Economic Analysis of Digital Health Infrastructure:

The Case of OneLondon's Impact on Time Efficiency and Safety in Healthcare Services

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ONE LONDON

LONDON CARE RECORD

In 2018 London's health and care partnerships came together through OneLondon to join up patient information across the Capital to support fast, safe and effective care. In 2020 the London Care Record was introduced.

The London Care Record is a secure way to share patient information with health and care professionals across the Capital so they have the information they need at the point of care to inform their clinical decision making. This is particularly important given that around 30% of Londoners are treated outside the area they live in.

Pan-London sharing of information began with nine hospitals followed by GP surgeries and other settings, and in 2021 we joined up with some of our neighbours due to the high patient flows with these areas. More connections continue to be made all the time including the first care homes and the first Mental Health Trust.

In total the London Care Record has been used almost 40 million times by health and care staff. That is 40 million moments of care that have been supported by staff having the information they need when they need it.

I would like to pay tribute to the hard work of everyone across the OneLondon Partnership in making this happen. Day in day out we hear positive examples of how the London Care Record is making a positive difference to the care Londoners receive. This includes supporting safe prescribing of medications, quicker hospital discharges and helping staff spend more time with patients. It is great that some of these stories are included in this report.

While it is clear that the London Care Record has become a vital tool for health and care staff across the Capital and beyond, we all want to maximise its positive impact so it is crucial we use every opportunity to evaluate its use.

That is why OneLondon commissioned Queen's University Belfast to undertake an independent economic evaluation of the London Care Record to quantify some of these benefits. This is intended to help our partners assess the value their investment in the London Care Record delivers for the communities they serve.

I am grateful to them for their detailed study that shows the London Care Record has saved health and care professionals' time of up to a value of £44.4 million.

While further analysis is needed in some areas these findings already demonstrate that the London Care Record is an essential and 'must have' tool for our frontline staff that genuinely supports more effective, safer and quicker care. Based on this report I am confident that the London Care Record will continue to play a central role in health and care for many years to come.

Luke Readman
Director of Digital Transformation
NHS England (London)

Background

Digital information technology (IT) plays a pivotal yet often unrecognised role in health service operations and constitutes a fundamental element of healthcare infrastructure. While certain aspects of health delivery such as bed capacity and staffing attract more extensive political discussions, IT remains indispensable for modern healthcare systems.

According to the recent British Medical Association (BMA) report[1], the integration of 'high-quality patient information, fully functioning technology, and interoperable systems can improve patient care, access, experience, increase productivity and transform the working lives of healthcare staff'.

The criticality of IT in facilitating communication, ensuring patient safety, and governing health delivery processes was highlighted during the targeted criminal cyber-attack on the Irish health system in 2021. This attack forced healthcare staff to revert to paper-based systems, leading to an 80% reduction in appointments in some areas in the immediate aftermath of the attack[2]. Additionally, there are significant consequences due to delays arising from 'inadequate or malfunctioning IT systems and equipment,' resulting in approximately 13.5 million hours of doctors' time lost annually in England. This loss is equivalent to the workload of approximately 8,000 full-time doctors or around £1 billion in costs[1].

Historical iterative adoption of administrative IT systems in both hospital and GP practices to provide laboratory, radiology and pharmacy systems and electronic records were siloed and not in line with current best practice moves where users require integrated electronic patient records. Clinical teams need systems to have effective interoperability to ensure functional, timely access across the range of practice settings.

EFFICIENCY – ASSESSMENT

"My admin team will check if blood tests have been completed. This saves more phone calls, more checking and gives the team and the patient confidence if things are going through ok."

GP, Hertfordshire and West Essex

To address this issue, a shift towards integrated electronic health records is essential to improve the overall quality of patient care and streamline healthcare processes to effectively collate information with which to assess and plan care and inform effective and timely decisions.

Indeed, decisions can vary substantially based on how information is received, perceived, and understood. Evidence shows that increased framing effects under time pressure arise from a fast, intuitive system[3], whereby the layout and construct of information can drive improvements. As such, making the right information available to health and care professionals at the right time should more effectively manage risk[4], save lives[5] and improve care[6].

The 'Plan for digital health and social care' identified that 'the long-term sustainability of health and social care is dependent on having the right digital foundations in place, and so digital transformation must be the linchpin upon which all of these reforms are based'[7]. Specifically, the BMA report recommendations suggested that it was necessary to 'improve interoperability to facilitate data sharing across health care systems, particularly the primary-secondary care interface'[1]. Consequently, the efforts of the OneLondon initiative have never been more pertinent[8].

The mission of OneLondon is to join up health and care information across the Capital to support safer, more effective care for patients. Based on user needs through the London Care Record, the OneLondon programme provides connected information across health and social care settings[9]. This integrated access supports the delivery of more effective services in medicines management and care planning, and at its most fundamental level, promotes effective communication.

Whilst there is strong clinician support for digital access to patients' medical history at and during decision-making and care planning[10], providing estimates of the value of such digital developments is complex.

Early feedback from London Care Record users showed that 'saved time' is the key message along with avoiding duplication and repeat visits. Downstream actions, such as 'chasing tests' or indeed repeating tests which contemporaneously appear unavailable or are assumed to be lost or not yet done, can be avoided with the result that other stakeholders no longer need to re-perform actions. Moreover, the avoidance of careless costs, the cost to an NHS employer for time spent on tasks which are unrelated to patient care, e.g. waiting for a computer to load or being on hold on a telephone call, and therefore time periods when patient care cannot be delivered[11] can be achieved. Indeed, a recent systematic review of health information technology implementations on nurses' documentation time indicated that it was potentially causal in affecting a redistribution of nurses' time which, in some cases, was spent in more 'value-adding' activities, such as delivering direct patient care as well as inter-professional communication[12]. Significantly, these vital time savings can be mapped[11] to key human resource factors. Evidence concerning staffing ratios demonstrated that staffing improvements produced reductions in mortality, this underscores the critical relationship between doctor and nursing time, and the consequent patient outcomes.[13,14].

