increased user support.<sup>58</sup> In a separate study, younger adults and females exhibited greater use of patient portal features overall. However, older patients utilised functions associated with education more frequently and individuals experiencing higher poverty used features related to billing and insurance more.<sup>22</sup> Such variations in patient engagement with different patient portal features may indicate an inherent user preference related to patient-specific needs. However, they also may indicate barriers to sustained use that extend beyond initial enrolment.

Previous research on patient portal use in NHS primary care services identifies similar disparities and they show greater use of certain functions such as medication requests and appointment booking, especially among people with more long-term health conditions.<sup>59</sup> In a more recent study, males, non-White ethnic groups, and older adults (over 85 years) showed reduced use of certain NHS online health services such as online appointment booking and prescription ordering, whereas, those with long-term conditions and from a higher socioeconomic status were generally more likely to use these functions.<sup>60</sup> Our earlier study on the NHS App use also found similar patterns of inequalities in its adoption, with higher registration rates among larger-sized, less deprived and less ethnically diverse GP practices and among younger population groups.<sup>40</sup> While an overall increase in the adoption of the various app features was seen over time, particularly in response to COVID events<sup>40</sup> relationship between the patterns of inequalities in uptake and the use of different NHS App features remains unexplored.

These issues need careful consideration as digital innovations are known to follow an inverse care law, where the availability and use of health care is inversely related to the population who need it most.<sup>61,62</sup> Furthermore, as national platforms such as the NHS App continue to evolve and play more prominent role in healthcare delivery,<sup>63</sup> prioritising sustained patient engagement and participation beyond initial uptake is essential to achieve meaningful success. Therefore, identifying patterns of uptake of the various app features and understanding how different population groups are engaging with those functions may be important first steps in advancing equitable outcomes. This will not only allow identification of groups who most benefit from using digital channels but will also help to reallocate resources to support those who remain at risk of exclusion. This study aims to address these knowledge gaps by analysing the patterns of uptake of various NHS App functions and changes in use across different population groups.

## Methods

### Data sources

An ecological study using data at the GP practice level exploring differences in the usage of NHS App features by the GP-registered population in England was conducted. The outcome variables were weekly registrations, logins, prescriptions ordered, medical record views and appointments booked. NHS App usage data were available for the period between March 2020 and June 2022, provided by the NHS Digital team as anonymised daily logs from the NHS App dashboard.<sup>41</sup>

Data on the sociodemographic characteristics of the GP-registered population and their healthcare needs at the GP level were used as covariates. Data on the age and sex of all GP-registered populations were obtained from the NHS Digital website, which is a reliable source for the collection and processing of national data across the health and social care sector in the UK.<sup>42</sup> We excluded data for those under 15 years as the NHS App is not offered to younger age groups,<sup>64</sup> and the resultant total for all GP registered males and females was combined to calculate the GP practice size. Population aged 15–34 years was used as the age identifier for analyses, and the percentage of males was used as the identifier for sex.

Data on long-term healthcare needs were extracted from the GPPS, which is a survey of approximately 2.4 million adult GP-registered patients in the UK.<sup>44</sup> Population-weighted positive response to the question, 'Do you have any long-term physical or mental health conditions, disabilities or illnesses?' obtained from the GPPS database was included.

Information on ethnic composition and the IMD quintile were obtained from Fingertips public health profile, which is an online repository of a range of health and social care indicators mapped as public health profiles at local and national levels.<sup>65</sup> The identifier for ethnicity included the per cent of population who reported their ethnicity as 'White'.

Data obtained from these public health data sources were then ranked into quartiles (four groups). Quartile 1 included practices with the lowest population percentage for the given variable, and quartile 4 the highest. The only exception to this was the IMD split which followed the ONS's method of ranking into quintiles (five groups)<sup>65</sup> where quintile 1 included practices with the lowest IMD score (i.e. least deprived practices), and quintile 5 included practices with the highest (i.e. most deprived practices).

For analysis, covariate data were linked to the NHS App data using the GP practice code, which serves as a unique identifier code for each GP practice in England. Practices with incomplete data on practice size or those with missing area codes were removed to avoid errors during analysis ( $n = 126$ ). Practices with  $< 200$  registered patients were also excluded ( $n = 20$ ) to remove practices that service atypical populations or those with unreliable practice-level data.

### Analyses

We had complete weekly usage data for a period between 23 March 2020 and 27 June 2022 for a total of 6386 GP practices in England. Outcomes were measured as weekly rates per 1000 registered GP practice population and as cumulative totals at the end of the study period. Negative binomial regression models using IRR were used to explore subgroup differences in the patterns of NHS App use by patient sociodemographic characteristics, their long-term healthcare needs and GP practice size. The regression models compared variations in app usage for the different covariates in comparison to the reference group Q1 (i.e. for IMD = least deprived practices and for all other covariates = practices with the lowest population percentage for the given variable). IRR values were then used to calculate the percentage change to report the relative difference between the different covariate quintiles. All statistical analyses were performed using Stata 17.0 (StataCorp LP, College Station, TX, USA).

## Results

We present cumulative totals for all NHS App features in [Table 6](#), and figures of percentage changes from fully adjusted models with full IRRs are presented in [Appendix 3, Table 8](#).

**TABLE 6** Cumulative total NHS App functions used between 23 March 2020 and 27 June 2022

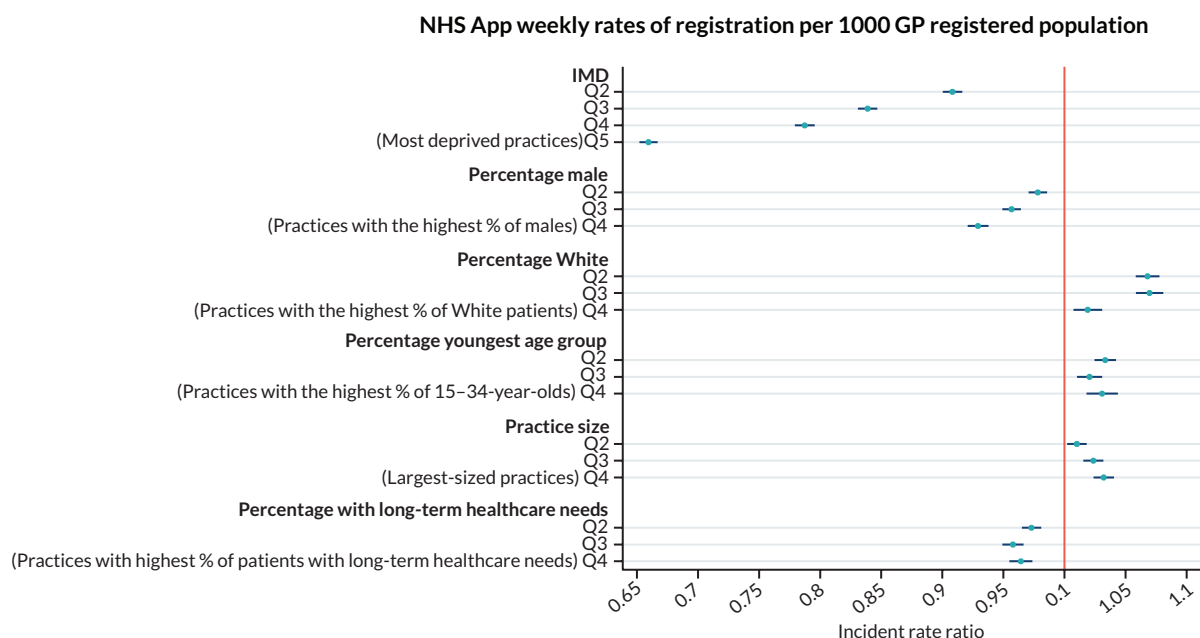
NHS App features	Cumulative total use
Registrations	24,168,835
Logins	447,976,852
Appointments booked	1,757,975
Medical record views	117,962,559
Prescriptions ordered	21,324,472

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## Registrations

Across the whole study period, there were 24,168,835 NHS App registrations (*Table 6*). Results showing subgroup differences in NHS App registrations using the fully adjusted models are presented in *Figure 5* and these show strong associations between IMD and app registration, with lower rates of registration in all quintiles than Q1 (i.e. least deprived) (test for trend  $p < 0.001$ ). For example, registration rates were 34.0% lower in Q5 than Q1 ( $p < 0.001$ ). Registrations were also lower in practices with higher proportions of male patients (e.g. 7.1% lower in Q4 than Q1  $p < 0.001$ ) and in practices with greater proportions of patients with long-term health needs (e.g. 3.6% lower in Q4 compared with Q1,  $p < 0.001$ ) (test for trend  $p < 0.001$ ).

Registrations were higher in practices with higher proportions of White patients (e.g. 1.9%, lower in Q4 compared with Q1  $p < 0.001$ ) and those with more patients from the youngest age group (e.g. 3.1%, lower in Q4 compared with Q1



**FIGURE 5** Weekly NHS App registration rates per 1000 GP registered population for the different covariate quintiles. Where IMD = Index of Multiple Deprivation. IMD Q1 (reference group) = least deprived practice and IMD Q5 = most deprived practices. For all other covariates, Q1 = practices with the lowest population percentage for the given variable and Q4 = practices with the highest population percentage for the given variable. Reproduced with permission from Kc *et al.*<sup>57</sup> This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) licence, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: <https://creativecommons.org/licenses/by/4.0/>. The figure above includes minor additions and formatting changes to the original text.

$p < 0.001$ ). Registration rates were also higher in larger-sized practices (e.g. 3.2% lower in Q4 than Q1  $p < 0.001$ ) (test for trend  $p < 0.001$ ).

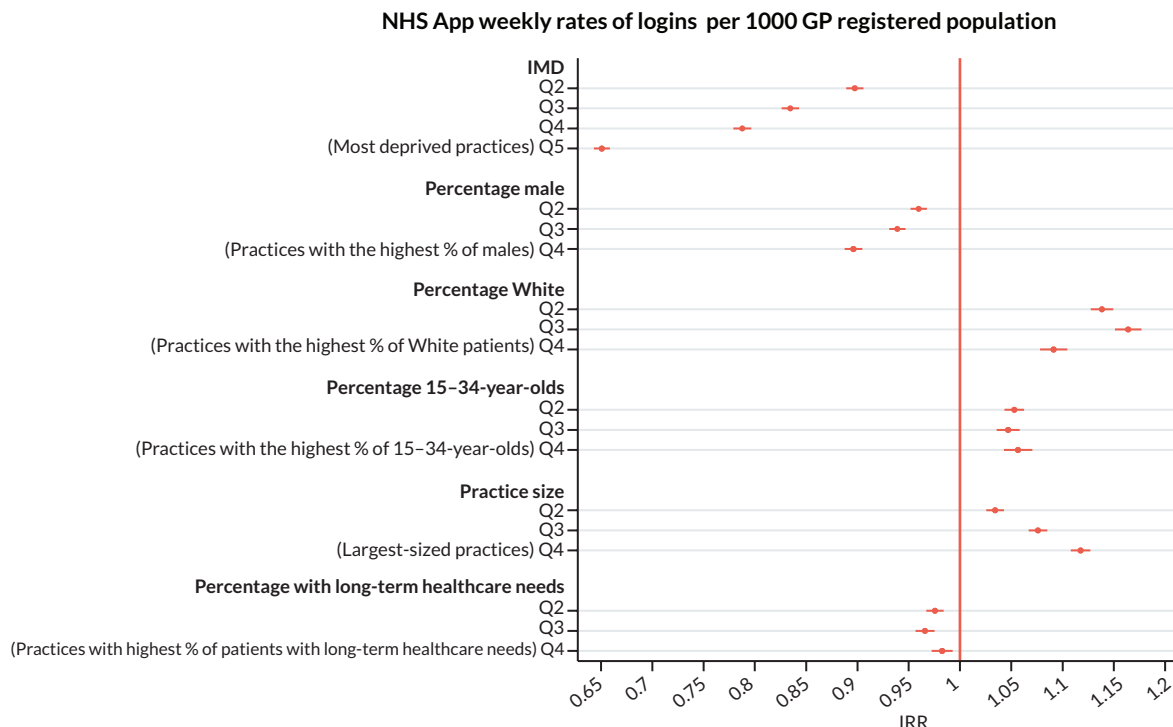
### Logins

Across the whole study period, there were 447,976,852 NHS App logins (see Table 6). Results showing subgroup differences in NHS App registrations using the fully adjusted models are presented in Figure 6 and they show strong associations between IMD and app logins, with lower login rates in all quintiles compared to Q1 (i.e. least deprived) (test for trend  $p < 0.001$ ). For example, login rates were 34.9% lower in Q5 than Q1 ( $p < 0.001$ ). Logins were also lower in practices with higher proportions of male patients (e.g. 10.4% lower in Q4 than Q1,  $p < 0.001$ ) and in practices with greater proportions of patients with long-term health needs (e.g. 3.4% lower in Q3 than Q1 and 1.7% lower in Q4 than Q1,  $p = 0.001$ ) (test for trend  $p < 0.001$ ).

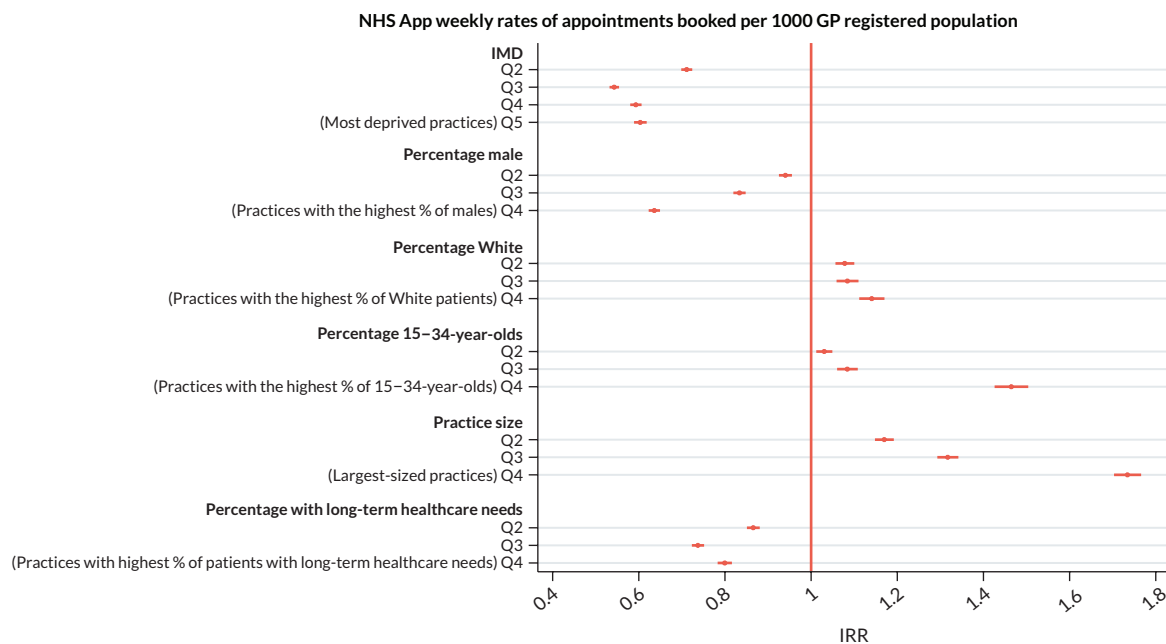
App logins were generally higher in practices with a higher proportion of White patients (e.g. 16.4% higher in Q2 than Q1 and 9.1% higher in Q4 than Q1,  $p < 0.001$ ) and in those with more patients from the youngest age group aged 15–34 years (e.g. 5.6% higher in Q4 than Q1,  $p < 0.001$ ). NHS App login rates were also higher in the larger-sized practices (e.g. 11.7% higher in Q4 than Q1,  $p < 0.001$ ) (test for trend  $p < 0.001$ ).

### Appointments booked

Across the whole study period, there were 1,757,975 GP appointments booked using the NHS App. Results showing subgroup differences in the rates of appointment booked using the fully adjusted models are presented in Figure 7 and they show strong associations between IMD and appointments booked, with lower rates of appointment booking rate in all quintiles than Q1 (i.e. least deprived) (test for trend  $p < 0.001$ ). For example, rates of appointments booked were 45.7% lower in Q2 than Q1 and 39.7% lower in Q5 compared to Q1 ( $p < 0.001$ ). Appointments booking rates were also lower in practices with higher proportions of male patients (e.g. 36.4% lower in Q4 than Q1,  $p < 0.001$ ) and in those with more patients with long-term health needs (e.g. 20.0% lower in Q4 than Q1,  $p = 0.001$ ) (test for trend  $p < 0.001$ ).



**FIGURE 6** Weekly NHS App login rates per 1000 GP registered population for the different covariate quintiles. Where IMD = Index of Multiple Deprivation. IMD Q1 (reference group) = least deprived practice and IMD Q5 = most deprived practices. For all other covariates, Q1 = practices with the lowest population percentage for the given variable and Q4 = practices with the highest population percentage for the given variable. Reproduced with permission from Kc *et al.*<sup>57</sup> This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) licence, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: <https://creativecommons.org/licenses/by/4.0/>. The figure above includes minor additions and formatting changes to the original text.



**FIGURE 7** Weekly rates of appointments booked using the NHS App per 1000 GP registered population for the different covariate quantiles. Where IMD = Index of Multiple Deprivation. IMD Q1 (reference group) = least deprived practice and IMD Q5 = most deprived practices. For all other covariates, Q1 = practices with the lowest population percentage for the given variable and Q4 = practices with the highest population percentage for the given variable. Reproduced with permission from Kc *et al.*<sup>57</sup> This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) licence, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: <https://creativecommons.org/licenses/by/4.0/>. The figure above includes minor additions and formatting changes to the original text.

The rates of appointments booked were higher in practices with the highest proportion of White patients (e.g. 14.1% higher in Q4 than Q1,  $p < 0.001$ ) and those with the most patients from the youngest age group aged 15–34 years (i.e. 46.5% higher in Q4 than Q1,  $p < 0.001$ ). The rates of appointments booked were also higher among the larger-sized practices (e.g. 73.4% in Q4 than Q1,  $p < 0.001$ ) (test for trend  $p < 0.001$ ).

