Health Innovation Kent Surrey Sussex

Unity Insights

HealthTech-1: Impact evaluation report

Final report

April 2026

Working in collaboration with

Health Innovation Kent Surrey Sussex is one of fifteen Health Innovation Networks (HINs) working to transform lives through innovation.

NHS Surrey Heartlands is one of 42 Integrated Care Boards in England, planning the provision of health services across Surrey.

The Office for Life Sciences (OLS) is a government organisation promoting research, innovation, and the use of technology to improve health and care.

Healthtech-1 provides automated registration capabilities to primary care sites across England.

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Executive summary

Context

Typically, the primary care patient registration process involves a practice administrator manually inputting information provided through a standardised registration form onto the local electronic patient record (EPR) system. This takes approximately 15 minutes per registration – time that could instead be used for more productive tasks.

Healthtech-1 streamlines GP registration by automatically generating and completing patient profiles on the EPR system using a customisable 'local form' inquiring on a wide range of patient details, paired with the standard patient registration form. This ensures comprehensive SNOMED coding and eliminates manual data entry. The 'Signals' feature alerts practice staff to safeguarding issues, health concerns, and key patient details requiring attention. Healthtech-1 is currently implemented in over 1,400 practices across England, including 87 out of 99 GP practices in Surrey.

Methods

Pseudonymised patient-level data was obtained via Surrey Heartlands ICB. Analyses were conducted in order to assess whether Healthtech-1 meaningfully affected rates of SNOMED code completion, time-to-intervention, and registration speed. Further health inequalities analyses were conducted to assess whether identified groups were particularly affected by Healthtech-1's implementation.

A cost-benefit analysis was conducted to assess the health economic benefit generated by Healthtech-1, exploring administrative time savings and reductions in A&E attendances, as well as licensing and training costs. A number of plausible benefits remained unmodelled, including quality of life benefits from reduced wait-time anxiety and improved population health management (enabled by better data quality) as well as reduced secondary care activity.

Key results

Quantitative analysis

Healthtech-1 significantly improved SNOMED coding completeness across multiple data categories at the point of registration, with particularly large increases observed for ethnicity, alcohol screening, and smoking status. For example, ethnicity recording increased from 23.8% to 96.4%, and alcohol screening from 24.0% to 75.9%, representing substantial absolute and relative gains compared with non-Healthtech-1 registrations. These improvements reflect automated, structured data capture at the point of registration, replacing manual data entry and ensuring more consistent and standardised recording across patients. In other areas, such as carer status, coding rates also increased, although interpretation is limited by the absence of underlying prevalence data. There was no observed change in overall registration volume, including among deprived and ethnic minority groups.

Improved coding completeness enhances the ability of practices to systematically identify patient cohorts based on risk factors and lifestyle characteristics, supporting more proactive follow-up and targeted delivery of care. Beyond the individual practice, more complete and standardised data strengthens the foundations for population health management by improving the accuracy of segmentation, risk stratification, and identification of health inequalities across Primary Care Networks and Integrated Care Systems. This may reduce reliance on data linkage to address gaps in key variables and enable more timely, data-driven interventions at scale.

Individuals registering via Healthtech-1 tended to receive interventions more slowly than those registering through other routes. This finding may reflect differences in patient characteristics, registration intent, or underlying health status, as well as operational behaviours such as prioritisation or 'defensive' decision-making, where more complete information enables practices to assign non-urgent pathways with greater confidence.

Health economic modelling

Healthtech-1 yielded positive net present values (NPVs) across all scenarios modelled, ranging between benefit-cost ratios (BCRs) of 1.48 to 1.58. The value generated by Healthtech-1 was highly sensitive to the unit price charged per registration, as well as the amount of time the technology saves for administrators who were completing registrations.

Scenario	NPV	BCR
1: Selected sites	£65k	1.48
2: All sites in Surrey	£287k	1.48
3: All sites in Surrey and Sussex	£1,176k	1.58

The value of Healthtech-1 may be higher than modelled due to a number of plausible, potentially monetisable benefits such as improved population health management, however these were not possible to include in the cost-benefit analysis due to data availability issues.

Conclusion

Healthtech-1 leads to improved SNOMED coding upon registration, which may in turn lead to improved population health management due to having wider and more accurate information about the health of individuals and communities. Over a five-year time horizon, it generates a positive return on investment primarily through administrative time savings, with total value being particularly sensitive to time savings and licensing costs per registration. Healthtech-1 registrants consistently displayed longer times-to-intervention after registering, perhaps due to sampling biases and a reduction in 'defensive medicine' behaviour towards this group.

Introduction

Context

Public satisfaction with access to general practice is decreasing; patients encounter difficulties in securing appointments and express dissatisfaction with waiting times and the range of appointment options available (The Health Foundation, 2024). GP practice registration processes are also seen as complex due to the steps involved, an issue that is exacerbated among transient groups, limiting access to care (Worthing et al., 2023). Simultaneously, existing GP registration processes rely on administrative staff manually inputting patient information provided through a standardised registration form onto the local electronic patient record (EPR) system. While elements of this process could be automated through integration with EPR systems, capabilities vary across platforms, with systems such as SystmOne offering more advanced workflow automation than EMIS. Existing digital tools, including the NHS App, enable partial online registration and data capture but still require manual processing within practices. As a result, much of the process remains repetitive and could reasonably be further automated, allowing practice staff to use this time for more productive ends.

Created in 2021, Healthtech-1 is a software platform that automates GP registration processes, in use at over 1,500 practices across England, including at 87 of 99 GP practices in Surrey. It utilises a customisable '*local form*' attached to the pre-existing registration form, where GP practices can create various data fields for the patient to complete while registering. This information is automatically uploaded to the patient record, eliminating the need for manual administrator input and generating staff time savings within the registration process. The platform also automatically completes SNOMED coding, leading to a richer patient record with a more complete representation of the individual's health history, allowing for more informed clinical decision-making and facilitating wider population-level interventions. A further feature of Healthtech-1, '*Signals*', automatically notifies GP practice staff of safeguarding concerns, health concerns, and other patient details that are important to make note of or proactively action.

Purpose of this report

Unity Insights was commissioned by Health Innovation Kent Surrey Sussex ('Health Innovation KSS') to perform a quantitative and health economic evaluation of Healthtech-1's implementation across Surrey, analysing uptake, effectiveness, health inequalities, and

value of the technology. The current report presents the findings generated by the analyses undertaken and discussion on how the results should be interpreted given contextual factors and limitations of the methodology used.

Methodology

Analysis aims and theory of change

Unity Insights conducted a logic modelling workshop to establish a theory of change for the implementation of Healthtech-1 in primary care. Attendees included representatives of Healthtech-1, Health Innovation KSS, NHS Surrey Heartlands ICB ('Surrey ICB'), and clinical users of Healthtech-1. This activity sought to establish the key short- and long-term benefits of the technology, as well as any dependencies in the logic connecting elements of the theory of change. Similarly, key assumptions underlying the theory of change, and potential risks to both the evaluation and successful implementation of the technology, were identified. A full explanation of the theory of change with a graphically presented logic model for Healthtech-1 can be found in Appendix A: Logic model.

Quantitative analysis

Data sources

Unity Insights collaborated with representatives of Surrey ICB to create an EMIS Enterprise Search and Reports request form. This formalised efforts to retrieve structured, pseudonymised, patient-level data from electronic patient record (EPR) systems in place at practices across Surrey for the purposes of evaluation and listed metrics desired (see below) alongside purposes of analysis. Such data was then retrieved by Surrey ICB before being provided to Unity Insights.

Data was also procured for a number of sites in Sussex. Analysis of this data segment is presented separately in Appendix B: Quantitative results continued.

Analysis methods

The majority of selected sites implemented Healthtech-1 between March 2025 and April 2025; of these sites, the average implementation date was the 29th of March 2025. In order to streamline time-series analyses, sites that implemented Healthtech-1 outside of March or April of 2025 were excluded from analyses, and the implementation date of the remaining sites was approximated to 1st April 2025 to align with the financial year. This date was also

used as an ‘assumed’ implementation date for sites who did not adopt Healthtech-1, in order to facilitate comparative analyses against non-adopting sites.

Three time periods were subsequently constructed; the intervention (in other words, post-Healthtech-1) time period was defined as being six months long, lasting from 1st April 2025 to 1st October 2025, to reflect data availability constraints. Two comparator time periods were also established to reflect identical in-year time periods in previous years (Table 1).

Table 1: Time periods utilised in comparative analyses.

Time period	Start date	End date
Post-intervention	01/04/2025	01/10/2025
Comparator 1	01/04/2024	01/10/2024
Comparator 2	01/04/2023	01/10/2023

These time periods were used in cases where the metric in question could reasonably exhibit levels of seasonality, such as time-to-intervention metrics that may vary with seasonal pressures. Other metrics that were assumed to not exhibit seasonality, such as coding completeness metrics, utilised the full range of data available (April 2023 to November 2025) with April 1st 2025 serving as the date separating the pre-intervention and post-intervention periods.

Descriptive statistics analyses were constructed to reflect either month-level time-series data, or aggregated time period-level data, depending on the metric in question.

Cohort definitions

Two principal cohorts were defined in order to investigate differences in outcomes between those using Healthtech-1, and those not using Healthtech-1:

- **Healthtech-1 registrants** are those who utilised Healthtech-1 during the process of registering for their GP. By definition, these registrants can only be present in the post-intervention period at **adopter sites**, which are GP practices that have implemented Healthtech-1. These registrants would necessarily have registered online, where Healthtech-1 is situated.

    - To identify Healthtech-1 registrants within EMIS, any registrant with a '*Registered By's Mnemonic*' containing 'RPA' has been designated as a Healthtech-1 registrant.

- **Non-Healthtech-1 registrants** are those who *did not* utilise Healthtech-1 during the process of registering for their GP. These registrants can be present at both **adopter sites** and **non-adopter sites**;
    - at non-adopter sites, Healthtech-1 is not present and hence may not be utilised by registrants,
    - whereas at adopter sites, patients who elect to register using the paper form rather than the online form never interact with Healthtech-1.

Metrics of interest

Following on from the development of the theory of change, a range of metrics were identified for exploration in demonstrating the benefits of Healthtech-1.

CODING COMPLETENESS

One of the proposed benefits of Healthtech-1 was improved SNOMED coding upon registration, particularly for elements that are not covered by the standard registration form. A number of SNOMED codes were identified for analysis:

- Alcohol screening activity
- Being a carer
- Chronic obstructive pulmonary disease (COPD)
- Ethnicity
- Hypertension
- Pregnancy
- Smoking cessation offer
- Smoking status

The listed codes cover a range of elements, including three of the five clinical areas of focus highlighted in the Core20PLUS5 approach (NHS England, n.d.), and indicators that are not typically considered by the standard registration form.

Data relating to the presence of the above SNOMED codes on patient profiles was analysed by exploring counts of codes over time, comparing coding rates in pre-intervention and post-intervention time periods.

REGISTRATION SPEED AND INITIAL CONTACT

Another proposed benefit of Healthtech-1 is that it enables registrations to be completed faster through automation and improved Primary Care Support England (PCSE) review success rate, thereby improving the speed at which individuals can access care. Simultaneously, the local form, as well as functions of the Healthtech-1 platform, allow for indications to be made of care and contact needs. These benefits explored through a number of datapoints:

- PCSE submission date
- Registration date
- First appointment date
- First prescription dispensation date

No data was available describing datetime of registration form submission, rendering analysis on delays in registration not possible. Instead, dates of PCSE submission were requested to allow durations between these dates and registration completion dates to be explored as a proxy measure.

First appointment dates and first prescription dispensation dates were requested to allow analyses to be conducted investigating whether Healthtech-1 meaningfully reduced delays in accessing care post-registration.

HEALTH INEQUALITIES

Healthtech-1 was discussed to have potential to reduce health inequalities in access to primary care. The increased speed and completeness of registration is said to be of benefit to transient communities, such as the Gypsy, Roma, and Traveller community, who may need to regularly re-register at GP practices across the country to access care. Simultaneously, Healthtech-1 may exacerbate health inequalities incurred in the registration process via the inclusion of the local form, representing an additional digital task needing to be completed before accessing care. Digital exclusion and low digital literacy are more prevalent in deprived communities (Holmes & Burgess, 2022), meaning those who are already more likely to require care (UK Health Security Agency, 2025) may encounter increased difficulty in accessing care. These propositions are explored through the following datapoints:

- Ethnicity

- IMD quintile

The ethnicity and deprivation profiles of those registering were explored, namely through time-series counts of registrations, in order to gain insight into whether Healthtech-1 meaningfully affected the number of registrations made by groups that experience higher levels of digital exclusion and lower levels of digital literacy.

Health economic analysis

Cost-benefit analysis

A cost-benefit analysis was conducted to report the key costs and benefits as monetary values. The perspective is social and considers the wider context of the public sector and the population, rather than solely that of the budget holder. Despite being presented in monetary terms, it does not always correspond directly to budgetary implications; for example, an existing resource (such as a member of staff) may be reallocated to work with a new intervention. From a financial perspective, the budget holder may not have needed to allocate extra funds to employ this member of staff. Despite this, there remains an economic cost because the staff member's time was directed towards the intervention rather than other duties. This is referred to as opportunity cost.

Alternatively, an intervention may lead to an improvement in the quality of life of an individual, which can be monetised through metrics such as Quality-Adjusted Life Years (QALYs) but does not represent a new availability of monetary resources. Benefits that permit a reallocation or optimisation of existing resources, such as those preventing a hospital admission thus allowing healthcare resources to be used for other means, are referred to as a 'non-cash-releasing' benefit.

Financial modelling, on the other hand, typically considers solely the budget holder's perspective and, therefore, costs and benefits are directly related to the organisation's revenues and expenditures. As a result, the costs and benefits of the health economic cost-benefit analysis do not necessarily represent cash flows.

Scenarios

Three scenarios were explored as part of the health economic modelling conducted:

- **Scenario 1: Selected sites** considered only sites that were included within quantitative analyses.

- **Scenario 2: All sites in Surrey** was a hypothetical scenario exploring the net benefit generated by spreading Healthtech-1 to all practices within Surrey. This scenario was not significantly different to scenario 1 in modelling assumptions, as the intention of this scenario was to identify *total* return on investment should all other sites in Surrey exhibit similar results to those analysed in scenario 1.
- **Scenario 3: All sites in Surrey and Sussex** was a hypothetical scenario exploring how more advantageous bulk pricing of Healthtech-1 may affect the total value generated for the budget holder. As such, this scenario explored both *total* return on investment across a wider geography, as well as *rate* of return on investment as modified by intervention pricing.

Benefit streams

REDUCTION IN ADMINISTRATOR TIME COMPLETING REGISTRATIONS

Figure 1 displays the method of calculating benefit stream 1. The direct economic benefit of Healthtech-1 lies in its ability to automate registrations. Presently, upon a patient completing an electronic or analogue registration, a practice administrator must create the patient profile and input all supplied information manually. Healthtech-1 automates these steps, meaning that a majority of the time that would have been spent registering patients can instead be used for other tasks. The difference between time to complete a registration has been derived through a survey completed by practice staff at adopting practices across Surrey Heartlands ICB. This is a non-cash-releasing benefit.

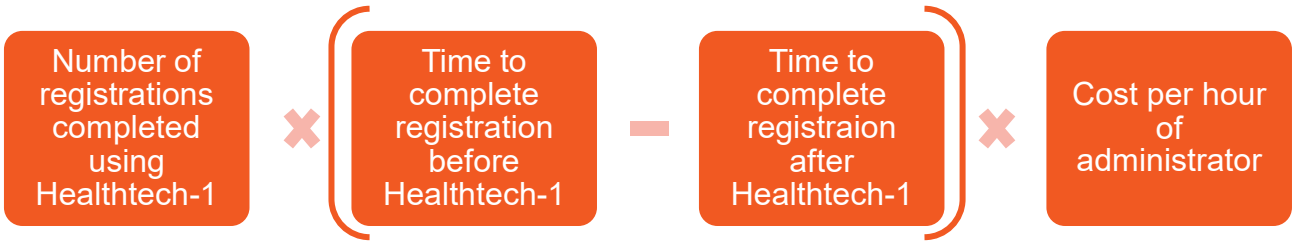

Figure 1: Benefit stream 1 - Reduction in administrator time completion registrations calculation.

REDUCTION IN A&E VISITS

Figure 2 displays the method of calculating benefit stream 2. Cowling et al. (2013) investigated the relationship between the proportion of individuals attending primary care within two weekdays of requesting an appointment, and visits at emergency departments. The paper finds that the percentage of the registered practice population able to attend primary care within two weekdays was negatively associated with the rate at which patients

at the practice self-referred to the emergency department. In simple terms, patients who could see a GP quickly were less likely to attend A&E. The paper proceeds to explore 2011/12 GP Patient Survey data, which demonstrated that 9% of patients who were unable to obtain a 'convenient' appointment at their last attempt reported subsequent attendance at an emergency department.

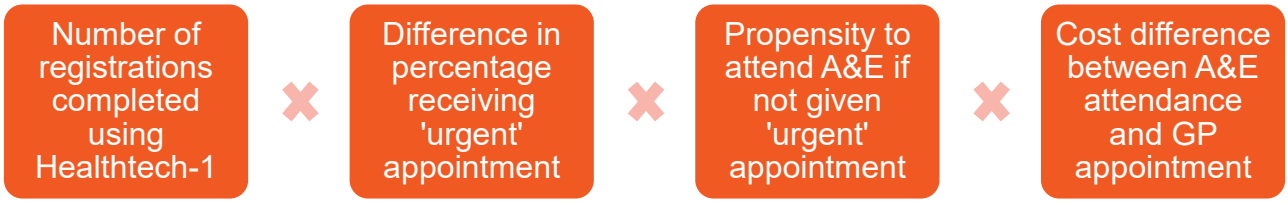

Figure 2: Benefit stream 2 - Reduction in A&E visits calculation.