Thus, to support evaluation for future funding and commissioning of digital capital investments such as the London Care Record, it is critically important to map and cost the economic aspects of time and resource consequences.

EFFICIENCY – ASSESSMENT

"In pre-assessment the care is improved with more time spent with patients and less time chasing results."

Specialist Nurse, South East London

Aims

This is an economic analysis of 'Level 1: Joining-up information for direct care' of the OneLondon programme, the London Care Record. The proposed report will examine key features which existing users have reported to derive value and model potential safety aspects of digital architecture to enhance health services.

Specifically:

1. **To model London Care Record utilisation metrics mapped to safety and care outcomes**
2. **To estimate the costs of changes to safety and time consequences of London Care Record users**
3. **To model the potential downstream consequences of London Care Record on morbidity**

Methods

The economic evaluation focuses on the 'Level 1: Joining-up information for direct care' phase of the OneLondon programme (London Care Record), with an emphasis on key user-reported benefits related to time-saving, quality, and safety outcomes.

Initially, we postulated that the electronic record would require fewer steps and less time to perform tasks[15], in both primary and secondary care settings. Consequently, we developed a model to determine the time-based cost savings equivalent attributable to monthly system access encounter rates using NHS Staff Earnings Estimates[16]. These estimates were applied to London Care Record utilisation metrics for January 2022 and January 2023, and disaggregated source data, which indicated that GP practices were the origin of 28.6% of system accesses and the majority (71.4%) of system accesses were from those working in the Acute NHS setting.

SAFETY - MEDICATIONS

"I assessed a breathless patient over the phone who had significant palpitations and felt faint. I was almost certainly going to arrange an ambulance but then on accessing the London Care Record it came to light he had a background of anxiety and was on propranolol. He hadn't taken his medication that morning. I advised him to take it. I eventually called the patient back to reassess and he was symptom free. I was able to give him the best support and treatment and freed up an ambulance to treat patients elsewhere."

Urgent Care Advanced Clinical Practitioner, South East London

Cost Assumptions

In this study, we utilised data on basic pay costs for different staff groups obtained from the NHS Staff Earnings Estimates Statistics, applied to NHS National Workforce Statistics for England and General Practice Workforce data for January 2022[17,18]. The NHS Staff Earnings Estimates for England, derived from a sample size of 47,004 staff, representing approximately 3.4% of the total NHS workforce staff.

Whilst the pay data encompassed a wide range of staff groups within the healthcare system, these particular NHS Staff Earnings Estimates did not include estimates for specific staff groups, namely midwives, ambulance staff, staff-grade doctors, and GPs (or the range of GP practice staff). To address this, we supplemented the pay estimates for these staff groups by referencing relevant literature[19–22], and made assumptions regarding certain GP practice staff, by assuming corresponding NHS roles. Further details on staffing assumptions are noted in Appendix 1.

To provide comprehensive estimates of total compensation for each staff group, we included additional on-costs beyond basic pay. These on-costs encompassed National Insurance contributions (13.8%), pension contributions (20.68%), and London weighting payments (applying the minimum outer London rate for all staff)[23]. By incorporating these supplementary components, we sought to reflect an accurate representation of the overall remuneration for each staff group.

To facilitate direct comparison and analysis, we converted the annualised basic pay estimates into an hourly or minute rate estimate based on the assumption of a standard 40-hour work week. This conversion enabled us to assess the relative remuneration levels consistently across all staff groups. For detailed information on the specific pay estimates for each staff group, including the supplemented estimates from literature sources and the calculation of on-costs, we refer readers to Table 1, where all relevant data are comprehensively presented.

In an additional (sensitivity) analysis, real-world staff utilisation data from the North West London Integrated Care System were applied instead of the NHS National Workforce Statistics proportions to determine an alternative staffing profile and an underlying rate per minute for time saved, as detailed in Appendix 1.

EFFICIENCY - DISCHARGE

“It helps me to quickly find the relevant hospital or ward, how many times they have been admitted and why, as well as their discharge summary. This helps ensure all health partners are working together to complete a safe discharge.”

Hospital Discharge Officer,
South East London

EFFICIENCY – TIME SAVED

“The London Care Record has massively helped us access information as needed and means that we do not need to spend upwards of half an hour on the phone on hold just to be given the same information we can now access ourselves.”