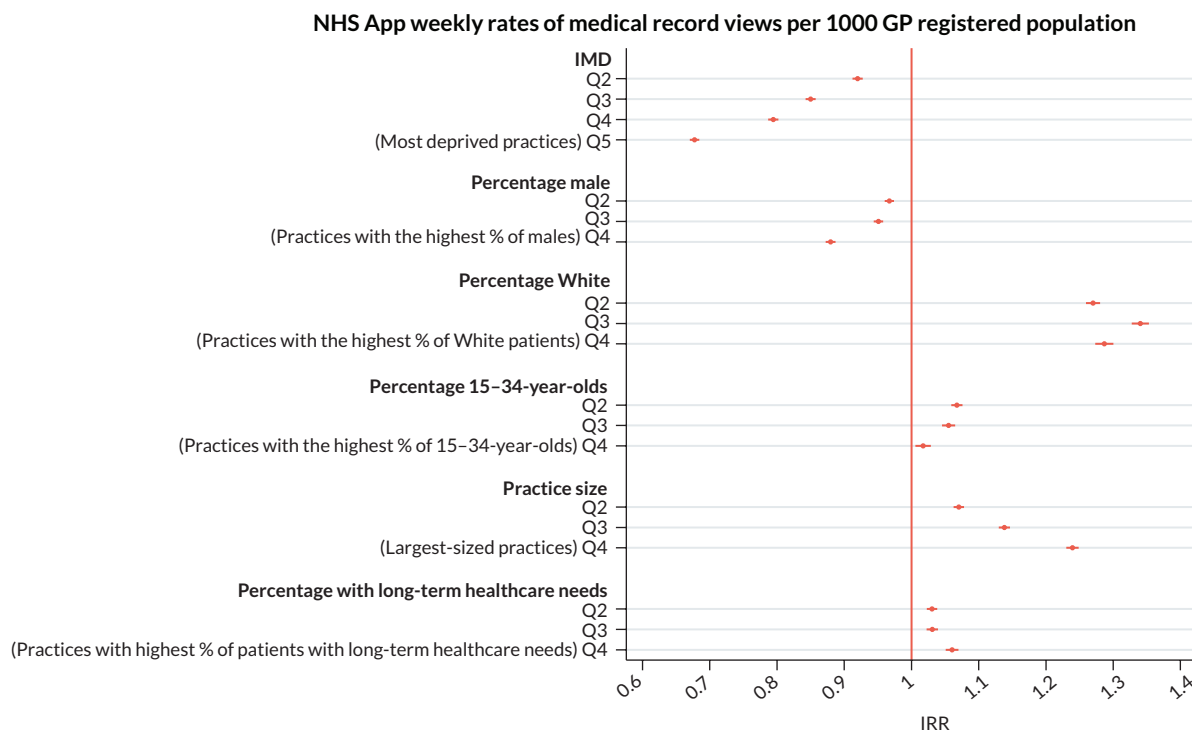
### Medical record views

Across the whole study period, there were 117,962,559 medical record views through the NHS App. Results showing subgroup differences in the rates of medical records viewed using the fully adjusted models are presented in [Figure 8](#) and they show strong associations between IMD and medical record views, with higher rates in all quintiles than Q1 (i.e. least deprived) (test for trend  $p < 0.001$ ). For example, rates of medical record views were 32.3% lower in Q5 than Q1 ( $p < 0.001$ ). They were also lower in practices with higher proportions of male patients (e.g. 12.0% lower in Q4 than Q1,  $p < 0.001$ ) (test for trend  $p < 0.001$ ).

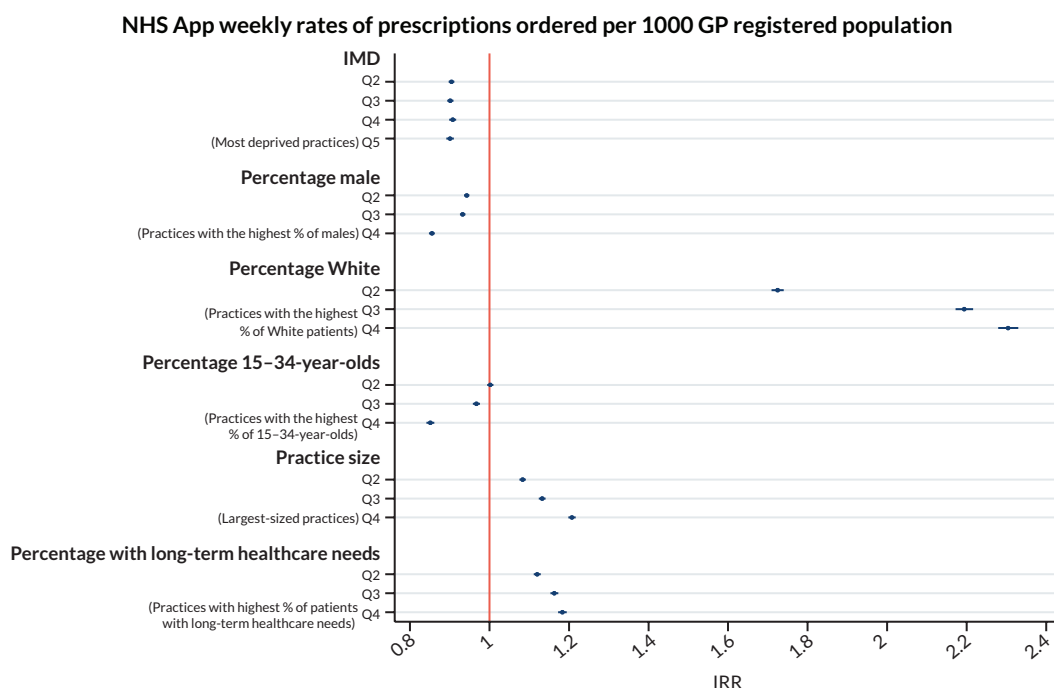
Rates of medical record views were higher in practices with a higher proportion of White patients (e.g. 34.0% higher in Q2 than Q1 and 28.7% higher in Q4 than Q1,  $p < 0.001$ ) and in those with more patients from the youngest age group aged 15–34 years (e.g. 6.7% higher in Q2 than Q1,  $p < 0.001$  and 1.7% higher in Q4 than Q1,  $p = 0.003$ ). The rates of medical records views were also higher in larger-sized practices (e.g. 23.9% higher in Q4 than Q1,  $p < 0.001$ ) and in practices with more people with long-term healthcare needs (e.g. 6.0% in Q4 than Q1,  $p < 0.001$ ) (test for trend  $p < 0.001$ ).

### Prescriptions ordered

Across the whole study period, there were 21,324,472 prescriptions ordered using the NHS App. Results showing subgroup differences in the rates of prescriptions ordered using the fully adjusted models are presented in [Figure 9](#) and they show strong associations between IMD and rates of prescriptions ordered, with lower rates in all quintiles compared to Q1 (i.e. least deprived) (test for trend  $p < 0.001$ ). For example, rates of prescriptions ordered were 9.9% lower in Q5 than Q1 ( $p < 0.001$ ). Prescription order rates were also lower in practices with higher proportions of



**FIGURE 8** Weekly rates of medical record views using the NHS App per 1000 GP registered population for the different covariate quantiles. Where IMD = Index of Multiple Deprivation. IMD Q1 (reference group) = least deprived practice and IMD Q5 = most deprived practices. For all other covariates, Q1 = practices with the lowest population percentage for the given variable and Q4 = practices with the highest population percentage for the given variable. Reproduced with permission from Kc *et al.*<sup>57</sup> This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) licence, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: <https://creativecommons.org/licenses/by/4.0/>. The figure above includes minor additions and formatting changes to the original text.



**FIGURE 9** Weekly rates of prescriptions ordered using the NHS App per 1000 GP registered population for the different covariate quantiles. Where IMD = Index of Multiple Deprivation. IMD Q1 (reference group) = least deprived practice and IMD Q5 = most deprived practices. For all other covariates, Q1 = practices with the lowest population percentage for the given variable and Q4 = practices with the highest population percentage for the given variable. Reproduced with permission from Kc *et al.*<sup>57</sup> This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY 4.0) licence, which permits others to distribute, remix, adapt and build upon this work, for commercial use, provided the original work is properly cited. See: <https://creativecommons.org/licenses/by/4.0/>. The figure above includes minor additions and formatting changes to the original text.

male patients (e.g. 14.5% lower in Q4 than Q1,  $p < 0.001$ ) and in practices with a higher proportion of people aged 15–34 years old (e.g. 14.8% lower in Q4 than Q1,  $p < 0.001$ ).

The rates of prescriptions ordered were significantly higher in practices with a higher proportion of White patients (e.g. 119.4% higher in Q3 than Q1 and 130.40% higher in Q4 than Q1,  $p < 0.001$ ) and in larger practice sizes (e.g. 20.7% higher in Q4 than Q1,  $p < 0.001$ ). The rates of prescriptions ordered were also higher in practices with more people with long-term healthcare needs (e.g. 18.3% higher in Q4 than Q1,  $p < 0.001$ ) (test for trend  $p < 0.001$ ).

## Discussion

### Principal results

This study exploring NHS App use showed high patient engagement with variations in the use of different features overall and across the different covariate categories. Subgroup analyses found a clear deprivation gradient with lower rates of use of the various NHS App features among practices in the most deprived areas and in those with more registered males. In contrast, the use of the different features was higher among the largest-sized practices and in those with more White patients, with a 130% difference in the rates of prescriptions ordered in practices with the highest proportion of White patients than Q1. These patterns varied in practices with more younger patients, which had higher appointment booking rates, but lower rates of prescription ordered. Similarly, in practices with the most people with long-term healthcare needs, there were significantly higher rates of medical record views and prescriptions ordered but lower appointment booking rates, registrations, and logins.

Some results stand out as particularly striking, for example, with ordering prescriptions online – one of the most used features – there is a strong ethnicity gradient, with practices with a higher proportion of White patients using this function more than twice as much as practices with a lower proportion of White patients, suggesting particular opportunities for changes in design and practice to reduce inequality.

### Strengths and limitations

This is the first study to explore variations in the use of different NHS App features in relation to different sociodemographic groups. It provides a crucial understanding of digital health engagement in a real-world setting. While these initial findings suggest an unequal pattern of patient engagement with the NHS App features in relation to patient age, sex, ethnicity, deprivation and patient healthcare needs, there are limitations in using population-level data to understand individual-level differences. Although patients can select their data-sharing preferences through the NHS App,<sup>64</sup> individual-level data are not yet available for research, which restricts a more direct evaluation of these usage patterns.

Furthermore, this study used data over 27 months since the launch of the NHS App, providing insight into its usage trends. However, challenges in capturing and controlling the effects of the influences of wider confounding factors such as regulatory changes, competing availabilities of similar commercial digital health platforms and changes in strategic decisions impacting provider and public response to the app<sup>48</sup> have implications for our research findings. In addition, this study includes a number of sociodemographic variables and their proxies identified in consultation with the wider research team and the PPIE group. However, the full range of indicators used (e.g. additional age ranges and ethnic groups) and broader socioeconomic variables have been excluded due to analytical considerations and data acquisition challenges. While some variables are encompassed within existing indicators (e.g. income and education for IMD value calculation) and their proxies offer reference points for the different sociodemographic categories, these factors may operate in silos to influence how people engage with digital resources,<sup>66</sup> and they merit further exploration in future studies.

Also, exclusions were applied to remove practices with incomplete data and small sample sizes to remove practices serving unconventional populations or those with unreliable practice-level data for the outcomes. This along with the ecological nature of the analysis may affect the generalisability of results and present missed opportunities to capture the demography these practices serve and their distinct challenges. Nevertheless, our study provides a comprehensive overview of public uptake of the NHS App using a nationally representative sample of the GP-registered population in England.

### **Comparison with prior work**

The results of the current study further the findings presented in Chapter 3. They indicate a continued pattern of inequality in patient engagement with the NHS App. A recent publication from NHS Digital highlights that the NHS App currently has over 30 million registrations, with over 65 million patient record views and 22 million repeat prescription orders through the app in the year 2022 alone.<sup>4</sup> While our data support these findings by highlighting high usage across all app features, evidence of a varied pattern of use of the different app functions among different population groups is congruent with wider research in the field.<sup>59,60</sup> Most notably, reductions in use of the different functions linked to increases in deprivation and reduction in ethnic diversity across practices reinforce concerns related to the digital inverse care law<sup>62</sup> and underscore persistent equity challenges that may warrant targeted support and interventions. A previous study exploring disparities in the uptake of NHS primary care services including the NHS App highlighted the scale of digital health inequality related to non-activation of the app, which corresponded to approximately 4.27 million patients living in the most deprived quintiles in England.<sup>67</sup> This figure could be more pronounced when considering the inequalities in patient interaction with the NHS App features as highlighted by our findings, indicating that activation may not necessarily translate to sustained utilisation. This emphasises the multifaceted nature of digital health disparities and prompts a critical examination of the factors contributing to unequal access, as well as continued user interaction.

Although the diffusion of innovation theory tells us that some of these differences may level out as the technology is more widely used by the general population,<sup>68</sup> certain patient portal features may continue to have differential adoption based on individual capacity, need and access.<sup>22</sup> Discrepancies in use of the functions, as highlighted by our results, such as younger adults showing increased appointment bookings but decreased prescriptions, underscore these complexities confounded by various factors. Younger adults generally have better capacity for engagement with digital health technology, yet they generally use healthcare utilisation less overall due to their low healthcare needs.<sup>69</sup> Therefore, the reduction in prescription orders through the NHS App among this group may reflect a good health status overall and low care needs. However, the evidence of increased uptake of certain transactional services such as appointment booking in this user group may also be indicative of their technological literacy and motivation to utilise these services. While we could not measure these associations directly for the NHS App, it warrants further exploration in future studies.

In congruence with previous studies, our results also indicate pronounced variations in different app feature usage among individuals with long-term health conditions.<sup>59,60</sup> While appointment booking rates decreased, medical record views and prescription orders increased, signalling heightened patient engagement with features catering to their ongoing healthcare needs, such as prescription refills and health record monitoring.<sup>70</sup> The decline in appointment booking could be associated with the configuration of this feature, which is contingent upon the specific provisions implemented by individual practices. It could also be linked to variations in the self-care ability of individuals with long-term healthcare needs, as they might often depend on family, social networks, and caregivers for support, potentially benefiting from delegated digital access for care co-ordination.<sup>16,71</sup> Although the NHS App offers access to linked profiles for family members and carers, the availability of these proxy access entitlements relies on individual GP practice provisions<sup>72</sup> Therefore, further analysis of app functions, variations in the activation of features dependent on GP practice provisions and patients' ability for self-care can offer further insight into broader system issues influencing NHS App use.

However, disparities in access and use of digital tools may not inherently lead to inequalities in healthcare outcomes. If those with better capacity, interest and opportunity to engage with technology utilise digital services more, this may reduce pressures on the healthcare system and offer cost-saving opportunities to improve care for those who continue to benefit from in-person support.<sup>73</sup> This may be particularly relevant to a patient-facing tool such as the NHS App, which is scaled at a national level, offering a range of functions for diverse population groups. Therefore, identifying early users and non-users of the NHS App and supporting engagement with features most relevant to their specific needs may be crucial to creating equal outcomes for all.<sup>74</sup> There is also a need for ongoing assessment of the uptake

trends of the NHS App contingent on continued policy efforts and facilitation strategies to understand its ongoing relevance, user satisfaction, and equitable access, contributing to the overall success of such digital health initiatives.

Our results, showing variation in use of the app overall and specific functions by various patient characteristics, suggest opportunities for design, policy and practice change. This might include targeted marketing of the app and its functions towards specific groups – such as advertising the prescription function to wider ethnic groups, or ensuring user research and testing with diverse populations, to make sure future design decisions do not reinforce existing variation.

## Conclusions

We found ongoing patient engagement with the various NHS App functions. However, inequalities in the rates of use of the different app features indicate an ongoing digital divide. NHS App uptake and use followed a strong deprivation gradient and influences of patient age, ethnicity and healthcare needs, indicating the need for dedicated efforts to meaningfully engage different population groups. Further research is also needed to explore how these differences affect disparities in health and care outcomes.

Our study contributes to the growing body of evidence on digital health engagement and lays the groundwork for future research and policy-making. It underscores the importance of continuous monitoring, evaluation, and adaptation of digital health initiatives to ensure they meet the evolving needs of diverse populations and contribute to equitable health outcomes for all. The NHS App has the potential to be a valuable tool for patient care in the NHS in England, but it is important to address the digital divide and ensure that all individuals can use the app effectively irrespective of their demographic, ethnic or socioeconomic characteristics.

# Chapter 5 Patient experience of primary care and use of the NHS App (quantitative study 3)

## Introduction

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GP services account for the largest volume of activity with the NHS<sup>76</sup> and with approximately 31 million appointments (excluding COVID-19 vaccinations) delivered through general practices in November 2023 alone<sup>77</sup> it forms a fundamental component of the UK Primary Healthcare system. However, persistent issues, in part due to changes in healthcare delivery models due to COVID, have impacted patient access to GP services and continuity of primary care.<sup>78</sup> There are reports of severe delays to timely access to care with approximately 7.6% of all GP appointments taking place after more than 2 weeks since booking<sup>77</sup> and a significant drop in public satisfaction with GP services, which fell to 35% in 2022, marking the lowest levels recorded since 1983.<sup>79</sup> These challenges are exacerbated by an ongoing workforce crisis due to chronic reductions in the number GPs available and concurrent increases in demands for servicing an ageing population with complex healthcare needs.<sup>80</sup>

Strategies to recover access to primary care services include a number of national initiatives, such as the Modern General Practice model in England, which focuses on ensuring equitable and easy access to care across multiple channels using optimised telephone systems, well-designed practice websites, as well as using digital tools such as the NHS App (also referred to as 'the app').<sup>81</sup> These approaches align with a global commitment to prioritise primary care access, as outlined in the WHO Declaration of Astana, which emphasises the significance of primary health care in achieving universal health coverage and supports the use of technologies to improve access to care and to involve individuals in their healthcare decisions.<sup>6</sup> They also reflect on patient and public views regarding priorities for improving the NHS, with ease of access to GP appointments highlighted as one of the top two concerns.<sup>79</sup>

Online services, including patient portals, have become almost universally implemented by GP practices in England over the past decade, serving as alternatives to traditional contact methods like phone or face-to-face interactions.<sup>82</sup> The NHS App is one such service that currently forms a part of a multi-channel approach offering diverse healthcare access options, including in-person, phone and web services alongside online tools. Through the app, several options for primary care interactions have been shifted online using functions that allow booking GP appointments, communicating with care providers, ordering repeat prescriptions etc. Additionally, it grants patients access to health information online through features like NHS 111 symptom checks and GP record access etc. There are also plans for improving secondary care access using features for managing hospital appointments and related documents,<sup>64</sup> with targets to achieve a 75% adoption rate among the population in England by early 2024.<sup>83</sup>

However, uptake alone does not always translate to engagement and not everyone can use digital technologies equally.<sup>40</sup> Patient experience of care and familiarity with existing GP services may be important considerations that affect how patients engage with novel technological solutions, as evidence highlights the influence of patient experience of access to care and service interactions on the uptake of GP provides and resultant quality outcomes.<sup>84</sup> There are also known overlaps between digital and interpersonal aspects of health care, where positive experiences with both enhance patient self-management and overall user engagement,<sup>85</sup> which may foster a culture of trust and motivation to navigate the digital healthcare landscape. Digital tools facilitating patient-provider communication are more effective when positive clinician-patient relationship is present and they aid in overcoming access issues and mitigate past negative experiences, especially for marginalised groups.<sup>86</sup> They may also offer alternatives to traditional

care approaches, particularly for health information seeking in cases where patients express dissatisfaction with their GP care providers.<sup>87</sup>

Patient experience of using existing digital channels may also be equally important in understanding public amenability to newer technologies. Digital competence that aids familiarity and satisfaction with broader information communication tools may increase exposure to digital pathways, enhancing patients' willingness to engage with new services.<sup>88</sup> Additionally, where patients remain dissatisfied with their existing GP practice digital ecosystem that greatly varies across practices, tools such as the nationally rolled-out NHS App may offer more standardised alternatives. As research on the uptake of the NHS App uptake is emerging, these factors that relate to the use of the app need to be explored to understand aspects pertaining to access in a national portal context

This study aimed to explore whether patients' experience of access to their general practices and their overall practice experience influences engagement with the NHS App. This would highlight whether there is a symbiotic relation between GP patient experience and experience of using the NHS App and if there is a need for concerted efforts to enhance the digital patient journey to achieve NHS England's 'digital by default' objective.

## Methods

### Study design

An ecological study with data at the GP practice level in England exploring differences in the usage of NHS App features by patient experience of care and care access was conducted.