For this benefit, it was assumed that the proportion of individuals registering who desired an 'urgent' appointment remained constant over time. It was also assumed that all appointments attended within two days of registration were requested out of urgency. Subsequently, it was assumed that the proportion of patients obtaining an 'urgent' appointment after Healthtech-1 was equal to that of before Healthtech-1, meaning that the difference in value of these variables reflects patients who did want to be seen urgently. The proportion of these individuals who would have otherwise attended A&E upon not receiving an 'urgent' appointment was assumed to be equal to the figure reported in the 2011/12 GP Patient Survey (9%).

Unmodelled benefits

IMPROVED QUALITY OF LIFE

The proposed immediate benefits of Healthtech-1 have potential to improve patient outcomes in two dimensions. Firstly, the ability of the patient to express greater urgency for an appointment upon registration, and subsequently being able to attend an appointment at an earlier time than otherwise, could reasonably be expected to improve both short-term and long-term quality of life. In the short-term, the patient would experience discomfort and/or anxiety for a shorter period of time before receiving clinical attention, hence improving their quality of life in the immediate term. Simultaneously, a patient receiving clinical attention faster means that their health condition may deteriorate less or their illness may progress less before being appropriately treated, thus improving their medium- and long-term health prospects, ergo, improving their quality of life.

Secondly, improvements in quality and quantity of clinical coding as provided by Healthtech-1 could reasonably improve patient outcomes. The presence of certain clinical codes upon registration may lead to individuals being targeted for intervention, for example, due to exhibiting risk factors for chronic conditions. These interventions would support in the early identification of certain conditions, leading to improved early-stage care, thereby improving prognoses and long-term health outcomes. Similarly, improved population-level coding completeness would provide a reliable base of data from which organisations within the healthcare sector, such as ICBs, may be able to construct population health profiles. These would allow various organisations to institute population health management initiatives to improve healthcare outcomes across larger geographies.

This type of benefit was unable to be modelled due to available data being insufficient. Research into this benefit stream revealed a lack of reliable data on short- and long-term QALY-type benefits stemming either from increased speed in accessing primary care or improved coding completeness.

REDUCTION IN SECONDARY CARE ACTIVITY

As discussed, a proposed benefit of Healthtech-1 is that it may provide the foundations of improving preventative and early care, allowing patients to receive sufficient treatment within primary care and preventing deterioration of conditions that would be subsequently addressed with more intrusive and costly interventions in secondary care. At present, long-term data quantifying the effectiveness of Healthtech-1 in reducing the need for medical interventions in secondary care is unavailable, hence this benefit could not be reliably modelled.

ENVIRONMENTAL SAVINGS

It is not clear whether Healthtech-1 would lead to a reduction in paper usage within the registration process; it does not introduce the possibility of a paperless registration, as there already exists the option to register online and at no point would a member of staff at the practice have to use paper to process those registrations. This benefit would only manifest in cases where the introduction of Healthtech-1 has either directly or indirectly led to individuals registering via digital means when they would have otherwise done so using a paper form. There is currently no evidence to support this notion, hence this benefit has not been modelled.

Cost streams

HEALTHTECH-1 LICENSING COSTS

Figure 3 displays the method of calculating cost stream 1. The principal direct cost of Healthtech-1 is the charge paid for the ability to use the service. At present, individual

'licenses' consumed each time a patient is registered may be bought in bulk by ICBs and GP federations, with larger packages offering a lower price-per-license. In order to simplify calculations, this cost was modelled as being charged per-registration; this may present inaccuracies over shorter time horizons on account of cost being front-loaded in practice, meaning that some financial years might demonstrate a drastically increased cost whereas others may demonstrate no cost at all. This methodology is still considered to be accurate over longer time horizons and in the cases of economic indicators such as BCR, as peaks and troughs in license cost fees would herein represent smaller relative deviations from the long-term cost average.

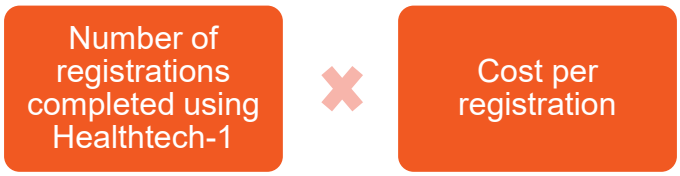

Figure 3: Cost stream 1 - Healthtech-1 licensing costs.

HEALTHTECH-1 TRAINING COSTS

Figure 4 displays the method of calculating cost stream 2. Site administrators who would be using Healthtech-1 to complete patient registrations are required to undergo training on how to use the service. This is completed via a free training webinar lasting one hour, and was assumed to be completed by 1.5 administrators at each practice. The time taken to complete this training represents an opportunity cost in which that time could have been used to complete other tasks, hence the time taken to undergo training is costed in proportion to the hourly cost of the staff in question.

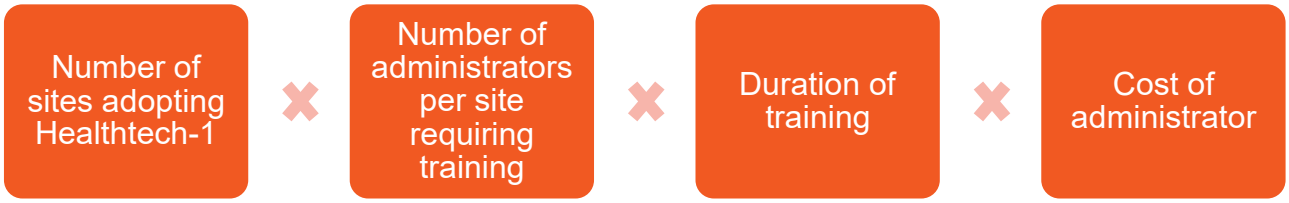

Figure 4: Cost stream 2 - Healthtech-1 training costs.

Optimism bias

Optimism bias (OB) is defined as, “the tendency for a project’s costs and duration to be underestimated and/or benefits to be overestimated” (Mott MacDonald, 2002) as found by historical UK government reviews on public sector procurement. To account for these ‘optimistic’ estimates, the model applies OB correction factors in response to the level of uncertainty in the data or assumptions used within the model.

Unity Insights’ approach to optimism bias is presented in ‘Appendix C: Health economic optimism bias application’. This is an adaptation of the model created by the Greater Manchester Combined Authority (GMCA) Research Team (formerly New Economy; HM Treasury et al., 2014). The GMCA model is featured in the supplementary guidance of HM Treasury’s Green Book and offers a robust and prudent approach to economic analysis (HM Treasury, 2022). In addition to the optimism bias factors applied at the benefit and cost stream level, a further factor of 15% is applied to reduce the benefits and increase the costs. This additional factor is included as an extra level of prudency to ensure that the model does not misrepresent the impact of the intervention.

GDP deflation adjustment

A real Gross Domestic Product (GDP) deflator has been applied that removes the general effects of inflation and presents costs and benefits included within the appraisal in ‘real’ base year prices rather than in nominal prices (such as the first year of the project). Within this appraisal, a GDP deflator of 2% has been used to convert nominal to real values. Various rates were applied depending on data that were sourced from the Office for Budget Responsibility forecast (Office for Budget Responsibility, 2022) and The Green Book (HM Treasury, 2022).

Discounting

Discounting is a technique that enables the comparison of costs and benefits on a consistent basis and accounts for the concept of ‘social time preference’ (in other words, it allows costs and benefits that occur at different time periods to be compared on a “present value” basis). Discounting is applied to all future costs and benefits and is not applied retrospectively.

A discount rate of 3.5% is applied to benefits to deflate outcomes to real terms and reflect the changing value of healthcare within GDP (HM Treasury, 2022). For social outcome streams linked to welfare or utility values (such as QALYs), a discount rate of 1.5% is applied as this excludes the change in expected growth per capita over time and only considers health and life effects.

Sensitivity analysis

A degree of uncertainty in the estimates of the model is accounted for by using sensitivity analysis. It is important to note that the sensitivity differs from optimism bias in that it is applied on each individual assumption or input in the model, rather than by benefit or cost stream as in the case of optimism bias. Unity Insights uses a Monte Carlo simulation to conduct the sensitivity analysis. This modelling technique simulates the impact of the expected variance in key variables on the output of interest, in this case the net present value return on investment. Further details on how this was applied are included in 'Appendix D: Health economic sensitivity analysis methodology'.

Qualitative analysis

No qualitative analyses were undertaken as part of Unity Insights' evaluation of Healthtech-1. As part of wider evidencing work around the technology, Health Innovation Kent Surrey Sussex are performing qualitative and Patient & Public Involvement and Engagement activities. At the time of writing, these activities are ongoing and results will be presented in a Patient, Public and Carer Views report later in 2026.

Limitations

Incomplete post-intervention data

At the time of data procurement, only eight months had elapsed since the implementation of Healthtech-1 at the selected sites in Surrey, meaning that data was not available for a full financial year post-implementation. While eight months remains a time period sufficient for conducting investigations into the effects of Healthtech-1, and large sample sizes therein mean that various conclusions can be made with reasonable confidence, no analyses could be conducted or observations made on in-year patterns in data. For example, practices may adjust their general activity when approaching the end of the financial year in order to meet various Quality Outcomes Framework targets that could implicate funding. As no data was available for this period within the 2025/26 financial year (as it had yet to be generated), no analyses could be conducted on whether Healthtech-1 factored into, or contributed to, seasonal variation in practice activity.

Health inequalities sample sizes

Health inequalities have become an increasing focus of NHS strategy, exemplified in the Core20PLUS5 framework (NHS England, n.d.), that identifies individuals in the most deprived 20% of the population as in need of improved access to, and outcomes of, healthcare services. Surrey as a county has a disproportionately low share of IMD 1 and 2 individuals with 0.6% of the population falling into this category – the lowest of any ICB (Ministry of Housing, Communities & Local Government, 2019). In fact, among the sites for which data was obtained, the highest proportion of IMD 1 and 2 individuals was 5.9%, and the second highest was 2.2%. As such, the sample sizes with which to conduct analyses relating to the impact of Healthtech-1 on deprived communities was insufficient, allowing only indicative observations to be made.

Unmodelled economic benefits

As discussed in Unmodelled benefits in Section 0, as well as Section 0, there exists a number of plausible monetisable benefits of Healthtech-1 that could not be included in the cost-benefit analysis as available literature did not contain sufficiently usable figures with which benefit streams could be constructed. Such a limitation does not exist for the costs utilised within the model, meaning the cost figures presented can be reasonably assumed to be comprehensive (except for in cases where there may be cost associated with tertiary activities, such as in population health management). As such, the net economic benefit of Healthtech-1 could reasonably be expected to be higher than presented in Section 0.

Results

Quantitative analysis

Registrations

Figure 5 displays counts of registrations by calendar month at sites utilising Healthtech-1. Almost 70% (69.4%; n = 9,591) of all 13,810 patient registrations were completed with Healthtech-1 between April 2025 and November 2025. The total number of registrations remained consistent across the total time period, averaging 1,650 registrations per month before Healthtech-1, and 1,726 registrations per month after Healthtech-1.

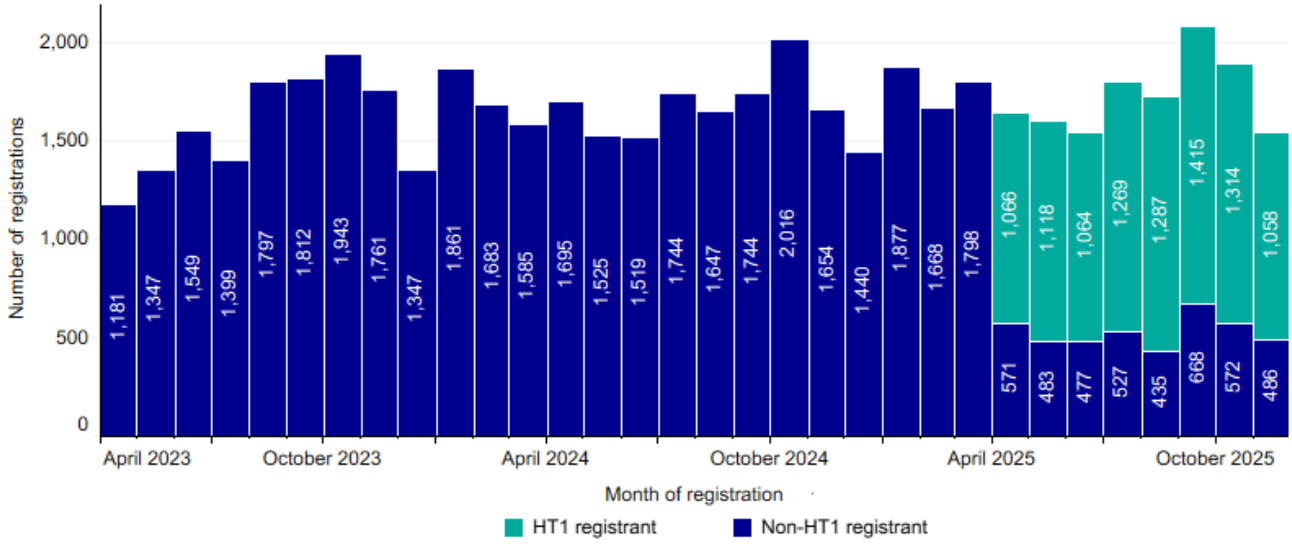

Figure 5: Count of registrations by calendar month; Healthtech-1 adopters only.

Table 2 displays counts of registrations within the defined comparative analysis periods (Table 1) at sites utilising Healthtech-1. The total number of registrations within the defined periods increased year-on-year, culminating in 10,380 registrations within the post-intervention period.

Table 2: Percentages of registrations within comparative analysis periods; Healthtech-1 adopters only.

Time period	Percentage non-Healthtech-1 registrations	Percentage Healthtech-1 registrations
Post-intervention	30.5% (*n* = 3,161)	69.5% (*n* = 7,219)
Comparator 1	100.0% (*n* = 9,874)	0.0% (*n* = 0)
Comparator 2	100.0% (*n* = 9,085)	0.0% (*n* = 0)

Coding completeness

ETHNICITY

Figure 6 displays percentages of registrations recording an ethnicity SNOMED code at sites utilising Healthtech-1. Almost all patients who registered via Healthtech-1 had an ethnicity SNOMED code (96.4%, n = 9,243), a much higher completeness rate than patients who did not register via Healthtech-1 in both the pre- (9.6%, n = 3,783) and post-intervention (23.8%, n = 1,004) periods.

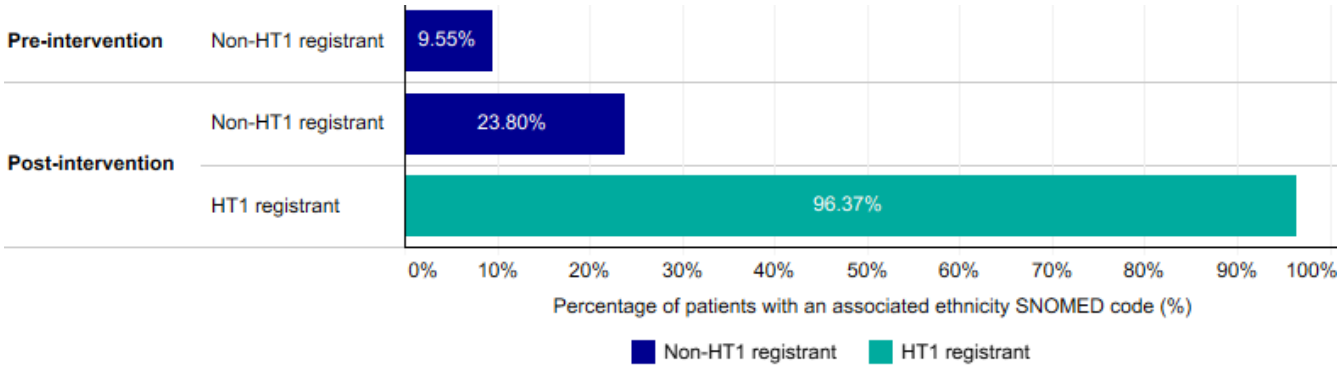

Figure 6: Percentage of registrations recording an ethnicity SNOMED code by calendar month; Healthtech-1 adopter sites only.

COPD

Figure 7 displays percentages of registrations with a COPD SNOMED code at sites utilising Healthtech-1. Among patients who registered via Healthtech-1, 0.4% (n = 42) had a COPD

SNOMED code, a lower coding rate than patients who did not register via Healthtech-1 in the post-intervention period (0.5%, n = 22) but higher than pre-intervention registrants (0.4%, n = 164) periods.

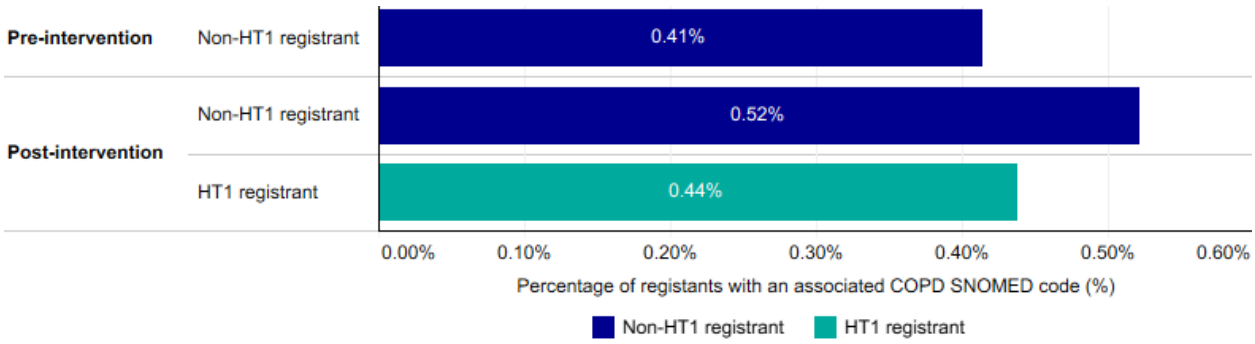

Figure 7: Percentage of registrations recording a COPD SNOMED code by calendar month; Healthtech-1 adopter sites only.