Care Home Manager, South West London

Time assumptions

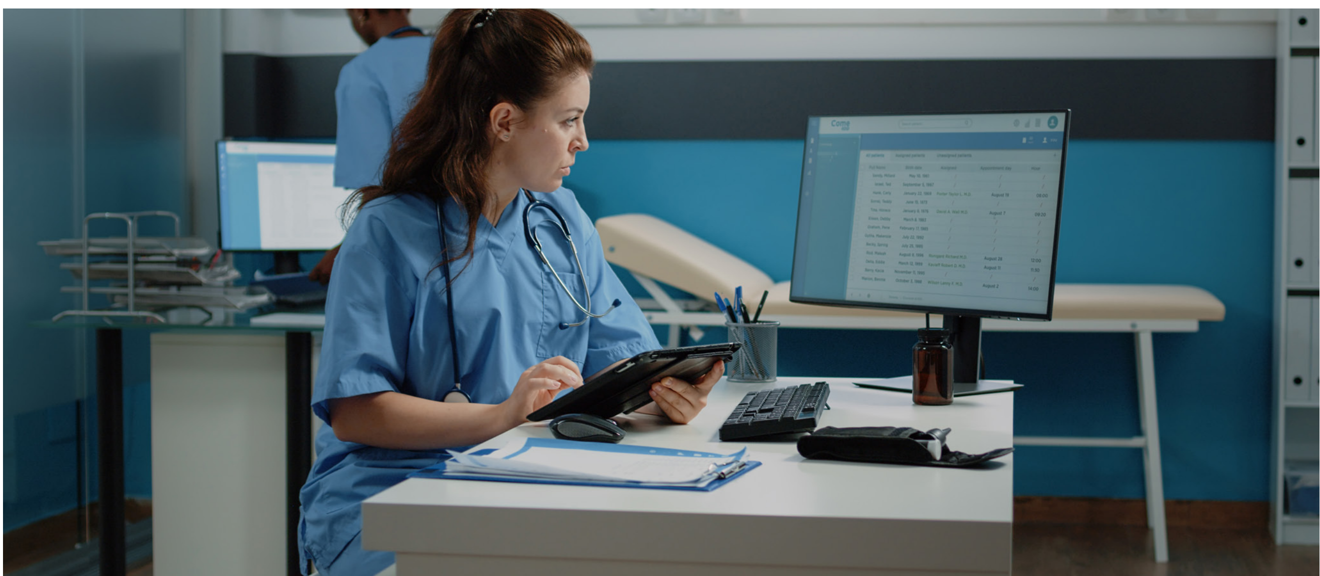
Whilst in qualitative feedback many system users stated a time-saving, no clear consensus on the time saved per system access was evident. Therefore, we applied results from published literature to evidence the estimated time-savings equivalent to relative historical resource utilisation methods.

Time saved would result from the contrast in time required by conventional methods in care assessment, planning and coordination. This includes manually retrieving physical case notes or accessing multiple digital health records to evaluate medical history and medication use, making referrals, requesting diagnostic tests or procedures. It assumes that this previously may have involved engaging in phone calls or other information-gathering processes and may be truncated or avoided in some cases using the London Care Record.

The absolute time-savings made in these assumptions do not include assumptions for those staff who occupy a role which is exclusively focused on the transport, retention, or handling of notes, such as records teams.

Our cautious base case estimate modelled a time-saving equivalent to at least 0.5 minute[24] per system access with the potential for up to 20 minutes of time-saving equivalent, which may arise from a more complex case (based on qualitative user reports). Whilst our base case estimates based on published time and motion results are modest, others have reported that with successful electronic record implementation, on average, nurses spent more time per task providing direct care (average 2.5 v 3.9 minutes per task, $P < 0.001$) ~ that is approximately 1.4 minutes on average additional direct care time availability[25].

Using these data, we estimate time-savings for fixed assumptions based on the literature and model three alternative, more complex scenarios. To provide a practical application of timesaving in clinical settings where staff typically spend minimal amounts of time dealing with low-risk tasks but occasionally encounter significant issues, and in one scenario consider a mediating effect of a net time loss due to training deficit or user errors.



Morbidity and Mortality Assumptions

Secondary analyses examine indicators of quality and safety outcomes, including potential mortality or morbidity changes associated with the London Care Record. The primary aim was to examine how mortality or morbidity rates could change using data from patient safety incidents reported to the NHS on a monthly basis. By comparing the relative risk of reported safety incidents between healthcare facilities who are part of the London Care Record and those outside it (across other parts of England), we aimed to identify any discernible differences in quality and safety outcomes.

Many believe that integrated healthcare data infrastructure can result in favourable patient outcomes using streamlined and efficient operations, which support improved clinical decision-making abilities, decreased medical errors, and enhanced coordination of healthcare plans. However, the published literature in this area is imperfect and often linked to single health data system improvements[26].

The London Care Record can create opportunities for more robust system processes to further reduce test or procedure duplication, prevent care readmissions, and evaluate such outcomes. To date, however, these metrics are unavailable whilst processes for data capture are considered for development. This current analysis offers a broad perspective on safety and mortality outcomes through a comparison of existing safety reports from the National Reporting and Learning System (NRLS) monthly report for England[27].

Our study compares total and average incident rates for a range of severity (no harm, low, moderate, severe and death) categories in London Care Record sites versus non-London Care Record sites throughout England. The objective was to estimate the relative risk reduction associated with the London Care Record's impact on safety. We determined the relative risk by calculating the ratio of the average incidents reported in sites using the London Care Record to the average incidents reported in other sites.

Finally, this study also sought to estimate the potential changes in doctor and nurse staffing levels that may result because of the time-equivalent cost savings achieved through the implementation of the London Care Record.

SAFETY - MEDICATIONS

“It is vital for GPs to have immediate access to the most up to date information about their patients. Recently London Ambulance Service were called to a patient at his home who was unwell but did not need immediate transfer to hospital. By being able to access information from the paramedic on the scene I was able to contact the appropriate services to quickly change both his care package and his medications.

“This was all done within a few hours of the visit to the patient helping to avoid a hospital admission. This meant the man could remain in his home which was what he wanted.”

GP, North East London

The examination of these staffing changes is crucial, as it sheds light on the broader impact of the digital health initiative on healthcare workforce requirements and resources. Based on the preceding evidence, we assumed one minute of potential time saved per system access for January 2022 and January 2023. The total time saved was subsequently represented as proportional utilisation, taking into account the NHS Workforce statistics staffing ratios to allocate the saved hours across various staff categories, and then presented as full-time equivalent staff figures for each staff group.