### Data sources and linkage

NHS App usage data were obtained from the NHS App dashboard with access provided by the NHS Digital team as anonymised daily logs for a 27-month period between March 2020 and June 2022. Baseline sociodemographic data on the profile of the GP-registered population in terms of their age, sex, ethnicity, long-term healthcare needs and deprivation were obtained in relation to an earlier publication in this series from public health data sources. The full list of variables considered, and their data sources are detailed in [Appendix 2, Table 7](#).

Data on patient experience of care and care access were extracted from the GPPS database. GPPS is a survey of approximately 2.4 million adult GP-registered patients in the UK and is currently conducted annually. The data used for this study were from a survey conducted in January 2021, which was completed online or via post by 850,000 patients nationally, with an overall response rate of 35.3%.<sup>44</sup> GPPS provides population-weighted positive responses at the GP practice level for a number of individual questions,<sup>2</sup> which was used to categorise practices into quintiles. For each covariate, quintile 1 included the lowest-ranked practices and quintile 5 the highest. Data related to the study aim included the following indicators and related GPPS questions:

- Ease of phone access: 'Generally, how easy is it to get through to someone at your GP practice on the phone?' (GPPS Question Q1)
- Ease of web access/use: 'How easy is it to use your GP practice's website to look for information or access services?' (GPPS Question Q4)
- Overall GP practice experience: 'Overall, how would you describe your experience of your GP practice?' (GPPS Question Q30)

The relevance of the GPPS indicators to the research aims, and their appropriateness for use was finalised with inputs from the PPIE group members, the NHS England team and the wider research team.

### Statistical analysis

General Practitioner Patient Survey data were linked to the NHS App data using GP practice code as an identifier for each GP practice in England. Data for practices with missing practice size or area codes were removed, as were practices with fewer than 200 registered patients ( $n = 146$ ) to avoid linkage errors and to improve data reliability. For

analysis, complete app data were available for a total of 6386 GP practices across England for the full period between 23 March 2020 and 27 June 2022. Stata 17.0 software was used for the statistical analysis.

The main outcome variables were weekly rates of each NHS App function used (e.g. registrations, logins, prescriptions ordered, medical record views and appointments booked) per 1000 registered GP practice population. Patient responses to the select GPPS variables were used as covariates capturing data related to patient experience of access to their GP practices by phone, website, as well as their overall practice experience.

IRR obtained from negative binomial regression models were used to explore differences in the use of the various NHS App features for each GPPS variable in comparison to the reference group (Q1), with others held constant. The regression models also controlled for all baseline differences in patient sociodemographic profiles.

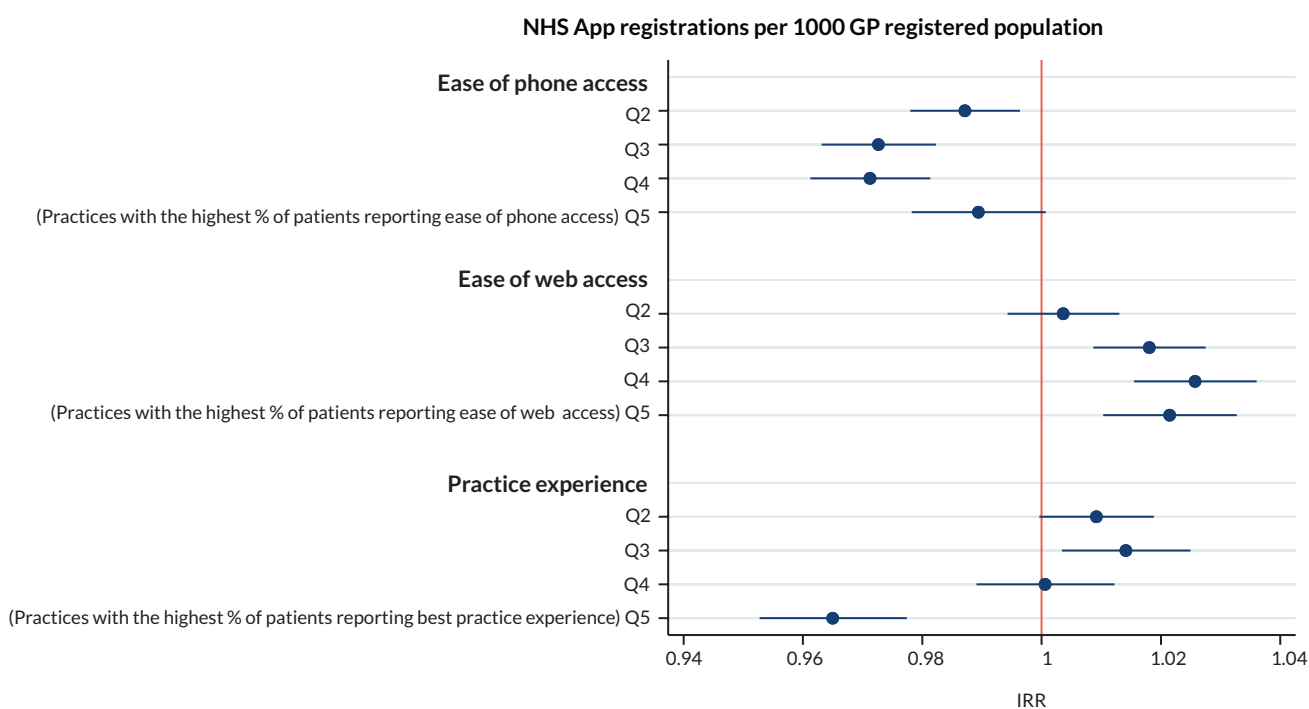
Charts of use of the various functions over time, showing the different quartiles of practice by overall patient experience, were also plotted to visually demonstrate the temporal trend in use of the different functions for context.

## Results

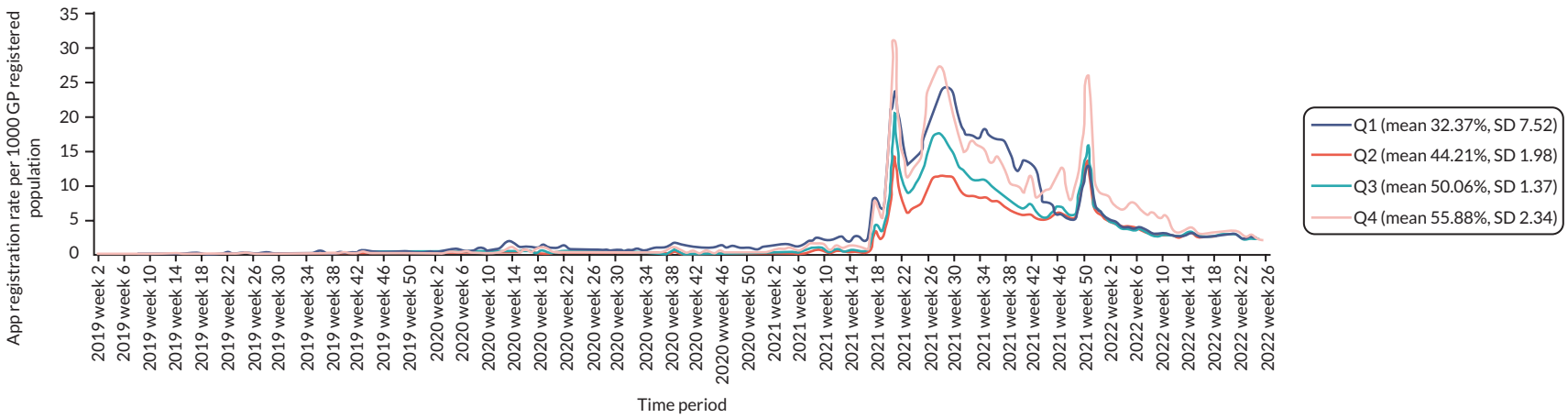
Results for each of the NHS App features in relation to the GPPS variables and their corresponding forest plots using IRRs and confidence intervals are presented below. A full table including percentage changes from adjusted models with complete IRR values is presented in [Appendix 4, Table 9](#).

### Registrations

[Figures 10](#) and [11](#) show weekly rates of NHS App registration by the covariates of interest. Results exploring differences in NHS App registration rates by patient experience of care and care access showed that practices with higher proportion of patients reporting better phone access had lower registration overall compared to those in the lowest quintile (i.e. reference group, Q1 = practices with the lowest proportion of patients reporting ease of phone access). For example, registration rates were 2.9% lower in Q4 than Q1 ( $p < 0.001$ ) and 1.1% lower in Q5 than Q1, although this was not statistically significant ( $p > 0.05$ ).



**FIGURE 10** Weekly NHS App registration rates per 1000 GP registered population.



**FIGURE 11** Time series graph showing mean NHS App registration rate over time per 1000 GP registered patients according to overall GP practice experience. Where, Q1 = GP practices the lowest percentage of patients reporting positive practice experience, Q4 = practices with the highest percentage of patients reporting positive practice experience. Time period = Weekly data from 7 January 2019 to 26 June 2022.

In terms of web access, practices with more patients reporting better access and use of practice websites had higher registration rates compared to practices in the lowest quintile (Q1 = practices with the lowest proportion of patients reporting ease of web access and use). For example, registration rates were 2.6% higher in Q4 than Q1 ( $p < 0.001$ ) and 2.1% higher in Q5 than Q1 ( $p < 0.001$ ).

Registration rates according to patient experience varied when comparing practices with higher reported experience to those with the lowest (i.e. reference group Q1 = practices with the lowest reported practice experience overall). For example, registration rates were 1.4% higher in Q3 compared to Q1 ( $p < 0.05$ ) and 3.5% lower in Q5 compared to Q1 ( $p < 0.001$ ).

**Logins**

Figures 12 and 13 show weekly NHS App login rates by covariates of interest. Results exploring differences in NHS App login rates by patient experience of care and care access showed a varied trend. In terms of phone access, practices in the higher quintiles had overall lower login rates compared to the reference group (i.e. Q1 = practices with the lowest proportion of patients reporting ease of access via phone). For example, login rates 2.3% lower in Q3 than Q1 ( $p < 0.001$ ). However, in practices with the highest proportion of patients reporting ease of phone access (Q5), login rates were 3.5% higher compared to Q1 ( $p < 0.001$ ).

In terms of web access, practices with higher proportion of patients reporting better access and use of practice website had higher login rates overall compared to practices in the lowest quintile (Q1 = practices with the lowest proportion of patients reporting ease of web access and use). For example, login rates were 5.4% higher in Q4 than Q1 ( $p < 0.001$ ) and 5.1% higher in Q5 than Q1 ( $p < 0.001$ ).

Login rates according to patient experience varied when comparing practices with lowest reported patient experience (i.e. reference group Q1) with the practices in the higher quintiles. For example, login rates were 1.3% higher in Q4 compared to Q1 ( $p < 0.05$ ) and 5.2% lower in Q5 compared to Q1 ( $p < 0.001$ ).

**Appointments booked**

Figures 14 and 15 show weekly rates of appointments booked by covariates of interest. Results exploring differences in the rates of GP appointments booked using the NHS App by patient experience of care and care access showed that

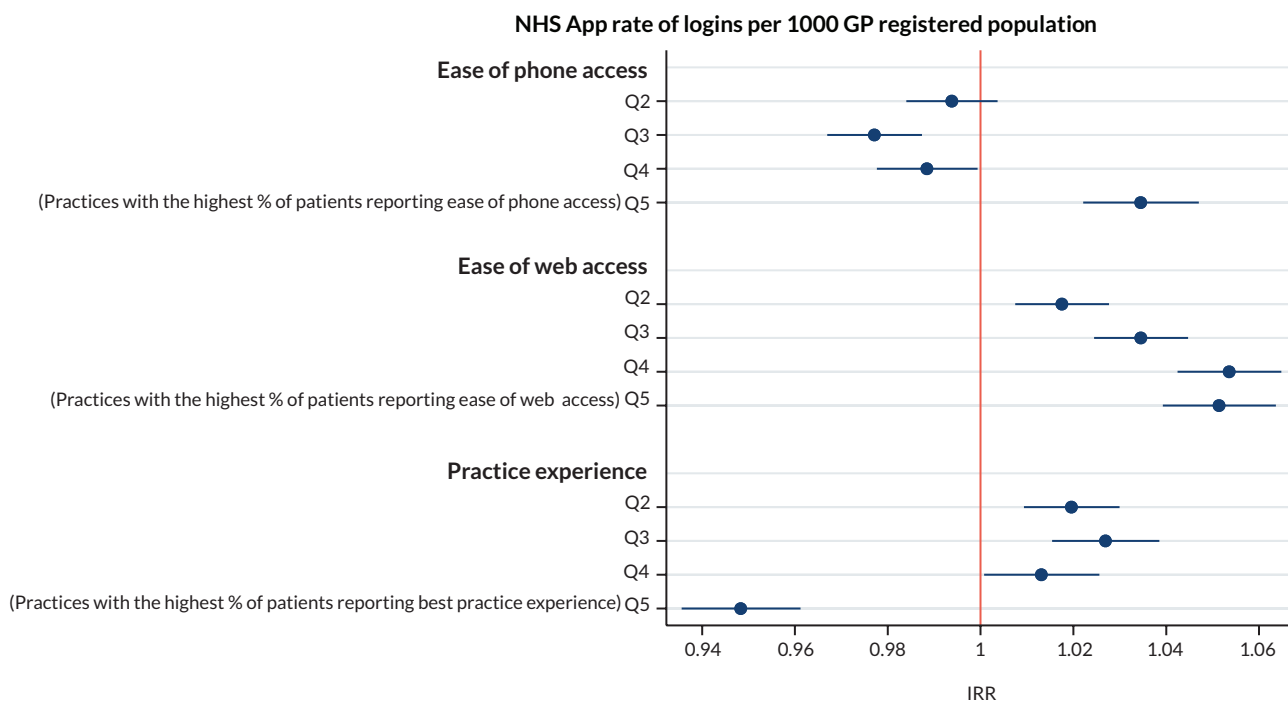
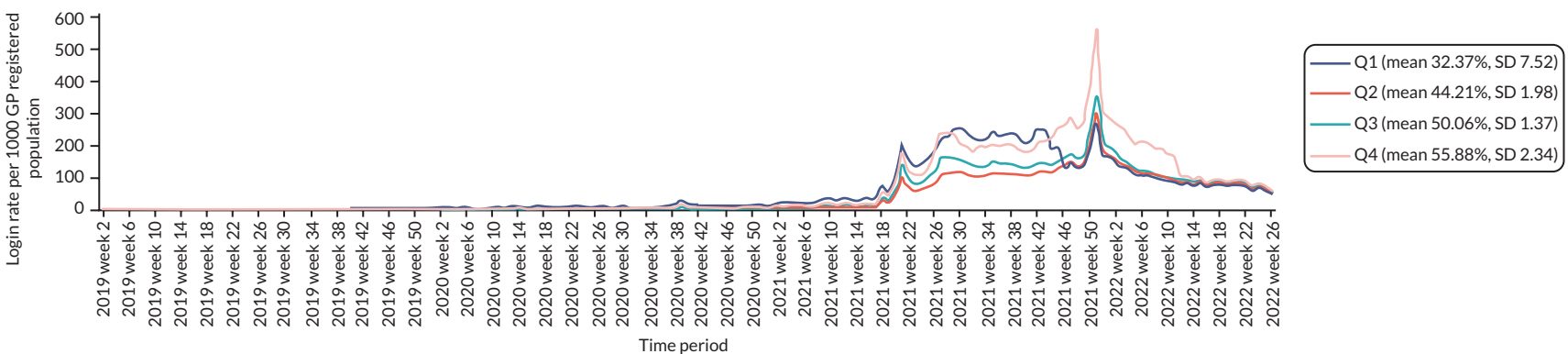
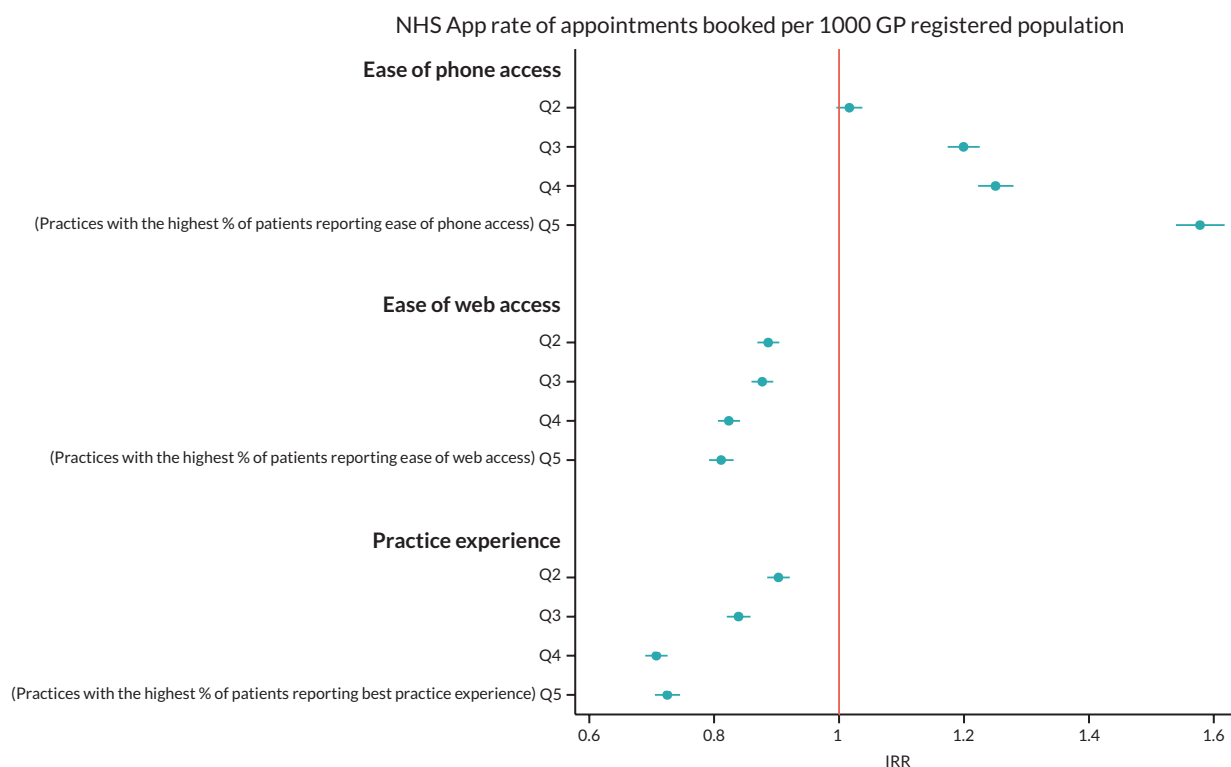


FIGURE 12 Weekly NHS App login rates per 1000 GP registered population.



**FIGURE 13** Time series graph showing mean NHS App login rate over time per 1000 GP registered patients according to overall GP practice experience. Where, Q1 = GP practices the lowest percentage of patients reporting positive practice experience, Q4 = practices with the highest percentage of patients reporting positive practice experience. Time period = Weekly data from 7 January 2019 to 26 June 2022.



**FIGURE 14** Weekly rates of appointments booked through the NHS App per 1000 GP registered population.

practices with the highest proportion of patients reporting better phone access had higher appointment booking rates overall compared to those in the lowest quintile (i.e. reference group, Q1 = practices with the lowest proportion of patients reporting ease of phone access). For example, rates of appointments booked were 25% higher in Q4 than Q1 ( $p < 0.001$ ) and 57.8% higher in Q5 than Q1 ( $p < 0.001$ ).