HYPERTENSION

Figure 8 displays percentages of registrations with an associated hypertension SNOMED code at sites utilising Healthtech-1. A higher proportion of patients who registered via Healthtech-1 had a hypertension SNOMED code (5.4%, n = 519) than patients who did not register via Healthtech-1 in both the pre- (4.9%, n = 1,922) and post-intervention (5.0%, n = 211) periods.

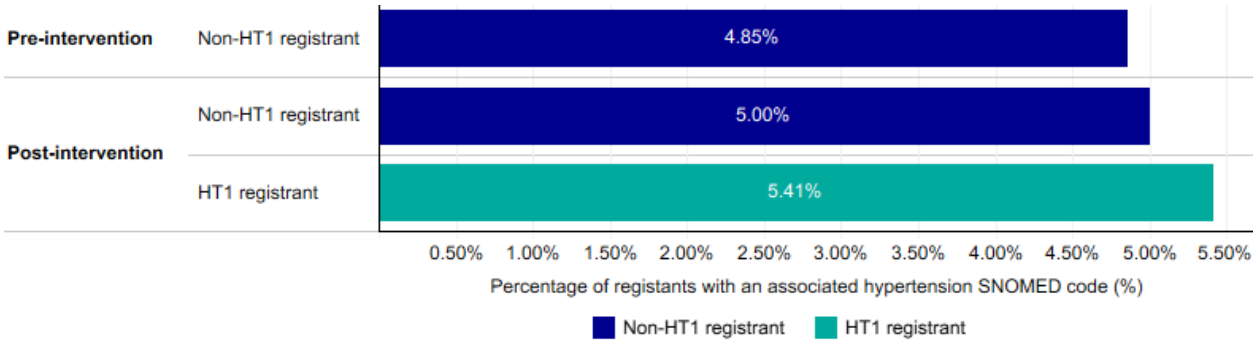

Figure 8: Percentage of registrations recording a hypertension SNOMED code by calendar month; Healthtech-1 adopter sites only.

ALCOHOL SCREENING ACTIVITY

Figure 9 displays percentages of registrations recording an alcohol screening SNOMED code at sites utilising Healthtech-1. A much higher proportion of patients who registered via Healthtech-1 had an alcohol screening SNOMED code (75.9%, n = 7,280) than patients who did not register via Healthtech-1 in both the pre- (21.9%, n = 8,682) and post-intervention (24.0%, n = 1,016) periods.

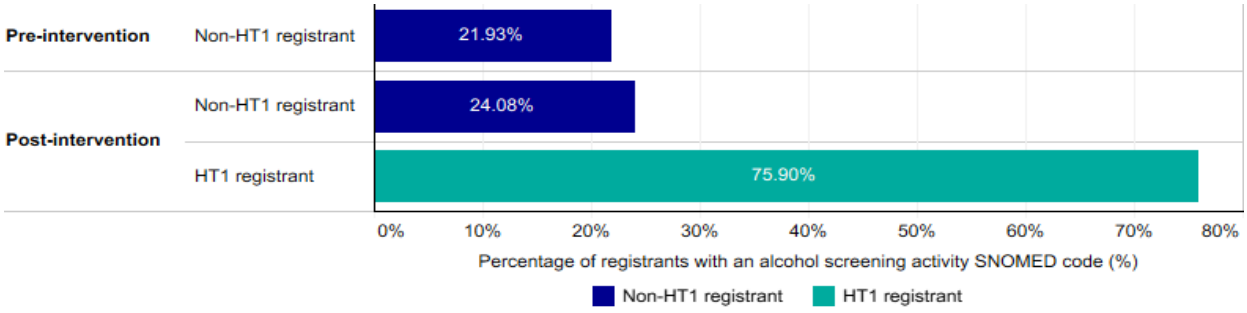

Figure 9: Percentage of registrations recording an alcohol screening SNOMED code by calendar month; Healthtech-1 adopter sites only.

CARER STATUS

Figure 10 displays percentages of registrations recording a carer status SNOMED code at sites utilising Healthtech-1. A higher proportion of patients who registered via Healthtech-1 had a carer status SNOMED code (3.2%, n = 306) than patients who did not register via Healthtech-1 in both the pre- (1.5%, n = 596) and post-intervention (1.6%, n = 66) periods.

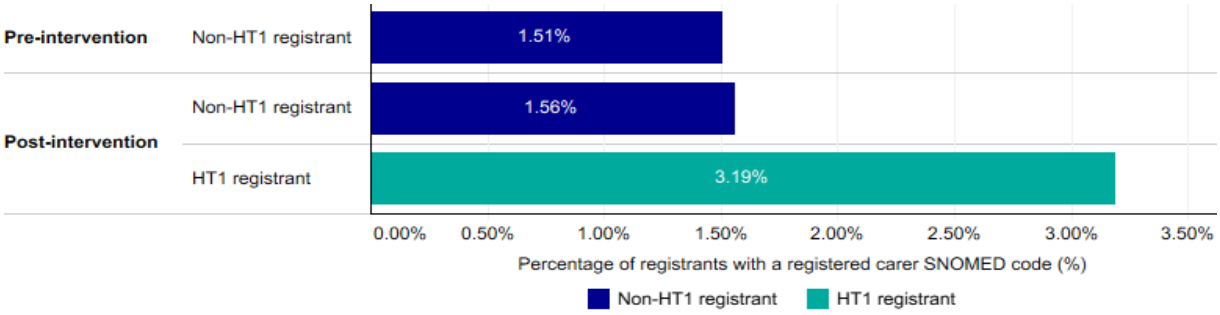

Figure 10: Percentage of registrations recording a carer status SNOMED code by calendar month; Healthtech-1 adopter sites only.

SMOKING CESSATION OFFERING

Figure 11 displays percentages of registrations recording a smoking cessation offering SNOMED code at sites utilising Healthtech-1. A higher proportion of patients who registered via Healthtech-1 had a smoking cessation offering SNOMED code (7.6%, n = 724) than patients who did not register via Healthtech-1 in both the pre- (5.7%, n = 2,256) and post-intervention (2.4%, n = 101) periods.

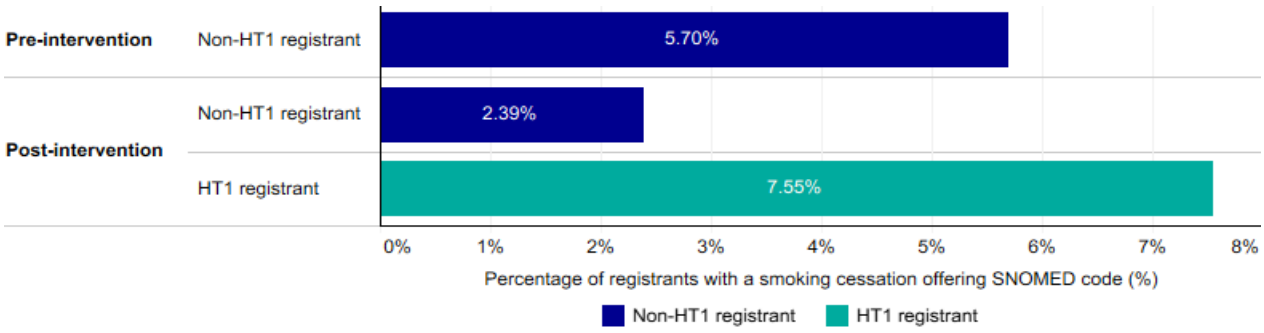

Figure 11: Percentage of registrations recording a smoking cessation offering SNOMED code by calendar month; Healthtech-1 adopter sites only.

SMOKING STATUS

Figure 12 displays percentages of registrations recording a smoking status SNOMED code at sites utilising Healthtech-1. A higher proportion of patients who registered via Healthtech-1 had a smoking status SNOMED code (25.2%, n = 2,418) than patients who did not register via Healthtech-1 in both the pre- (15.6%, n = 6,162) and post-intervention (9.8%, n = 412) periods.

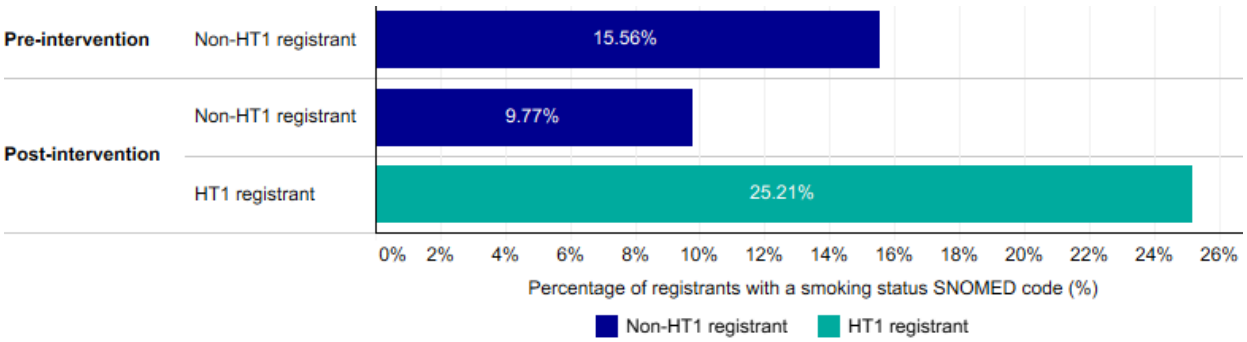

Figure 12: Percentage of registrations recording a smoking status SNOMED code by calendar month; Healthtech-1 adopter sites only.

Registration speed and initial contact

REGISTRATION SPEED

Figure 13 displays average durations between notification of registration (in other words, submission of registration) and confirmation of registration (by PCSE) by Healthtech-1 adoption status, time period, and registration method. At adopter sites, Healthtech-1 registrants demonstrated a shorter average time-to-registration than non-Healthtech-1 registrants in the post-intervention period, however, a longer average time-to-registration than registrants at non-adopter sites in the post-intervention period.

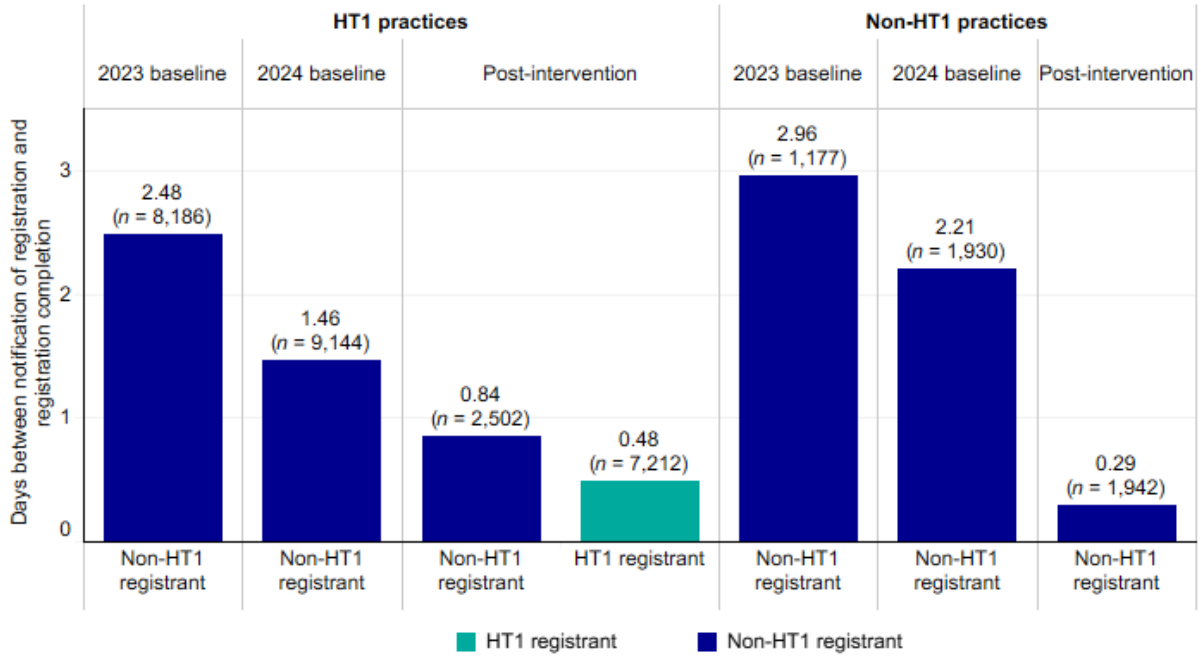

Figure 13: Average duration between notification of registration and registration confirmation.

FIRST APPOINTMENT

Figure 14 displays average durations between registration and first appointment, by time period, Healthtech-1 adopter status, and Healthtech-1 registrant status, with all times-to-appointment of longer than 60 days excluded. Here, Healthtech-1 registrants exhibit a similar (although the lowest) average time-to-appointment of all sub-cohorts, excluding non-Healthtech-1 registrants at adopter sites in the post-intervention period, who show a markedly lower average time-to-appointment than any other sub-cohort, an average wait 9.8% lower than Healthtech-1 registrants.

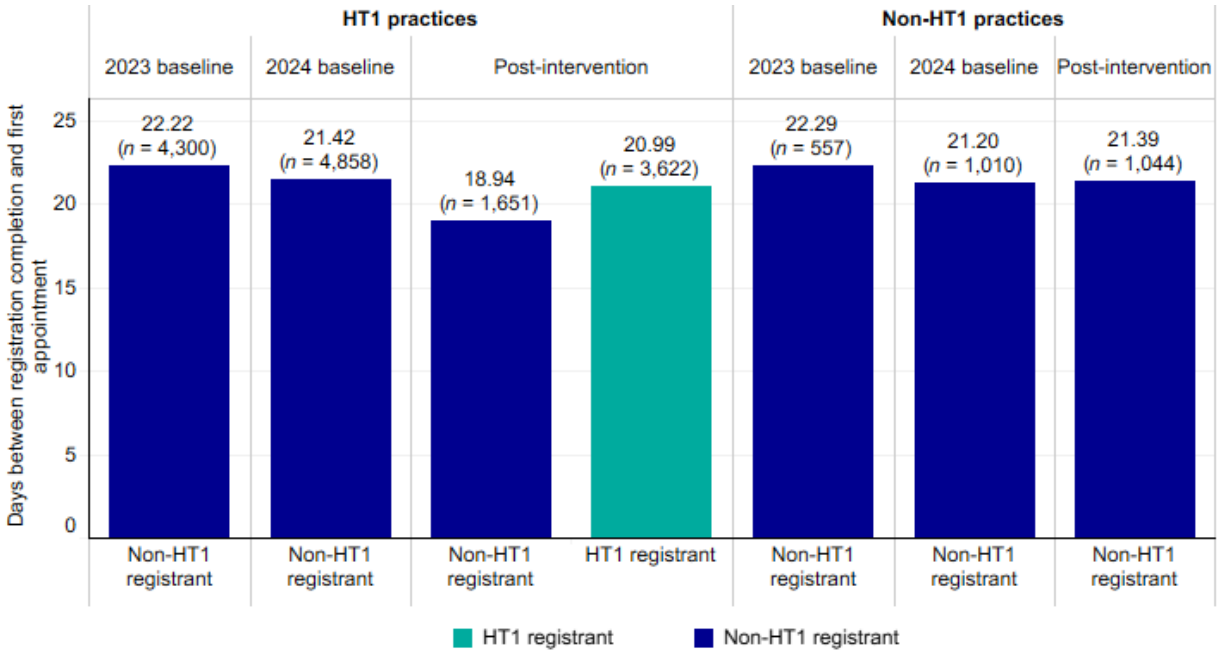

Figure 14: Average duration between registration and first appointment; maximum wait of 60 days.

Figure 15 displays the same data as in Figure 14, but with an exclusion threshold for time-to-appointment of 30 days. With this exclusion threshold, Healthtech-1 registrants no longer have the second-lowest average time-to-appointment, but non-Healthtech-1 registrants at adopter sites in the post-intervention period persist with having the lowest average time-to-appointment, 11.8% lower than Healthtech-1 registrants and 9.1% lower than the next shortest average time-to-appointment (post-intervention period registrants at non-adopter sites).

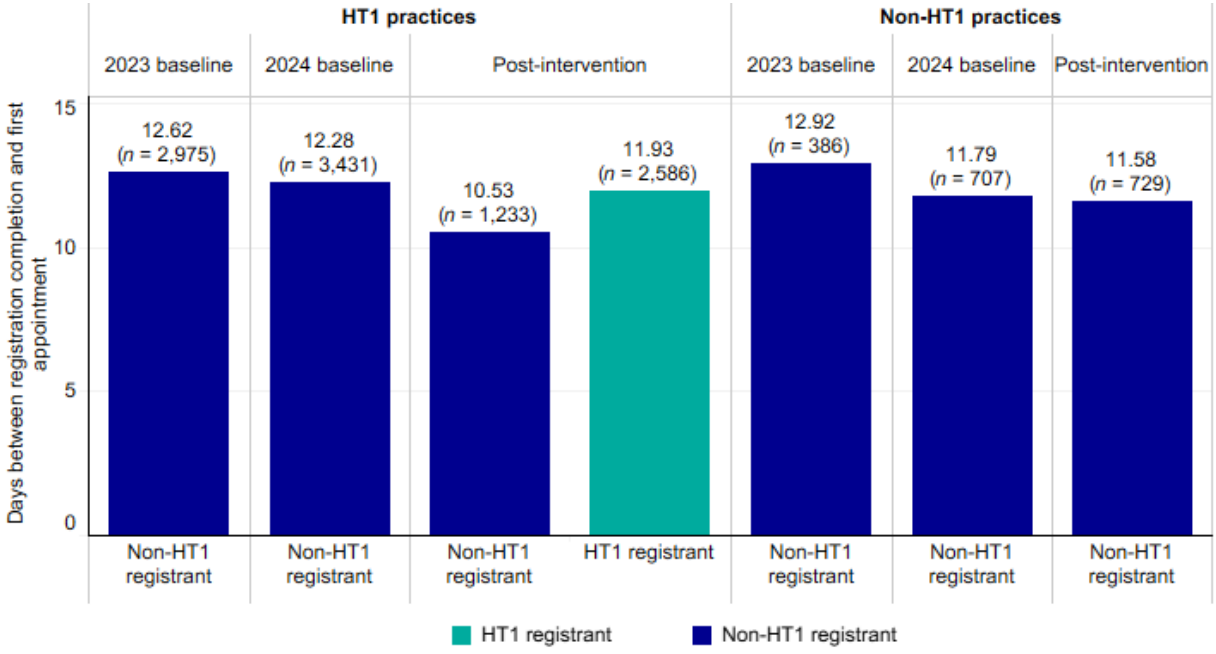

Figure 15: Average duration between registration and first appointment; maximum wait of 30 days.

