REFORM

Prescription for Prevention

Supplementary paper: A digitally enabled model of primary care

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After a decade of disruption, the country faces a moment of national reflection. For too long, Britain has been papering over the cracks in an outdated social and economic model, but while this may bring temporary respite, it doesn't fix the foundations. In 1942 Beveridge stated: "a revolutionary moment in the world's history is a time for revolutions, not for patching." 80 years on, and in the wake of a devastating national crisis, that statement once again rings true. Now is the time to fix Britain's foundations.

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ABOUT REIMAGINING HEALTH

This paper is part of the *Reimagining Health* work stream. While the National Health Service was once visionary, as demand rises and outcomes deteriorate, a fundamental rethink is needed. The current model no longer works for patients, who too often struggle to access high-quality timely care; for medical staff, who feel disempowered, stressed, and burnt out; or for taxpayers, who foot an increasing bill for a service which is struggling to cope. In short, the structures and institutions designed to meet the challenges of the post-war world are not equipped to deal with our current and future health challenges.

'Reimagining Health' seeks to explore how to transform England's approach to health. It will consider how to move from a treatment-oriented model to one geared towards health creation, the changes necessary in healthcare to facilitate this, and how to build a fair and sustainable approach to funding. This paper is the first of several that seeks to fundamentally redesign the health and care system.

Reimagining Health Council

Reform is grateful to the expert members of the *Reimagining Health* Council who provide valuable insight and advise on the programme. Their involvement does not equal endorsement of every argument or recommendation put forward.

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Recommendations

Recommendation 1: NHS England and the Health Research Authority should work to simplify the landscape of data controllership within primary care, seeking to consolidate joint data controllership at ICB level.

Recommendation 2: NHS England should introduce national information governance standards, cohering all of the advice and guidance that already exists into one body of standards. NHS England should also identify what a baseline of analytical capacity should look like in ICSs that can enable both tactical and strategic intelligence functions.

Making appropriate interventions to enable this may also require understanding why such a divergence in analytical capacity exists across ICSs – understanding the analytical capacity of each ICS, why analytical capacity may have been deprioritised, what other functions are considered a higher priority, and why. Once this is understood, appropriate interventions can be made and commensurate funding can be allocated.

Recommendation 3: NHS England should introduce a model akin to central government's Digital, Data and Technology (DDaT) profession. This would include a new pay framework outside of the Agenda for Change pay scales, as well as a capability framework to enhance personal development and recruitment. NHS England would maintain responsibility for the negotiating the pay bands with the Treasury, while recruitment responsibilities continue to sit with the ICS.

Recommendation 4: NHS England, and in a future devolved model, the Department of Health and Social Care (DHSC), should set a 'minimum viable digital standard' for technology hardware in general practice. Integrated Care Systems should then conduct an audit of both hardware and software in primary and community care to understand the scale of the technology challenge in detail, to understand where the infrastructure falls short in comparison to the baseline standard set by NHSE. The ICS should determine what it would take to meet that standard, and the government should then allocate resources to fix this.

Recommendation 5: DHSC and NHS England should pursue a combination of interoperability interventions to enable interoperable IT systems by 2027. The Secretary of State for Health and Social Care should introduce secondary legislation to legislate against 'information blocking'. NHS England should also work with ICSs to map the current commercial landscape of tech providers across both general practice and community care, how 'locked in' these contracts are, and use this information to determine how to approach commercial provision of technology that is standardised and interoperable across England.

Recommendation 6: Government should review the capacity of the MHRA SaMD team to ensure that is has the appropriate capacity to proactively manage the market of manufacturers as well as distributors. This should be with a view to maximising the potential of technological innovations while adequately policing products to ensure patient safety.

Recommendation 7: The MHRA should maximise the value of their sandbox approach by prioritising specific themes or clinical areas – such as remote monitoring for multi-morbid patients, home hospitalisation, or AI diagnosis based on image recognition – that could deliver the greatest system value.

1. Introduction

Technology is often touted as the solution to public services that are struggling to cope with growing supply and demand imbalances. It is certainly true that it can boost operational efficiency with better-than-human capability at many tasks. Its benefits are multifaceted: it could transform care for patients by opening up more capacity for clinicians, by intervening earlier in the progression of illness, and by monitoring patients more effectively to avoid preventable decline.

But realising the full benefits of technological innovation is only possible if implemented alongside more fundamental reform across the primary care system, including to funding, estates and workforce composition. This paper should therefore be read in conjunction with *Prescription for Prevention: A new model for primary care*. The smart use of tech and data is one of the building blocks underpinning this new model, enabling a primary care system that intervenes early, responds quickly and avoids decline.

While there is significant excitement surrounding emerging technologies, there are less 'cutting edge', but equally critical, interventions to be made. The basic hardware in general practice is clunky and difficult to use. Interoperability between computer systems in different services – whether that be the GP or the hospital – remains limited.[1] Sharing critical information to develop more precise approaches to prevention and early intervention is still difficult due to outdated data governance rules. Without this core infrastructure, more nascent innovations are impossible to implement.

The health and care system is uniquely interdependent – technology plays a specific role in ensuring the connection between general practice, community services, hospitals, and social care not only exists, but enhances the care that patients receive. The shift towards an interconnected health and care system has been desired for many years but has been difficult to achieve. The steps outlined in this paper go some way to addressing that.

Once these barriers are overcome, the potential of technology in supporting a preventative and productive primary care system is enormous. Data analytics can enable a much more effective approach to identification of those at greatest need of early intervention. Algorithms that have existed for years can reform how primary care providers manage administration – something that consistently drains capacity from staff across the system. AI-powered image recognition can help with diagnosing image-based ailments, such as in dermatology or ophthalmology.

Deploying technology that can scale quickly, often at lower cost, with a high impact, should be a priority. For primary care in particular, reform should be centred around three key pillars: data governance, interoperability and more regulatory capacity. Together, these would enable more proactive data analysis of the population and therefore smarter interventions and triage. They would also provide the foundation for more advanced algorithmic innovations in primary

[1] Royal College of General Practitioners, '4 in 10 GPs Working in Premises "Not Fit for Purpose", Says College Survey', 17 May 2023.

care to automate repetitive tasks, in turn helping to address the supply and demand imbalance.