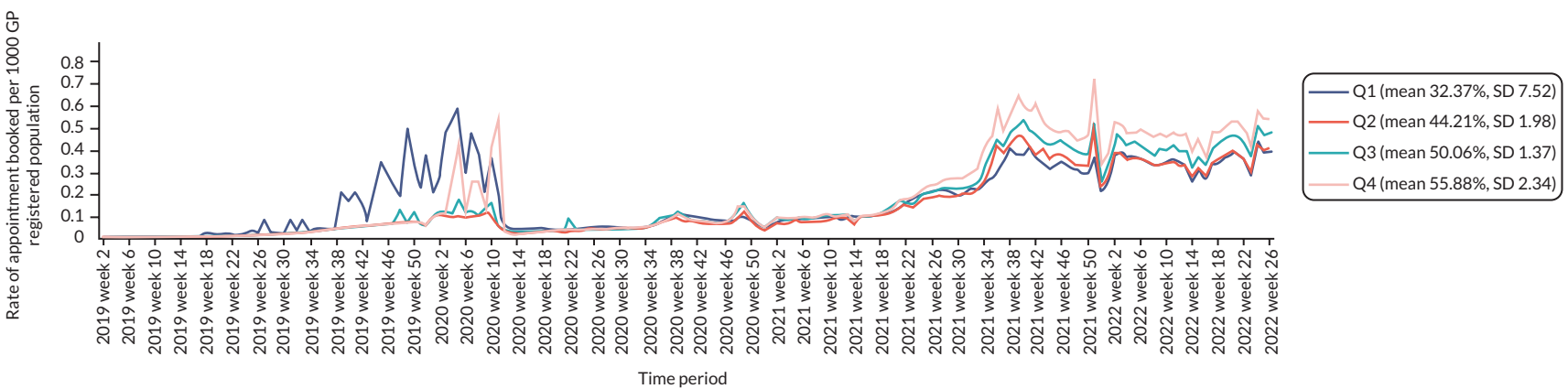
In terms of web access, practices with the highest proportion of patients reporting better access and use of practice website had lower appointment booking rates overall compared to practices in the lowest quintile (Q1 = practices with the lowest proportion of patients reporting ease of web access and use). For example, rates of appointments booked were 17.6% lower in Q4 than Q1 ( $p < 0.001$ ) and 18.9% lower in Q5 than Q1 ( $p < 0.001$ ).

Appointment booking rates according to patient experience were also lower in practices with more patients reporting better patient experience when compared to the reference group (Q1 = practices with the lowest proportion of patients reporting better patient experience). For example, appointment booking rates were 29.3% lower in Q4 compared to Q1 ( $p < 0.001$ ) and 27.5% lower in Q5 compared to Q1 ( $p < 0.001$ ).

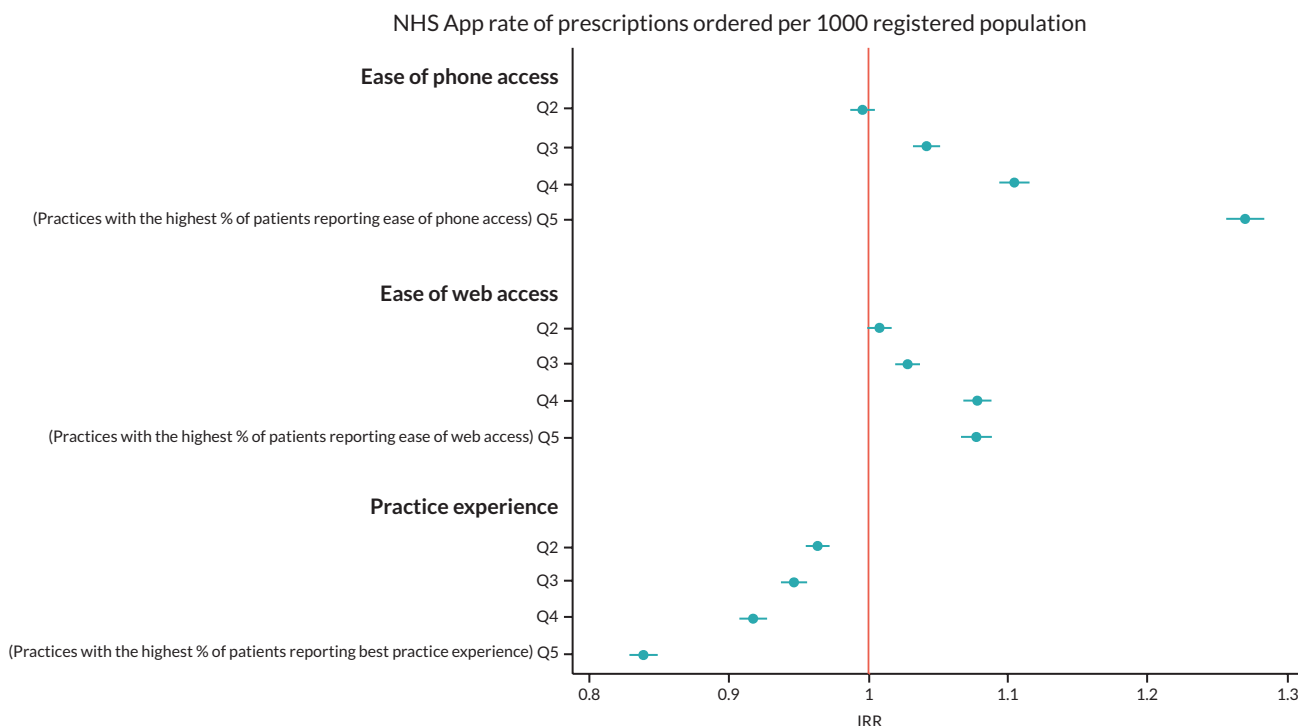
### Prescriptions ordered

Figures 16 and 17 show weekly rates of prescriptions ordered by covariates of interest. Results exploring differences in the rates of prescriptions ordered using the NHS App by patient experience of care and care access showed a varied pattern. In terms of phone access, practices with better phone access had higher rates of prescription orders overall compared to those in the lowest quintile (i.e. reference group, Q1 = practices with the lowest proportion of patients reporting ease of phone access), although this slightly varied for Q2. For example, the rate of prescriptions ordered was 27.0% higher in Q5 than Q1 ( $p < 0.001$ ) but was 0.4% lower in Q2 than Q1 although the difference was non-significant ( $p > 0.05$ ).

In terms of web access, practices with higher proportion of patients reporting better access and use of practice website had higher rates of prescription orders overall compared to practices in the lowest quintile (Q1 = practices with the lowest proportion of patients reporting ease of web access and use). For example, rates of prescriptions ordered were 7.8% higher in Q4 than Q1 ( $p < 0.001$ ) and 7.7% higher in Q5 than Q1 ( $p < 0.001$ ).



**FIGURE 15** Time series graph showing mean NHS App appointment booking rate over time per 1000 GP registered patients according to overall GP practice experience. Where, Q1 = GP practices the lowest percentage of patients reporting positive practice experience, Q4 = practices with the highest percentage of patients reporting positive practice experience. Time period = Weekly data from 7 January 2019 to 26 June 2022.



**FIGURE 16** Weekly rates of prescriptions ordered through the NHS App per 1000 GP registered population.

With regards to patient experience, rates of prescription orders were lower in practices with better patient experience when compared to those with lowest reported patient experience (i.e. reference group Q1). For example, prescription order rates were 8.3% lower in Q4 than Q1 ( $p < 0.001$ ) and 16.1% lower in Q5 than Q1 ( $p < 0.001$ ).

### Medical record views

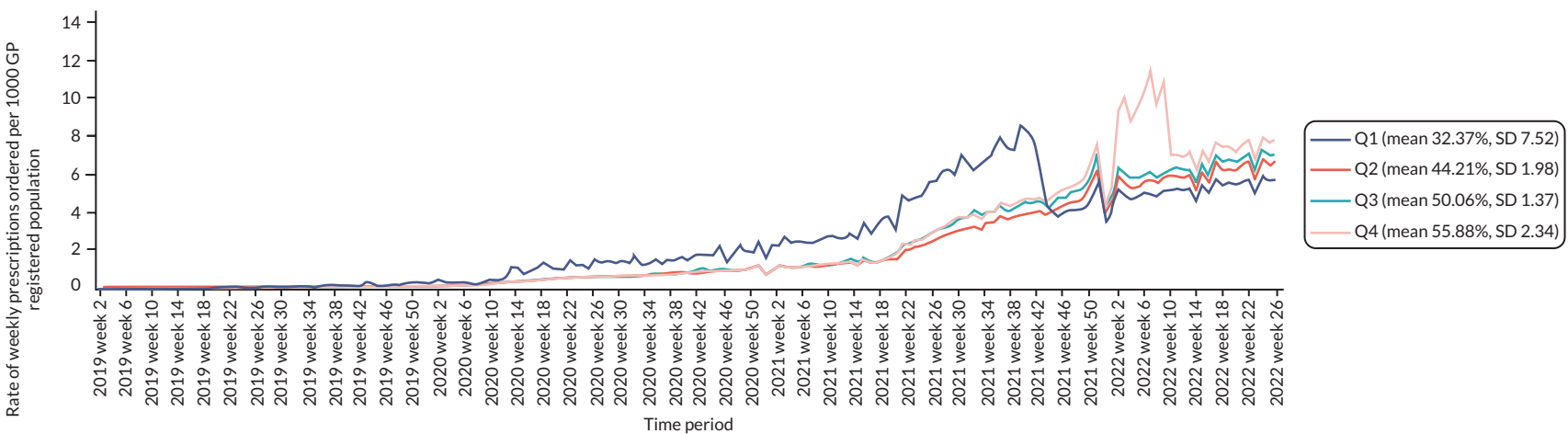
Figures 18 and 19 show weekly rates of medical record views by covariates of interest. Results exploring differences in the rates of medical record views using the NHS App by patient experience of care and care access showed that practices with higher proportion of patients reporting better phone access had higher rates of medical record views compared to those in the lowest quintile (i.e. reference group, Q1 = practices with the lowest proportion of patients reporting ease of phone access). For example, rates of medical record views were 5.4% higher in Q4 than Q1 ( $p < 0.001$ ) and 13.8% higher in Q5 than Q1 ( $p < 0.001$ ).

In terms of web access, practices with higher proportion of patients reporting better access and use of practice website also had higher rates of medical record views compared to practices in the lowest quintile (Q1 = practices with the lowest proportion of patients reporting ease of web access and use). For example, rates of medical record views were 3.4% higher in Q4 than Q1 ( $p < 0.001$ ) and 0.5% higher in Q5 than Q1, although this was not significant ( $p > 0.05$ ).

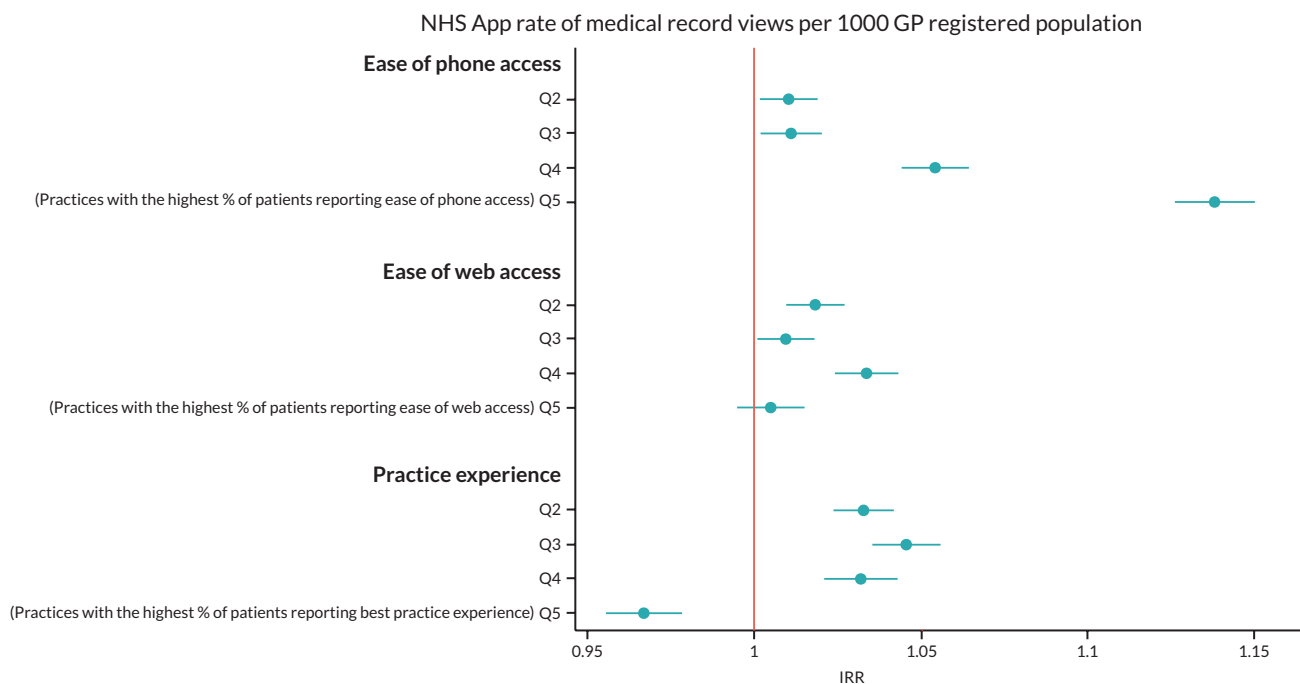
With regards to patient experience, rates of medical record views varied when comparing practices in the highest quintiles to practices with the lowest reported patient experience (i.e. reference group Q1). For example, rates of medical record views were 3.2% higher in Q4 compared to Q1 ( $p < 0.001$ ) and 3.3% lower in Q5 compared to Q1 ( $p < 0.001$ ).

## Discussion

Our analysis of GP patient experience of care and care access on public engagement with NHS App features highlighted a varied pattern of uptake and revealed a nuanced relationship between access modalities, patient experiences, and the utilisation patterns of NHS App features. It might have been anticipated that better patient experience was associated with higher NHS App use, or possibly lower use. We found a more complex and variable relationship.



**FIGURE 17** Time series graph showing mean rates of NHS App prescription orders per 1000 GP registered patients according to overall GP practice experience. Where, Q1 = GP practices the lowest percentage of patients reporting positive practice experience, Q4 = practices with the highest percentage of patients reporting positive practice experience. Time period = Weekly data from 7 January 2019 to 26 June 2022.

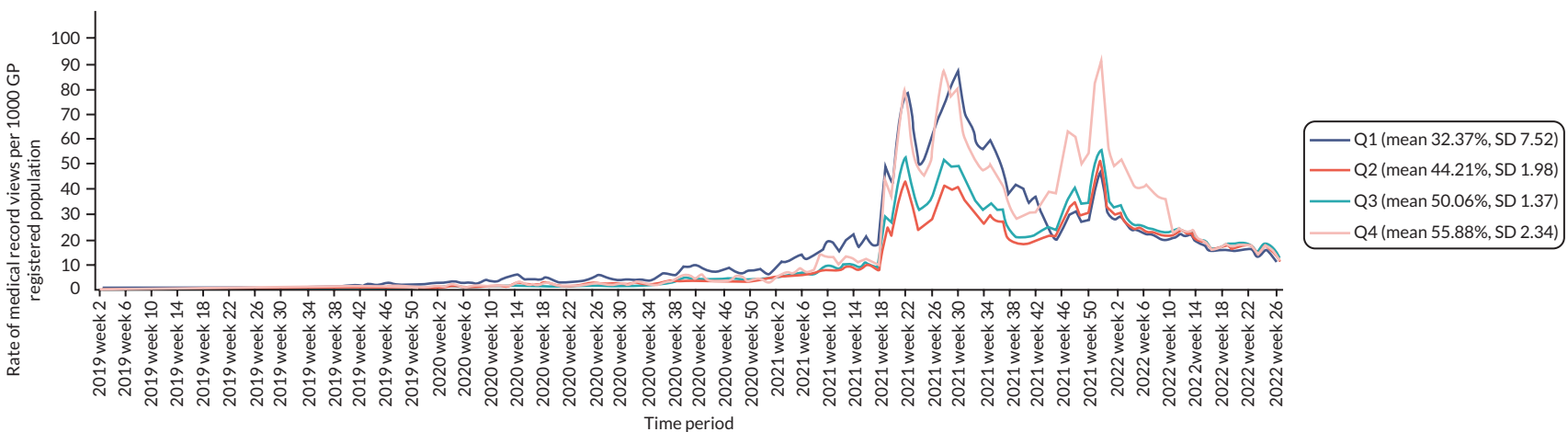


**FIGURE 18** Weekly rates of medical record views through the NHS App per 1000 GP registered population.

Generally, practices with better-reported phone access had higher usage overall for the different app functions but had lower registration rates and a varied pattern of logins. In particular, appointment booking rates were 57.8% higher in the practices that were reported as easiest to access via phone. In terms of web access, practices with websites that were reported as easiest to access and use had a mixed pattern of NHS App feature usage. Although registrations, logins and prescription orders were generally higher among these practices, appointment booking rates were substantially lower compared to the reference group. Also, rates of medical record views were overall higher among practices with websites that were easier to access and use, with modest but non-significant increase in the highest quintile. Similarly, the use of the different NHS App features also varied by patient experience with lower rates overall for appointment bookings and prescription orders among practices with better reports of patient experience. Although registrations, logins and medical record views were generally higher among these practices, usage rates were significantly lower in the highest quintiles, suggesting that practices with the best patient experience had lower rates of use of these different functions.

We found that better phone access meant people were signing up less to use the app, but where they had signed up, uptake of the different features remained high. Better phone access also corresponded to high rates of app appointment booking which may indicate that these practices were particularly focused on improving patient access or had lower demand than other settings. In contrast, appointment booking rates were significantly lower in practices with better practice websites which may suggest that patients prefer to utilise the practice websites to access this service and may be associated to availability of other commercial provides such as Accurx (Accurx Limited, London, UK) that allow patients to book their GP appointments directly using links provided by their providers or through the practice website. However, use of other transactional services such as prescriptions and medical record views remained generally high indicating that patients may prefer to engage with the NHS App for certain functions but find it easier to use their practice websites for others. It may also be indicative of practice provisions where certain practices had disabled the option to book appointments during certain time periods. A longitudinal analysis of the use of the different features and patient experience over multiple time points may provide a clearer overview.

In particular, patient experience and use of the different app features did not follow a clear gradient and highlighted a mixed picture making it difficult to ascertain the relation between the two. Significantly lower usage rates of all app features among the highest rated practices may suggest that where patients remained satisfied with their existing digital providers, they had less impetus to explore other digital channels. This prompts a critical reflection on the varying motivations and expectations that drive patient interactions with digital technologies and their different features.



**FIGURE 19** Time series graph showing mean rates of NHS App medical record views per 1000 GP registered patients according to overall GP practice experience. Where, Q1 = GP practices the lowest percentage of patients reporting positive practice experience, Q4 = practices with the highest percentage of patients reporting positive practice experience. Time period = Weekly data from 7 January 2019 to 26 June 2022.

### **Limitations**

The GPPS is the largest validated survey of patient-reported measures that exists in England but has a low completion rate (35.3% in 2021). The sensitivity of the GPPS may be insufficient to detect any impacts resulting related to a portal scaled at a national level but perhaps only reported a small subset of patients.