Figure 16 displays the same data as in Figure 14, but with times-to-appointment of greater than 14 days excluded. Here, Healthtech-1 registrants demonstrate an average time-to-appointment of 5.9 days, which is greater than the 4.8-day average exhibited by non-Healthtech-1 registrants at adopter sites, but lower than the 6.1-day average shown by registrants at non-adopter sites.

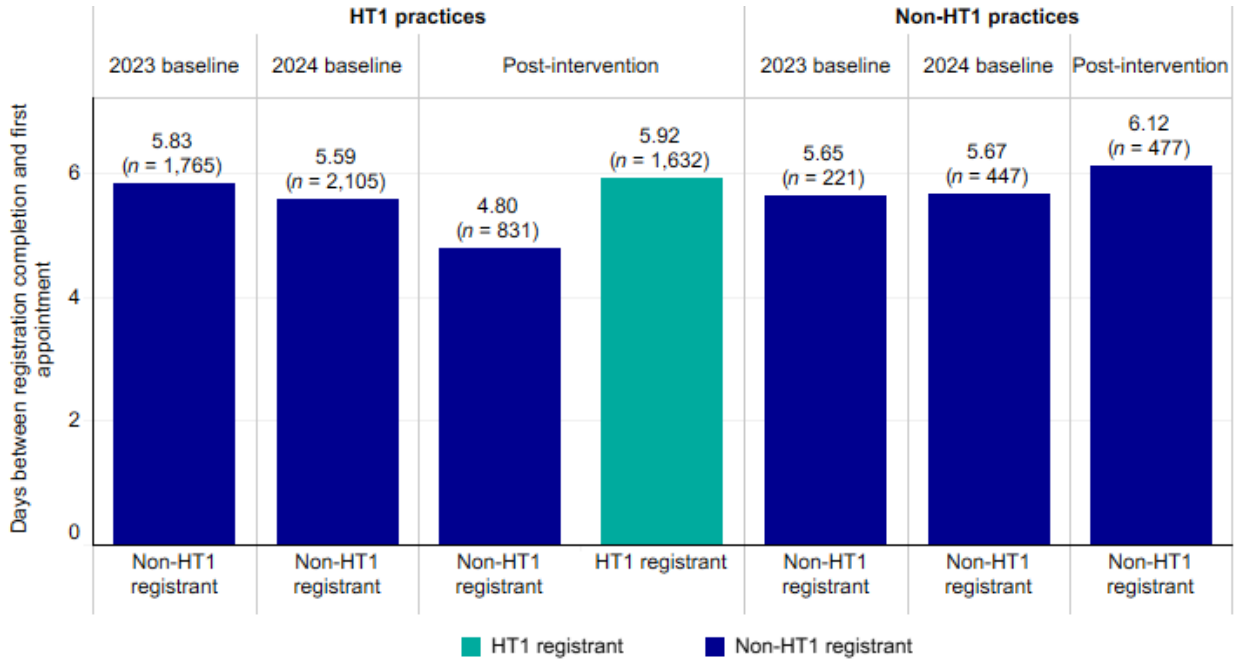

Figure 16: Average duration between registration and first appointment; maximum wait of 14 days.

Table 3 displays percentages of registrations receiving an appointment within 2 days by time period, Healthtech-1 adoption status, and Healthtech-1 registrant status. Here, Healthtech-1 registrants demonstrate a lower proportion of registrants receiving an appointment within two days when compared both with non-Healthtech-1 registrants at adopter sites and non-adopter sites.

Table 3: Percentages of registrants receiving an appointment within two days.

Time period	Healthtech-1 adopter sites		Non-adopters
	Healthtech-1 registrant	All others	All others
Post-intervention	6.6% (*n* = 478)	11.1% (*n* = 350)	7.2% (*n* = 142)
Comparator 1	N/A	7.4% (*n* = 735)	7.4% (*n* = 145)
Comparator 2	N/A	6.5% (*n* = 588)	6.3% (*n* = 75)

In both comparator time periods, the proportions of registrants receiving an appointment within 2 days was almost equal when comparing adopter and non-adopter sites. When disregarding whether a patient used Healthtech-1 to register, 8.0% of those registering at adopter sites in the post-intervention period received an appointment within 2 days. Here,

the adopter sites show an increase in this metric between the comparator 1 and post-intervention time periods – a trend in the data not mirrored by the non-adopter sites.

Figure 17 displays average durations between registration and first appointment for registrants recording Core20PLUS5 SNOMED codes within the post-intervention period. Individuals at adopter sites with an associated COPD code had the shortest average time-to-appointment, followed by individuals with an associated hypertension code, with pregnant individuals displaying the longest time-to-appointment. This trend was not the case at non-adopter sites, where registrants with an associated COPD code displayed a slightly higher average time-to-appointment than individuals with hypertension, although pregnant individuals persisted in exhibiting the longest average time-to-appointment at these sites.

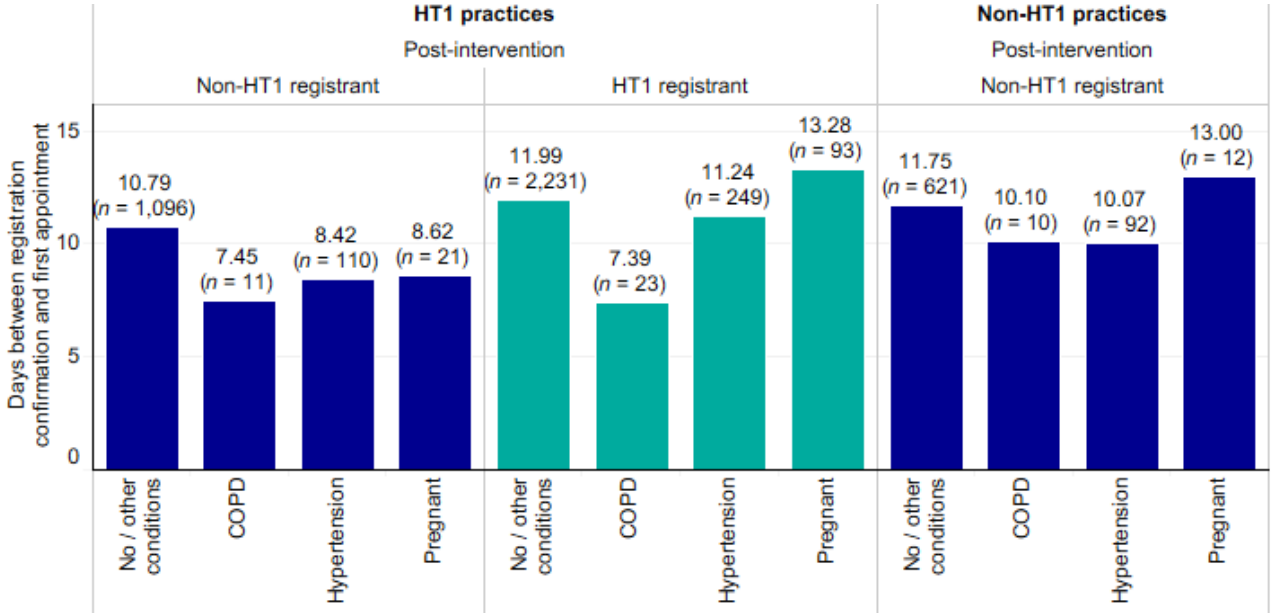

Figure 17: Average duration between registration and first appointment; Core20PLUS5 categories, maximum wait of 30 days.

When focusing on adopter sites, Healthtech-1 registrants with COPD showed a slightly shorter average time-to-appointment than those who did not register using Healthtech-1, however Healthtech-1 registrants who were hypertensive or pregnant displayed considerably longer average times-to-appointment. When comparing Healthtech-1 registrants to those who registered at non-Healthtech-1 sites, this general pattern persists.

FIRST PRESCRIPTION

Figure 18 displays average durations between registration and first prescription, with times-to-prescription of greater than 60 days excluded. All individuals, regardless of site or

registration method, demonstrated similar average times-to-prescription across all periods, ranging from 20.2 days to 25.1 days. Here, Healthtech-1 registrants exhibited a longer average time-to-prescription than non-Healthtech-1 registrants at adopter sites within the post-intervention period (and comparator periods), but a shorter average time-to-prescription than registrants at non-adopter sites in the post-intervention period.

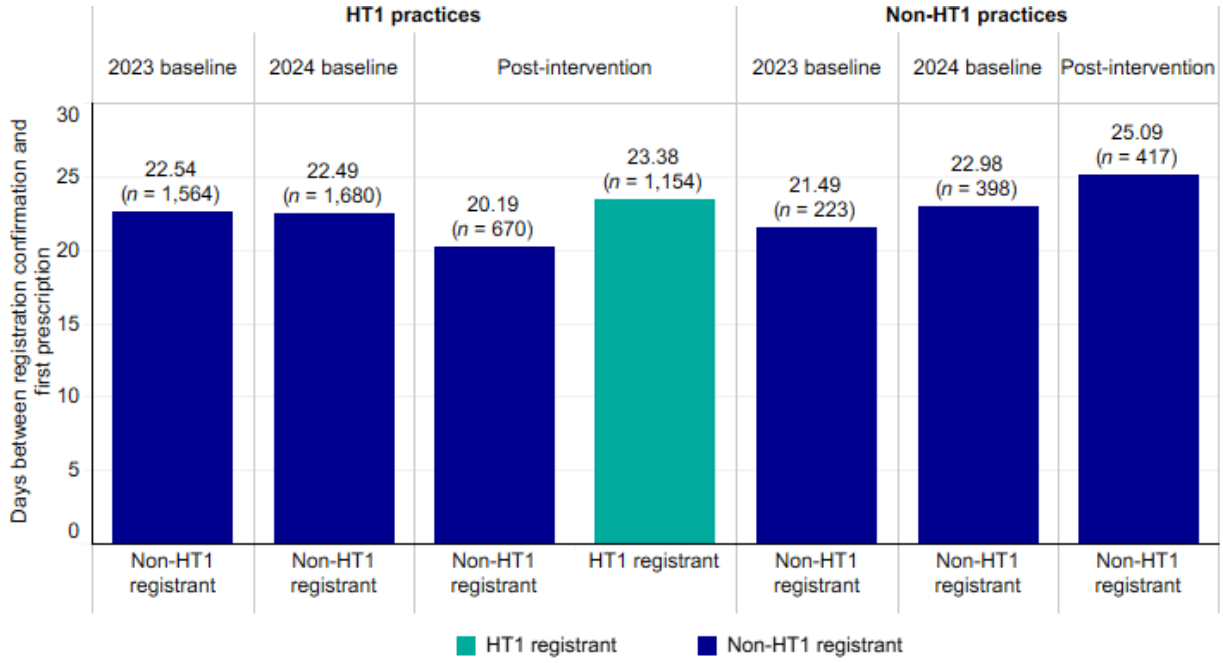

Figure 18: Average duration between registration and first prescription; maximum wait of 60 days.

Figure 19 displays the same data as in Figure 18, but with times-to-prescription of greater than 30 days excluded. Again, all individuals, regardless of site or registration method, demonstrated similar average times-to-prescription across all periods, ranging from 10.8 days to 13.3 days. In this instance, Healthtech-1 registrants exhibited the longest average time-to-prescription of all sub-cohorts.

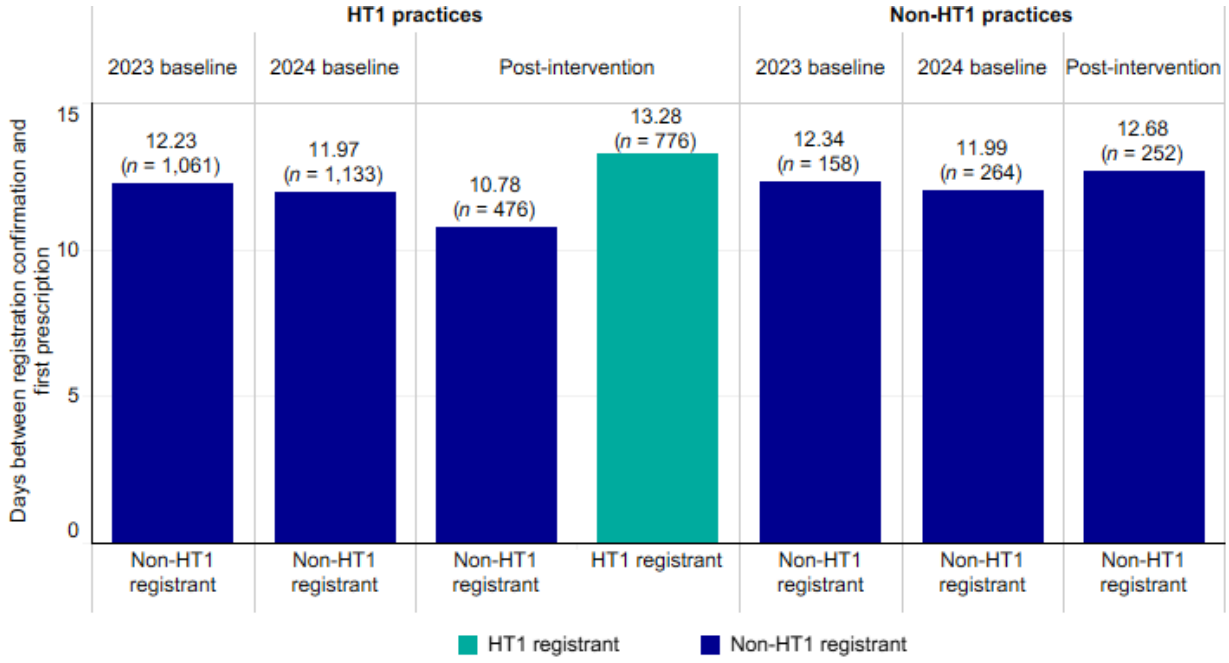

Figure 19: Average duration between registration and first prescription, maximum wait of 30 days.

FIRST INTERVENTION

Figure 20 displays average durations between registration and first intervention, with times-to-intervention of greater than 60 days excluded. In this instance, an intervention is defined as either an appointment, prescription, or referral. Here, registrants in the post-intervention period at adopter sites displayed the shortest average times-to-intervention, with non-Healthtech-1 registrants having shorter waits than Healthtech-1 registrants herein.

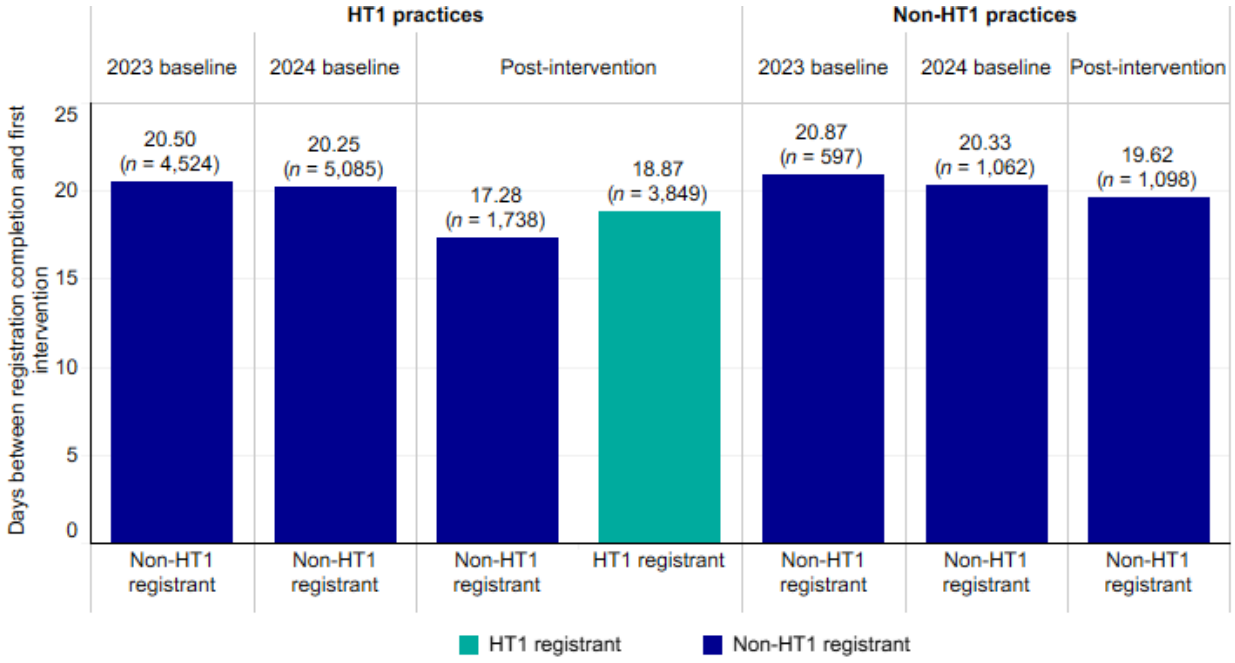

Figure 20: Average duration between registration and first intervention; maximum wait of 60 days.