EFFICIENCY – TIME SAVED/PATIENT EXPERIENCE

“We saved at least two hours of our team's time. Most importantly the gentleman didn't need to undergo another test or spend a number of hours of worrying.”

Integrated Discharge Team,
Hertfordshire and West Essex

Results

The London Care Record system has been steadily growing its number of system access visits, with around 840,000 recorded in January 2022, rising to around 1.3 million per month by January 2023. Using 2022 NHS workforce staffing-based cost estimates as a basis for analysis, with on-costs added, we found the average cost per minute of professionally-qualified clinical staff was around £0.50 for Acute NHS staff and around £0.77 for GP practice staff, which when applied to the system use were found to provide significant reductions in costs associated with the London Care Record system use.

By applying the minimum evidenced-based time of 0.5 minutes per patient interaction through streamlined processes and improved workflows, the potential time-based cost-saving equivalent estimated was £242,166 per month (Table 2). Nevertheless, if even more time optimisation were realised, in line with the evidence base, achieving 1.4 minutes time saving equivalent per system access, this figure would rise significantly, reaching £678,063 in monthly savings.

Three additional scenarios were modelled, where a more complex time-saving equivalent matrix for London Care Record system encounters was applied. In the first and second scenarios, we modelled that 75% of system accesses saved either 0.5 or 1 minute, 10% saved 3 minutes, and 5% each respectively saved 5, 10 and 20 minutes – in which we found a time-saving equivalent of £1,174,503 to £1,356,127 per month would result from the implementation of the London Care Record system in January 2022, as shown in Table 2.

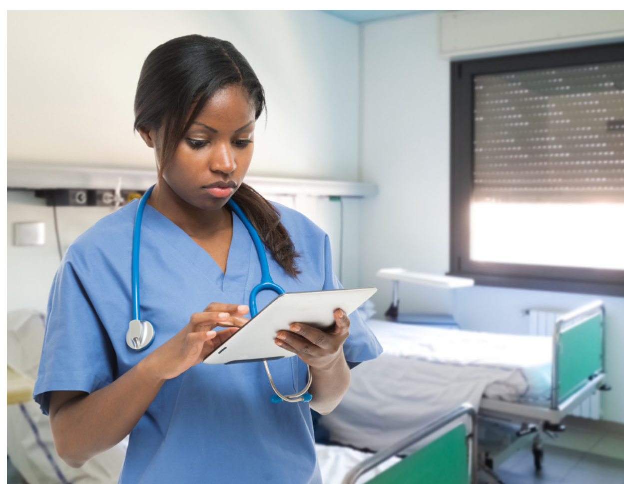
In our third and final analysis, we modelled a scenario where there was a net time loss of one minute in 10% of system accesses, along with 65% of system accesses saving 0.5 minutes, 10% saving 3 minutes, and 5% each respectively saving 5,10 and 20 minutes, which modestly reduced the savings relative to the first scenario to £1,259,261 per month for January 2022, as shown in Table 2.

The average cost per minute of professionally qualified clinical staff was applied to the system access episode data for the most recently reported period of January 2023 when the number of London Care Record accesses had increased significantly to 1.3 million per month. As a result, the attendant cost savings for each scenario rose to a minimum of £374,143 per month in the fixed access assumption of saving 0.5 minutes, to a potential range of £1,814,596 - £2,095,203 in the three mixed time assumptions, as shown in Table 2. **Based on the cumulative total reported 27 million London Care Record system accesses (April 2020 - March 2023) we estimated the total range of potential savings for the period to be £7.9 million to £44.4 million.**

SAFETY - UNDERSTANDING CARE

“I regularly use the London Care Record which is helping with our day to day work at the front door of Adult Social Care. It enables us to locate a person’s GP and confirm any medications and diagnoses. This gives us a better understanding of the person’s whole story.”

Adult Social Care Access Team,
South West London



SAFETY – UNDERSTANDING CARE/MEDICATIONS

“Before the London Care Record I used to rely on information provided by social workers during initial assessment and some residents’ medical reports were incomplete. Sometimes residents missed their hospital appointment because the appointment letters arrived late or we were unaware that the appointment had been cancelled.

“Now I can use the London Care Record to check a resident’s appointment and can also see their medical history so we can better support them with any medical help and wider care that they need. I can also check on a resident admitted in hospital and update their next of kin without having to spend a long time ringing the hospital to check.

“I had a resident discharged from hospital with no discharge summary. One of my staff was about to administer the medications that the resident was taking before admission but decided to confirm with me first. I checked the London Care Record and found out some serious medication changes had been made while they were in hospital. Without the London Care Record there could have been serious consequences for the resident.

“The London Care Record saves time, reduces delays in patient care and saves life.”

Care Home Manager, South West London

Safety Findings

The potential safety benefits were estimated by assessing the relative risk reduction associated with OneLondon’s London Care Record launch based on the impact on incident reports to the National Reporting and Learning System (NRLS) monthly report for England.

Comparative analysis between London Care Record sites and other sites, across various incident categories, found that at an organisational level, London Care Record sites reported fewer incidents on average (871.03) compared to other sites (1019.90), with a relative risk of 0.85.

‘Death’ incidents were slightly lower in London Care Record sites (2.31 on average) compared to other sites (2.66), with a relative risk of 0.89. ‘Severe’ incidents were less frequent in London Care Record sites (1.97 on average) compared to other sites (3.56), with a relative risk of 0.55. ‘Moderate’ incidents showed a similar occurrence in both settings, with a relative risk close to 1 (1.02). ‘Low’ incidents were more common in other sites (273.01 on average) than in London Care Record sites (186.79), with a relative risk of 0.68. ‘No Harm’ incidents were lower in London Care Record sites (648.12 on average) compared to other sites (709.66), with a relative risk of 0.91.