1.1 A note on this paper

This paper is published alongside *Prescription for Prevention: A new model for primary care*, which sets out a new framework for a preventative primary care system. Interviewees for this research impressed the importance of re-engineering processes and workflows to make the most of technology, and that this is essential if such technologies are to be used to their maximum potential. This paper outlines the specific interventions needed to establish a more tech-enabled primary care system, while *Prescription for Prevention* outlines further steps that would need to be taken to ensure they are implemented effectively.

2. Moving towards proactive healthcare

Understanding population health through sophisticated data analysis would enable both the efficient and effective commissioning of services and proactive targeting of those who have a higher need. The technology to do this already exists and is used in pockets. However, the development of more advanced population segmentation is undermined by relatively straightforward data governance obstacles and varied analytical capacity within ICSs.

2.1. Towards a smarter model

Health and care systems have historically categorised populations by the services utilised at a point in time, rather than the overall patient need.[2] This means that care can be inconsistent or duplicative across different parts of the system. Providers are also only reimbursed for services delivered at specific locations at a specific point in time, even if there are better, more sustainable ways to achieve the same or better results.[3] At the same time, universal interventions, such as screening programmes, have mixed evidence[4] – for example ethnic minorities can present with different symptoms making universal standards unhelpful,[5] and people who take up health checks tend to be healthier than the general population.[6]

In contrast, advanced population segmentation is used in different localities across the world, with the specific aim of developing a more precise understanding of patient demand in order to deliver services that meet the needs of different groups.

Population segmentation has multiple benefits, such as improving direct patient care, measuring outcomes, and monitoring costs (see Figures 1 to 3 below for examples). Ultimately it allows identification of meaningful groups who share similar needs, and in turn enables interventions that may otherwise not have been made, or would have been poorly targeted. In addition, rather than creating cohorts for particular diseases, population segmentation allows for a longitudinal view over a number of years for different groups.

Population segmentation is of particular importance for early intervention since it helps to understand the 'healthy' population – and those with need who are not presenting – rather than only those patients who are interacting with the health and care system. This will allow

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[2] *Whole Population Segmentation Models* (Outcomes Based Healthcare, 2021).
[3] Ibid.
[4] Nicolas Iragorri and Eldon Spackman, 'Assessing the Value of Screening Tools: Reviewing the Challenges and Opportunities of Cost-Effectiveness Analysis', *Public Health Reviews* 39, no. 1 (December 2018).
[5] Gabriel M. Leung et al., 'Will Screening Mammography in the East Do More Harm than Good?', *American Journal of Public Health* 92 (November 2002): 1841–46. Leung et al.
[6] Sarah Deeny et al., *Harnessing Data and Technology for Public Health: Five Challenges* (Health Foundation, 2019).

for more resources to be directed "up stream".[7] In Harrow, for example, the elderly population, including the healthy elderly, was targeted to improve preventative care.[8] Work in Leeds is targeting frailty, while work in Liverpool has targeted "complex lives".[9]

Figure 1: Segmenting for population intervention: Newport Pagnell Medical Centre and mental health

The primary care system met with a range of local stakeholders including the council, school, youth clubs, older people's clubs and health and social care providers to capture their views of mental health needs locally. It also collected public health and clinical commissioning group (CCG) data, and benchmarked the local area against the rest of Milton Keynes and England.

They were then able to segment the population into three groups of people with similar characteristics – young people aged 11 and over with mental health needs, the working-age population with mental health needs and frail older people. Each group was further divided into three groups according to their risk of needing more intense care.

Initiatives for young people aged 11 and over with mental health needs included gym courses to help with confidence and social isolation, and working with youth clubs to support those with low level anxiety and depression. For working age adults, a primary care navigators approach was implemented, while the local psychological therapies services provides cognitive behavioural therapy for patients.

This exercise helped to identify and avoid duplication across services through increased awareness of other health and wellbeing projects in the area. For example, the site became aware of a community provider project that was similar to its work with care homes, enabling them to pool resources and work together.

Source: National Association of Primary Care, 'Primary Care Home: Population Health Management', 2018.[10]

[7] Andi Orlowski, *How - and Why - to Get Started with Population Segmentation Analysis* (Imperial College Health Partners, 2020).
[8] Ibid.
[9] Ibid.
[10] *Primary Care Home: Population Health Management* (National Association of Primary Care, 2018).

Figure 2: Segmenting for disease prevention: Kaiser Permanente

Kaiser Permanente, a US-based health insurer and healthcare provider, shifted their focus from people with long term conditions with the most complex needs to all those for whom it has responsibility. It uses data about the population is serves, available through its system wide electronic health record, to understand members' health needs and distribution of health outcomes.

One example of this is their approach to preventing and treating heart disease, focusing heavily on preventative interventions like smoking cessation, promoting exercise and other lifestyle changes to reduce the risk of developing heart diseases across member populations. Between 2002 and 2005, in Northern Carolina, Kaiser Permanente helped reduce the prevalence of smoking among its members by 25 per cent, compared with a 7.5 per cent reduction across California as a whole.