Figure 21 displays the same data as Figure 20, with the exclusion threshold set to 30 days. Here, non-Healthtech-1 registrants at adopter sites in the post-intervention period persist in exhibiting the shortest average time-to-intervention. Healthtech-1 registrants no longer place second in this metric, with registrants at non-adopter sites in the post-intervention period exhibiting a slightly shorter average time-to-intervention.

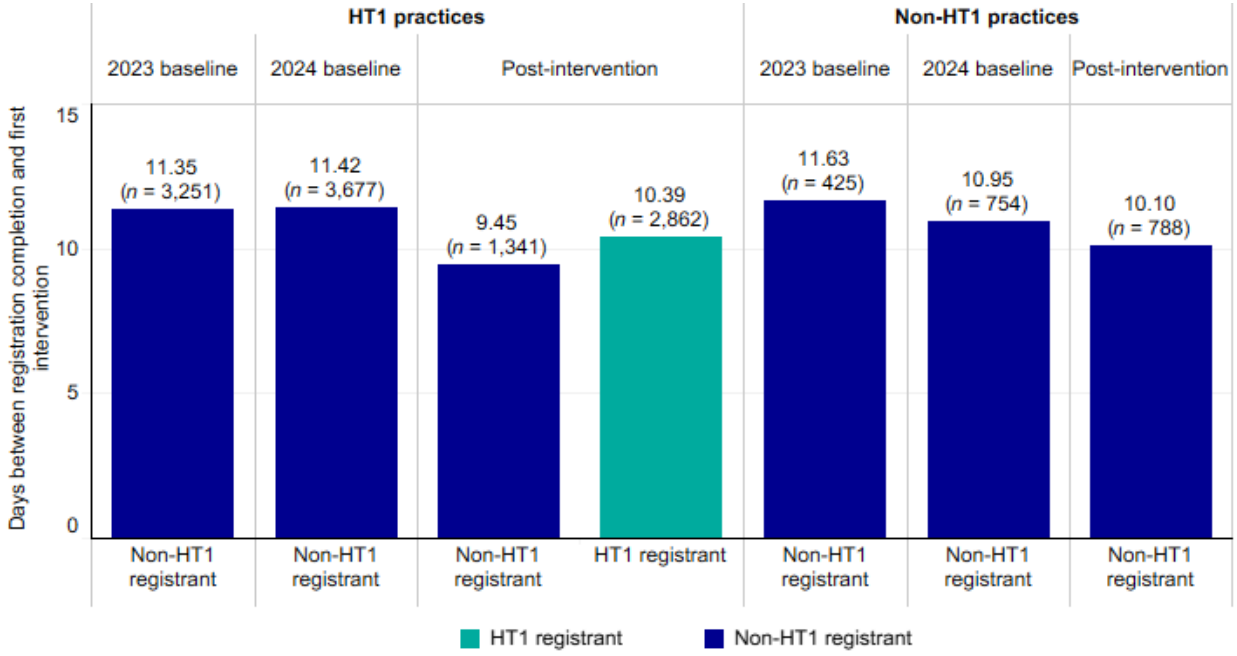

Figure 21: Average durations between registration and first intervention; maximum wait of 30 days.

Health inequalities

Figure 22 shows counts of registrations of individualds residing within Index of Multiple Deprivation (IMD) domains 1 and 2 at sites using Healthtech-1. No trend could be observed between the pre- and post-Healthtech-1 periods; there were 32.2 (n = 772) IMD 1 and 2 registrations per month before Healthtech-1, and 31.1 (n = 249) after Healthtech-1.

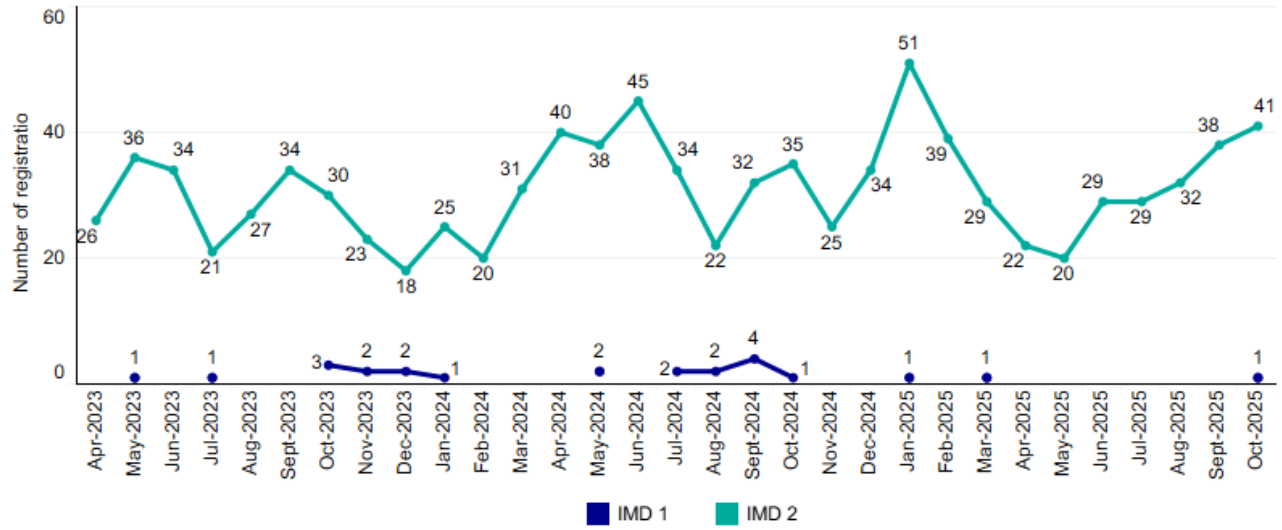

Figure 22: Counts of registrations of IMD 1 and 2 individuals; Healthtech-1 adopters only.

Similarly, no trend was observed when exploring IMD 1 and 2 registrations as a proportion of total registrations (Figure 23); IMD 1 and 2 individuals represented 1.9% of registrations before Healthtech-1, and 1.8% of registrations after Healthtech-1.

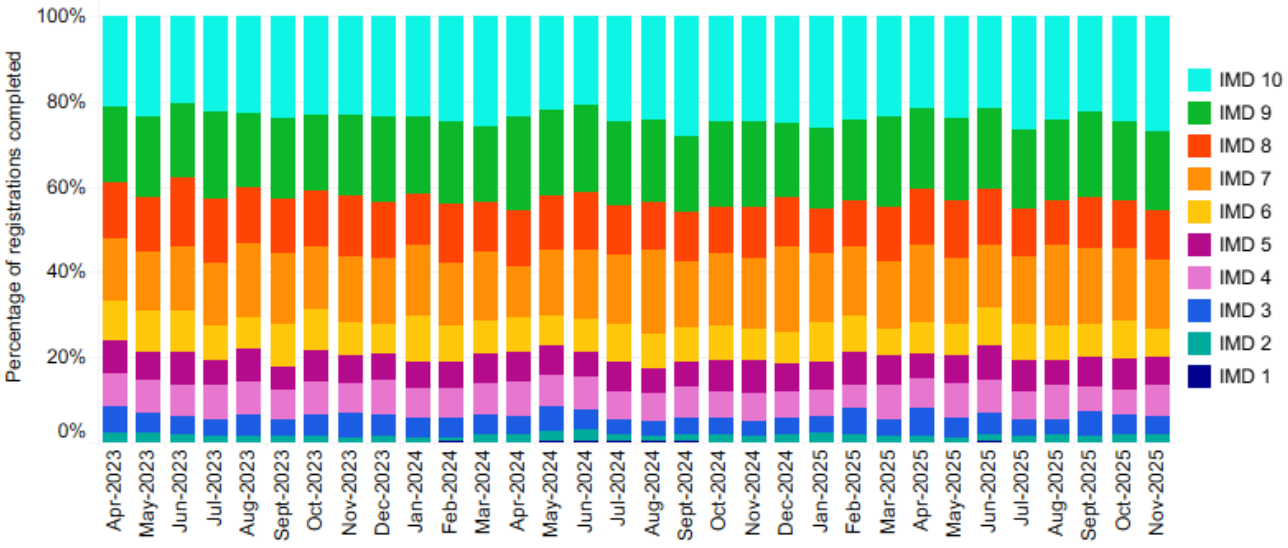

Figure 23: Percentages of total registrations by IMD, by month; Healthtech-1 adopters only.

Figure 24 displays the proportion of registrants in the post-intervention period living in IMD 1 and 2 areas by registration method. Here, the proportion of Core20 registrants in both

cohorts is small, however the proportion registering without using Healthtech-1 is over double the size of those registering with Healthtech-1 (2.56% versus 1.23%).

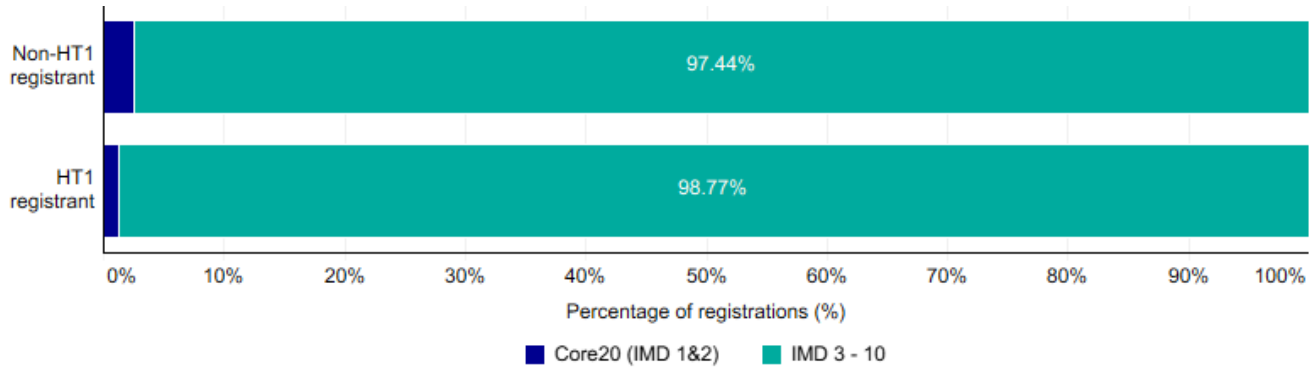

Figure 24: Proportion of registrants by IMD cohort and registration method; post-intervention period only.

Figure 25 also displays proportions of registrants by registration method in the post-intervention by IMD category. Here, Core20 individuals displayed a considerably lower proportion of registrations using Healthtech-1, compared to IMD 3 to 10 individuals (52.35% versus 69.83%).

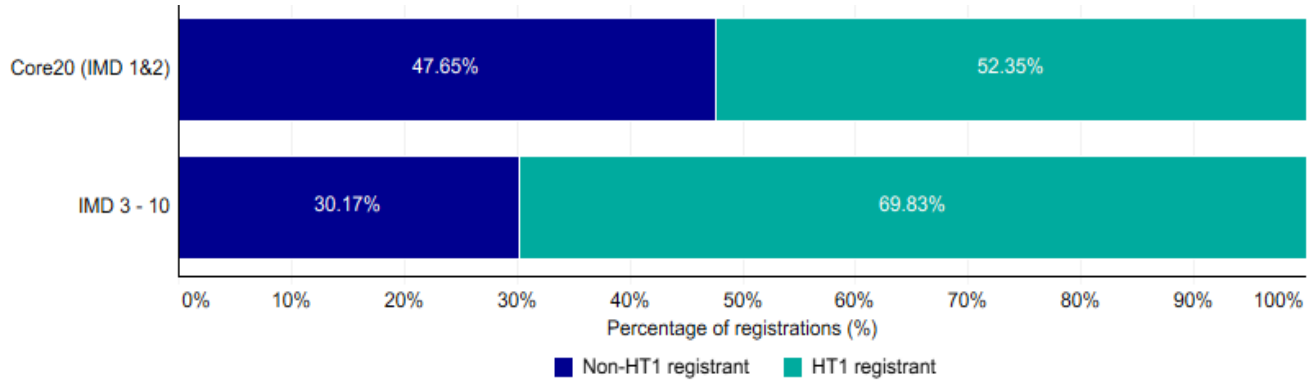

Figure 25: Proportion of registrants by IMD cohort and registration method; post-intervention period only.

Health economic modelling

Scenario 1: Selected GP practices in Surrey

Table 4 displays the health economic results for scenario 1, considering only Healthtech-1 adopter sites selected for inclusion within previous analyses. Each year within the five-year time horizon demonstrated higher benefits than costs, culminating in a five-year NPV of £198k and BCR of 1.48, meaning that £1.48 is returned in benefits for every £1 spent facilitating the adoption and ongoing usage of Healthtech-1 at these sites.

Table 4: Health economic results for scenario 1 - selected practices in Surrey. Note that figures have been rounded to the nearest £1k so may not sum correctly.

Scenario 1: Selected practices	Year 1 2025/26	Year 2 2026/27	Year 3 2027/28	Year 4 2028/29	Year 5 2029/30	5-year 2025/26-2029/30
Benefits						
Reduced admin time	£39k	£39k	£39k	£39k	£39k	**£196k**
Reduced A&E attendances	£1k	£1k	£1k	£1k	£1k	**£3k**
Total benefits	**£39k**	**£40k**	**£40k**	**£40k**	**£40k**	**£198k**
Costs						
Licensing costs	£26k	£27k	£27k	£27k	£27k	**£133k**
Training costs	£1k	£0k	£0k	£0k	£0k	**£1k**
Total costs	**£27k**	**£27k**	**£27k**	**£27k**	**£27k**	**£134k**
NPV and BCR						
NPV	£12k	£13k	£13k	£13k	£13k	**£65k**

Scenario 1: Selected practices	Year 1 2025/26	Year 2 2026/27	Year 3 2027/28	Year 4 2028/29	Year 5 2029/30	5-year 2025/26-2029/30
BCR	1.46	1.48	1.49	1.49	1.50	**1.48**

Scenario 2: All GP practices in Surrey

Table 5 displays health economic results for scenario 2, a hypothetical scenario exploring complete adoption of Healthtech-1 across all sites in Surrey. Each year within the five-year time horizon demonstrated higher benefits than costs, culminating in a five-year NPV of £287k and BCR of 1.48, meaning that £1.48 would be returned in benefits for every £1 spent facilitating the adoption and ongoing usage of Healthtech-1 across Surrey.

Table 5: Health economic results for scenario 2 - all practices in Surrey and Sussex. Note that figures have been rounded to the nearest £1k so may not sum correctly.

Scenario 2: All practices in Surrey	Year 1 2025/26	Year 2 2026/27	Year 3 2027/28	Year 4 2028/29	Year 5 2029/30	5-year 2025/26-2029/30
Benefits						
Reduced admin time	£173k	£174k	£175k	£175k	£175k	**£872k**
Reduced A&E attendances	£2k	£2k	£2k	£2k	£2k	**£12k**
Total benefits	**£176k**	**£177k**	**£177k**	**£177k**	**£177k**	**£884k**
Costs						
Licensing costs	£118k	£119k	£119k	£119k	£118k	**£593k**

Scenario 2: All practices in Surrey	Year 1 2025/26	Year 2 2026/27	Year 3 2027/28	Year 4 2028/29	Year 5 2029/30	5-year 2025/26-2029/30
Training costs	£3k	£0k	£0k	£0k	£0k	**£4k**
Total costs	**£121k**	**£119k**	**£119k**	**£119k**	**£119k**	**£597k**
NPV and BCR						
NPV	£54k	£57k	£58k	£58k	£59k	**£287k**
BCR	1.45	1.48	1.49	1.49	1.50	**1.48**

Scenario 3: All GP practices in Surrey and Sussex

Table 6 displays health economic results for scenario 3, a hypothetical scenario exploring complete adoption of Healthtech-1 across all sites in Surrey and Sussex. At the time of writing, NHS Surrey Heartlands ICB and NHS Sussex ICB are undergoing a merger that is set to be completed in April 2026 (NHS England, 2026). The purpose of this scenario was to explore the effect of improved bulk license pricing, where the unit cost of each license procured by the joint Surrey and Sussex ICB would be lower than if the two ICBs were to purchase licenses independently. Hence, this scenario begins in 2026/27 and spans four financial years. The increase in the benefit stream pertaining to reduced A&E attendances, compared to scenario 2, is driven by the fact that this scenario services an increased population and therefore a greater potential number of A&E attendances to be avoided.

Table 6: Health economic results for scenario 3 - all practices in Surrey and Sussex. Note that figures have been rounded to the nearest £1k so may not sum correctly.

Scenario 3: All practices in Surrey and Sussex	Year 1 2025/26	Year 2 2026/27	Year 3 2027/28	Year 4 2028/29	Year 5 2029/30	5-year 2025/26-2029/30
Benefits						
Reduced admin time	-	£456k	£457k	£458k	£458k	**£1,830k**
Reduced A&E attendances	-	£6k	£6k	£6k	£6k	**£25k**
Total benefits	**-**	**£463k**	**£464k**	**£464k**	**£465k**	**£1,855k**
Costs						
Licensing costs	-	£292k	£292k	£291k	£292k	**£1,165k**
Training costs	-	£8k	£1k	£1k	£1k	**£11k**
Total costs	**-**	**£300k**	**£292k**	**£292k**	**£291k**	**£1,176k**
NPV and BCR						
NPV	-	£162k	£171k	£172k	£173k	**£679k**
BCR	-	1.54	1.59	1.59	1.60	**1.58**

Each year within the four-year time horizon demonstrates higher benefits than costs, culminating in a four-year NPV of £679k and BCR of 1.58, meaning that £1.58 would be returned in benefits for every £1 spent facilitating the adoption and ongoing usage of Healthtech-1 across Surrey and Sussex.

Discussion

Quantitative analysis

Coding rates and completeness

Table 7 shows coding rates (COPD, hypertension, carer status, smoking cessation offering) and completeness rates (ethnicity, alcohol screening, smoking status) across various metrics, comparing Healthtech-1 registrants with non-Healthtech-1 registrants across two time periods. Besides COPD, Healthtech-1 registrants demonstrated a higher rate of coding rate or completeness than non-Healthtech-1 registrants, both in the same period and in the prior 24 months.