These findings highlight variations in incident reporting and relative risks, suggesting differences in safety outcomes between the two settings, as shown in Table 3.

SAFETY – UNDERSTANDING CARE

“Most staff in our Emergency Department use the London Care Record and it has revolutionised our ability to ensure that we have a patient’s whole story.

“Whether it’s because they are frail, vulnerable, elderly or just can’t tell you – not necessarily because they don’t want to tell you because – as they are just not that informed about their medical conditions and what medications they may be taking.

“In all those situations the London Care Record helps us to understand the patient’s story so we can provide the best possible care.

“This in itself makes care safer. But it also helps patients feel more like they can trust the process and systems better. They often feel reassured that we can see their GP record and other key information regardless of where they present. They often feel that ‘you know enough about them’ to provide the care they need.”

Emergency Department Clinical Lead,
North East London

Staffing Findings

In January 2022, there were 839,996 London Care Record accesses to the systems services, which increased to 1,297,786 in January 2023, indicating a notable rise in demand and dissemination of uptake in the IT infrastructure - a clear gauge of user-derived value. Table 4 shows how assuming one minute per system access, this data can further reveal the likely proportionate uptake based on the NHS Workforce Statistics and expresses the workload distribution among different staff groups.

Consultants, for example, are likely to have accounted for 66,192 minutes proportionate to staffing ratios in January 2022, which translates to 1,103 hours or 6.4 full-time equivalent (FTE) staff. By January 2023, the London Care Record system usage increased significantly to 102,266 minutes, equivalent to 1,704 hours or 9.8 FTE consultant roles. This pattern was observed across various staff categories, reflecting an overall growth in healthcare staff uptake of the London Care Record system, as reflected in the user workload. In total, the system access time-saving equivalent rose from 840,920 minutes (80.9 FTE staff) in January 2022 to 1,299,213 minutes (124.9 FTE staff) in January 2023. These insights are critical for healthcare resource management and planning, highlighting the changing demands on the London Care Record system over this period.

Sensitivity Results

As shown in Appendix 1, using real-world staff utilisation data for the North West London Integrated Care System instead of the proportions from NHS National Workforce Statistics to generate the attendant staffing profile, the underlying rate per minute for time saved was lower than the base case £0.47 (versus £0.50) for the acute sector staffing and unchanged in the GP sector (Appendix 1, Table 5).

This reduction is driven by the inclusion of administrative roles, which tend toward a lower salary level. Primary care sector use was 23.4% of system accesses and the acute sector 76.6% of system accesses – that is a 5% lower relative use in primary care than found in the overall London Care Record cohort data applied in the base case (Appendix 1, Table 6). The overall effect of these alternative assumptions leads to a lower overall time-saving equivalent based cost savings for the London Care Record, with the range of net difference of £16,557 (in 0.5 minute time saving for January 2022) to £3,042,157 (for the cumulative accesses in the first mixed time assumption), as shown in Appendix 1 (Table 7).

Discussion

In recent years, the concept of integrated health and care systems has gained significant attention globally. In London, the collaborative partnership between NHS England, local authorities, and other stakeholders led to the development of OneLondon, an ambitious project aimed at creating a shared health and care record across different care providers in the City[8]. While such projects have potential benefits such as improved coordination of care delivery, they also raise important economic value questions that warrant further examination. In this context, we provide the first critical analysis of the economic implications associated with delivering OneLondon's London Care Record.

Through a comprehensive literature review and empirical analysis based on data from similar initiatives, we identified that the cost impact of the London Care Record use of the technology infrastructure, including a mediating negative time loss for those with training requirements, showed that £1.2 to £1.8 million per month savings arise.

The study provides valuable insights for healthcare policymakers and administrators in terms of funding, commissioning, and evaluating digital health initiatives like OneLondon's London Care Record. The potential cost savings demonstrated in the study can be leveraged to justify the scale of investments in such projects. The overall effect of sensitivity assumptions grounded in real-world staffing proportions led to a slightly lower overall time-saving equivalent, driven by the inclusion of higher levels of administrative staff usage. This finding indicates that there is added value across the service to those in such roles, who were in all likelihood, not the primary targeted end-user.

The relative risk reduction associated with OneLondon's London Care Record launch based on the impact on incident reports to the NRLS monthly report for England has demonstrated the potential for safety benefits and relative risk reduction.

Whilst these reports are encouraging, they are subject to several potential confounding features, which would likely include the overall level of staff vacancies, staffing ratios and other human resource factors at any of the non-London Care Record sites, which may be causally linked to the effects noted here. Moreover, we are aware that many of the other Trusts in these data also have integrated care records at various stages of dissemination; as such it is exceedingly difficult to reliably attribute the observed effect solely to the London Care Record system.

However, to expand the overall legitimacy of these metrics, future programme reporting should delve deeper into a comparative analysis of incident reports submitted to the NRLS to closely examine the statistical findings of the results above.

By utilising a broader range of data sources – including targeted data collection linked to existing research studies on mortality effects on staffing ratios[13], and medicine-related incidents[28] and building on the existing expert input from healthcare professionals, OneLondon can provide a more comprehensive understanding of safety trends and identify potential areas for improvement, or where risks may be introduced. Incorporating these additional resources may not only enhance the accuracy and validity of findings but also contribute to expanding knowledge within this field. Furthermore, to ensure patient safety and mitigate future incidents related to computer systems, the NHS needs to maintain accurate data on health IT impact.