Using practice-level GPPS data for assessing individual-level patient satisfaction with their primary care services in relation to the NHS App use may not be appropriate and the cross-sectional nature of the analysis limits establishing any causal relationships. The primary objective of this study is to assess whether patient experience of care and access provisions has any influence on the NHS App use; however, the practice-level assessment did not support subgroup stratification to explore potential impacts. It is plausible that data on patient experience of access directly in relation to the NHS may exhibit significant differences in the association.

Our study focused on the NHS App, even though there are alternative commercial providers that offer similar services within the NHS framework. While this approach is effective for capturing a national population sample, it carries the potential for bias since it is limited to a specific portal which still exhibits differential trends of adoption among different population subsets, therefore excluding some marginalised groups.

As the study explores UK general practice, which is free at the point of access, it does not consider whether patient experience of technology enabled care fosters uptake of novel solutions offering multiple functions for improved access through reduction of costs to the patients.

General Practitioner Patient Survey data used relates to January 2021, whereas the use of the NHS App peaked around May 2021.<sup>40</sup> Using this time point allows measuring patient satisfaction with web and phone routes before alternatives options through the app were more widely used. As the GPPS survey was redeveloped in 2021 to account for pandemic-related changes to service delivery,<sup>44</sup> we could not assess patient satisfaction before the app was released and after using multiple time points. Future studies should consider a longitudinal approach by capturing data directly in relation to NHS App use for a more direct measure of association.

### **Conclusions**

In conclusion, this study provides an evaluation of the multifaceted dynamics that shape public engagement with digital health solutions such as the NHS App, and how app usage interacts with patient experience. The findings underscore the complexity of patient interactions with novel digital solutions in relation to their experience of care and care access, highlighting the need for a tailored and nuanced approach to digital health technology interventions. To maximise patient engagement with digital tools, a flexible and individualised approach is likely to be required.

## Chapter 6 Patient and public involvement

This project was fortunate to have both a PPIE coinvestigator and a committed group of PPIE participants who advised both the quantitative and qualitative aspects of the work. Dr Bernard Gudgin, a patient with much experience of PPIE, as well as expert knowledge as an IT specialist, was asked to join the team at the outset, while the original proposal and application were being developed. He was a Coinvestigator throughout the project, attending weekly project meetings and being involved in all discussions. In addition, we held six PPIE workshops at project initiation and set-up, through recruitment, and as data emerged. The workshops enabled a space for sharing, discussing and challenging insights gained, and considering and prioritising approaches and directions for continuing data collection. Further, through our weekly team meetings, the PPIE lead facilitated continued engagement throughout the study to ensure PPIE was involved in the process of data analysis and sense-making.

The following section describes our work from the perspective of our PPIE Coinvestigator and core team member, in addition to his fundamental input into our approaches and findings described elsewhere, alongside other PPIE activity, which is not reiterated here (e.g. as described in [Chapter 2](#)).

### The NHS App: a PPIE perspective

There is confusion as to what the NHS App is. Searching on either Android or iOS for NHS App reveals scores of apps all branded with the NHS logo but many are commercial offerings and others are provided by specific parts of the NHS. In the first days of the app, there was a widely held view that its only role was to provide a COVID Pass. This was reinforced by the number of downloads of the app that occurred during the COVID-19 pandemic. However, the number of downloads does not automatically equate to usage. The COVID-19 Pass could have been used as a Trojan horse to establish the app as the 'front door' to a wide variety of NHS services – more widespread than the app itself. This was all very confusing for the public who often say their app does not provide a particular feature only to find that they are using **an** app, not **the** app. The NHS branding is widely recognised but is widely appropriated by many providers.

From the start the app was marketed as a gateway to all medical services, that would include features such as prescription renewals, GP appointments and many more. However, for these to work GP practices needed to implement the necessary backend to give the app access to their existing systems. This is no trivial task and with surgeries under much pressure, giving the administrative staff time to implement such access is inevitably a low priority. In particular, there is no financial incentive for GP practices to implement these links, particularly when many already have their own existing systems in place.

For any IT implementation to be successful often the most overlooked aspect is 'wiifm' – what is in it for me. In this case, what does it do for the patient; does it make it easier for them to make an appointment to see their GP, does it make it easier for them to order repeat medication, does it make it easier for them to make an appointment in secondary care? In many cases, the answer to these questions is often 'doubtful'. The same question has to be asked (what does it do) for GPs, healthcare professionals and administrative staff.

We also noticed a marked difference between the use of the app between acute patients and those with a chronic condition. In the PPIE representatives' experience, there are significant differences in usage between those with an acute condition and those with a chronic condition. The former normally want or need a quick intervention involving a GP or allied health professional (AHP), whereas those with chronic conditions are better at managing their conditions and are looking for support when something is not as it should be. Among regular users, many only use 1 or 2 functions and are often unaware of other offerings.

The app seems to have been developed on the principle of 'Build a better mousetrap, and the world will beat a path to your door'. However, if the app is not marketed in a way that appeals to the end-user it will not take off. There is concern that the app has not been marketed in a way that will appeal to the end user both in terms of what it **can** do

and what it **will** do. A particular area of concern is over the security of individuals' data; there is no publicity of what steps are taken to protect an individual's data.

It is the perception of the PPIE representatives that patients were not asked how they use the app or, more importantly, how they would like to use it. If there had been more consultation with patients, the take-up and eventual success of the app might have been higher. There are many examples of implementing major IT systems and the transferrable lessons that can be learnt. It appears to the patient public involvement representatives that such lessons have not been applied. For example, looking at any GP practice that has implemented the app, some functions are switched on whereas others are not. There does not appear to be any rationale for this, apart from ensuring receptionists maintain their role as gatekeepers.

But perhaps it is because implementing it requires a significant input of time and effort from practice staff. There is no provision for practices to be paid for the extra staff time needed and so the incentive to implement it are less than would otherwise be the case.

We have mentioned before the paucity of marketing of the app, and this is exaggerated by the question of whether there is one app or many and is the app designed as a self-contained app or is it intended to be a platform upon which others may develop further facilities? This is not clear to most patients, and there needs to be greater clarity around this.

In carrying out research, the question that needs to be asked is what do GPs, AHPs and patients need and what do they want. There appears to be little research in this area. It is also important to look at patient behaviour, how will they react and use different facilities? Perhaps the final question is: 'Tell me what the App will do and ask what I want it to do'.

## Chapter 7 Reflections on challenges of evaluating a major government project, research approaches used and research recommendations

This section reflects on the successes, and failures, of the project – particularly within the context of evaluating a major government programme while it is in flight. It covers the complexities of working with a government project, and also a reflection on the nature of the data access and linkage that was planned in the initial project planning, compared to the nature of the data access and linkage we were actually able to achieve.

### Involvement with the delivery team

Evaluating a product which is still in flight in terms of delivery presents challenges to an evaluation team, which we clearly felt in this project. There is a classic evaluator's dilemma – how close to get to the delivery team?<sup>89</sup> If you are closer, then you become more trusted, may have better access and insights, and become able to better influence and impact the programme being evaluated. On the other hand, becoming too close presents a risk of becoming too closely engaged with the team, and a risk of alignment and bias.

This evaluation took place at a complex time in terms of wider events, health system reconfiguration and digital health reorganisation. First and foremost, this project took place during and shortly after the COVID-19 pandemic. As a result, many organisations – both at the national level and in terms of NHS delivery at the local level – were working in an emergency response mode and an atypical way. At the start of this project, the NHS App was commissioned by NHSX and delivered by NHS Digital. Over the course of the programme, the governance and organisation of digital work in the NHS changed, and the two organisations were merged (along with others) into NHS England and its new transformation directorate.

As with many collaborations with delivery organisations, there was often a changeover of staff within teams, which presents complexity for continuity of relationship and understanding of the progress. We had strong high-level support from the evaluation from leadership figures in both NHSX and NHS Digital at the start of the progress. Some of the senior sponsors and supporters left, particularly in the time around COVID-19 where large numbers of people moved roles or were redeployed. This meant we had to build new relationships with the senior leadership team on more than one occasion, including rearticulating the value of the evaluation, and the independent nature of its findings.

We were able to establish working relationships with the delivery team for the app. We were grateful for the largely highly continuous nature of the core delivery team – as this meant we were able, over time, to build up a trusted relationship with the team delivering and deploying the app. As often occurs, the relationships were slower to start with, and then grew in terms of strength and effectiveness and the evaluation team got to know the delivery team. Towards the latter stages of the project, we had high functioning monthly meetings with the delivery team, in which we would share our latest results and thinking, and the delivery team would share back both their plans and their take on our results and interpretation.

Useful specific aspects that emerged from this programme of regular meetings included: (1) collaborative identification of potential case study sites; (2) detailed discussion and reflection on the nature of the findings; and (3) detailed functional discussion on the potential for data linkage, and what was and was not possible given the existing privacy notices and terms associated with the app.

These regular meetings also led to opportunities for our findings to be considered at a national level, for example, (1) our data on inequalities of access were shared with the NHS App delivery team, who went on to share the data with other interested parties, including the NHS inequalities board and (2) we were invited to share our findings with the parliamentary and social care select committee (described in the next chapter).

## NHS App data linkage: a reflection

This project was by nature a multimethod study – using both qualitative and quantitative approaches. As part of the quantitative component, we had intended to do some data linkage studies. We always anticipated data linkage would be difficult – it is with all projects that use NHS data, often for very appropriate reasons of governance and the maintenance of trust. However, in this project, what we planned to achieve proved not to be possible – at least during the study period – and there are a number of lessons learnt, and suggestions to take forward that might allow data linkage in the future.

### Practice-level data linkage

In the approved protocol that was agreed by the NIHR funding committee, we had hoped to link data about patient outcomes and patient flow into hospital at the practice level, so we could see whether higher usage of the app was associated with better (or worse) outcomes and more (or less) healthcare service utilisation.

We had intended to conduct this analysis using a bespoke Clinical Practice Research Datalink (CPRD) linkage at the practice level. We were unfortunately not able to conduct this analysis in the funded time frame, as due to the COVID-19 pandemic, the CPRD bespoke linkage service was turned off. As a result, we had to limit our practice-level analysis to those where we were able to obtain data, including from the GPPS. We should note that this change was discussed with and agreed by NIHR.

While these results were calculable and are interesting – they are limited in their interpretation. The results remain fundamentally at the ecological level – providing a useful suggestion of the nature of relationships but limiting causal explanation due to risk of ecological fallacy. As a result of the limitations of our quantitative approach, we reprioritised some of the time and effort towards the qualitative work – and in particular to look in more detail at inequalities with the inclusion of an additional, unplanned case study site designed to focus on inequalities in uptake – as this was a core finding of the initial quantitative work.

### Person-level data linkage

What we would have ideally liked to have achieved with this project – if we could find a legitimate mechanism – was to link data at the person level, allowing us to investigate NHS App usage with various health outcomes and healthcare utilisation patterns at the individual level. This had been included in the first submission to the NIHR funding committee for this project – but the committee cautioned against this as they thought it would be too complex to deliver. Even though we had – through close working with the NHS App programme team and their management at NHSX and NHS Digital (as they were) – succeeded in securing support for a direction under section 254 of the Health and Social Care Act to allow this to happen. This would have provided a legal basis for the linkage to take place through an established route (section 254 directions are used around a dozen times a year by NHS England to achieve data flows for important purposes for the system).

In reality, the wisdom of the NIHR funding committee was entirely correct – and due to the events of COVID it would not have been possible to obtain this direction, due to the other more urgent prioritised data activity at the time. However, the ability to link NHS App use to other data remains both a substantial challenge, and a real opportunity for future research.

If, as it is planned, more services are added to the NHS App – including possible use of digital therapeutics, preventative services and more detailed patient information and choice – then being able to track the impact of these interventions – at the individual level, will become increasingly important. At present, NHS England have within their systems both person-level app-usage data and person-level primary care and often secondary care usage – via their secure data environment (SDE). The potential for the systematic and data-driven evaluation of new services as they come online – in a cost-effective way – is real, but only if appropriate data linkage can be achieved.

## Potential options for data linkage in the future

During this work, we also explored other potential routes for data linkage for the NHS App, as we were not able to use the route suggested in our original protocol. Despite our best efforts, we were not able to find one that was operational during the study period, but they may become feasible soon. These include:

1. OpenSAFELY. We discussed whether it would be possible to use the OpenSAFELY platform to measure outcomes for those who used the NHS App, compared with those who did not. This could potentially be feasible but would require a usable indicator of who is using the NHS App in the patient record. Most GP IT systems report the Interface Mechanism 1 Application Programming Interface usage – a marker of NHS App usage, but this is unfortunately not captured by databases that are accessible in the same format as the other captured information.
2. Using the NHS SDE. The NHS SDE is a developing resource allowing data from a number of NHS data sets to be linked – predominantly using the NHS number as the common linkage point. As NHS England also holds the NHS login data for each NHS user, they are able to identify the NHS number for each app user – therefore potentially allowing for a detailed link between NHS App usage (including frequency of use, and use of specific functions) to a number of other outcome and healthcare utilisation data sets.

While both of these linkages are technically possible, at the moment the NHS App terms and conditions do not provide a specific consent for individuals data to be linked, nor is there a wider legal basis for the linkage. Linkage would therefore require either: (1) person-based consent, (2) a Section 254 direction or (3) a control of patient information notice extension allowing linkage of the data.

Data linkage for the NHS App is complex – and made more so by the events that led to its widespread adoption, described elsewhere in this monograph. While it is now used by more than 75% of adults in England, its rapid increase in use was driven in large part by the use of the COVID Pass feature. This was required for people to perform many normal life activities, including attending large events, booking holidays abroad or ordering COVID tests. As such, while never mandated, there was often a high level of requirement for people to download it if they wanted to live a relatively normal life. Consequently, sharing data on users of the app has a further level of caution that must be considered beyond a routine digital health intervention.

We suggest that being able to link these data is of substantial interest to both the NHS and to researchers studying and seeking to learn lessons from large digital patient portals around the world. This would enable fundamental questions to be answered with a more causal evidential basis, including whether people who used the app had different patterns of healthcare utilisation, healthcare cost and, ultimately, patient outcomes. These options should be explored but should be done with a keen desire to retain public trust and confidence in how the data are being used – and would likely benefit from specific public engagement and consultation exercises.

## Chapter 8 Equality, diversity and inclusion

### Language and terminology

In this research, terminology has been carefully selected to ensure sensitivity to the diverse characteristics of the population groups studied. We have described the socioeconomic and demographic variables in terms of deprivation levels, ethnic backgrounds, age groups, and health status to clearly present differences in disease burden and access to digital health resources. Language used in the report aims to reflect inclusivity and accuracy, and to not assume homogeneity within these groups.

### Consideration of disease burden and epidemiological differences

The study extensively examines the differences in the application of the NHS App among various population groups, focusing on the disparities in usage rates linked to the broader epidemiological context of health inequalities. It considers how existing preventative, screening, or diagnostic strategies might be differentially accessed through the NHS App. For example, the study highlights how demographic variables such as age and ethnicity influence the utilisation of specific app functions like medical record views or prescription orders, potentially reflecting varying disease burdens across these groups.

### Generalisability and transferability of evidence

Findings from this research are intended to be generalisable to broader NHS settings, albeit with an understanding of the inherent limitations of both the qualitative approach, and the use of aggregated, practice-level data in the quantitative work. Insights into how different demographic groups engage with digital health tools can inform the development and adaptation of similar apps in different regions or contexts, enhancing their relevance and effectiveness.

### Participant representation

The quantitative work prioritised comprehensive participant representation by analysing data from a national scale across England, encompassing diverse GP practices. By categorising these practices into quartiles and quintiles based on sociodemographic indicators, the research ensures a nuanced analysis that considers the gradient of deprivation and demographic diversity.

### Enrolment and retention of diverse participants

In the qualitative work, we used theoretical and maximum variation sampling to ensure a diverse sample of patient/public participants, with diversity achieved in terms of their age, gender, ethnicity, caring responsibilities, and diverse experiences of illness and access to health services. While the quantitative work did not involve direct enrolment of participants (as it used existing databases), the population samples analysed were representative in terms of their diverse demographic characteristics.

### Participant data

Careful attention has been given to the handling of participant data, with measures to protect confidentiality, privacy and ensure data integrity. The quantitative work only used aggregated data without personal identifiers, adhering to

ethical standards and data protection regulations. This approach respects participant confidentiality while allowing for the analysis of significant trends across population groups.

## Reflections on the research team and wider involvement

Our research team comprises individuals from diverse academic and professional backgrounds, which enriches our approach to the EDI aspects of the study. We also engaged with patient and public groups to validate our findings and methodologies, ensuring that the perspectives of app users from varied backgrounds are considered in interpreting the data and formulating recommendations.

## Conclusion

This work incorporated diverse perspectives in the evaluation of the NHS App. By understanding and addressing the disparities in NHS App usage, we aim to contribute to more equitable healthcare outcomes through improved digital health services. Moving forward, the engagement with diverse groups and reflection on our research practices will help the inclusivity of health innovations, and their evaluation. Further consideration on the implications of our findings, and actions that should be taken in future, around inequality in app use are covered in [Chapter 9](#).

# Chapter 9 Discussion including overall findings, impact, implications and recommendations

## Overall findings

### *Core lessons on the roll-out of the NHS App*

In this section, we draw together the findings of our studies to bring together some interlinked reflections on the success of the roll-out of the NHS App – and also make a number of recommendations for policy, practice and future research.

The key messages which we have taken from this study are that:

1. Adoption of the NHS App has been high.
2. Adoption was, initially, driven by events around COVID – and in particular the introduction of the COVID Pass feature.
3. Different functions of the NHS App have been used to different extents, and with different patterns over time.
4. Roll-out has not been equal across different populations.
5. The app has done a good job on seeking to understand and build for patient needs. There is a need to focus more on understanding and meeting practitioner needs with further development of the NHS App.
6. There is an unresolved question about whether the NHS App represents ‘an app for the NHS’ or ‘the app for the NHS’.
7. NHS login – with a single account and linked data – present real opportunities for research and for tailoring patient offers, but as yet cannot be fully utilised.

We will explore each of these key messages in detail, and suggest specific policy, practice and research activities to be taken forward.

### *Adoption of the NHS App has been high*

The first, and perhaps most important assessment, is that the adoption of the NHS App has been high. This can be observed in both the time frame that we studied in detail, and in the subsequent progress of the app roll-out. In December 2023, it was announced that it was being used by 75% of the UK adult population. This showed a steady if gentle increase from its figure of 68% in 2023. By the standards of most health systems around the world, this represents a substantial success. And given the scale of the NHS, marks it out as a unique national capability and resource to be built on. The UK parliamentary select committee on health and social care gave the NHS App a ‘good’ report on meetings its stated commitment on uptake – including using invited data from our study to make this assessment.

On a more reflective note, while the percentage of adults who have downloaded the app is a good top-level metric of adoption, it is simplistic compared to other measures of use and adoption. In particular, whether people download it once and then forget, or keep coming back to it, because they find it presents a significant and meaningful ongoing offer. In addition, our data in Chapter 3 suggested that there is a discrepancy between the numbers who download the app, and the numbers who are registered to use it with different levels of engagement.

### *The adoption and roll-out has been substantially influenced by external events*

The second simple point to make about the adoption of the NHS App was not linear, but was driven by events in the wider world. In particular, the COVID pandemic drove the adoption of adoption, both in the initial lockdown phase, and then with the introduction of the COVID Pass on the app. An examination of the cumulative frequency charts of NHS App adoption show, in a simple observational analysis, that there are different rates of adoption on the app at different time points. These be broken down into:

1. pre COVID-19 – from launch of the app, to the start of the COVID pandemic, there was a gentle, if slow, growth in app adoption

2. initial COVID-19 response – app adoption started to increase rapidly in the period immediately after the lockdown
3. COVID-19 Pass functionality – after the introduction of the COVID Pass feature, adoption increased at its most rapid rate
4. post COVID-19 recovery and slow growth with addition of further features, a steady but shallow climb from its post COVID Pass plateau, to its current levels of 75%.