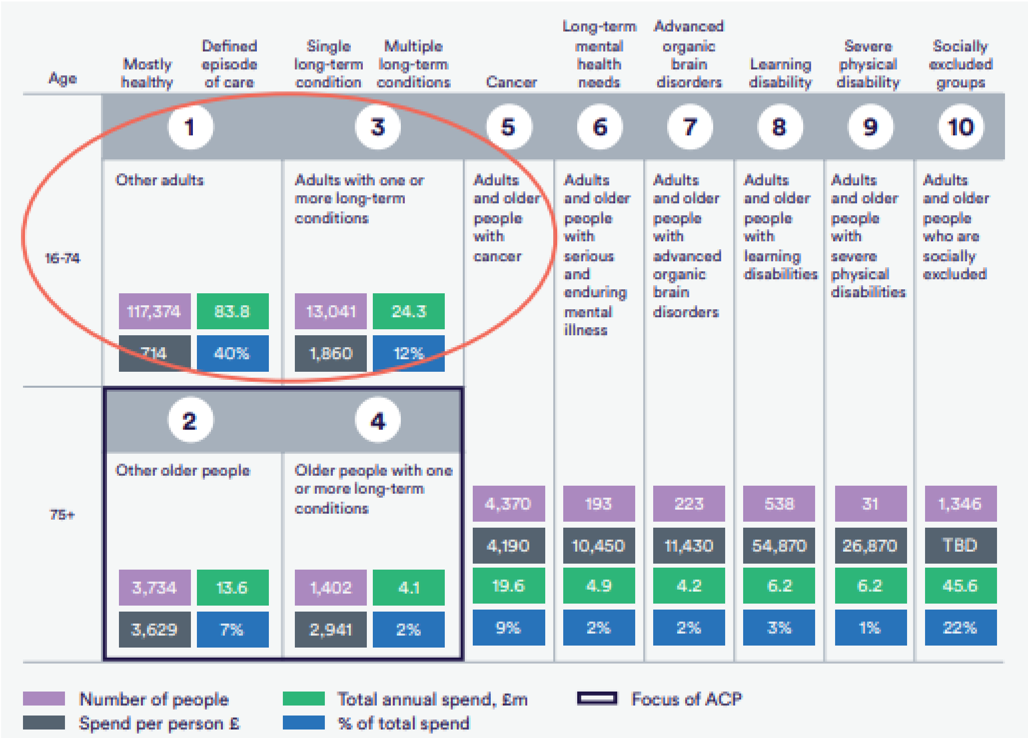
In addition to focusing on improving members' health, Kaiser Permanente has been involved for a number of years in efforts to improve the 'total health' of the broader community it serves. This includes supporting food stores in deprived areas to stock fresh fruit and vegetables and working with local schools to offer healthier food and drink options for pupils.

Source: Commonwealth Fund, 'Kaiser Permanente: Bridging the Quality Divide with Integrated Practice, Group Accountability, and Health Information Technology', 2009.[11]

While the above case studies illustrate an approach that segments the general practice population, the North West London Integrated Care model below demonstrates a whole population segmentation model. This helps to understand the biggest spending drivers, describing the cost of care and percentage of health expenditure for different segments in one area in North West London. The circled segments highlight the adult population – including the 'mostly healthy' and those with one or more long-term condition, who constitute 82 per cent of the total population and 52 per cent of total spend.[12] What this means for the nature of primary care demand is multifaceted, and is explored more in Section 5.3.2 in *Prescription for Prevention.*

[11] Douglas McCarthy and Kimberly Mueller, *Kaiser Permanente: Bridging the Quality Divide with Integrated Practice, Group Accountability, and Health Information Technology* (The Commonwealth Fund, 2009).
[12] Rebecca Rosen, *Divided We Fall: Getting the Best out of General Practice* (Nuffield Trust, 2018).

Figure 3: Service use for different population segments in a North West London community



Source: Nuffield Trust, 'Divided we fall: getting the best out of general practice', 2018.[13]

2.2 Current system use

Population health management is used by Integrated Care Systems (ICSs) but its sophistication varies.

2.2.1 The national population dashboard

Currently, ICSs have some form of capability to segment their populations, but according to interviewees for this paper, it is more often used for commissioning direct care than understanding population health for proactive intervention. The NHS Federated Data Platform was also created to help bring together operational data currently stored in different systems, with one of the aims being to support population health management.[14]

ICSs have access to a national "Population and Person Insight" segmentation dashboard developed by NHS England, which enables them to see aggregated longitudinal data for their local populations for a wide variety of conditions, alongside capitated expenditure and certain outcomes.[15]

[13] Rosen.
[14] *Federated Data Platform - Improving and Connecting Our Health Information* (NHS England, 2024).
[15] *NHSE Segmentation Dataset Reference Guide* (Outcomes Based Healthcare, 2016).

Without the integration of any further datasets, this dataset can be used to directly generate a limited number of insights, such as prevalence of a particular condition and mortality rates for any given period and geography. It can also stratify within each segment or subsegment by sociodemographic variables or clinical variables (e.g. other occurring conditions or segments, multimorbidity, and risk factors). The data for this comes from a number of sources, including secondary use services, emergency care, community services, mental health services, maternity services.

2.2.2 Scope for more insight

Further value can be derived from this data when it is linked to other datasets that are protected by different data governance models. Specifically for the purposes of preventative primary care, the most sophisticated and transformational form of population segmentation involves the integration of primary care data.

This can allow for a much more precise understanding of the local population's clinical need as it generates insights on total and per person GP practice activity. It does this for people in each segment by appointment type and healthcare professional. This is substantively different from the approaches that have been taken before in public health or within the NHS. Where public health has traditionally looked at promoting healthy life through coordinated programmes – normally offered to the whole population – population health management focuses on key outcomes for identified groups. These groups often share more specific common characteristics, not just a disease diagnosis.

Interviewees for this paper highlighted that the integration of primary care data has several benefits for early intervention:

- It creates a broader record with a better description of the person
- The data quality tends to be reasonably high, at least partially because the Quality and Outcomes Framework (QOF)[16] requires GPs to submit extensive data points on a frequent basis
- It enables users who have very frequent interactions with the healthcare system to be identified at a much earlier stage, rather than waiting until they are hospitalised to then make tailored interventions around self-management
- It allows identification of the 'healthy' population, that is, those who are not using general practice as much as other groups, or who experienced an illness and did not frequently return to the general practice following diagnosis

This then enables two main uses in primary care, which are largely oriented around avoiding preventable decline in patients, rather than predicting the occurrence of an illness. However, some nascent algorithms are also being developed that predict how people might move

[16] The Quality and Outcomes Framework is a system for the performance management and payment of general practitioners. It was introduced in 2004 and was intended to improve the quality of general practice.

between segments throughout their life, therefore enabling interventions before a condition has started to develop.

However, in the short term, the major benefits of population segmentation in proactive clinical care relate to case finding (identifying people in potential need of care) and gaps in care (identifying those who have a gap in their clinical interventions). For example, in some ICSs, on a quarterly basis GPs receive a list with patients who have gaps in care for their specific condition.[17]

Enabling this integration of primary care data – and therefore realising these broad benefits for patients and the system as a whole – is complicated by information governance at a local level. Indeed, as with many technological innovations in this paper, much of the software has already been developed, but integrating it into the system requires overcoming internal obstacles.

2.3 Obstacles to implementation

The biggest obstacle to obtaining the most complete or meaningful set of information to perform robust population segmentation is gaining access to the data held by GPs. Legally, each GP practice is a data controller which means that to get a complete picture at the ICS level, ICSs would have to enter a data sharing agreement with each GP practice.