The study represents one of the first attempts to analyse the potential value and safety aspects of this digital architecture in health services. The key strength of the study is its comprehensive approach, which considers both the time-based cost savings and potential changes in morbidity and mortality associated with the implementation of the London Care Record system. This approach provides a holistic understanding of the programme's impact on healthcare operations and patient outcomes. Moreover, our report uses real-world data from the London Care Record programme access and staff pay from the NHS, which enhances the study's applicability and relevance to current healthcare practices.

There are some limitations; this study relies on published literature to estimate time savings resulting from the implementation of the London Care Record system. However, a lack of a clear consensus on the exact time saved per system access will naturally introduce uncertainty into the findings. Nevertheless, we applied the most conservative assumptions with the minimum time-saving estimate, taken from appropriate methodological studies and offered alternate scenarios which included a representative time loss, to enhance the real-world accuracy of our estimates.

The study attempts to estimate potential changes in morbidity and mortality rates associated with the London Care Record. However, the analysis is based on scenarios derived from existing data on patient safety incidents, which may not fully capture the complex interactions between digital infrastructure and clinical outcomes. We have identified two practical ways to enhance the quality of healthcare research. However, it is essential to prioritise future studies focusing on outcome metrics for safety and mortality. Secondly, establishing a standardised method for retrieving these metrics from existing systems will facilitate the assessment of integrated healthcare data infrastructure's impact on patient safety and care quality.

In our assumptions around staffing, social care staff were not directly considered in terms of direct staff pay rates, however, we understand that adult social care accesses for the London Care Record range between 1-2% of overall usage per month, reflecting later stage system adoption, which we do not believe will materially affect the overall cost ratios to any greater degree than those identified in sensitivity analyses. Nonetheless future research could include this staff group during analyses.

Finally, capital allowances for the establishment of technology development and infrastructure or ongoing governance structures, stakeholder management or privacy concerns/regulations compliance were not included herein since these were embedded in budget impacts at the time of commissioning.

SAFETY – SAFEGUARDING

"Individuals experiencing self-neglect often don't tell us all the information we need about their health and care, so it's very useful in adult safeguarding."

Acute Trust Safeguarding Lead, Hertfordshire and West Essex

EFFICIENCY – TIME SAVED

"For me, it easily saves half an hour a day, just by having access to the information that I need. It is such a better way of working."

Community Palliative Nurse, Hertfordshire and West Essex

SAFETY – UNDERSTANDING CARE

"It saves our time, and it also improves residents' safety as it helps ensure they have their medications on time and will not miss any doses. The London Care Record is also helpful when we admit new residents as we can view more information about them such as their past medical history, allergies and other information that is useful in best meeting their needs."

Care Home Manager, South West London

Conclusion

In conclusion, this study provides a valuable and timely economic evaluation of the OneLondon programme's 'Level 1' phase, implementing the London Care Record, highlighting the significant potential cost savings associated with time-based efficiencies and improved safety outcomes. While the findings offer valuable insights for healthcare stakeholders, further research, empirical data collection, and long-term evaluations are necessary to validate and refine the study's conclusions. The integration of digital information technology in healthcare remains a critical aspect of modern healthcare systems, and studies like this contribute to the ongoing effort to optimise the benefits of digital transformation in healthcare services.

SAFETY – UNDERSTANDING CARE

"Working in a busy NHS Trust I see first hand the positive difference the London Care Record is making. It allows me to have a more informed conversation with my patients, providing them with assurance but also significantly increasing the clinical safety through having the right information in the right place at the right time."

Consultant Anaesthetist,
North West London

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Table 1 Professionally Qualified Clinical Staff Pay Estimates for January 2022

Staff Group	Amount	Sample Size	Annual Salary Estimate	Final Annual Salary With On-Costs
Based on NHS Pay Estimates[16]				
All staff	3,424.15	47,004	41,089.80	43,004.80
Professionally qualified clinical staff	3,387.77	7,004	40,653.24	42,568.24
HCHS Doctors	3,693.45	2,391	44,321.40	46,236.40
Consultant	6,875.97	443	82,511.64*	84,426.64
Associate Specialist	6,583.88	21	79,006.56	80,921.56
Specialty Doctor	5,229.14	43	62,749.68	66,749.68
Specialty Registrar	3,212.82	709	38,553.84	42,553.84
Core Training	4,140.64	21	49,687.68	53,687.68
Foundation Doctor Year 2	2,673.89	17	32,086.68	36,086.68
Foundation Doctor Year 1	2,317.70	14	27,812.40	31,812.40
Hospital Practitioner / Clinical Assistant	1,888.79	203	22,665.48	24,580.48
Other and Local HCHS Doctor Grades	2,732.32	950	32,787.84	34,702.84
Nurses & health visitors	3,179.46	1,610	38,153.52	40,068.52
Scientific, therapeutic & technical staff	3,256.05	3,002	39,072.60	40,987.60
Support to clinical staff	1,754.26	3,241	21,051.12	22,966.12
Support to doctors, nurses & midwives	1,460.34	1,691	17,524.08	19,439.08
Support to ST&T staff	2,073.59	1,551	24,883.08	26,798.08
**Contractor GPs[21]	11,833.33	-	142,000	193,536.89
**Salaried GPs[21]	5,408.33	-	64,900	89,852.81
Based on literature searches				
Midwives[22]	3345.83	10,000	40150.00	56,569.01
Ambulance staff[19]	3275.00	-	39300.00	55,425.93
Staff Grade Doctor[20]	5091.42	-	61,097.00	84,738.54

*We note that this estimate is lower than the published minimum salary for NHS consultants for the 2022 Pay Circular 20. We applied the average hourly rates, based on these salaries, to the volume of NHS workforce by staff group in January 2022, divided by sixty, which was then averaged by the total volume of professionally qualified clinical staff in each group, returning a rate of £0.50 per minute of average staff time.
** GP practice staff ratios differ significantly from that of NHS workforce – when modifying for the staffing differences the rate per minute of average staff time was £0.77.