The nature of this adoption is by nature unlikely to be easily reproduced for other product launches, or launches of similar services in other health systems. In many ways, the COVID use cases presented a Trojan Horse to get the app used by and in the phones in the pockets of the majority of the population. However, while hard to recreate, this presents a genuine rare opportunity to make the most use of these events – and go with the grain of this almost enforced adoption.

In order to do this, the app needs to prove its worth as a regular and routine feature of health system access for a large part of the population. The health IT literature is well populated with examples of ‘one use and done’ apps which have high initial use and then tail off. The challenge for the NHS App is to retain its relevance, by providing the feature the patients really want, and that make NHS practitioners lives easier. If the app can be transformed into a platform that people want to come back to, again and again, it will enable it to become a mainstay of the NHS activity – and have the potential to become a genuine single ‘front door’ to many NHS services.

### ***Different functions have been used to different extents***

Beyond the nature of overall adoption patterns of the app, the real functionality of the app comes from how patients choose to make use of the different services it provides. One of the key findings of this report is that the app has several different functions – and they are used very differently, over time and by different groups of the population.

As discussed above – Single metrics of app adoption and usage do not tell the whole story. The functions provided by the app are broad, and have different use to different groups, reflecting on how useful they are to the public, but also how workable they are for the practices. Some have proved more popular than others and better meet the needs of the users. Some functions are clearly ‘hits’ – notably the use of prescriptions. In the language of digital development, this may represent the ‘killer app’ which drives regular use, particularly for certain key demographics, including those who are older and have long-term conditions – requiring them to frequently use repeat prescriptions.

Others are clearly popular, but usage is variable, and often dependent on whether the practices have the choice to make use of the feature – or the extent to which they have used it – for example, with appointment bookings (where the practice can choose not to use, or choose to use only for a limited number of appointments) and access to the care record – where access varies by practice – with some people seeing more than others.

### ***Roll-out has not been equal across different populations***

A further key finding is that roll-out has not been equal across different populations, leading to real risks of widening inequalities in health system access. Our data – which are limited and only at the ecological level – show clear variation in usage patterns by a number of characteristics.

Many of these gradients reflect well-established issues in healthcare provision well described by the inverse care law<sup>90</sup> – with those in greatest need of services often least well served or least likely to access those services.

Here, we urge caution and further work to study these patterns of variation – what can be done to mitigate them, and when they cannot be easily mitigated, what can be done to make sure services can still be accessed by those with less access.

### ***Less focused on practitioner needs***

A more nuanced reflection from our findings is about who the app is designed and optimised for. It was clear from our work with the technical team building the product that an extensive amount of user testing with the public had been undertaken. However, while the roll-out has had a strong focus on user research and user needs for the public, it has

not perhaps been as focused on user needs with practitioners, in particular GPs and practice staff who are required to promote/gatekeep the use of the app – often receptionists and practice managers.

Efforts primarily focused on development of the app and user-centred design mode. However, regarding the continued use and implementation at scale, unclear about whose remit it is, what does it mean to implement a complex technology that services different functions for different practices, focus is mainly on people and less on the NHS ecosystem.

We also noted that there was sometimes a lack of clarity regarding integrated care that is how primary and secondary care services communicate and how the different systems operate/whether it is accessible through the NHS App.

### ***An app or the app?***

The question of where the app fits in relation to the wider economy of digital offerings for primary care – including incumbents from private enterprise – remains unresolved. There remained a confusion regarding the purpose of the app, for whom it is intended and critically its position related to other competitors. While the app has proven successful, there is a persistent and continuing busy ecosystem of other digital services and apps that provide many of the features offered by the app.

The constantly changing features of the app pose further challenges, particularly for potential competitors, who may now be cautious of entering the market – if they can be replaced by the national offer at short notice.

Clear signalling to industry of their anticipated role – whether they can build into the app ecosystem, and what is due to be developed in the pipeline by the central NHS App team would all be important to allow industry to better collaborate.

### ***National Health Service login***

The backbone identity service that supports the NHS App, known as NHS login, provides the ability for the public to have a personal linked account with the NHS, and linked to their medical records and accompanying data. This is a potentially powerful tool for both linked services, personalised recommendations, and to provide powerful, personalised data for both service planning and research. At present, there is a technical ability to link data on app use with data on outcomes, diagnosis and service utilisation – however, it is not currently possible to link these data within existing consent approaches and information governance legislation. The app may represent a powerful tool for the future digitalisation of the NHS – but there needs to be an appropriate and trusted mechanism for data sharing and linkage.

### ***Impact and learning***

We believe the project has been impactful in that it has (1) provided information directly to the Health Select Committee in Parliament at their request on the effectiveness of digitisation in the NHS, (2) provided direct feedback to the policy and delivery team developing the app, to allow them to improve their product iteratively, and (3) contributed to a wider community of literature for academics and practitioners developing digital health interventions through contribution to the wider literature and discussion.

### **Providing information to Parliament**

The programme team was approached by the Health and Social Care Select Committee of the Houses of Parliament, looking at digital transformation in the NHS in 2023. The inquiry explored the use of digital technology and examined how it needs to change to deliver an improvement in services and outcomes for patients. The inquiry approached our team and asked us to provide a submission. We created a bespoke evidence submission, responding to the specific questions they asked, with emerging findings from both the quantitative and qualitative aspects of the study<sup>91</sup> and also included in [Appendix 5](#) and [Table 10](#).

Our findings were cited 14 times in the evaluation report of the select committee<sup>92</sup> and used both as evidence of the success of the app in some respects around (1) high levels of uptake and use, (2) increasing a sense of control for patients managing their own health and (3) high levels of use of particular functions including the access to repeat prescriptions. However, our evidence was also used to highlight issues around (1) inequalities in access

by demographics, (2) the lack of dedicated funding and support for GP practices to roll it out, (3) potential for increases in GP workload, (4) uneven availability of app functions across GP practices and (5) the need for a clear long-term strategy for the app. This led to the NHS App being rated overall as being 'Good' in terms of meeting the government's commitment, but 'Requires Improvement' overall when also considering aspects of resourcing, impact and appropriateness.

The government response to this report noted the findings and highlighted a number of specific actions being taken to improve accessibility of the NHS App, including the use of proxy access, use of a patient and user panel to improve user understanding, and use of campaigns and wider media channels to reach wider groups.<sup>93</sup>

### Direct feedback to the team

By working directly with the team (as described in [Chapter 6](#)), we were able to feedback findings each month to the NHS App delivery team. This allowed us to share findings, discuss interpretations, and suggest improvement to the programme delivery.

Many of our findings reflected their own experiences of running the programme, in particular the popularity of certain core functions including repeat prescription. However, we were able to provide novel analysis that they had not seen before, including the variation in access and the corresponding inequalities regionally and with populations with particular protected characteristics. This led to our work being presented to the NHS inequality board, and issues around inequalities being escalated within the thinking of the delivery team. While it is hard to demonstrate a direct causality, it is noticeable that specific delivery activity to reduce inequalities was initiated after the provision of our findings (which were also supported by their own user studies), including further user research on the needs of different ethnic groups, work to translate app content into different languages and work to increase engagement in digital channels target at diverse ethnic groups.

### Wider academic and research dissemination

As well as informing the evaluation of this specific programme, the findings of this research should be generalisable to other similar developments and roll-outs of digital interventions. A full list of publications, conference presentations and public engagement events are included in Publications. In addition, we have prepared the following one-page summaries of simple messages on our findings from this project for three core groups: policy-makers and service commissioners, NHS teams working with the app, and patients.

Further funded project building on this work for Claire Reidy. Project title: A focused exploration of the experiences and perspectives of digital inclusion and exclusion for specific community groups accessing and using the NHS App. Lead: Claire Reid. Amount: £10,000. Funder: NIHR Applied Research Collaboration Oxford and Thames Valley.

### Implications for policy-makers

Based on the overall findings regarding the roll-out of the NHS App, here are specific recommendations for policy and practice:

**Understanding usage patterns:** while adoption of the NHS App has been high, it is essential to delve deeper into usage patterns beyond simple download statistics. Policy-makers should prioritise understanding how frequently users engage with the app and which features are most meeting the needs of their users. They should publicly report usage and adoption metrics by protected characteristics on a regular basis. This can inform ongoing development and improvements to ensure sustained usage.

**Addressing inequality in roll-out:** take proactive measures to mitigate disparities in app adoption across different populations. Identify and address barriers to access, particularly for marginalised groups, to prevent widening health inequalities. Implement strategies to ensure equitable distribution and utilisation of digital healthcare resources – for example, through structured community outreach into groups with lower usage patterns.

**Engaging practitioners:** place a stronger emphasis on understanding and meeting the needs of healthcare practitioners, such as GPs and practice staff, who play a crucial role in promoting and facilitating app usage. Involve practitioners in the development process and provide training and support to maximise their engagement with the app. The NHS

App team should publicly report on the proportion of practices using various features – for example, appointment booking – on a regular basis to demonstrate primary care adoption.

**Support healthcare provider engagement:** establish policies to support healthcare providers in engaging with and promoting the use of the NHS App among their patients. Provide incentives, training, and resources to encourage providers to integrate the app into their practice and actively promote its adoption.

**Clarifying purpose and positioning:** provide clear communication regarding the purpose of the NHS App and its position within the broader landscape of digital healthcare services. Establish its unique value proposition compared to other competitors and articulate its role in improving healthcare delivery and patient outcomes.

**Foster collaboration and innovation:** foster collaboration between government agencies, healthcare providers, technology companies, and other stakeholders to drive innovation and improvement in digital healthcare services. Encourage the development of interoperable systems and open standards to facilitate seamless integration and data exchange between different healthcare platforms.

**Evaluate impact and effectiveness:** implement policies to monitor and evaluate the impact and effectiveness of digital healthcare initiatives like the NHS App. Collect and analyse data on adoption rates, usage patterns, and outcomes to assess whether these tools are achieving their intended goals and identify areas for improvement.

**Enhancing NHS login:** recognise the potential of NHS login as a powerful tool for personalised healthcare services and data-driven insights. Address regulatory and governance challenges to enable secure data sharing and linkage, ensuring that user privacy and consent are prioritised.

**Capitalising on external events:** acknowledge the role that external events, such as the COVID pandemic, played in driving adoption. Use this as an opportunity to solidify the app's place as a regular and essential tool for accessing healthcare services. Continuously demonstrate its value beyond crisis situations to encourage continued usage.

### Implications for practice

**Promote app adoption:** actively promote the adoption of the NHS App among your patient population. Provide information and resources to educate patients about the benefits of using the app for tasks such as appointment booking, prescription management, and accessing medical records.

**Ensure equitable access:** be mindful of potential disparities in app adoption across different patient demographics. Take proactive measures to ensure equitable access to the NHS App for all patients, including those from marginalised or underserved communities.

**Train staff:** provide training and support to healthcare staff, including receptionists and practice managers, to effectively promote and support the use of the NHS App among patients. Ensure that staff are knowledgeable about the app's features and can assist patients with any questions or issues they may encounter.

**Integrate the app into your workflow:** integrate the NHS App seamlessly into your practice's workflow to maximise its efficiency and effectiveness. Ensure that appointment bookings made through the app are seamlessly integrated into your scheduling system, and that prescriptions requested through the app are processed efficiently.

**Collect and act on feedback:** regularly collect feedback from both patients and staff about their experiences with the NHS App. Use this feedback to identify areas for improvement and make necessary adjustments to enhance the app's usability and functionality.

**Prioritise data security:** prioritise the security and privacy of patient data when using the NHS App or any other digital healthcare tool. Ensure that appropriate safeguards are in place to protect patient information and comply with relevant data protection regulations.

### Implications for patients

**Stay informed and engaged:** keep yourself updated about digital healthcare offerings like the NHS App. Stay informed about the features it offers and how it can benefit you in accessing healthcare services more conveniently.

**Explore app features:** take the time to explore the different functions of the NHS App to see which ones are most relevant to your healthcare needs. Whether it is managing prescriptions, booking appointments, or accessing your medical records, familiarise yourself with the features available to you.

**Provide feedback:** if you encounter any issues or have suggestions for improvement while using the NHS App, do not hesitate to provide feedback. Your input can help shape future updates and enhancements to make the app more user-friendly and effective.

**Advocate for equitable access:** be aware of potential disparities in app adoption across different populations and advocate for equitable access to digital healthcare resources. Encourage efforts to address barriers to access for marginalised groups to ensure that everyone can benefit from these technologies.

**Communicate with healthcare providers:** keep your healthcare providers informed about your use of the NHS App and how it fits into your healthcare routine. Discuss any concerns or questions you may have about using digital healthcare tools to ensure that they align with your overall care plan.

**Protect your privacy:** be mindful of your privacy and data security when using the NHS App or any other digital healthcare platform. Familiarise yourself with the app's privacy policies and settings to understand how your personal information is being used and protected.

## Recommendations for future research

Building on the findings of this project, we suggest some areas for potential future work – both looking at the NHS App in particular but also looking at other comparable lessons for digital health technologies and patient portals. Our recommendations focus on improving the evaluation process, enhancing data linkage capabilities, addressing inequalities in access, and supporting the integration of digital tools into healthcare delivery more effectively.

### *Enhancing data linkage for comprehensive evaluation*

Given the challenges faced in linking data at both practice and individual levels, future research should focus on developing and testing new approaches for data linkage that are feasible within current governance and privacy constraints. Research could also examine alternative legal and consent frameworks that facilitate data linkage for research purposes while maintaining public trust.

### *Longitudinal studies on app usage and health outcomes*

To better understand the long-term impact of the NHS App and similar digital tools on health outcomes and healthcare utilisation, longitudinal studies are recommended. These studies should aim to track individuals' app usage patterns over time and correlate these with changes in health behaviours, access to care, service utilisation, and health outcomes. This would require overcoming current barriers to person-level data linkage but would provide invaluable insights into the effectiveness of digital health interventions.

### *Evaluating the impact of digital tools on healthcare inequalities*

The findings suggest that the roll-out of the NHS App has not been equitable across all populations, potentially exacerbating existing health inequalities. Future research should focus on identifying the specific barriers to app adoption and use among marginalised and underserved communities. This includes qualitative research to understand the unique needs and preferences of these populations and developing targeted interventions to increase accessibility and usability of digital health tools.

### *Exploring the integration of digital health tools into clinical workflows*

Research is needed to explore how digital tools like the NHS App can be better integrated into clinical workflows to support healthcare providers. This includes understanding the barriers and facilitators to the adoption of digital tools by healthcare professionals and investigating how these tools impact clinical practices, patient-provider interactions, and overall healthcare delivery efficiency.

### *Assessing the effectiveness of public engagement and consultation in digital health projects*

Given the complexities around data sharing and linkage, as well as the potential for digital tools to impact public trust in the healthcare system, research into effective methods of public engagement and consultation is critical. This should include evaluating different strategies for involving the public in the development and implementation of digital health projects and assessing how these strategies impact public trust and acceptance.

### *Comparative studies on digital health platforms*

Future research could benefit from comparative studies that evaluate the NHS App against other digital health platforms, both within the UK and internationally. Such studies could identify best practices, innovative features, and

successful strategies for user engagement that could inform the ongoing development of the NHS App and other digital health initiatives.

Specific interventions to increase NHS App effectiveness and access:

In addition to the general research recommendations above related to digital health interventions and patient portals, there are specific recommendations for the NHS App that should be considered.

### ***Design of the app***

Further and ongoing user research should be undertaken to ensure that the app is as usable and useful as possible – as part of the regular product development cycle for the app, and as new functions are added or improved.

### ***Understand and optimisation of how the app is used in general practice***

Building on our findings, further work should explore the mechanism by which the NHS App is used in general practice, how it alters workflows and displaces or reduces work, and how it can be optimised to safely improve efficiency and productivity within clinical pathways.

### ***Evaluation of interventions to broaden access***

The results have demonstrated inequalities in access to the NHS App. Specific interventions – including recommendations for support within general practices, and in wider civic society should be evaluated to see what benefit they achieve in widening access and reducing inequality – for example, NHS England's new work to use libraries staff and volunteers to support access to the NHS App<sup>94</sup> should be evaluated to see the impact it creates.

# Additional information

## CRedit contribution statement

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### **Study advisory group**

We would like to thank the following Study Advisory Group members for their invaluable advice and contribution to the project: Claudia Pagliari (chair, Edinburgh University), Gordon Moultry (patient and public involvement representative), Ronen Rosenblum (Harvard University) and Helen Atherton (Warwick).

### **Patient data statement**

This work uses data provided by patients and collected by the NHS as part of their care and support. Using patient data is vital to improve health and care for everyone. There is huge potential to make better use of information from people's patient records, to understand more about disease, develop new treatments, monitor safety, and plan NHS services. Patient data should be kept safe and secure, to protect everyone's privacy, and it is important that there are safeguards to make sure that they are stored and used responsibly. Everyone should be able to find out about how patient data are used. #datasaveslives You can find out more about the background to this citation here: <https://understandingpatientdata.org.uk/data-citation>

### **Data-sharing statement**

All data requests should be submitted to the corresponding author for consideration. Access to anonymised data may be granted following review. Any queries should be addressed to the corresponding author.

### **Ethics statement**

Ethical approval for the qualitative study was granted by the National Research Ethics Service and Health Research Authority, Reference 21/WS/0031 (approved by the West of Scotland Research Ethics Service on 2 March 2021). Ethical approval for the quantitative studies was provided by Imperial College London Research Ethics Committee (ICREC), Reference 21IC7292 (approved on 11 November 2021). The qualitative study was registered with the ISRCTN registry – ISRCTN72729780.

### **Information governance statement**

Imperial College London and the University of Oxford are committed to handling all personal information in line with the UK Data Protection Act (2018) and the General Data Protection Regulation (EU GDPR) 2016/679. Under the Data Protection legislation, Imperial College London and the University of Oxford are the Data Controllers, and you can find out more about how we handle personal data, including how to exercise your individual rights and the contact details for our Data Protection Officers here: [www.imperial.ac.uk/research-and-innovation/research-office/research-governance-and-integrity/what-is-research-governance/data-protection---information-for-participants/](http://www.imperial.ac.uk/research-and-innovation/research-office/research-governance-and-integrity/what-is-research-governance/data-protection---information-for-participants/) and [www.ox.ac.uk/privacy-policy](http://www.ox.ac.uk/privacy-policy)

### **Disclosure of interests**

**Full disclosure of interests:** Completed ICMJE forms for all authors, including all related interests, are available in the toolkit on the NIHR Journals Library report publication page at <https://doi.org/10.3310/XYRV6485>

**Primary conflicts of interest:** Felix Greaves: PHR – Research Funding Board 16 February 2016–13 May 2020. PHR Prioritisation Group 19 February 2016–13 May 2020. PHR Programme Advisory Board 13 January 2015–13 May 2020. Felix Greaves was employed by the National Institute for Health and Care Excellence (NICE) to 2023. Felix Greaves is employed by the Department of Health and Social Care (from August 2023), in addition to his role at Imperial. Bernard Gudgin: HTA EESC Panel 1 January 2016–31 May 2018. HS&DR Funding Committee Members 19. September

2018–30 September 2020. Anthony A Lavery: PHR Funding Committee – 13 June 2017–29 February 2028. PHR Prioritisation Committee – 15 February 2021–29 February 2024. Programme Oversight Committee – 14 February 2017–30 June 2027. John Powell was employed by the National Institute for Health and Care Excellence (NICE) to 2023. John Powell receives funding from the National Institute for Health and Care Research (NIHR) Applied Research Collaboration Oxford and Thames Valley at Oxford Health NHS Foundation Trust. NIHR HTA and EME Editorial Board 2005–22. COVID-19 Reviewing 1 June 2020–30 September 2020. ESP – Evidence Synthesis Programme Grants Committee 2021–2. ESP – NIHR Incentive Awards Committee 2021. ESP – Evidence Synthesis Programme Advisory Group 2020–2. TARs Contract Retender 2020 Committee, 2020.