There are three key roles in data governance:

- Data processor: usually a third party external to the company and processes data only on behalf of the controller
- Data controller: decides the purposes and means of processing personal data, this can be a business, SME, public authority, an agency or other body. There can also be joint controllers
- Data subject: the individual to whom the personal data relates

Data controllership is currently held by GPs. There are standardised templates for general practices to use for data sharing agreements and some broad principles that can help advise them. But ultimately it comes down to the judgement of individuals and interpretations of legal risk, notably the risk of patient re-identification from the data.

In the absence of indemnity insurance, GPs are legally responsible for breaches, which can be costly. Claims or monetary penalties arising from data loss or data breaches fall outside healthcare indemnity and are therefore out of scope for Medical Protection assistance.[18]

Changing the data controllership within primary care is therefore the logical solution. This can take two forms: shifting the entire controllership or creating a joint controllership model.

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[17] It is worth noting that the data is still not universally representative of the whole population – people registered with a GP are not the same as the whole population of an area.
[18] *Data Breaches - Are You Covered?* (Medical Protection, 2021).

Changing the data controller entirely to a more central body, like NHS England, may appear the most straightforward solution, as it covers the entire population and therefore removes fragmentation. However, for reasons outlined below, NHS England is not necessarily set up for the scale of demand this would create. The prospect of moving data control entirely away from the GP would be logistically nonsensical – removing it completely would mean they have to have a contract for every single use of patient data, including the delivery of direct care.

A potential solution to this is to create joint controllership with another body within the primary care system that can take on the lion's share of controllership responsibility. Joint data controllers could include:

- NHS England (NHSE), or in a model where the NHS is devolved to combined authorities, the Department for Health and Social Care (DHSC). Some interviewees proposed this as it would be consistent across the entire primary care system and could be easier when people move between localities. However, some also highlighted NHSE may not have the capacity or capability to take on further data governance responsibilities. Data controllership would mean that each time someone wants to use primary care data, they would have to go to NHSE and the volume of interactions could be enormous.

- Integrated Care Boards (ICBs). ICBs are statutory entities at a bigger scale than a Primary Care Network (PCN) that would still enable controllership to be retained a more local level. There are distinct controllership benefits to more local control – the controllers will have a much greater understanding of the data they hold, and what it might be appropriate to access. As data controller, they would need to make sure that the data-sharing agreements comply with principles within data protection, like data minimisation, which is sometimes harder to assess if they do not have an understanding of the data they have.

Recommendation 1: NHS England and the Health Research Authority should work to simplify the landscape of data controllership within primary care, seeking to consolidate joint data controllership at ICB level.

2.3.1 Using the data

Population health data is used and analysed at an Integrated Care System (ICS) level. The primary reason population health management has not been scaled universally is a lack of uniformity across ICSs. Some ICSs are leading the way in their analytical capacity for population health management while others are still developing.

Maintaining ICS autonomy and local decision making, while ensuring some national consistency in outcomes, requires a careful balance of policy interventions. However, as demand changes and the health system transitions to a model of early intervention, there are some core services that should be considered a fundamental part of care provision across the country. As such, given its instrumental role in enabling preventative interventions, ensuring standardisation in population health management should be considered a foundational part of any modern health system. Therefore, some interventions may be required at a national level to create the conditions for advanced data analysis at a local level.

It is generally understood what the problems resulting from this lack of standardisation are, but it is not clear *why* some ICSs have deprioritised population health analytical capacity. Naturally, in cash-constrained environments, funding and resource limitations may partially explain differing prioritisation, but understanding what drives these differences is crucial to overcoming them if the ultimate priority is to ensure an adequate baseline of capacity.

How the data is used

Currently population health analysis is only done by, and accessible to, people that have access to this data already, namely:

- ICS analysts – who identify the need for interventions
- Clinicians – who execute the interventions

There are nevertheless still substantial complexities in actioning the data once insights are generated. Population health management that results in the delivery of a care intervention requires re-identifying individuals from a pseudonymised, aggregated data set. This can be a lengthy process. It requires:[19]

- Data to be de-identified in way that still enables it to be later re-identified
- A data infrastructure that can link the analytical data set with clinical workflows
- An information governance infrastructure that facilitates these processes without compromising data security

Integrating local government insights

Population health management is also not just the domain of the NHS. It is much broader, encompassing all the wider determinants of health, and should include for example education, employment, and housing data, involving colleagues from local authorities and public health.

However, integrating this data into a population health model at an ICS level and using it to generate insights is not yet widespread practice. While there are some outlier case studies such as Newport Pagnell that have used public health data, this is often sought proactively and is done, for example, through stakeholder meetings rather than at scale.

Some ICSs are starting to add data provided by local authorities, and will continue to add more datasets from local government when they are able to. At a minimum, public health officials within local authorities should have access to population segmentation data where it can

[19] Chris Branson, Helen Crump, and Claire Maynard, *Research into the Use of Data by Integrated Care Systems (ICSs)* (Understanding Patient Data, 2024).

improve the precision of public health interventions. This has been done in some ICSs, however it varies as information governance is done differently across every ICS.[20]

Information governance

Indeed, a major obstacle to the widespread use of population health management across the country is varied information governance practices. Each ICS has different barriers to data access with different processes and there is an overall lack of standardisation in best practice. Some of the more advanced ICSs have an information governance infrastructure in place that enables a consistent flow of data into a managed data warehouse (central repositories of data). This enables the implementation of an overarching framework or charter agreed by the data controllers, which creates a standardised process every time someone needs to access it.[21]

By contrast, other ICSs have no governance in place to support the ongoing use of data or a data warehouse.[22] While this is understandably more burdensome to gain permissions and build datasets with, even with the most sophisticated infrastructures, governance still remains a complex challenge.

These individual approaches are undermined further by national guidelines, laws, and regulations. There is a lack of coherence and clarity in national policy guidance on data sharing, making it challenging to interpret what can and cannot be done, and how to approach borderline use cases, "there's no right answer and within there being no right answer, it's up to every organisation to do it independently and that causes issues."[23]

Recommendation 2: NHS England should introduce national information governance standards, cohering all of the advice and guidance that already exists into one body of standards. NHS England should also identify what a baseline of analytical capacity should look like in ICSs that can enable both tactical and strategic intelligence functions.