Table 2 Initial time-saving equivalent based cost savings for OneLondon by system access reports, with on-costs included

	January 2022	January 2023	Cumulative Access Apr 2020 - Mar 2023
Reported Number of OneLondon Record Accesses	839,996	1,297,786	27,559,911
Net Time Change (minutes)	**Average (£) saved**		
+ 0.5[24]	242,166	374,143	7,945,347
+ 1.4[25]	678,063	1,047,602	22,246,972
Mixed Scenario 1*	1,356,127	2,095,203	44,493,944
Mixed Scenario 2**	1,174,503	1,814,596	38,534,934
Mixed Scenario 3***	1,259,261	1,945,546	41,315,806

*Scenario 1 = 75% of system accesses save 1 minute, 10% save 3 minutes and 5% each save 5, 10, 20 minutes, respectively.

** Scenario 2 = 75% of system accesses save 0.5 minutes, 10% save 3 minutes and 5% each save 5,10,20 minutes, respectively.

***Scenario 3 = 10% lose 1 minute, 65% of system accesses save 1 minute, 10% save 3 minutes and 5% each save 5,10,20 minutes, respectively. The estimate assumes 28.6% of accesses are from GP practices (incurring a higher rate per minute).

Table 3 Estimated relative risk reduction associated with OneLondon's impact on incident reporting

Type of Incident Reported	Sample Size	Total No. of Incidents	Average No. Incidents in Intervention Sites	Standard Deviation	Confidence Interval	Sample Size	Total No. of Incidents	Average No. Incidents in Other Sites	Standard Deviation	Confidence Interval	Relative Risk
	OneLondon Sites					Other Sites					
Organisational Totals	36	31,357	871.03	414.20	290.34 ± 135.19	177	180,522	1019.90	493.79	340.52 ± 72.72	0.85
Death	36	83	2.31	1.40	0.39 ± 0.58	177	470	2.66	1.67	0.44 ± 0.12	0.89
Severe	36	71	1.97	1.12	0.33 ± 0.47	177	630	3.56	2.53	0.60 ± 0.18	0.55
Moderate	36	1,146	31.82	20.74	5.30 ± 7.63	177	5,487	31.00	17.93	5.19 ± 3.14	1.02
Low	36	6,725	186.79	92.46	31.13 ± 43.32	177	48,323	273.01	138.24	45.58 ± 27.04	0.68
No Harm	36	23,332	648.12	317.27	108.02 ± 148.03	177	125,611	709.66	356.02	118.45 ± 66.77	0.91

Note: Using the NHS England number of patient safety incidents uploaded per month by provider in England from Apr 2022 to Mar 2023, we stratified those trusts who are participating in the OneLondon implementation and those who were not.

These data were totalled by type of incident and then relative risk values, standard deviation and confidence intervals were calculated. Relative risk was calculated to indicate the ratio of the average incidents reported in OneLondon sites compared to other sites for each type of incident. A value less than 1 indicates a lower risk in OneLondon sites, while a value greater than one indicates a higher risk in OneLondon sites.

Table 4 Corresponding additional time gained from OneLondon system availability per professional group (applying 1 minute per staff group)

OneLondon Accesses	January 2022 839,996					January 2023 1,297,786			
Staff group	Staff group	Total minutes proportionate to staffing ratio	Converted to hours	Converted to FTE staff	Hrs/Yr.	Total minutes proportionate to staffing ratio	Converted to hours	Converted to FTE staff	Hrs/Yr.
Consultant	Consultant	66,192	1,103	6.4	13,238.3	102,266	1,704	9.8	20,453.1
Associate Specialist	Associate Specialist	2,352	39	0.2	470.4	3,634	61	0.3	726.8
Specialty Doctor	Specialty Doctor	11,004	183	1.1	2,200.8	17,001	283	1.6	3,400.2
Staff Grade	Staff Grade	420	7	0.0	84.0	649	11	0.1	129.8
Specialty Registrar	Specialty Registrar	40,572	676	3.9	8,114.4	62,683	1,045	6.0	12,536.6
Core Training	Core Training	20,916	349	2.0	4,183.2	32,315	539	3.1	6,463.0
Foundation Doctor Year 2	Foundation Doctor Year 2	7,392	123	0.7	1,478.4	11,421	190	1.1	2,284.1
Foundation Doctor Year 1	Foundation Doctor Year 1	7,728	129	0.7	1,545.6	11,940	199	1.1	2,387.9
Hospital Practitioner / Clinical Assistant	Hospital Practitioner / Clinical Assistant	1,932	32	0.2	386.4	2,985	50	0.3	597.0
Other and Local HCHS Doctor Grades	Other and Local HCHS Doctor Grades	1,596	27	0.2	319.2	2,466	41	0.2	493.2
Nurses & health visitors	Nurses & health visitors	417,394	6,957	40.1	83,478.8	644,870	10,748	62.0	128,974.0
Midwives	Midwives	31,416	524	3.0	6,283.2	48,537	809	4.7	9,707.4
Ambulance staff	Ambulance staff	22,596	377	2.2	4,519.2	34,910	582	3.4	6,982.1
Scientific, therapeutic & technical staff	Scientific, therapeutic & technical staff	209,411	3,490	20.1	41,882.2	323,538	5,392	31.1	64,707.6
TOTAL*	TOTAL*	840,920	14,015	80.9	168,184	1,299,213	21,653	124.9	259,842

*Subject to rounding

Appendix 1

Sensitivity Analysis

In a supplementary analysis aimed at assessing the robustness of workforce assumptions, we employed actual staff utilisation data sourced from the North West London (NWL) Integrated Care System. In contrast to relying on the proportions derived from the NHS National Workforce Statistics, we opted to utilise this real-world data, to construct a staffing profile and thereby establish any difference in the rate per minute for time saved. These assumptions were based on the top five system users for June 2023, and are presented in detail in Table 5, along with the resultant alternative cost per minute. This approach aims to enhance the credibility and applicability of our workforce assumptions, aligning them more closely with the specific operational context of the NWL Integrated Care System.