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## Publications

Kc S, Tewolde S, Lavery AA, Costelloe C, Papoutsi C, Reidy C, *et al.* Uptake and adoption of the NHS App in England: an observational study. *Br J Gen Pract* 2023;**73**:e932–40. <https://doi.org/10.3399/BJGP.2022.0150>

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## Conference presentations

Papoutsi C, Reidy C, Powell J, Greaves F, Gudgin B. *The 'Unrealistic Simplicity' of the NHS App as 'Front Door' to the NHS in England: Qualitative Study*. BSA Medical Sociology Conference 2022, Lancaster, UK, September 2022.

Reidy C, Powell J, Greaves F, Gudgin B, Costelloe C, Tewolde S, Papoutsi C. *Patient, Staff and Stakeholder Experiences with the National NHS App in General Practice: Qualitative Evaluation*. European Health Psychology Society (EHPS) Annual Conference 2022, Bratislava, Slovakia, August 2022.

Reidy C, Papoutsi C, Greaves F, Gudgin B, Costelloe C, Tewolde S, Powell J. *Patient, Staff and Stakeholder Experiences with the NHS App in General Practice: National Evaluation Using Qualitative Methods*. Health Services Research UK (HSRUK) 2022, Sheffield, UK, July 2022.

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***Public/community engagement***

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Reidy C, Papoutsi C, Greaves F, Gudgin B, Lavery A, Kc S, Powell J. The NHS App and Digital Exclusion. Reading Voluntary Action Voluntary and Community Sector Forum, Reading, UK, March 2023.

NHS App evaluation project website: [www.arc-oxtv.nihr.ac.uk/research/national-rollout-NHS-app-evaluation](http://www.arc-oxtv.nihr.ac.uk/research/national-rollout-NHS-app-evaluation)

***Policy presentations***

Monthly presentations and discussion of emerging results with the NHS England and NHS Digital NHS App delivery team January 2022 to July 2023

Our results were shared – by the NHS England team – with the NHS Inequalities board in April 2023.

Invited evidence submission to the health and social care committee of the houses of parliament – see [Appendix 5](#).

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## Appendix 1 Images of the app from patient interviews

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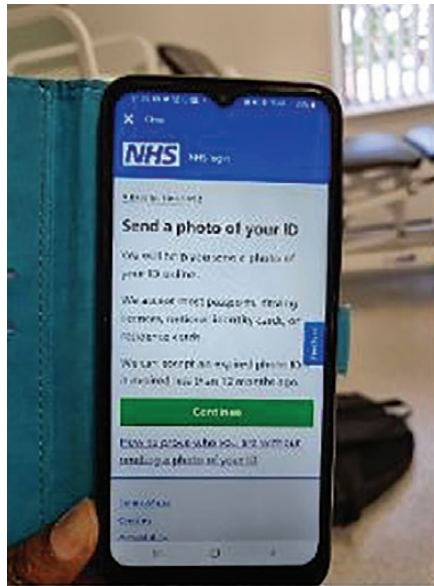


FIGURE 20 Site 4, P25 – Patient proof of identification required to register with the app.

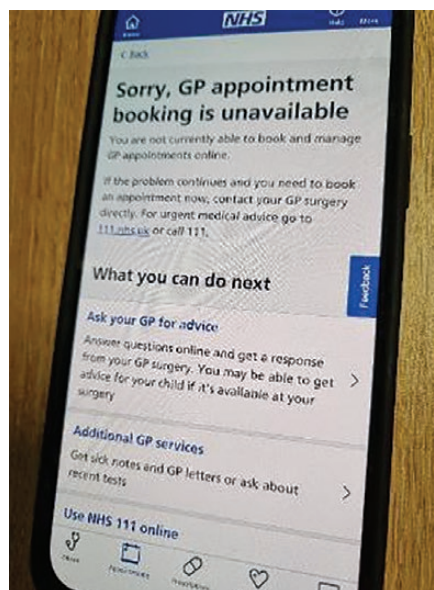


FIGURE 21 Site 4, P23 – Appointment booking unavailable.

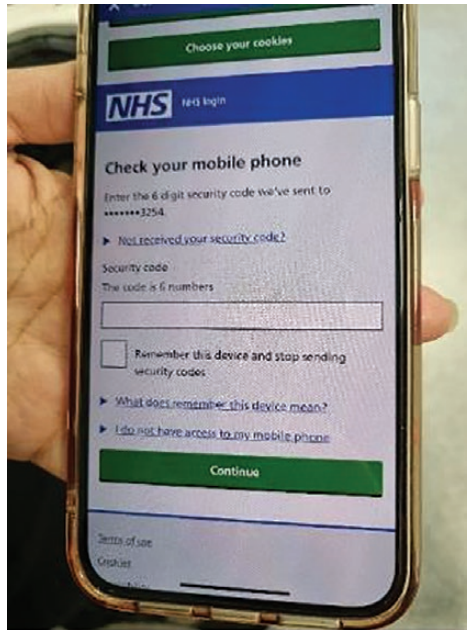


FIGURE 22 Site 4, P24 – Security features.

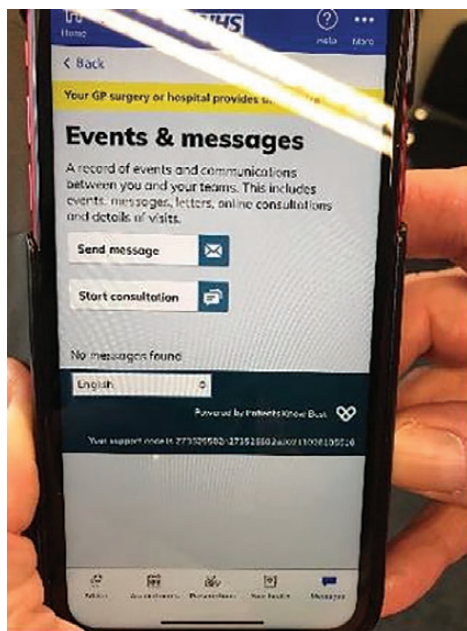


FIGURE 23 Site 2, P3 – Additional services through industry partners (messages to secondary care providers).

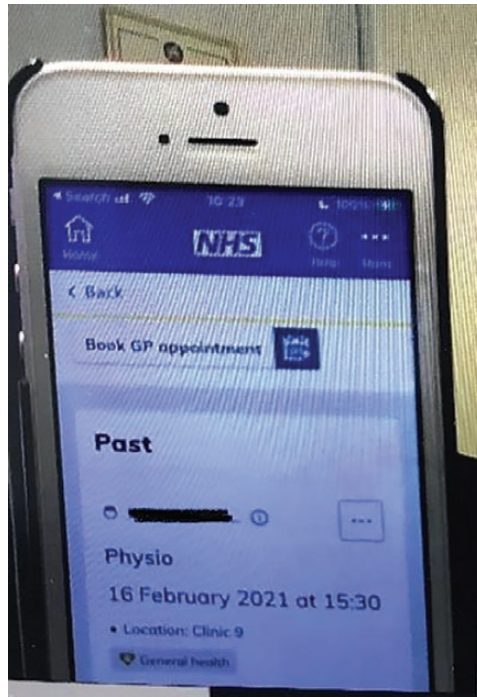


FIGURE 24 Site 2, P4 – Past appointment viewing.

## Appendix 2 Details of the variables used and their sources

TABLE 7 Details of the variables used and their sources

Variables	Indicators used for analysis
NHS App data	Number of registrations*, logins*, prescriptions ordered, medical record views and appointments booked ( <b>data available from NHS App dashboard from January 2019 to June 2022</b> ) *Data presented in the current report
IMD	Quintiles of IMD split according to IMD score at the GP practice level (IMD 2019) ( <b>data available from Fingertips for 2021/2022</b> : indicator ID 93553)
Population with long-term physical or mental health conditions, disabilities or illness	Percentage responding 'yes' to: 'do you have any long-term physical or mental health conditions, disabilities or illnesses?' ( <b>data available from GPSS for 2021</b> : question Q32)
Ease of GP phone access	Percentage responding 'Very Easy' and 'Fairly Easy' to: 'Generally, how easy is it to get through to someone at your GP practice on the phone?' ( <b>data available from GPSS for 2021</b> : question Q1)
Ease of GP web access	Percentage responding 'Very Easy' and 'Fairly Easy' to: 'How easy is it to use your GP practice's website to look for information or access services?' ( <b>data available from GPSS for 2021</b> : question Q4)
GP practice experience	Percentage responding 'Very Good' and 'Fairly Good' to: 'Overall, how would you describe your experience of your GP practice?' ( <b>data available from GPSS for 2021</b> : question Q30)
Confidence in self-managing health/ health conditions	Percentage responding 'Very Confident' and 'Fairly Confident' to: 'How confident are you that you can manage any issues arising from your condition (or conditions)?' ( <b>data available from GPSS for 2021</b> : question Q35)
Age	Percentage of people in 15–54-year age group ( <b>data available from NHS Digital for May 2022</b> )
Sex	Percentage males (data available from NHS Digital for May 2022)
Ethnicity	Percentage White (data available from Fingertips for 2021/2: indicator ID 1679)

Where GPPS provides weighted response data for individual question categories.

## **Appendix 3** Full table of results for Chapter 4

TABLE 8 Full table of results for *Chapter 4*

	Registration rate/1000				Login_rate/1000				Appointments booked_rate/1000				Medical record views_rate/1000				Prescription orders_rate/1000			
	% change	IRR	p-value	95% CI	% change	IRR	p-value	95% CI	% change	IRR	p-value	95% CI	% change	IRR	p-value	95% CI	% change	IRR	p-value	95% CI
<b>IMD quintile</b>																				
<i>Reference group 1 = least deprived practices</i>																				
2	-9.17	0.908	< 0.001	0.900 to 0.916	-10.26	0.897	< 0.001	0.889 to 0.906	-28.86	0.711	< 0.001	0.699 to 0.724	-8.02%	0.920	< 0.001	0.912 to 0.927	-9.53	0.905	< 0.001	0.897 to 0.912
3	-16.12	0.839	< 0.001	0.831 to 0.847	-16.55	0.835	< 0.001	0.826 to 0.843	-45.69	0.543	< 0.001	0.532 to 0.554	-14.99%	0.850	< 0.001	0.843 to 0.858	-9.83	0.902	< 0.001	0.894 to 0.910
4	-21.26	0.787	< 0.001	0.779 to 0.796	-21.22	0.788	< 0.001	0.779 to 0.797	-40.68	0.593	< 0.001	0.580 to 0.606	-20.57%	0.794	< 0.001	0.787 to 0.802	-9.23	0.908	< 0.001	0.899 to 0.917
5	-34.05	0.660	< 0.001	0.652 to 0.667	-34.91	0.651	< 0.001	0.643 to 0.659	-39.66	0.603	< 0.001	0.589 to 0.618	-32.27%	0.677	< 0.001	0.670 to 0.684	-9.90	0.901	< 0.001	0.891 to 0.911
<b>% males</b>																				
<i>Reference group 1 = practices with the lowest percentage of males</i>																				
2	-2.19	0.978	< 0.001	0.971 to 0.986	-4.03	0.960	< 0.001	0.952 to 0.968	-5.97	0.940	< 0.001	0.925 to 0.955	-3.30%	0.967	< 0.001	0.960 to 0.974	-5.70	0.943	< 0.001	0.936 to 0.950
3	-4.33	0.957	< 0.001	0.949 to 0.964	-6.12	0.939	< 0.001	0.931 to 0.947	-16.62	0.834	< 0.001	0.820 to 0.848	-4.91%	0.951	< 0.001	0.944 to 0.958	-6.72	0.933	< 0.001	0.926 to 0.940
4	-7.08	0.929	< 0.001	0.921 to 0.938	-10.39	0.896	< 0.001	0.888 to 0.905	-36.39	0.636	< 0.001	0.623 to 0.649	-12.03%	0.880	< 0.001	0.872 to 0.887	-14.45	0.855	< 0.001	0.848 to 0.863
<b>% White</b>																				
<i>Reference group 1 = practices with the lowest percentage of White patients</i>																				
2	6.79	1.068	< 0.001	1.058 to 1.078	13.83	1.138	< 0.001	1.127 to 1.149	7.82	1.078	< 0.001	1.057 to 1.100	27.00%	1.270	< 0.001	1.260 to 1.281	72.46	1.725	< 0.001	1.709 to 1.740
3	6.96	1.070	< 0.001	1.058 to 1.081	16.39	1.164	< 0.001	1.151 to 1.177	8.43	1.084	< 0.001	1.059 to 1.110	34.03%	1.340	< 0.001	1.328 to 1.353	119.38	2.194	< 0.001	2.172 to 2.216
4	1.90	1.019	< 0.001	1.007 to 1.031	9.12	1.091	< 0.001	1.078 to 1.104	14.08	1.141	< 0.001	1.112 to 1.170	28.67%	1.287	< 0.001	1.273 to 1.300	130.40	2.304	< 0.001	2.279 to 2.329

continued

**TABLE 8** Full table of results for Chapter 4 (continued)

	Registration rate/1000				Login_rate/1000				Appointments booked_rate/1000				Medical record views_rate/1000				Prescription orders_rate/1000			
	% change	IRR	p-value	95% CI	% change	IRR	p-value	95% CI	% change	IRR	p-value	95% CI	% change	IRR	p-value	95% CI	% change	IRR	p-value	95% CI
<b>% youngest age group</b>																				
<i>Reference group 1 = practices with the lowest percentage of patients aged 15–34 years</i>																				
2	3.33	1.033	< 0.001	1.025 to 1.042	5.30	1.053	< 0.001	1.043 to 1.063	3.05	1.030	0.001	1.012 to 1.049	6.74%	1.067	< 0.001	1.059 to 1.076	0.23	1.002	0.565	0.995 to 1.010
3	2.05	1.020	< 0.001	1.010 to 1.031	4.68	1.047	< 0.001	1.036 to 1.058	8.41	1.084	< 0.001	1.061 to 1.108	5.52%	1.055	< 0.001	1.045 to 1.065	-3.28	0.967	< 0.001	0.958 to 0.976
4	3.08	1.031	< 0.001	1.018 to 1.044	5.65	1.056	< 0.001	1.043 to 1.070	46.46	1.465	< 0.001	1.426 to 1.504	1.72%	1.017	0.003	1.006 to 1.029	-14.85	0.852	< 0.001	0.842 to 0.862
<b>Practice size</b>																				
<i>Reference group 1 = practices with the lowest number of GP-registered patients</i>																				
2	1.01	1.010	0.013	1.002 to 1.018	3.42	1.034	< 0.001	1.026 to 1.043	16.97	1.170	< 0.001	1.148 to 1.192	7.04%	1.070	< 0.001	1.063 to 1.078	8.36	1.084	< 0.001	1.075 to 1.092
3	2.36	1.024	< 0.001	1.015 to 1.032	7.59	1.076	< 0.001	1.067 to 1.085	31.71	1.317	< 0.001	1.293 to 1.342	13.82%	1.138	< 0.001	1.130 to 1.147	13.27	1.133	< 0.001	1.124 to 1.141
4	3.21	1.032	< 0.001	1.024 to 1.040	11.75	1.117	< 0.001	1.108 to 1.127	73.42	1.734	< 0.001	1.703 to 1.766	23.94%	1.239	< 0.001	1.230 to 1.249	20.75	1.207	< 0.001	1.198 to 1.217
<b>% with long-term health illness or disability</b>																				
<i>Reference group 1 = practices with the lowest percentage of people with long-term health illness or disability</i>																				
2	-2.71	0.973	< 0.001	0.965 to 0.981	-2.45	0.976	< 0.001	0.967 to 0.984	-13.43	0.866	< 0.001	0.851 to 0.881	3.04%	1.030	< 0.001	1.023 to 1.038	12.01	1.120	< 0.001	1.111 to 1.129
3	-4.22	0.958	< 0.001	0.949 to 0.967	-3.41	0.966	< 0.001	0.957 to 0.975	-26.27	0.737	< 0.001	0.723 to 0.752	3.09%	1.031	< 0.001	1.022 to 1.039	16.31	1.163	< 0.001	1.153 to 1.173
4	-3.57	0.964	< 0.001	0.955 to 0.974	-1.74	0.983	0.001	0.972 to 0.993	-20.04	0.800	< 0.001	0.783 to 0.816	6.03%	1.060	< 0.001	1.051 to 1.070	18.34	1.183	< 0.001	1.173 to 1.194

## Appendix 4 Full table of results for Chapter 6

**TABLE 9** Full table of results for *Chapter 6*

Covariates	Registration rate/1000				Login rate/1000				Appointment booking rate/1000				Prescriptions ordered rate/1000				Medical record view rate/1000			
	% change <sup>a</sup>	IRR	p-value	95% CI	% change <sup>a</sup>	IRR	p-value	95% CI	% change <sup>a</sup>	IRR	p-value	95% CI	% change <sup>a</sup>	IRR	p-value	95% CI	% change <sup>a</sup>	IRR	p-value	95% CI
<b>% reporting ease of GP phone access</b>																				
<i>Practices with the lowest % of patients reporting ease of practice access via phone</i>																				
2	-1.3	0.99	0.01	0.98 to 1.00	-0.6	0.99	0.22	0.98 to 1.00	1.6	1.02	0.12	1.00 to 1.04	-0.4	1.00	0.35	0.99 to 1.00	1.0	1.01	0.02	1.00 to 1.02
3	-2.7	0.97	< 0.001	0.96 to 0.98	-2.3	0.98	< 0.001	0.97 to 0.99	19.9	1.2	< 0.001	1.17 to 1.23	4.2	1.04	< 0.001	1.03 to 1.05	1.1	1.01	0.02	1.00 to 1.02
4	-2.9	0.97	< 0.001	0.96 to 0.98	-1.2	0.99	0.04	0.98 to 1.00	25.0	1.25	< 0.001	1.22 to 1.28	10.5	1.1	< 0.001	1.09 to 1.12	5.4	1.05	< 0.001	1.04 to 1.06
5	-1.1	0.99	0.07	0.98 to 1.00	3.5	1.03	< 0.001	1.02 to 1.05	57.8	1.58	< 0.001	1.54 to 1.62	27.0	1.27	< 0.001	1.26 to 1.28	13.8	1.14	< 0.001	1.13 to 1.15
<b>% reporting ease of GP web access</b>																				
<i>Practices with the lowest % of patient reporting ease of practice website access/use</i>																				
2	0.4	1.00	0.45	0.99 to 1.01	1.8	1.02	< 0.001	1.01 to 1.03	-11.3	0.89	< 0.001	0.87 to 0.9	0.8	1.01	0.08	1.00 to 1.02	1.8	1.02	< 0.001	1.01 to 1.03
3	1.8	1.02	< 0.001	1.01 to 1.03	3.5	1.03	< 0.001	1.02 to 1.04	-12.3	0.88	< 0.001	0.86 to 0.89	2.8	1.03	< 0.001	1.02 to 1.04	0.9	1.01	0.03	1.00 to 1.02
4	2.6	1.03	< 0.001	1.02 to 1.04	5.4	1.05	< 0.001	1.04 to 1.06	-17.6	0.82	< 0.001	0.81 to 0.84	7.8	1.08	< 0.001	1.07 to 1.09	3.4	1.03	< 0.001	1.02 to 1.04
5	2.1	1.02	< 0.001	1.01 to 1.03	5.1	1.05	< 0.001	1.04 to 1.06	-18.9	0.81	< 0.001	0.79 to 0.83	7.7	1.08	< 0.001	1.07 to 1.09	0.5	1	0.34	0.99 to 1.02
<b>% reporting positive practice experience</b>																				
<i>GP practices with the lowest % of patients reporting positive practice experience</i>																				
2	0.9	1.01	0.06	1.00 to 1.02	2.0	1.02	< 0.001	1.01 to 1.03	-9.7	0.9	< 0.001	0.89 to 0.92	-3.6	0.96	< 0.001	0.96 to 0.97	3.3	1.03	< 0.001	1.02 to 1.04
3	1.4	1.01	0.01	1.00 to 1.02	2.7	1.03	< 0.001	1.02 to 1.04	-16.1	0.84	< 0.001	0.82 to 0.86	-5.3	0.95	< 0.001	0.94 to 0.96	4.6	1.05	< 0.001	1.04 to 1.06

Covariates	Registration rate/1000				Login rate/1000				Appointment booking rate/1000				Prescriptions ordered rate/1000				Medical record view rate/1000			
	% change <sup>a</sup>	IRR	p-value	95% CI	% change <sup>a</sup>	IRR	p-value	95% CI	% change <sup>a</sup>	IRR	p-value	95% CI	% change <sup>a</sup>	IRR	p-value	95% CI	% change <sup>a</sup>	IRR	p-value	95% CI
4	0.1	1.00	0.92	0.99 to 1.01	1.3	1.01	0.04	1.00 to 1.03	-29.3	0.71	< 0.001	0.69 to 0.73	-8.3	0.92	< 0.001	0.91 to 0.93	3.2	1.03	< 0.001	1.02 to 1.04
5	-3.5	0.96	< 0.001	0.95 to 0.98	-5.2	0.95	< 0.001	0.94 to 0.96	-27.5	0.73	< 0.001	0.71 to 0.75	-16.1	0.84	< 0.001	0.83 to 0.85	-3.3	0.97	< 0.001	0.96 to 0.98

a Percentage change calculated using IRR obtained from the negative binomial regression model.