Making appropriate interventions to enable this may also require understanding why such a divergence in analytical capacity exists across ICS – understanding the analytical capacity of each ICS, why analytical capacity may have been deprioritised, what other functions are considered a higher priority, and why. Once this is understood, appropriate interventions can be made and commensurate funding can be allocated.

Attracting capability

This lack of uniformity across ICSs is also reflected in their analytical workforce. There is significant variation in scale, skills, and organisation. The most advanced ICSs have coordinated analytical teams serving clear functions. In ICSs where their data infrastructure is

[20] Branson, Crump, and Maynard.
[21] Ibid.
[22] Ibid.
[23] Ibid.

less mature, the demand for situation reporting often comes at the expense of longer term analytical work; as one ICS Chief Analytical Officer said, "if you don't create the space for strategic intelligence it just gets completely mopped up in tactical stuff."[24]

At the most basic level, analysts are needed in order to gain data insights, and pay is a significant barrier to attracting this high skill, high demand workforce. While public services are unlikely to be able to match private sector salaries, the NHS Agenda for Change (AfC) pay scales are simply not sufficient.[25]

In central government, the Digital, Data and Technology (DDaT) profession was established to address skills shortages by helping departments to attract, develop and retain talent. As part of this, the profession involves a capability framework, which acknowledges the degrees of technical specialism, and its own pay brackets which can pay up to 30 per cent more than equivalent civil service roles.[26] Applying this DDaT pay flexibility to data analyst roles in ICSs could help address the recruitment challenge.

NHS England should therefore implement a model akin to the civil service's DDaT profession for data analysts, including more market competitive pay bands – negotiating budgets with the Treasury in the same way DDaT does. This would go with the grain of NHS England's ambition to build a "modernised" framework for the health informatics and digital workforce.[27]

This would not affect actual recruitment, which would continue to happen at a local level based on local needs.

Recommendation 3: NHS England should introduce a model akin to central government's Digital, Data and Technology (DDaT) profession. This would include a new pay framework outside of the Agenda for Change pay scales, as well as a capability framework to enhance personal development and recruitment. NHS England would maintain responsibility for the negotiating the pay bands with the Treasury, while recruitment responsibilities continue to sit with the ICS.

[24] Branson, Crump, and Maynard, *Research into the Use of Data by Integrated Care Systems (ICSs)*.
[25] Branson, Crump, and Maynard.
[26] Public Accounts Committee, *Digital Transformation in Government: Addressing the Barriers to Efficiency*, 2023.
[27] *Digital, Data and Technology (DDaT) Occupational Framework Development* (NHS England, 2021).

3. Equipping the primary care system

Despite acceleration of technology in general practice during the pandemic, and primary care being comparatively more advanced than other parts of the health system, the technological landscape remains underdeveloped. This has three interconnected themes: software, hardware and interoperability.

3.1 Current technological landscape

Many general practices are not even equipped with very basic IT facilities including highspeed broadband and fully functional Wi-Fi.[28] GPs report that the technology in general practice is slow to log in, clunky to use and unreliable.[29]

In addition to hardware, interoperability – how systems talk to each other – between health and care services is poor.[30] This exacerbates the administrative burden, particularly the fragmented digital interface with hospitals. The processing of hospital prescriptions, for example, requires manual transcription once they reach the general practice. If the drugs need to be taken for longer than three days, the general practice have to re-write the prescription, the volume of which, unsurprisingly, rapidly accumulates. In addition to being inefficient and therefore a drag on productivity, poor coordination of care can pose significant risks to patient safety.

Poor interoperability is perhaps most obvious with Electronic Health Records (EHR). There are three main ways of providing continuity of care: relationship, management and informational.[31] The latter relies heavily on the availability of records to all involved in the care of individuals, which is still not the norm within the NHS.[32] This is especially problematic in primary and community care given the range of practitioners that could be involved in the delivery of care across different physical locations.

In England, more than 300 million appointments are conducted in primary care each year across 6,500 GP practices of varying size. Routine NHS data are generated through every patient interaction with the system, and through wider administrative and clinical tasks such as diagnostic tests.[33]

Yet, while most NHS primary and secondary care providers now have some form of EHR in place – one of the most widely adopted technologies across all regions and sectors of care –

[28] *Fit for the Future: Digital Technology Roadmap* (Royal College of General Practitioners, 2020).
[29] Deloitte Centre for Health Solutions, *Closing the Digital Gap Shaping the Future of UK Healthcare*, 2019. Deloitte Centre for Health Solutions.
[30] *Fit for the Future: Digital Technology Roadmap*. *Fit for the Future: Digital Technology Roadmap*.
[31] Richard Baker et al., 'Primary Medical Care Continuity and Patient Mortality: A Systematic Review', *British Journal of General Practice* 70 (September 2020).
[32] Claire Fuller, *Next Steps for Integrating Primary Care: Fuller Stocktake Report* (NHS England and NHS Improvement, 2022).
[33] Josh Keith and Fiona Grimm, *How Better Use of Data Can Help Address Key Challenges Facing the NHS* (Health Foundation, 2022). Keith and Grimm.

they are extremely fragmented. There is significant variation between NHS organisations in the types, age and functionality of EHR platforms that have been implemented,[34] and since every trust and practice can procure a different system, this means that every organisation may use a slightly different way of collecting information. This leads to a fragmented data landscape with limited linking of data, not least because hospital and specialist care in England is provided by more than 200 NHS trusts.[35]

3.2 Solving interoperability

Improving interoperability in the NHS has been a policy ambition for years. NHS England have introduced the Connected Care Records programme which seeks to bring electronic records from different health and care organisations together digitally in one place. However, there is still some way to go to achieve fully interoperable records.

Achieving interoperability in disparate healthcare systems, while complicated, is possible. In Northern Ireland for example, the healthcare data of nearly 1.8 million patients was held in multiple systems spread across six trusts, and was combined into a single platform, accessible online in real-time.[36] It is worth noting that this is the equivalent to the average population covered by an ICS in England, but is instructive for how to overcome a fragmented data landscape.

Figure 4: Integrating care records using Northern Ireland's Electronic Care Record Programme (NIECR)

In 2013, the NIECR rolled out a programme aiming to bring together the healthcare data of nearly 1.8 million patients which, at the time, was located in numerous disparate systems. The programme intended to combine the systems into a single, accessible webpage which contained clinically relevant information that was to be updated in real-time, and available to access at any point in the health and social care trusts in Northern Ireland.