Table 7: Coding completeness rates of various metrics, comparing Healthtech-1 registrants with non-Healthtech-1 registrants.

Metric	April 2025 to November 2025		Prior 24 months
	Healthtech-1 registrants	Non-healthtech-1 registrants	Non-healthtech-1 registrants
Ethnicity	96.4%	23.8%	9.6%
COPD	0.4%	0.5%	0.4%
Hypertension	5.4%	5.0%	4.9%
Alcohol screening	75.9%	24.1%	21.9%
Carer status	3.2%	1.6%	1.5%
Smoking cessation offering	7.5%	2.4%	5.7%
Smoking status	25.2%	9.8%	15.6%

It is important to note that no information was available as to the true prevalence (that is to say, the prevalence of these metrics including among individuals who did not have these metrics recorded) of some of these metrics within the defined subpopulations. For example, while the coding recording rate of hypertension was higher among Healthtech-1 registrants than non-Healthtech-1 registrants in both time periods, it is possible for a sampling bias to exist whereby those registering using Healthtech-1 have a higher background prevalence of hypertension. This would mean that while a greater proportion of all registrants using Healthtech-1 had a hypertension code recorded upon registration, it cannot be known if Healthtech-1 generated a higher rate of coding completeness among those who had hypertension.

This caveat applies to COPD, hypertension, carer status, and smoking cessation offering; these metrics are only coded within EMIS in positive cases, that is to say, if the individual has COPD, hypertension, is a carer, or has been offered smoking cessation advice. Although these figures do not represent a definitive measure of underlying condition prevalence, Healthtech-1 enables the identification of patients with COPD and hypertension through derived signals. These signals surface individuals who may have relevant long-term conditions based on available records, supporting practices to proactively identify cohorts and take action. In turn, this facilitates more targeted follow-up and the delivery of proactive care for patients who may otherwise not be readily identifiable.

Conversely, this caveat does not apply to ethnicity, smoking status, or alcohol screening; all registrants necessarily have an ethnicity regardless of if it was recorded, and smoking status and alcohol screening codes also cover instances in which registrants do not smoke or drink alcohol at all, meaning these codes apply to 100% of registrants. In the cases of ethnicity, smoking status, and alcohol screening, the rates of coding completeness for these metrics among Healthtech-1 registrants far exceeds those of non-Healthtech-1 registrants within both time periods. Here, it can be safely concluded that Healthtech-1 leads to a higher rate of coding completeness upon registration for these metrics than the pre-existing registration form.

These findings have potential implications beyond the individual patient record, it may have potential benefits in the form of facilitating both patient-level and population-level targeted health interventions based on underlying risk and lifestyle factors. NHS England defines population health management as a data-driven approach to improving outcomes through segmentation, risk stratification, and targeted intervention, underpinned by the availability of accurate and standardised data (NHS England, 2023a). Improved structured coding of variables such as ethnicity, smoking status, alcohol use, and long-term conditions may therefore enhance the ability of practices, Primary Care Networks, and Integrated Care Systems to identify at-risk cohorts, monitor health inequalities, and deliver targeted preventative interventions. Empirical evidence supports the importance of coding completeness for population-level analytics; for example, primary care data quality underpins disease registers and prevalence estimates used in programmes such as the

Quality and Outcomes Framework. Additionally, large-scale linked dataset studies have demonstrated that incomplete recording of key demographic variables, such as ethnicity, can obscure population need and that linkage across datasets is often required to achieve sufficient completeness for robust analysis (OpenSAFELY Collaborative et al., 2024).

In order to form conclusions about the effectiveness of Healthtech-1 at improving coding completeness within COPD, hypertension, carer status, and smoking cessation offering, further research must be conducted in order to establish the true prevalence of these metrics within the sub-populations as defined by registration method and time period.

Registration speed and initial contact

Figure 13 displays average durations between notification of registration and confirmation of registration. All GP registrations must be submitted to PCSE for review, where it may be rejected if there is insufficient information in some fields. Within the post-intervention period at adopter sites, Healthtech-1 registrants had a shorter average time-to-confirmation than non-Healthtech-1 registrants. A possible reason behind this would be that Healthtech-1 completes patient profiles in a way that suits PCSE criteria at a higher rate than GP practice staff, however, this would not explain why non-Healthtech-1 registrants in the post-intervention period at non-adopter sites exhibited an even shorter time-to-confirmation. Future evaluations should seek to explore adjacent metrics (such as PCSE review success rates) in order to determine the cause for this pattern in the data.

Figure 14 displays average durations between registration and first appointment, by time period and registration method; Figure 16 shows the same, with all time-to-appointments longer than 14 days excluded. The exclusion threshold of 14 days was selected with the aim of including only individuals who registered at a new GP practice with the intention of booking an appointment, regardless of urgency.

In both Figure 14 and Figure 16, it can be seen that Healthtech-1 registrants demonstrated a longer average time-to-appointment than those who did not use Healthtech-1 to register at adopter sites. This would appear antithetical to the notion that Healthtech-1 would allow registrants to receive an appointment faster due to the ability to greater express the desire or need for an appointment, however there may be confounding variables that led to this pattern in the data.

One explanation is that individuals who do not register using Healthtech-1, and instead register in-person at the GP practice, have a greater propensity to use healthcare services or have a greater level of urgency for appointments (greater health-seeking behaviour). As explored earlier, age is a key factor influencing digital literacy, whereby older individuals are more likely to possess fewer digital skills (Holmes & Burgess, 2022) and are less likely to engage in digital avenues to accessing healthcare or managing health (Chowdhury et al., 2023). Simultaneously, age is negatively associated with self-reported health (Office for

National Statistics, 2023) and positively associated with healthcare utilisation (OECD, 2025). Hence, it is possible that those who eschew registering online, ergo not registering using Healthtech-1, have innately more urgent healthcare needs that are reflected in a shorter average time-to-appointment.

Another explanation is that Healthtech-1 allows GP practice staff to feel more comfortable in not booking relatively more urgent appointments due to knowing more about registrants. 'Defensive medicine' is the over-cautious management of patients, typically driven by uncertainty (Finucane et al., 2022), with common behaviours including increased follow-up and monitoring beyond what may be necessary (Zheng et al., 2023; Eftekhari et al., 2023). As Healthtech-1 increases the amount of information about a patient provided upon registration, it is possible that this leads to reduced uncertainty about new patients and improved confidence within GP practice staff to judge whether a registrant has urgent needs, leading to fewer urgent appointments being booked out of an abundance of caution. Should this be the case, it would represent a benefit generated by Healthtech-1 in the form of more confident decision-making on when to see new patients, and improved triage of clinical time, which itself may improve patient outcomes.

Both of these explanations are supported by the data presented in Table 3, which shows the percentage of registrants receiving an appointment within two days by registration method and adopter status. Here, the exclusion threshold of two days was selected with the aim of only including individuals seeking urgent appointments. Within this data, sites demonstrate almost equal values of this metric within the comparator periods (before Healthtech-1). In the post-intervention period, non-Healthtech-1 registrants at adopter sites demonstrated a considerably higher value for this metric than both non-Healthtech-1 registrants at non-adopter sites and Healthtech-1 registrants at adopter sites. This lends further credence to the above explanations; adopter sites were allocating their most short-term and urgent appointment slots to non-Healthtech-1 registrants, possibly due to either a sampling bias or a re-allocation of these appointments to patients where GP practice staff have greater levels of uncertainty.

A possible third explanation is that in-person registrations provide a more successful avenue for registrants seeking appointments, perhaps due to the option of being able to speak to GP practice staff directly. This would allow registrants to more fluently and expressively indicate a need for appointments to a member of staff, beyond the options available when registering online. It could be that this dynamic is actively recognised and exploited by the registrant to achieve an earlier appointment, or could be an incidental effect of registering in person that is not intentional on behalf of the registrant.

Health inequalities

Figure 22 displays counts of individuals living in IMD 1 and 2 areas registering at Healthtech-1 adopter sites. Similarly, Figure 23 shows percentages of total registrations by IMD by

month at adopter sites. Neither visualisation showed a discernible difference between the pre-intervention periods and the post-intervention period in their respective metrics, with counts and proportions of IMD 1 and 2 registrants remaining consistent.

Superficially, this is to be expected as Healthtech-1 has no inherent mechanism to encourage primary care registration among more deprived communities, and its implementation did not coincide with any auxiliary efforts to do so. Despite this, considering that digital literacy is negatively associated with deprivation (Holmes & Burgess, 2022), and that the Healthtech-1 local form adds an increased digital burden to those registering online, it would have been reasonable to expect that the introduction of Healthtch-1 may have led to fewer registrations among the IMD 1 and 2 cohort. Hence, it may be positively concluded that Healthtech-1 did not add to the digital burden of registering online, and that its implementation did not dissuade individuals in the IMD 1 and 2 cohort from registering. However, the small sample size of this cohort at the selected sites (and indeed across Surrey) prevents these conclusions from being made with a reasonable level of confidence, and such hypotheses are more suited to being analysed through qualitative means in the future.

Health economic analysis

Table 4 and Table 5 display health economic results for scenario 1 (selected sites) and scenario 2 (all sites in Surrey) respectively. Both scenarios had an identical five-year BCR of 1.48: this was to be expected, as there was no difference modelled between the two scenarios in terms of per-patient or per-site cost or benefit. Most notably, all sites in both scenarios were modelled as paying the same price per patient for Healthtech-1; this was the main point of difference between these two scenarios and scenario 3 (Table 6), which was modelled to incur a lower per-patient price by accessing a higher tier of bulk pricing.

The per-patient price in scenarios 1 and 2 was taken to be £1.60, with this variable being £1.50 in scenario 3, leading the final BCR to increase from 1.48 to 1.58; this figure could reasonably be expected to be even higher in the case of a five-year time horizon (rather than four, as was modelled for scenario 3) due to training costs being overwhelmingly front-loaded into the first year of implementation whereas both benefit streams remained relatively constant. The observation that a reduction in price-per-patient of £0.10 (6.3%) resulted in an improvement in BCR of 0.10 (6.8%) demonstrates that the net value potentially returned to the NHS was particularly sensitive to the per-patient price of Healthtech-1.

This is further supported by the observation that the proportion of total cost occupied by licensing costs was 99.5%, 99.2%, and 99.1% across the three scenarios respectively. Similarly, the proportion of total benefit occupied by reductions in administrator time

completing registrations exceeded 98% across all three scenarios. While there exist a number of unmodelled benefits (presented in Unmodelled benefits in section 0) that, if they were possible to include within the health economic analysis, would reasonably have diversified the base of benefits, these figures demonstrate that the net value returned to the NHS was sensitive to the amount of time that Healthtech-1 saves GP practice staff completing registrations.

Similarly, it is important to note when discussing administrator time-saving benefits that in this instance, Healthtech-1 routinely captures a wider range of structured data elements that are not typically captured in the traditional registration process. Hence, when considering the potential unmodelled benefits relating to improved SNOMED coding upon registration, there is a hidden benefit; if humans were to be capturing all of the data fields that Healthtech-1 does, the time taken to complete a registration would be significantly longer. Hence, while Healthtech-1 provides monetisable benefit through automating existing real-world registration processes, it saves additional time versus a scenario wherein a human would be inputting the same breadth of data as Healthtech-1 does.

Table 8 displays health economic indicator results for each scenario, including sensitivity analysis results. Scenarios 1 and 2 exhibited BCRs of approximately 1.5, indicating that the economic return on investment in these scenarios surpasses the break-even point. As discussed, scenario 3 exhibited a higher BCR resulting from the assumption of being able to access a more advantageous unit price for Healthtech-1 registration licenses. Beyond the observation made previously that unmodelled benefits would diversify the base of economic benefits provided by Healthtech-1, they would also increase the total benefits generated in each scenario, ergo, increase the NPV and BCR in each scenario.

Table 8: Health economic indicator results for each scenario, including sensitivity analysis results.

Scenario	5-year NPV *(90% CI)*	5-year BCR *(90% CI)*
Scenario 1: Selected sites	£65k *(£42.5k to £88.3k)*	1.48 *(1.31 to 1.68)*
Scenario 2: All sites in Surrey	£287k *(£190.0k to £390.0k)*	1.48 *(1.31 to 1.67)*
Scenario 3: All sites in Surrey and Sussex	£679k *(£480.5k to £894.7k)*	1.58 *(1.40 to 1.78)*

Two unmodelled quality of life-related benefits were discussed:

- A short-term improvement stemming from a possible reduction in time spent waiting for an appointment in which the individual may be anxious.
- A long-term improvement in quality of life resulting either from having medical needs addressed faster or being targeted for intervention by profiling efforts within the GP practice or ICB.

Short-term quality of life improvements would be unlikely to generate considerable monetisable benefit due to the short timeframe in which they would manifest and the relatively small impact that would be had upon the individual's health-related quality of life (HRQoL), that can range from 0 (death) to 1 (best conceivable health state). For example, at a QALY price of £25,000 (The National Institute for Health and Care Excellence, 2025), if anxiety applied a flat HRQoL penalty of 0.1 and a patient were to receive an appointment two days sooner, a benefit of £10.96 would be generated. Furthermore, this benefit would only be applied to patients who do experience anxiety while waiting for an appointment, and do receive an earlier appointment due to Healthtech-1.

Long-term quality of life improvements would likely generate greater monetisable benefit, as such improvements in HRQoL would manifest over a far longer time period, and perhaps also extend the lifespan individuals affected. Despite this, additional costs would be incurred in facilitating these benefits, such as the time cost of clinicians and practice staff identifying and co-ordinating interventions, as well as the cost of delivering these additional interventions (as both time costs and material costs). Here, the theoretical value generated by Healthtech-1 in facilitating such efforts is necessarily tied to the cost-effectiveness of the interventions being delivered, which may vary considerably depending on target cohort, disease area, and time horizon. For example, targeted prostate cancer screening has been modelled to generate QALY benefits at a rate below the NICE cost-effectiveness threshold (Prostate Cancer Research, 2025), some public health interventions such as smoking cessation have been modelled to be cost-saving (Masters et al., 2017), and ovarian cancer screening has been modelled to not be cost-effective (Kearns et al., 2016). Furthermore, the monetisable benefit of these interventions is likely to manifest considerably far in the future, beyond the 5-year time horizon utilised within the cost-benefit analysis, due to the nature of such programs being preventative or targeting chronic conditions rather than acute health events.

Besides cases where improved coding may lead to tertiary health initiatives such as through population health management, improved and standardised coding quality would reduce downstream effects of human error in the registration process. Manual registration is prone to small transcription errors, such as single incorrect characters within telephone numbers or email addresses; these may silently undermine efforts to make contact, preventing appointment reminders, recalls, or follow-up messages from reaching patients, in turn increasing did-not-attends and delaying care. Furthermore, unintentional data loss through

forgetting to input, for example, a patient's BMI, smoking history, language or contact preferences would further compound delays in care. The effect of Healthtech-1 in reducing such errors would be difficult to quantify, but nonetheless significant. Instances of these errors would be made more common in cases where administrators are operating under time pressures, such as when a patient is waiting at the desk or calling in – here, the administrator may prioritise speed over completeness of entry, leading to errors and data gaps.

It must be noted that quality of life-related benefits would return a different kind of benefit; while still presentable in monetary terms, such benefits do not represent a cash-related benefit as with reducing administrator time completing registrations, rather, a social benefit would be returned that does not represent an immediate and direct monetary efficiency benefit to the healthcare system, but one that may have an impact upon the population further in the future.

Such a stipulation is not applicable to unmodelled benefits concerning a reduction in secondary care activity. The mechanism for this benefit is closely linked to that of the long-term quality of life-related benefits discussed above – Healthtech-1 may facilitate earlier, more widespread, and more effective preventative and early care within primary care settings, improving the management of individuals with health conditions that may deteriorate with time, and would have otherwise caused more significant or acute health crises requiring attention in secondary care. Secondary care contacts are typically more expensive than primary care contacts on account of the heightened intrusion and comprehensiveness in care that is necessitated by more severe health states or events, hence substitution of such activity with primary care activity could lead to improved monetary efficiency in the healthcare system. Again, the true value generated by Healthtech-1 in this regard is necessarily tied to the value generated in the cases of individual interventions, which may vary considerably, as discussed previously.

Conclusion

Overall, Healthtech-1 was shown to improve SNOMED coding completeness rates upon registration for ethnicity, alcohol screening activity, and smoking status, when compared to the pre-existing registration process; while similar trends in data existed for hypertension, smoking cessation offering, and carer status, a lack of data on underlying prevalence in sub-populations prevented such a conclusion from being made regarding these metrics.

Healthtech-1 registrants displayed longer times-to-intervention across first appointment and first prescription relative to non-Healthtech-1 registrants at adopter sites – this was theorised as being the result of sampling biases whereby non-Healthtech-1 registrants are predisposed to having a greater level of urgency (that can also be expressed more effectively when registering in person), compounded by the improved level of information about Healthtech-1 registrants reducing unnecessary 'defensive medicine' behaviours among practice staff. Conversely, Healthtech-1 adopter sites were observed to provide a greater proportion of appointments within two days of registering than non-adopter sites within the post-intervention period, which was modelled to lead to a reduction in A&E attendances. Healthtech-1 registrants were also observed to have a shorter time-to-registration than non-Healthtech-1 registrants at adopter sites, but longer times-to-registration than registrants at non-adopter sites – future evaluations should seek to identify the cause for this by exploring alternative metrics, such as PCSE review success rates.

No trends could be observed regarding the effect of Healthtech-1 on registration rates among cohorts identified as part of health inequalities analyses, including ethnic minority groups and individuals residing in Core20 areas. This may be seen as a positive result when considering the additional digital burden created by the local form when registering. Core20 individuals were seen to utilise Healthtech-1 at lower rates than non-Core20 individuals, however this group may be more predisposed to register in person due to lower rates of digital literacy and access to technology.