#### Note

For all other covariates, Q1 represents practices with the lowest population percentage for the given variable and Q5 represents practices with the highest population percentage for the given variable.

NHS App functions used by provider factor controlling for baseline differences in covariates and across categories of age, sex, ethnicity, deprivation and long-term healthcare needs.

# Appendix 5 Evidence submission to Parliamentary Select Committee

Evidence submission to the parliamentary health select committee on health and social care at their request.<sup>91</sup> To note, this evidence submission responds to specific questions which were asked by the select committee. This evidence was cited 17 times in the final select committee report.<sup>40</sup>

## Evidence submission

This evidence submission is informed by an evaluation of the roll-out of the NHS App being conducted by Imperial College London and Oxford University. This work is funded by the NIHR. Annex contains more detail on the project.

### Policy area 1: the care of patients and service users

'Our aim is that, by 2024, 75% of adults will have registered for the NHS App with 68% (over 30 million people) having done so by March 2023.'

## Was the commitment met overall? Or (in the case of a commitment whose deadline has not yet been reached) is the commitment on track to be met?

### *Does the commitment have a clear and fixed deadline for implementation?*

The commitment for the first stage of NHS App roll-out (68% of adults until March 2023) has a clear and fixed deadline, and appears feasible given current rate of registrations, whereas the deadline for the second stage remains more vague (75% of adults by 2024). The commitment focuses on user registrations – a significant goal in terms of establishing authentication infrastructure through the NHS login (which is required for patients to register on the app). Yet, there is less emphasis on the extent to which it is anticipated the NHS App would be used routinely following registration to deliver service and patient outcomes.

### *Are there any mitigating factors or conflicting policy decisions that may have led to the commitment not being met or not being on track to be met? How significant are these? Was appropriate action taken to account for any mitigating factors?*

The NHS App has been introduced into an already well-established and crowded ecosystem of patient portals and smartphone applications with similar functionality from major IT system providers and an established user base (following previous policy decisions in this area). These systems have been used for years by GP practices and their patients, therefore the rationale and incentives for switching to the NHS App does not always appear to be clear for users, and the impact on market and competition dynamics has been challenging. Awareness and perceived usefulness of the NHS App between our participants was low initially, as patients and practices were not familiar with the app and its functionality (and in some cases, this continues to date). There was particular confusion between the NHS App and the NHS COVID App despite public awareness campaigns.

### *To what extent has the National Health Service's COVID response affected progress on targets?*

The pandemic and COVID response had both positive and negative impacts on the roll-out of the NHS App. Awareness and familiarity with the NHS App increased significantly with integration of the COVID Pass, which drove a significant rise in user registrations. It remains to be seen whether this will translate into sustained use for health-related purposes. At the same time, GP appointment booking, one of the core functionalities of the NHS App, has been negatively affected by the shift to triage models in the context of the COVID response, meaning GP practices had to disable direct appointment booking on the app.

### **How has this commitment been interpreted in practice at trust/patient level?**

Many GP practices publicise the NHS App on their websites and in interactions with patients (e.g. in relation to ordering prescriptions) although sometimes the NHS App is offered as one option among a number of patient portals/apps. There has been mention of patient and public representatives supporting other patients registering with and using the NHS App, but we have found little evidence in terms of this being current practice (also see response above).

### **Does data show achievement against the target (if applicable)?**

Results of our quantitative analysis using data from January 2019 up to May 2021 shows that there has been strong adoption of the NHS App, which has been driven by COVID-related events. From January 2019 to May 2021, there were a total of 8,524,882 NHS App downloads and 4,449,869 registrations.

The highest number of downloads during the study period occurred after the announcement and launch of the COVID Pass in May 2021, with a total of 2,668,535 downloads for that month. During this month, 2,099,234 users registered for the app. The number of GP registered patients in England at the end of May 2021 were 51,956,423. Of these registered patients, 8.56% of the population aged 13 + were registered for the NHS App.

Our evaluation did not include data after May 2021. Although the analysis is ongoing, preliminary results suggest high rates of download of the NHS App, with a potential to increase the registration rates. The NHS App team at NHS England and NHS Digital will have more up to date data. It will be important to monitor the ongoing relationship between downloads, registrations, and active use of the various functions the app provides.

### **Was the commitment effectively funded (or resourced)?**

Our evaluation did not include a health economics component. Yet in our qualitative research we identified that there has been little dedicated funding and support (apart from generic 'digital health' budgets at CCG level) for GP practices to incorporate aspects of the NHS App into their administrative practices (e.g. appointment booking, ordering prescriptions) and engage with patient requests for support with the registration process, access to their records etc.

### **Did the commitment achieve a positive impact for patients and service users?**

#### **What was the impact on equity of outcome different groups?**

From a quantitative perspective, using data up to February 2021:

Compared to GP practices in the least deprived areas, practices in more deprived areas had fewer NHS App registrations (see [Table 10](#)). Practices in the most deprived areas (IMD quintile 5) had a 25% lower registration rate ( $p < 0.001$ ) compared to the practices in the least deprived areas (IMD quintile 1).

Practices with a higher proportion of White patients had higher app registration rates. For example, compared to practices with the lowest percentage of White patients, those with the highest percentage White patients had a 36% higher app registration rate ( $p < 0.001$ ). Similarly, practices with the highest percentage of the youngest age group (i.e. 15- to 34-year-olds), had a 23% higher registration rate compared to the practices with the lowest percentage of 15- to 34-year-olds.

Practices with more GP registered patients (i.e. larger practice size) had higher NHS App registration rates. For example, practices with the largest practice size had a 44% higher app registration rate ( $p < 0.001$ ) compared to practices in the smallest practice size group.

Also, compared to the practices with fewer registered male patients, those with a higher percentage of registered males had fewer NHS App registrations overall. Practices with the highest percentage of males had a 13% lower app registration rate ( $p < 0.001$ ) compared to the practices with the lowest per cent males.

Similarly, practices that had more patients with long-term chronic illnesses or disability had lower app registration overall ( $p < 0.001$ ), although the size of the difference was comparatively small, with a difference of 2% between the practices with the highest proportion of people with greater healthcare needs compared to those with the fewest.

Overall, practices with higher NHS App registration rates were more likely to be less deprived, have a higher proportion of younger people, have a higher proportion of White patients and be larger in size.

Of note, these analyses were conducted at the practice, not individual, level.

From a qualitative perspective:

Given the NHS App is only available in English and requires a certain level of IT literacy and confidence, as well as relevant equipment, our participants have commented on specific social groups currently being excluded and the risks this would carry if the NHS App becomes a mainstream mode of engaging with the NHS.

To maintain equity GP practices needed to set up processes and safeguards so they did not disadvantage non-users, such as only making some appointments available on the NHS App and reserving slots for those who could only reach the practice by phone or in-person.

Core functionality of the NHS App remains the same across England. Yet, depending on commissioning decisions in different areas and availability of specific systems in different GP practices, additional functionality is available for some users but not others (e.g. integration with solutions provided by private companies, such as eConsult, Patients Know Best, Accurx).

### ***Has (or will) there been (or be) a meaningful improvement in measurable outcomes, reasonably attributable to the commitment?***

Our research shows there is some potential for the NHS App to contribute to improvement in outcomes such as administrative efficiency (e.g. ordering prescriptions), if a critical mass of users engage in sustained and appropriate use, and administrative and clinical processes at practice level are streamlined to support this use. Yet, as with all technological solutions, any efficiency savings in one area usually translate into additional work in other areas. Healthcare work is underpinned by vast complexity, therefore many of the tasks assumed to be transactional (such as appointment booking) often require discussion, background work and negotiation to be carried out effectively, for example, for patients to be able to choose the right appointment with the right clinician, access their health records with due consideration for safeguarding (especially consultations before automatic access to prospective consultations is enabled in November 2022), be provided with proxy access for minors or carers etc. It is unlikely changes in patient outcomes can be reasonably attributable to this commitment, although patient access to own records has the potential to influence safety in case significant errors are identified.

### ***Will (or have) patients and service users benefit(ed) directly, indirectly or both?***

There are benefits of the NHS App pertaining to supporting the navigation of complex, changeable, ongoing and/or ambiguous health conditions, whereby patients having access to letters, test results and appointment notes enables them to monitor and track different elements of health and to chart progress and change. This access also has the potential for patients to perceive a level of control over managing their health. In addition, Patients describe the ability to request prescriptions electronically through the app quick, easy and convenient.

For patients with more acute care needs, the app currently has limited capacity to support health care in those circumstances, however, having access to allergies, test results, medications, and consultations (for one's own health, or others through proxy access) enables the potential to avoid emergency admissions or to ease worry around safety concerns. Not all patients or carers that we spoke to could access these records though, which were reliant on practices enabling full access.

In our research we have not come across an 'enhanced range of services from local pharmacies' other than functionality related to ordering prescriptions on the app and being able to collect from the local pharmacy. We have also come across little evidence that the NHS App is used routinely for correspondence with GPs (instead, eConsult or Accurx were used for this purpose where available). Functionality related to managing hospital appointments, viewing referral

letters, as well as test results and patient records at secondary care level was limited and primarily linked to integration of a commercial PHR platform (Patients Know best) with the NHS App.

***What category of patients and service users have benefited? And why?***

Please see response above.

***Have (some) patients and service users been hindered by the commitment and its implementation?***

Please see response C1 on equity above.

**Was it an appropriate commitment?**

***Was (or is) the commitment likely to achieve meaningful improvement for service users, healthcare staff and/or the healthcare system as a whole?***

Please see response C2 above.

***Is the commitment wide enough in scope? Does it cover interoperability?***

The commitment focuses only on the proportion of adults registered for the NHS App. This does not take in account whether the app is actually being used by patients and does not support routine app use to achieve measurable improvements. It is well known that mobile apps have relatively short retention rates across all categories including health care, with most users abandoning apps 30 days after installation. Broader commitment is necessary to ensure the app continues to provide added value to users, including by working more closely with healthcare providers (e.g. GP surgeries) as a key, but so far relatively neglected, group creating value for the app (e.g. by making appointments available and so on). Young and healthy participants in our sample particularly commented they did not see value in the NHS App beyond the COVID Pass, as they did not need to have frequent interactions with the service.

***Is the commitment specific enough?***

The commitment is specific, measurable and necessary, but not sufficient (please see responses A1 and D2).

***Has the commitment had any unintended consequences?***

It is likely sole emphasis on user registrations detracted attention from developing the NHS App in a way that can provide sustained value for both direct/indirect users and those affected across the system (e.g. see response C1 on equity). Although users registered on the app, it has not always been easy for them to understand what functionality was available (especially as this has shifted over time and is also controlled by their GP practice).

***Was the level of ambition as expressed by the commitment reasonable?***

Given the COVID Pass integration has already driven significant increase in patient registrations on the app, the ambition appears reasonable (but see responses A1, C1 and D2).

***Is the target contained in the commitment an effective measure of policy success (if applicable)?***

As explained above, success in the user registration rate on the NHS App is highly commendable and creates a foundation for authentication infrastructure and further digital solutions. Yet, registration does not necessarily lead to (repeat) use in a way that would add value for patients, healthcare staff and the service as a whole. Additional commitment, resource and implementation planning is needed to harness the benefits of digitisation through the NHS App. As it runs on legacy technical and classification systems (e.g. GP systems), patient information through the app remains largely system, rather than patient-facing (in terms of terminology, structure, availability and presentation).

***Was the commitment addressing an identified need and relevant to the problem?***

It is not clear from our data that needs assessment preceded initiation of app development, although a significant amount of 'user research' has taken place since to support ease of use and positive user experience. There has been less emphasis on user groups beyond patients and service users, such as GP practices across the country having to switch from similar patient access solutions to facilitate use of the NHS App, without the relative advantage always becoming clear.

***Did the system have the relevant tools to support the change?***

Beyond an initial roll-out stage where specific Beacon sites were supported with the implementation of the NHS App, there seems to be little concrete and ongoing support for GP practices to increase awareness among their staff and provide support to patients, especially considering groups that may be at risk of exclusion. There has been significant emphasis on user research involving patient groups directly, without necessarily considering the mediating role of healthcare organisations and how they may be considered as direct and indirect users affected by the shift to the NHS App in their practices.

**Annex to evidence submission to Parliamentary Select Committee*****Project background and methods***

Findings in this evidence submission are informed by the academic research project 'Evaluating the national roll-out of the NHS App in England'. This project is funded by the NIHR's Health and Social Care Delivery Research Programme. Reference: NIHR128285.

**Abstract**

**Aims and objectives:** this project aims to identify and understand the use and acceptability of the NHS App, measure the extent to which it improves patient experience and influences health service access, and understand patterns of early take-up and participation.

**Background:** the NHS in England has introduced a new smartphone app for patients: the NHS App. This has been available to everyone in England from July 2019. Initial functions include online GP appointment booking, access to medical records and ordering repeat prescriptions.

**Methods:** the study has two workstreams. A qualitative element uses comparative case studies in five general practices to explore experiences and views on the acceptability of the app through interviews and focus groups with patients, GPs, practice staff, commissioners and policy-makers. Iterative thematic analysis allows us to develop a theory of change for the NHS App. Our theoretical approach is based on the NASSS framework. A quantitative element looks at patterns of uptake and adoption of the app, and its various functions. This involves analysis of NHS App usage, together with practice-level data linkage with the Patient Online Management Information and demographic data. Primary outcomes are use of online appointment booking, access to medical records online and online repeat prescriptions, comparing changes before and after the introduction of the NHS App. Patient participation is done through a specific PPIE group for this project, who are engaged in the design, delivery and interpretation of the research, including as co-researchers in the analyses. This work is being done in a 24-month period starting in November 2020.

**Anticipated impact and dissemination:** The study is being done in collaboration with the team at NHS England and NHS Digital delivering the app. The research feeds back findings to the delivery team and policy-makers to inform their work through regular structured meetings between the research and delivery teams. Dissemination includes conventional academic approaches, but also conferences and online material specifically targeted at patients, GPs and practice managers.

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Qualitative findings are still being analysed and published (already presented at several conferences), and initial themes and findings are presented in our response for your information.

Tables<sup>40</sup>**TABLE 10** Negative binomial regression table showing unit change in the NHS App registration rate per 1000 GP registered population, with other variables held constant

Registration rate/1000	% difference <sup>a</sup>	IRR	p-value	95% CI
<b>IMD quintile (reference group 1 = least deprived practices)</b>				
2	-6%	0.94	< 0.001	0.93 to 0.95
3	-8%	0.92	< 0.001	0.91 to 0.93
4	-9%	0.91	< 0.001	0.90 to 0.92
(most deprived practices) 5	-25%	0.75	< 0.001	0.74 to 0.75
<b>% males (reference group 1 = practices with the lowest percentage of males)</b>				
2	-11	0.89	< 0.001	0.89 to 0.90
3	-10	0.90	< 0.001	0.89 to 0.91
(Practices with the highest percentage of males) 4	-13	0.87	< 0.001	0.87 to 0.88
<b>% White (reference group 1 = more ethnically diverse practices)</b>				
2	24	1.24	< 0.001	1.23 to 1.25
3	42	1.42	< 0.001	1.41 to 1.44
(Least ethnically diverse practices) 4	36	1.36	< 0.001	1.34 to 1.38
<b>% youngest age group (reference group 1 = practices with the lowest percentage of 15- to 34-year-olds)</b>				
2	7	1.07	< 0.001	1.06 to 1.08
3	12	1.12	< 0.001	1.10 to 1.12
(Practices with the highest percentage of 15- to 34-year-olds) 4	23	1.23	< 0.001	1.21 to 1.25
<b>Practice size (reference group 1 = practices with the lowest number of GP-registered patients)</b>				
2	13	1.13	< 0.001	1.12 to 1.14
3	26	1.26	< 0.001	1.25 to 1.27
(Practices with the highest number of GP registered patients) 4	44	1.44	< 0.001	1.42 to 1.45
<b>% with chronic health illness or disability (reference group 1 = practices with the lowest percentage of people with chronic health illness or disability)</b>				
2	-1	0.99	< 0.001	0.98 to 0.10
3	-2	0.98	< 0.001	0.97 to 0.99
(Practices with the highest percentage of people with chronic health illness or disability) 4	-2	0.98	< 0.001	0.97 to 0.99

a Percentage difference calculated using IRR obtained from the negative binomial regression model.

**Note**

Submission prepared by the project core team: Chrysanthi Papoutsis, Claire Reidy, Sukriti KC, Bernard Gudgin, John Powell and Felix Greaves.

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For IMD, the percentage difference represents change across the IMD quintiles, in comparison to the reference group IMD Q1 (i.e. least deprived practices). For all other variables, the percentage difference represents change across the variable quartiles, in comparison to the reference group 1 (i.e. practices with the lowest population percentage for the given variable). Data up to February 2021.





EME  
HSDR  
HTA  
PGfAR  
PHR

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