By January 2018, the NIECR system had 700,000 user logins; it is in use by over 98 per cent of clinicians, and 95 per cent of those confirm the platform has saved time. Since its inception, additional enhancements have been made to provide a range of other functions including: eTriage, diabetes pathway, regional mortality and morbidity system, and radiology order comms.

The system won the HSJ 2014 award in 'Enhancing Care by Sharing Data and Information' and the 2016 'Building Better Healthcare Award for best Administration, Information or Data System' thanks to its eTriage function.

Source: Deloitte, 'Closing the digital gap: Shaping the future of UK healthcare', 2019.

Indeed some progress has been made in England. Unlike many other parts of primary care, there is broad consensus among experts that technology and data standards should be

[34] Deloitte Centre for Health Solutions, *Closing the Digital Gap Shaping the Future of UK Healthcare*. Deloitte Centre for Health Solutions.
[35] Keith and Grimm, *How Better Use of Data Can Help Address Key Challenges Facing the NHS*.
[36] Deloitte Centre for Health Solutions, *Closing the Digital Gap Shaping the Future of UK Healthcare*.

centralised, to enable them to be standardised across the system. This is currently done through SNOMED Clinical Terms (SNOMED CT), which is a structured clinical vocabulary for use in an electronic care record.[37] It is one of the most comprehensive and precise clinical health terminology products in the world. This gives clinical IT systems a single shared language, which makes exchanging information between systems easier, safer and more accurate.

The key problem is that different general practices have procured their technology systems from different companies, making the technological landscape disparate and fragmented. There is also poor interoperability between these systems. There are some well-established methods that can transfer data between healthcare systems, but these are often complicated by each trust or general practice being locked into different pre-existing commercial contracts.[38]

This has also left them vulnerable to 'vendor lock in'. Some software vendors see interoperability as a commercial threat in that the easier it is to get data in and out of their systems, the less locked in the practice might be as a customer.[39] Some vendors may also treat the lack of interoperability as a revenue stream, charging both customers and third parties a premium to integrate with their systems.[40]

Indeed in the US, there is now federal legislation preventing these kind of practices, termed 'information blocking'.[41] Information blocking in the US occurred in many forms – when physicians tried to access patient records from other providers, when connecting their EHR systems to local health information exchanges, when migrating from one EHR to another and when linking their EHRs with a clinical data registry.[42] The 21st Century Cures Act prohibited such information blocking in law.

The potential options for government could be to introduce secondary legislation to make it illegal to interfere with, prevent, or materially discourage access, exchange or use of electronic health information. Alternatively, the Competition and Markets Authority could review any anti-competitive practices and sanction these companies.

Notably, the scale of the technology problem in general practice is poorly understood. Interviewees argued that, particularly with hardware, nobody knows what is in place across the system: "nobody knows what we have and therefore what we need to do". Indeed, for both software and hardware, there remains a significant gap in knowledge. In particular, it is not clear the scale of commercial lock-in across the system and the length of the procurement contracts for the technology that do exist.

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37 SNOMED CT is a National Information Standard and a contractual requirement, and is therefore used to capture information in all GP systems. It contains all the clinical terms needed for the whole NHS, from procedures and symptoms through to clinical measurements, diagnoses and medication.

38 Ibid.
39 *Making the Right Technology Decisions* (NHS Providers, 2021z).
40 Ibid.
41 Ibid.
42 *What Is Information Blocking?* (American Medical Association, 2021).

Crucially, an audit of the current technological landscape should seek to understand the contracts general practices currently have and the remaining duration of those contracts. Understanding this would then allow ICSs to negotiate terms with vendors at scale.

Recommendation 4: NHS England, and in a future devolved model, the Department of Health and Social Care (DHSC), should set a 'minimum viable digital standard' for technology hardware in general practice. Integrated Care Systems should then conduct an audit of both hardware and software in primary and community care to understand the scale of the technology challenge in detail, and therefore where the infrastructure falls short. The ICS should determine what it would take to meet that standard, and the government should allocate appropriate resources to fix this, recognising that a one-off investment will deliver significant benefits.

Recommendation 5: DHSC and NHS England should pursue a combination of interoperability interventions to enable interoperable IT systems by 2027. The Secretary of State for Health and Social Care should introduce secondary legislation to legislate against 'information blocking'. NHS England should also work with ICSs to map the current commercial landscape and providers of EHRs across the system, and how 'locked in' these contracts are, and use this information to determine how to approach commercial provision of technology that is standardised and interoperable across England.

4. Adopting innovation in primary care

Aside from inefficiency and frustration for clinicians, not getting the basics right precludes the use of more nascent but revolutionary innovations including algorithms, artificial intelligence (AI) and machine learning (ML). Of course, it is critical to apply these innovations with a specific purpose rather than for innovation's sake. While AI is not a universal solution to all problems in primary care, it would be an extremely effective solution to specific problems, such as relieving the administrative burden in general practice.

The following analysis is predicated on the assumption that technology should amplify human decision making, largely by freeing up much needed capacity, instead of replacing it.

4.1 The role of artificial intelligence in primary care

The application of these innovations is still being explored, but generally, their utility lies in processing huge volumes of data at a far faster rate than any human, and with much greater consistency. Deployed in the right way, algorithms can enable government services to re-allocate resources much more efficiently and effectively.[43]

Artificial intelligence can refer to a variety of different functions and processes in computing, but it can be distilled down to the following three core concepts.[44] It is important to note that in all of these cases, data quality and governance, and system interoperability, are key, as would be presenting the reasoning in a format that is understandable to clinicians.

[43] Kirsty Innes and Beacon, Rosie, *Government by Algorithm: The Myths, Challenges and Opportunities* (Tony Blair Institute for Global Change, 2021).
[44] Innes and Beacon, Rosie.

Figure 7: Distinction between algorithms, artificial intelligence, and machine learning

1. **Algorithms** are a form of automated instruction, or a list of related instructions.
    - Many decision-making processes could be considered an algorithm. For example, the process that determined the tiers during the COVID-19 pandemic looked at specific input factors, such as the rate of infection, the reproduction rate and the current pressures faced by local NHS departments, to determine which tier should be applied in a given geography.
    - Similarly, a medical diagnosis algorithm simplifies complex decision making to provide a structured pathway for evaluating symptoms, signs, and test results.
    - When applied in the context of computing, examples of sophisticated algorithms include those used in satellite navigation systems to help find the optimum travel route or Google's PageRank, which determines which webpages are displayed in what order.
    - Algorithms can work standalone, but are often used to build AI systems.