Healthtech-1 was estimated to result in positive NPVs and BCRs over a five-year time horizon in every scenario modelled, starting at a BCR of 1.48 for scenarios 1 and 2, and increasing to a BCR of 1.58 for scenario 3. The overwhelming majority of monetary benefits was comprised of administrative time savings, while the overwhelming majority of costs was comprised of license fees – the total value returned to the budget holder, and whether it is positive or negative, is highly sensitive to changes within these two variables. With current pricing structures, NHS organisations would benefit greatly from co-ordinating license purchases across users in order to maximise cost reductions from larger bulk pricing options. Additionally, the long-term total benefit of adopting Healthtech-1 could be assumed to be greater than health economic results shown due to a number of plausible benefits that could not be included within the cost-benefit analysis due to data availability issues. These primarily include improved length and quality of life stemming from earlier, broader, and

more comprehensive interventions being facilitated, as well as reductions in secondary care activity as a result of improved proactive health management within primary care.

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Appendices

Appendix A: Logic model

Figure 26 contains a simplified version of the theory of change that emerged from the logic modelling workshop; some elements have been omitted for brevity. The intention of Healthtech-1 is for patients to complete the additional, customisable 'local form' when registering, in which the patient provides key information relating to health inequalities they may experience, wider determinants of health, and intentions and desires upon registering, among others. This information is processed in combination with the standard GP registration form by the Healthtech-1 platform in automatically creating patient profiles, bypassing the need for administrators to manually input data and assigning a wider and more complete range of SNOMED codes to the patients.

Upon registration, the platform may emit 'signals' for GP practice staff to address if a patient provides information indicating they may need specific consideration (the criteria for which are customisable by the practice), aiding in proactive care and the provision of reasonable adjustments. These outcomes are proposed to lead to the long-term benefits of cost savings via automation of registration processes, improved patient outcomes, and a reduction in health events requiring attention in secondary care.

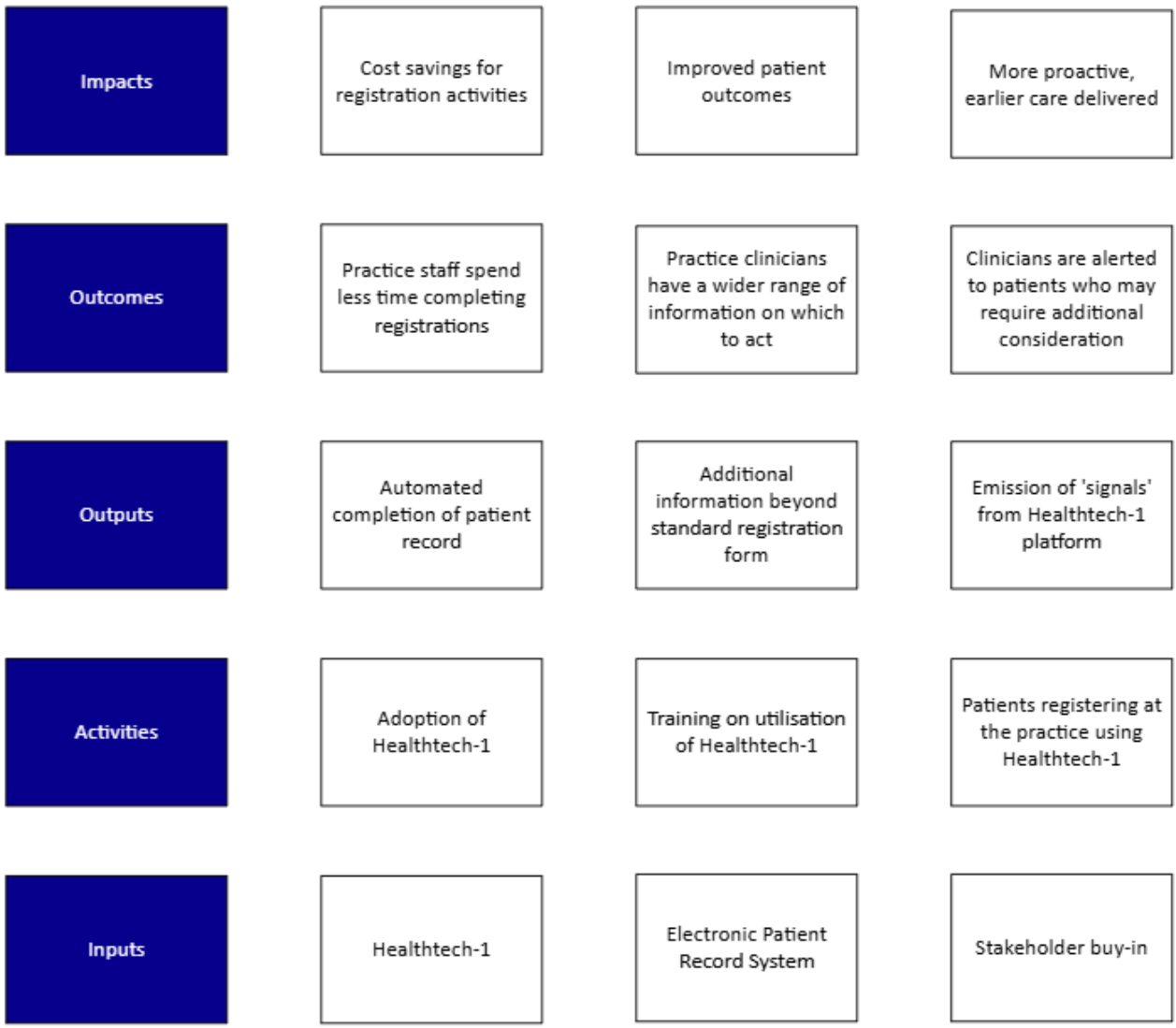

Figure 26: Simplified theory of change for Healthtech-1.

Additional benefits were identified for individuals experiencing health inequalities. The local form inquires upon a range of factors and characteristics that may inform or impact care, such as religion, sexual orientation, main spoken language and others. The provision of this information to the practice allows for adjustments in care to be made, allowing for a more individualised healthcare experience. Another benefit identified was for transient communities; individuals of no fixed abode may be more likely to need to access care in a variety of locations across the country. The ability of Healthtech-1 to automate registrations (and potentially have a lower rate of rejection upon PCSE review) has the proposed benefit of reducing the delay between application and registration, allowing such individuals to more freely and rapidly access care.

Appendix B: Quantitative results continued

This appendix contains supplementary results for sites in Sussex for which data could be acquired. In total, three sites within Sussex were able to provide data to Unity Insights for analysis, all three of which are Healthtech-1 adopter sites; any conclusions drawn from the data should be caveated with the limitation of small sample size. The time period for analysis was restricted to begin in April 2025, in accordance with the approach taken for the Surrey sites analysed.

Registrations

Figure 27 shows registrations at Sussex adopter sites after 1st April 2025. Until the 30th November 2025, there were 2,505 registrations, of which 56.8% (n = 1,423) utilised Healthtech-1. This is slightly lower than the proportion registering with Healthtech-1 at adopter sites in Surrey (69.4%; Figure 5). One of the sites included within this dataset has a high student population, which explains the spike in registrations in September and October, in line with the start of the academic year.

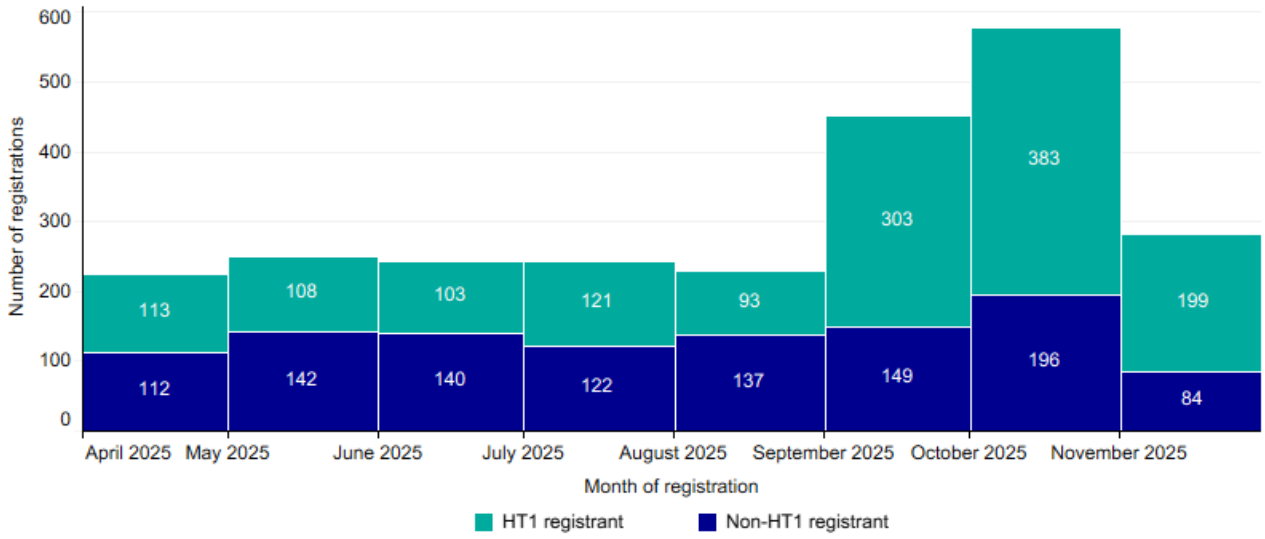

Figure 27: Registrations at Sussex sites.

Registration speed and initial contact

FIRST APPOINTMENT

Figure 28 displays average durations between registration and first appointment, by timer period, Healthtech-1 adopter status, and Healthtech-1 registrant status, including Sussex sites. A similar pattern in post-intervention period data can be observed between Sussex adopter sites and Surrey adopter sites – Healthtech-1 registrants demonstrated longer times-to-appointment than non-Healthtech-1 registrants.

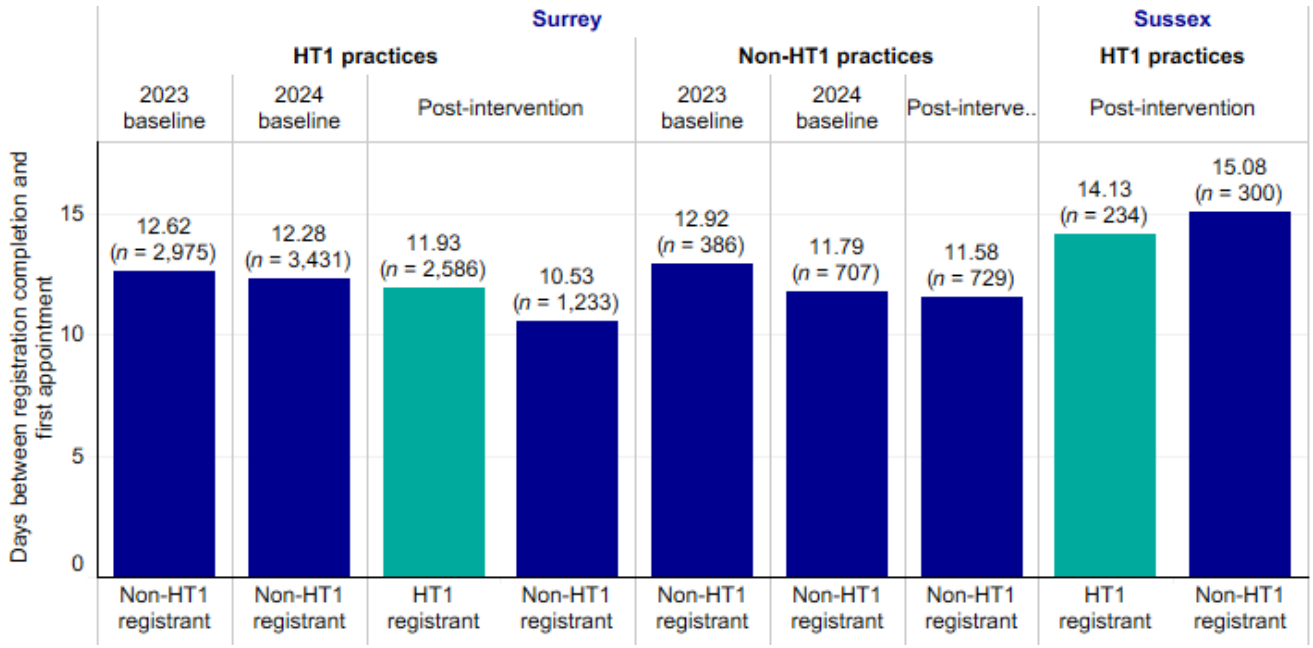

Figure 28: Average duration between registration and first appointment; Sussex sites included, maximum wait of 30 days.

Figure 29 displays the same data as before, but with times-to-appointment of greater than 14 days excluded. Again, similarities between Surrey adopters and Sussex adopters may be observed, in which Healthtech-1 registrants demonstrated a longer average time-to-appointment than non-Healthtech-1 registrants.

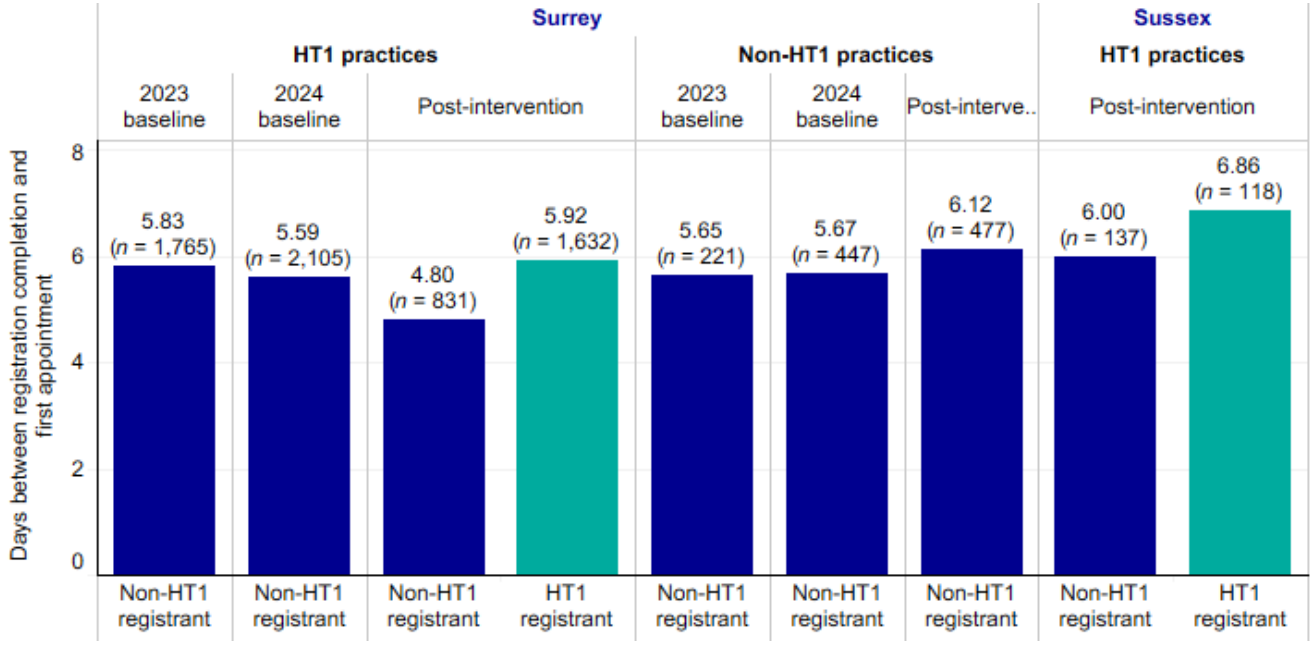

Figure 29: Average duration between registration and first appointment; Sussex sites included, maximum wait of 14 days.

FIRST PRESCRIPTION

Figure 30 displays average durations between registration and first prescription. Here, Healthtech-1 registrants demonstrate slightly shorter time-to-prescription than non-Healthtech-1 registrants at adopter sites, contrasting with the pattern observed with Surrey.

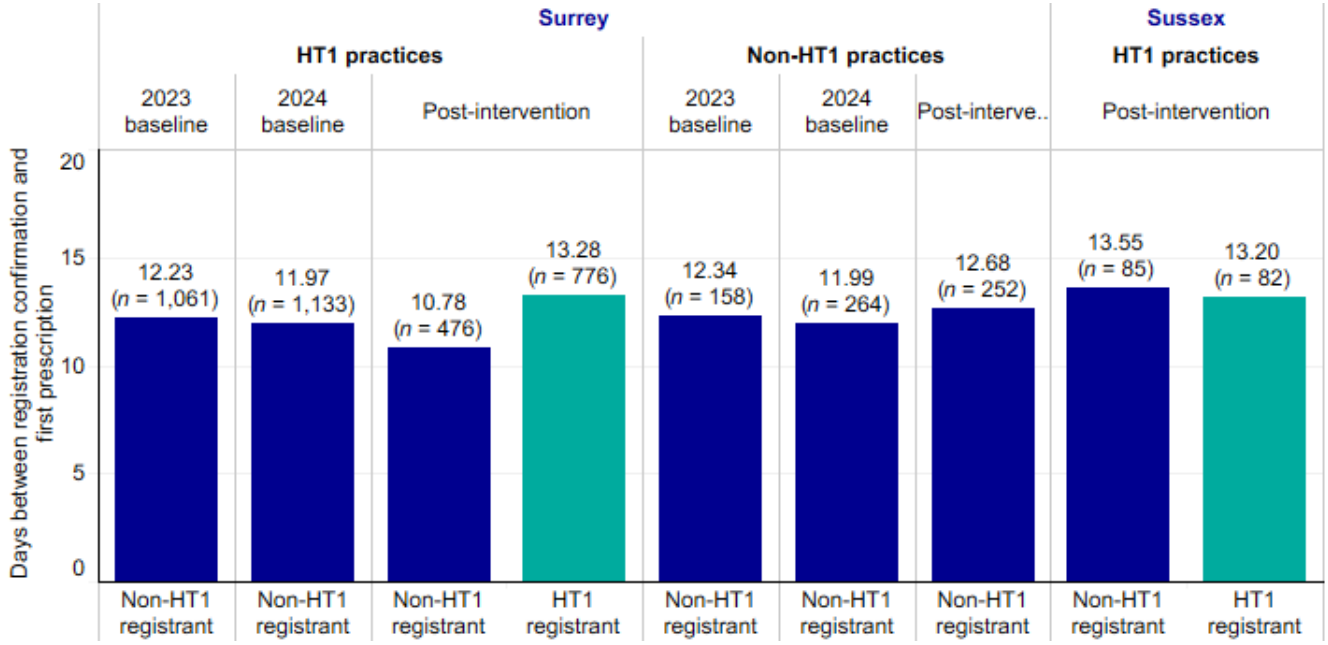

Figure 30: Average duration between registration and first prescription; Sussex sites included, maximum wait of 30 days.