Table 5 North West London real-world proportions of staff accessing the London Care Record

Staff role	Proportion of staff accessing the London Care Record (%)	Additional Assumptions	Alternate Cost per minute**
Acute sector*			
Clinical Practitioner	34.44	Specific ratios of medical staff were applied from the underlying NHS Workforce statistics for proportions of consultants to junior doctors.	£0.47
Nurse Access role	19.47	As per NHS Staff pay estimates statistics	
Health Professional	12.72	Matched to staff costs for scientific, therapeutic & technical staff	
Clinical Coder Access	7.34	Matched to support to clinical staff costs	
Clerical Access role	7.10	Matched to support to doctors, nurses & midwives' costs	
Misc Admin	18.92	*Based on manual extracts of data remaining users likely to be from this source	
Primary Care*			
Clinical Practitioner	57.49	Specific ratios of medical staff were applied from the underlying General Practice Workforce data	£0.77
Receptionist	10.76	Matched to support to doctors, nurses & midwives' costs	
Admin Clinical support	4.87	Matched to Support to clinical staff costs	
Gen Med Pract	4.52	Matched to salaried GP costs	
Pharmacist	3.60	As per NHS Staff Earnings Estimates	
Misc Admin	18.76	* Based on manual extracts of data remaining users likely to be from this source	

*We applied the above proportions to reset the underlying calculations of staff pay - with corresponding hourly pay rates as provided in the base case – i.e. several clinical roles were excluded based on this data, overall, the inclusion of admin roles is now more prominent in this sensitivity analysis.

In the context of the NWL data for June 2023, an important aspect addressed in this sensitivity analysis involved the recalibration of the proportionate mix of primary care and acute care system accesses based on real-world data. Specifically, during this defined period, the observed primary care sector usage accounted for 23.4% of system accesses, while the acute care sector represented the remaining 76.6% of system accesses. This observation is notable because it reflects a 5% lower relative use of the primary care sector when compared to the overall London Care Record cohort data applied in the base case scenario.

This adjustment in the distribution of system accesses is significant as it has implications for the efficiency and cost profile of service utilisation. It is noteworthy that administrative staff across both primary care and acute care sectors demonstrated a higher level of access during this period, resulting in a lower time-saving equivalent cost compared to the initial base case assumptions.

Indeed, it is important to emphasise that these revised findings, as illustrated in Table 6, provide a more conservative estimate of the potential benefit. This recalibration underscores the importance of incorporating real-world data into health economic modelling, as it can lead to more accurate assessments of the actual impact and cost-effectiveness of the IT infrastructure changes.

Table 6 Time-saving equivalent based cost savings for OneLondon based on NWL staffing rates

Cumulative access since March 2020	January 2022	January 2023	Cumulative access Apr 2020 - Mar 2023	Cumulative access Apr 2020 - Mar 2023	
Reported Number of London Care Record Accesses	839,996	1,297,786	27,559,911		
Time saved (minutes)	**Average (£) saved**			**Average (£) saved per access**	**Total hours saved**
0.5	225,608	348,562	7,402,105	0.27	229,666
1.4	631,703	975,975	20,725,894	0.75	643,065
Mixed Scenario 1	1,263,405	1,951,949	41,451,788	1.50	1,286,129
Mixed Scenario 2	1,094,199	1,690,528	35,900,209	1.30	1,113,880
Mixed Scenario 3	1,173,162	1,812,524	38,490,946	1.40	1,194,263

*Scenario 1 = 75% of system accesses save 1 minute, 10% save 3 minutes and 5% each save 5,10,20 minutes, respectively. ** Scenario 2 = 75% of system accesses save 0.5 minutes, 10% save 3 minutes and 5% each save 5,10,20 minutes, respectively. ***Scenario 3 = 10% lose 1 minute, 65% of system accesses save 1 minute, 10% save 3 minutes and 5% each save 5,10,20 minutes, respectively.

Certainly, the findings presented in this sensitivity analysis indicate an overall net figure that is lower than that of the base case scenario. To facilitate a straightforward comparison, a clear representation of this net difference is provided in Table 7, as depicted below. This table serves as a concise visual aid to illustrate the contrast between the outcomes of the base case assumptions and the real-world data scenario for NWL, thus enhancing the comprehensibility of the results.

Table 7 Net difference in time-saving equivalent based cost savings for OneLondon – NWL compared to base case findings

Cumulative access since March 2020	January 2022	January 2023	Cumulative access Apr 2020 - Mar 2023
Reported Number of London Care Record Accesses	**839,996**	**1,297,786**	**27,559,911**
Time saved (minutes)	**Average (£) saved**		
0.5	-16,557	-25,581	-543,242
1.4	-46,361	-71,627	-1,521,078
Mixed Scenario 1	-92,722	-143,254	-3,042,157
Mixed Scenario 2	-80,304	-124,068	-2,634,725
Mixed Scenario 3	-86,099	-133,022	-2,824,860

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