2. **Artificial intelligence (AI)** refers to a collection of scientific disciplines and technology that enable machines to carry out tasks usually associated with human intelligence. AI is built using algorithms, but not every program built using algorithms is considered AI.
    - AI enables machines to mimic human cognitive functions, such as learning and problem solving. It can include any software with decision making capability, automated software with decision making capability, and self-learning software.
    - AI is not one ubiquitous technology but represents several subfields that individually, or in combination, add intelligence to applications.
    - AI is already widely used in other industries, for example, computer vision (e.g. face or automatic number plate recognition), natural language processing (e.g. search engines understanding questions entered in human language), and speech recognition.

3. **Machine learning (ML)** is a subset of artificial intelligence that allows machines to learn from data without being explicitly programmed to. It is one of the most common forms of AI.
    - Machine learning aims to teach a machine how to perform a specific task and provide accurate results by identifying patterns, for example, by sorting through images.
    - It has a more limited scope of applications than AI. It is therefore used as a complement to AI to make it significantly more predictive and adaptable, enabling AI to learn without direct instruction.
    - AI allows a machine to simulate human intelligence to solve problems and the goal is to develop an intelligent system that can perform complex tasks, whereas the goal of ML is to build machines that can learn from data to increase the accuracy of the output.
    - In healthcare, this could look like scanning X-rays for cancerous growths, programmes that can develop personalised treatment plans and systems that efficiently allocate hospital resources.

The application of these innovations in the delivery of care can broadly be split into three types: diagnostic, treatment, and administrative. They can also have other uses which do not directly impact care on the ground such as speeding up drug discovery and managing healthcare data.

While there is certainly scope for diagnostic and treatment AI to be applied in a primary care setting, research and investment is currently more focused on secondary care applications.[45] For example, using AI to determine what combination of drugs would be most effective for a cancer patient or reading X-ray images in an A&E department. While promising, many of the frontier systems in AI are still in an elementary phase of development and both the innovations and the regulatory landscape would need updating before they are scaled across the health system.

In primary care specifically, algorithms, artificial intelligence, and machine learning could be deployed to automate repetitive tasks that currently consume too much time among highly skilled clinicians – in turn relieving capacity. The largest near-term benefit of AI to primary care is in its application to administrative tasks and freeing up a professional's time.[46] In the medium to longer term, it may be able to replace tasks in the consultation.

Interviewees suggested that bolstering administrative staff could have a much more direct impact on GP capacity than some of the non-clinical roles in general practice funded by the Alternative Roles Reimbursement Scheme (ARRS). As outlined in *Prescription for Prevention: A new model for primary care*, ARRS staff tend to carry out tasks that GPs do not typically do themselves.[47] In addition, retention of administrative staff – especially receptionists – is poor.[48]

27 per cent of practice time is spent on activities relating to GPs "getting paid", which refers to tasks such as filling out reports and entering data into various information systems that report to other agencies.[49] Other areas include processing information from hospitals (26 per cent), keeping up to date with changes, reporting information, and supporting patients dealing with the NHS.[50]

Innovation can also offer some diagnostic benefits, particularly for illnesses that occur in a high volume and lend themselves to imaging, such as dermatology. But it has particular benefits for administrative automation.[51] This could include but is not limited to:

- Streamlining and automating documentation tasks, e.g. natural language processing to dissect patient-doctor conversations and create notes

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[45] *Artificial Intelligence and Primary Care* (Royal College of General Practitioners, 2019).
[46] Ibid.
[47] Stuart Hoddinott and Nick Davies, *Performance Tracker 2023: General Practice* (Institute for Government, 2023).
[48] Ibid.
[49] Matt Willis et al., 'The Future of Healthcare: Computerisation, Automation and General Practice Services', 2020, https://doi.org/10.13140/RG.2.2.23586.45760.
[50] NHS Alliance, *Making Time in General Practice*, 2015. NHS Alliance.
[51] Willis et al., 'The Future of Healthcare'.

- Automating repetitive administrative and clerical workflow like letter scanning and prescriptions, e.g. robotic process automation – a type of software robot that reproduces repetitive tasks on a desktop computer
- Stock and inventory management in a pharmacy, e.g. a stockroom curated by a robot
- AI-aided diagnosis based on image recognition, e.g. ophthalmology and dermatology images scanned by an AI
- Continuous monitoring of patients and early recognition of deteriorating patients, e.g. remote monitoring and home hospitalisation
- Data analysis of population data, e.g. using AI to spot patterns in practice population data not previously identified

4.2 Increasing regulatory capacity

However, in the same way that the efficiency gains are unprecedented, so too are the risks. If a task is executed thousands of times at scale, but is incorrect, the damage could be time-consuming to fix and potentially dangerous for patients.

Therefore, while these innovations are promising, even if underlying infrastructure problems were fixed, the rollout of frontier innovations is some way off being scaled across the NHS. This is due primarily to the regulatory landscape and issues surrounding implementation, the latter of which is explored in Section 5.1 of *Prescription for Prevention: A new model for primary care*.

Improving the regulatory capacity of the NHS is an essential prerequisite to the roll out of innovation in primary care and the wider health system, but so too is identifying the most appropriate uses.

For instance, there is a growing discussion about the use of Large Language Models (LLMs) in primary care.[52] One of the most well-known uses of LLM is as generative AI – when given a prompt or asked a question, it can generate text in response. Suggestions for its use include an LLM-powered chatbot where patients can check their symptoms and be directed to the right point in the health system. This is known as Algorithmic Clinical Decision Support Software.

However, regulating LLMs to be used in a healthcare setting is particularly difficult. LLMs are stochastic in their processes, meaning their results are unpredictable and could vary for the same input. This makes it difficult to quantify risk, assign a risk class, or implement a risk management process.

Crucially, there are often innovations that can produce similar outcomes (in this case, faster access to the right clinical specialist in primary care) that do not involve technological innovations that are inherently difficult to regulate, and indeed have been used for many years in other industries. For example, Brookside Practice (see *Prescription for Prevention: A new model for primary* care, Section 5.1) have already rolled out an AI-powered triage system that

[52] Richard Armitage, *How LLMs Will Transform General Practice* (BJGP Life, 2024).

enables people to contact their GP practice quickly and efficiently, and did not require extensive regulatory analysis.