Appendix C: Health economic optimism bias application

Table 9: Unity Insights' optimism bias confidence grades.

			Data Source									
	Confidence grade		Formal service delivery contract costs		Practitioner monitored costs		Costs developed from ready reckoners		Costs from similar interventions elsewhere		Cost from uncorroborated expert judgement	
			Figures derived from local stats / RCT trials		Figures based on national analysis in similar areas		Figures based on generic national analysis		Figures based on international analysis			
			1		2		3		4		5	
Age of Data	< 2 Years	1	1.1	0%	2.1	10%	3.1	15%	4.1	25%	5.1	40%
	2 - 3 Years	2	1.2	5%	2.2	10%	3.2	15%	4.2	25%	5.2	45%
	3 - 5 Years	3	1.3	10%	2.3	15%	3.3	20%	4.3	30%	5.3	50%
	5 - 10 Years	4	1.4	15%	2.4	25%	3.4	30%	4.4	40%	5.4	55%
	> 10 Years	5	1.5	25%	2.5	30%	3.5	40%	4.5	50%	5.5	60%

Appendix D: Health economic sensitivity analysis methodology

The below represents an example of how the Monte Carlo sensitivity analysis is run. Please note all figures used in this example do not represent actual Healthtech-1 outcomes.

Step One: Allocation of ranges

Variables of interest are given base-case values (or mean estimates), and an expected range. The range given to each assumption is dependent on the confidence grading applied seen in Table 10.

Table 10: Unity Insights' sensitivity confidence grades.

			Data Source									
	Confidence grade		Formal service delivery contract costs		Practitioner monitored costs		Costs developed from ready reckoners		Costs from similar interventions elsewhere		Cost from uncorroborated expert judgement	
			Figures derived from local stats / RCT trials		Figures based on national analysis in similar areas		Figures based on generic national analysis		Figures based on international analysis			
			1		2		3		4		5	
Age of Data	< 2 Years	1	1.1	10%	2.1	10%	3.1	15%	4.1	20%	5.1	25%
	2 - 3 Years	2	1.2	10%	2.2	15%	3.2	20%	4.2	25%	5.2	25%
	3 - 5 Years	3	1.3	15%	2.3	20%	3.3	25%	4.3	25%	5.3	30%
	5 - 10 Years	4	1.4	20%	2.4	25%	3.4	25%	4.4	30%	5.4	35%
	> 10 Years	5	1.5	25%	2.5	25%	3.5	30%	4.5	35%	5.5	40%

The example in Table 11 demonstrates the quality-of-life adjustment factor and life expectancy.

Table 11: Example of a sensitivity range allocation.

Variable	Sensitivity Grading	Range Applied	Lower range estimate	Base-case / mean estimate	Upper range estimate
Quality of life adjustment factor	2.4	+/- 25%	0.420	0.565	0.70
Life expectancy (years)	**4.4**	**+/- 30%**	**4.41**	**6.30**	**8.19**

Step Two: Allocation of a distribution shape

All data has a shape to its distribution. If there is equal likelihood of any value within a range being drawn, then a rectangular distribution can be used (so called because a graph of the probability of any specific value being drawn would appear to be a rectangle). If there is a lower likelihood of a value at the extreme ends of the range being drawn, then a triangular distribution could be used.

If there is reason to believe the distribution meets the statistical qualities required to be defined as normal, Poisson, etc, then these can be applied. In this study, we have generally applied triangular distributions as this best reflects the ranges used and diminishing probabilities of more extreme ends. Where a different distribution has been used, it is expressly noted in the text.

Step Three: Random selection of values within the range

The model selects at random a value for each variable from within the range between the upper and lower estimate and calculates the outcome from each draw, considering the distribution shape selected and therefore the probability of any value being drawn.

Step Four: Repetition

Five draws are given in Table 12, using a rectangular distribution. These deliver estimates lying between £40,500 and £105,000. The draw is repeated thousands of times. In this evaluation we use 10,000 runs as standard.

Table 12: Example of random variation within the Monte Carlo simulation.

Variable	Draw 1	Draw 2	Draw 3	Draw 4	Draw 5
Quality of life adjustment factor	0.45	0.50	0.55	0.60	0.70
Life expectancy (years)	4.5	5.0	5.5	6.0	7.5
Quality of Life Year monetary value	£20,000	£20,000	£20,000	£20,000	£20,000
Benefit (lives saved * value of lives saved)	£40,500	£50,000	£60,500	£72,000	£105,000

Creating 10,000 estimates allows the creation of a distribution of possible outcomes from the draws made. From this distribution we can then compute the range within which we expect 90% of the observations from the draws to fall. This is called the 90% confidence interval, illustrated in Figure 31.

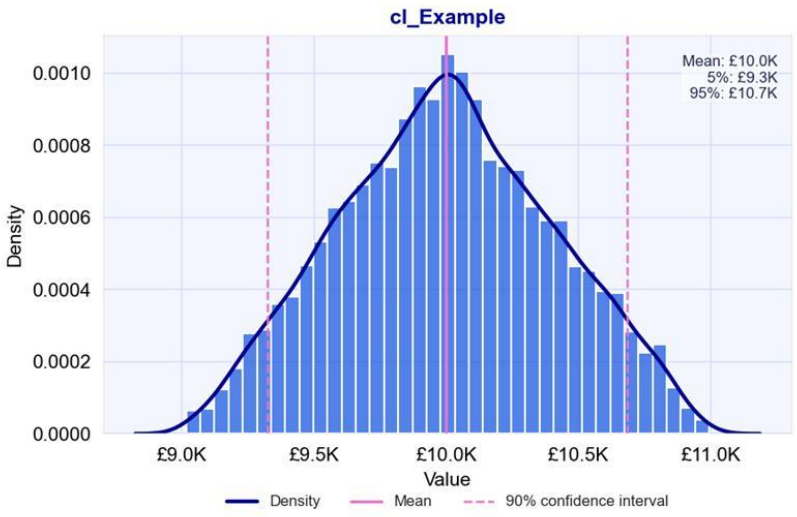

Figure 31: Illustration of sensitivity analysis.

The source for many of the data inputs in the model may also include a confidence interval, such as if the source is an academic study. In these cases, the confidence interval from the data source is used to provide the maximum and minimum ranges for the data input in the sensitivity analysis. Where no confidence interval is provided, the quality of the data is graded in a similar way to optimism bias to express the degree of certainty that Unity Insights has in the estimates.

Appendix E: Health economic sensitivity analysis results

Scenario 1: Selected sites

Figure 32 displays NPV sensitivity analysis results for scenario 1. A mean NPV of £65.0k was identified, with a 90% confidence interval of £42.5k to £88.3k.

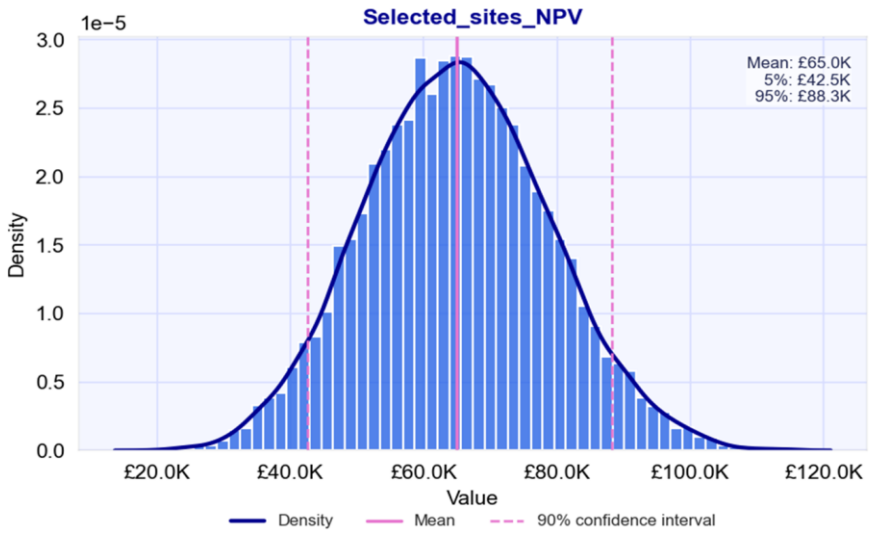

Figure 32: NPV sensitivity analysis results for scenario 1.

Figure 33 displays BCR sensitivity analysis results for scenario 1. A mean BCR of 1.49 was identified, with a 90% confidence interval of 1.31 to 1.68.

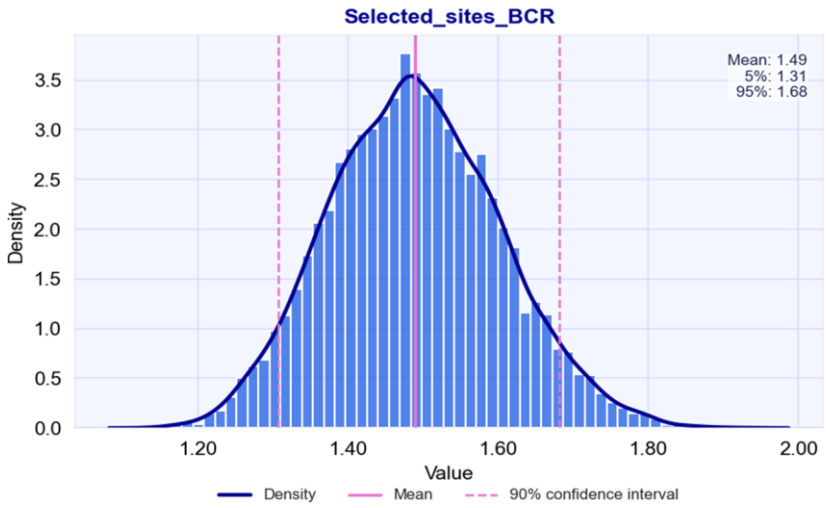

Figure 33: BCR sensitivity analysis results for scenario 1.

Scenario 2: All GP practices in Surrey

Figure 34 displays NPV sensitivity analysis results for scenario 2. A mean NPV of £288.2k was identified, with a 90% confidence interval of £190.0k to £390.0k

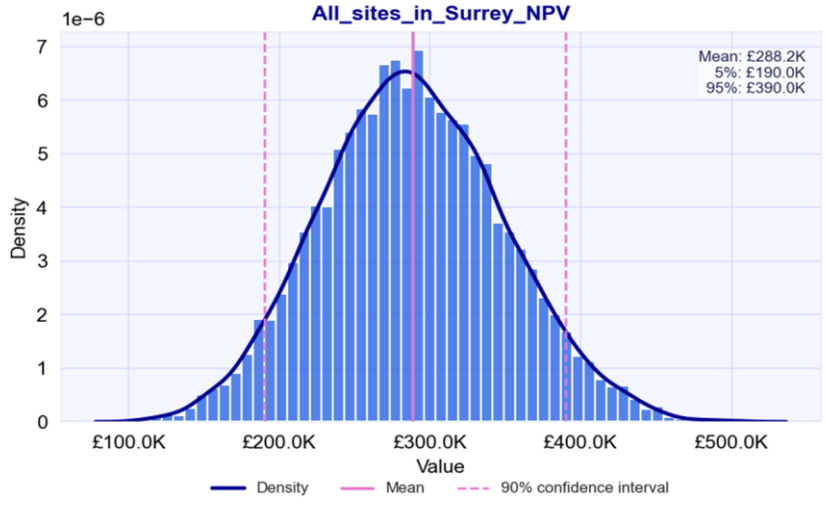

Figure 34: NPV sensitivity analysis results for scenario 2.

Figure 35 displays BCR sensitivity analysis results for scenario 2. A mean BCR of 1.49 was identified, with a 90% confidence interval of 1.31 to 1.67.

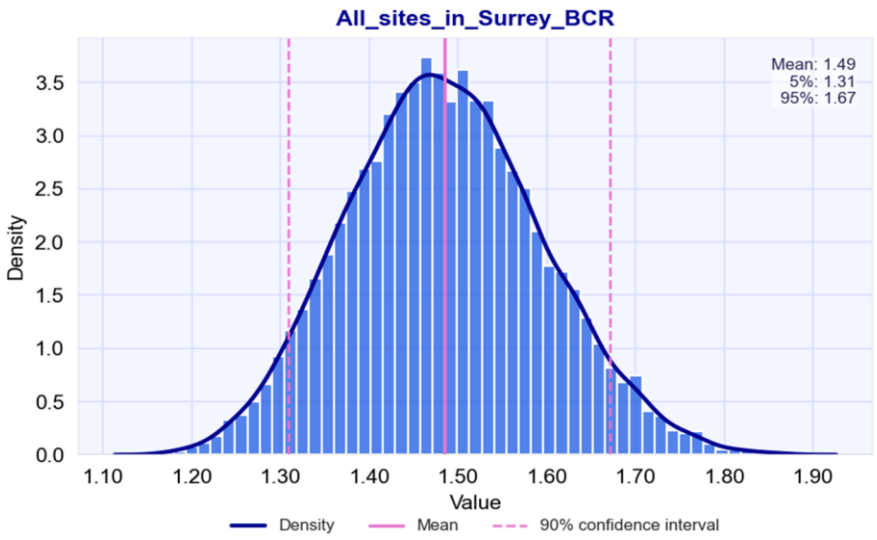

Figure 35: BCR sensitivity analysis results for scenario 2.

Scenario 3: All GP practices in Surrey and Sussex

Figure 36 displays NPV sensitivity analysis results for scenario 3. A mean NPV of £682.4k was identified, with a 90% confidence interval of £480.5k to £894.7k.

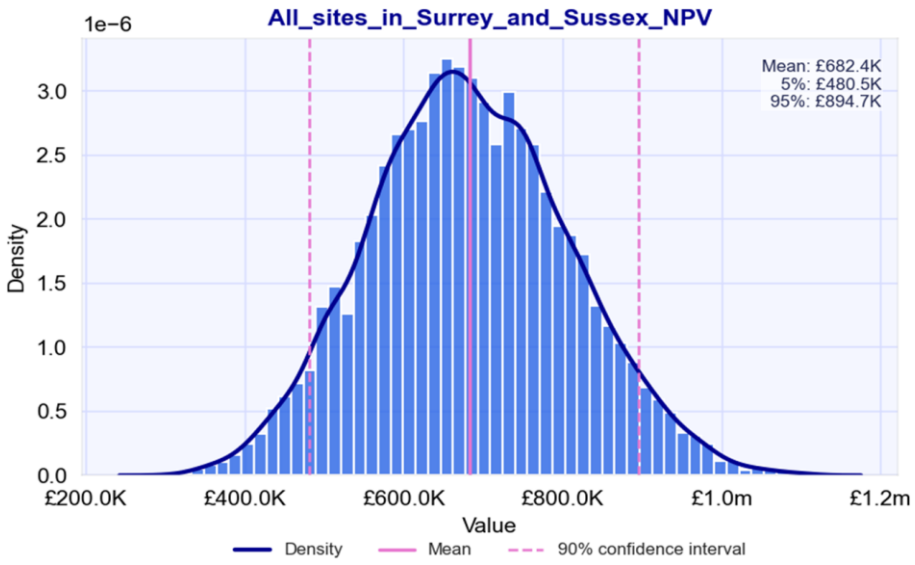

Figure 36: NPV sensitivity analysis results for scenario 3.

Figure 37 displays BCR sensitivity analysis results for scenario 3. A mean BCR of 1.58 was identified, with a 90% confidence interval of 1.40 to 1.78.

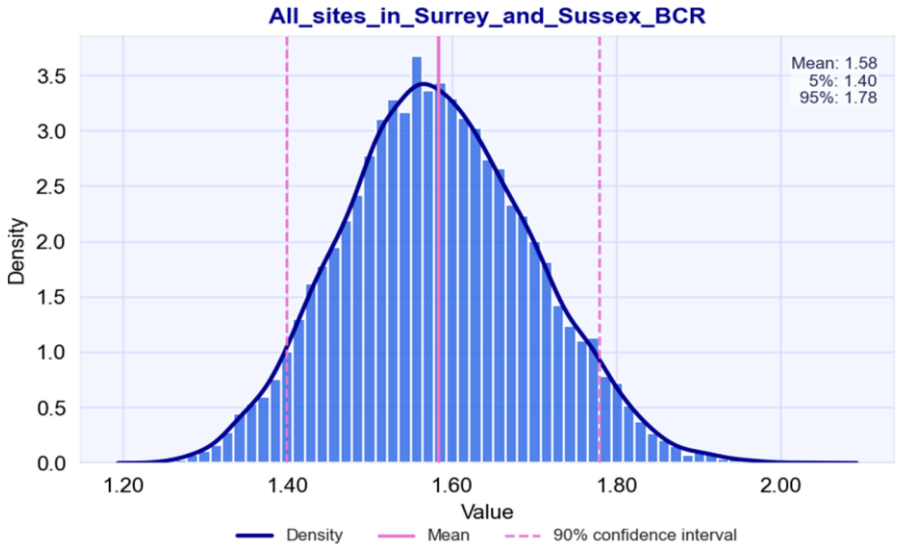

Figure 37: BCR sensitivity analysis results for scenario 3.