This is not to say that the regulatory landscape should not adapt to the modern challenges of health innovation – it will inevitably be required to regulate highly complex technologies – but it is crucial to recognise that there are strategic decisions to make about how to use limited regulatory capacity in the short term to achieve the best outcomes for patients.

4.3 Current regulatory landscape

Nevertheless, the rise of both simple and sophisticated technology in the delivery of care will continue to challenge the NHS' regulatory landscape – which is already crowded and inefficient.

Regulation provides a variety of benefits in terms of maintaining safety and quality of care, but the variability, extent, and fragmentation of the regulatory system makes it hard for regulators to act effectively and places a significant burden on NHS provider organisations.[53] There are over 126 organisations who exert some regulatory influence on NHS provider organisations.[54] This includes ten service regulators, eight professional regulators, eleven information and standards regulators, alongside numerous royal colleges, professional associations, and advisory groups.[55]

The most relevant bodies for technology are the Health Research Authority (HRA), the Medicine and Healthcare Products Regulatory Agency (MHRA) and the National Institute for Health and Care Excellence (NICE).

The main way of regulating software in health is through 'Software as a Medical Device' (SaMD) regulation. Software intended to provide diagnostic or therapeutic information is usually regulated as a medical device according to a classification system. All medical devices require a clinical evaluation, and in many cases, this may require a clinical investigation.

Not all IT systems or software used in healthcare qualify as a medical device. The definition of a medical device applies to a broad range of use cases as it covers any instrument including software "intended by the manufacturer to be used, alone or in combination, for human beings" for a set of medical purposes such as diagnosis, prevention, monitoring, prediction, prognosis, treatment or alleviation of disease or disability.

There is also Software in a Medical Device (SiMD) which helps to run a hardware medical device, for example, software that controls the inflation or deflation of a blood pressure cuff or used in closed loop control of a pacemaker.

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[53] Eirini Oikonomou et al., 'Patient Safety Regulation in the NHS: Mapping the Regulatory Landscape of Healthcare', *BMJ Open* 9, no. 7 (July 2019): e028663. Oikonomou et al.
[54] Ibid.
[55] Ibid.

Examples of what falls into the scope of SaMD regulation:[56]

- Software that helps triage patients based on their symptoms and medical history
- Software that reads mammography scans to detect the presence of breast cancer
- Software embedded in a wearable that monitors a patient's heart rate through an ECG app and triggers alerts of possible atrial fibrillation
- Algorithmic Clinical Decision Making Support Software

Examples of what does not fall into the scope of SaMD regulation:

- Automated transcription of patient-doctor conversations and the creation of notes
- Automation of repetitive administrative and clerical workflow like letter scanning and prescriptions
- Stock and inventory management in a pharmacy

Health IT systems mostly have to comply with a set of information standards.[57] Much of this does not need to be regulated at all, and involves the use of algorithms rather than advanced AI.

4.4. Options for reform

Given the fast-moving market, interviewees highlighted the need for additional regulatory expertise and capacity. Creating a new regulator is unlikely to be the fastest way to do this nor the most cost effective. There is also already a team at the MHRA that do this work – the SaMD team.

However, particularly given the growing complexity of the market, this team lacks the manpower to police the market in a more proactive way and generally deal with the volume of policy work that is required for SaMD.

There are also alternative regulatory approaches that can help with the development of innovation. Regulatory sandboxes have started to be used within healthcare, and could be a way of overcoming the regulatory obstacles associated with innovation. Sandboxes are "safe spaces in which businesses can test innovative products, services, business models and delivery mechanisms without incurring all the normal regulatory consequences".[58]

The sandbox environment allows exploration of processes that may violate current rules and regulations but have the potential to deliver a large benefit. The MHRA is already doing this with the AI Airlock.[59] Other examples include the UK Care Quality Commission sandbox, NHS

[56] Wade Schroeder, *Ultimate Guide to Software as a Medical Device (SaMD)* (2023: Greenlight Guru, n.d.).
[57] *DCB0129: Clinical Risk Management: Its Application in the Manufacture of Health IT Systems* (NHS England, 2018).
[58] Emily Leckenby et al., 'The Sandbox Approach and Its Potential for Use in Health Technology Assessment: A Literature Review', *Applied Health Economics and Health Policy* 19, no. 6 (November 2021).
[59] *AI Airlock: The Regulatory Sandbox for AIaMD* (Medicines and Healthcare products Regulatory Agency, 2024).

Test Beds Programme and the Health Data Research sandbox. In fact, the UK CQC sandbox was significant in developing the regulatory approach to algorithmic digital triage.[60] Interviewees suggested that to maximise the utility of sandboxes, they should focus on particular technical themes or clinical areas, rather than being generalist.

Recommendation 6: Government should review the capacity of the MHRA SaMD team to ensure that is has the appropriate capacity to proactively manage the market of manufacturers as well as distributors. This should be with a view to maximising the potential of technological innovations while adequately policing products to ensure patient safety.

Recommendation 7: The MHRA should maximise the value of their sandbox approach by prioritising specific themes or clinical areas – such as remote monitoring for multi-morbid patients, home hospitalisation, or AI diagnosis based on image recognition – that could deliver the greatest system value.

[60] *Getting to the Right Care in the Right Way - Digital Triage in Health Services* (Care Quality Commission, 2020).

5. Conclusion

Technology is a fundamental building block of a modern, preventative primary care system. Indeed, the role of technology will only grow in significance as the innovations mature within the health system. It could transform care for patients by opening up more capacity for clinicians, by intervening earlier in the progression of their illnesses, and by monitoring them more effectively to avoid preventable decline.

There is significant 'hype' surrounding technology. But this paper identifies some quick wins with large returns that can revitalise how care is delivered in people's communities. If the core aims of the primary care system are to intervene early, respond quickly, and avoid decline, then technology and data will unquestionably be essential to achieving this – and getting the basics right is essential.

If the primary care system is to adapt to the growing volume and complexity of demand, then technology must play a central role in predicting and personalising care. But only once the basics are in place across the system can more frontier technology be applied in reimagining primary care.

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