

BMJ Open Evaluating the impact of a digital leadership programme on national digital priorities: a mixed methods study

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ABSTRACT

Objectives This study aimed to determine the impact of the United Kingdom's National Health Service Digital Academy (NHSDA) Digital Health Leadership course on high-level recommendations in digital preparedness and the development of a proficient leadership to oversee digital transformation, which has been a longstanding priority within the NHS.

Design A mixed methods study incorporating an online questionnaire, in-depth interviews and focus groups that were then analysed through a thematic analysis, underpinned by a constructivist approach.

Settings An online mixed methods study of a defined cohort of participants who had completed the NHSDA course.

Participants 26 participants were recruited to the study, of whom 50% were clinicians, 26.9% in management and 19.2% in data science. All had completed the 2-year NHSDA programme in Digital Health Leadership more than 6 months prior.

Results Interviews and focus groups elicited two key areas of impact of the course: loco-regional digitisation and the development of a network of change agents. The dissertation project had direct effects on local digital transformation efforts. Most of these projects focused on clinician (11.7%) or service user (10.3%) engagement, as oppose to de novo digital processes (9.4%). The development of a network of digital leaders has facilitated communication between organisations and improved the efficiency of the national digital infrastructure.

Conclusions A bespoke course incorporating a dissertation of practice model for digital health leaders can have broader impact for the attainment of digital priorities. This includes helping trusts to successfully adopt digital solutions, as well as fostering shared organisational learning. These influences, however, are mediated by resource and cultural barriers, which continue to hinder transformation efforts.

BACKGROUND

Delivery of a digitally transformed healthcare service has been at the forefront of NHS plans for over a decade. Estimates indicate that this digital transformation strategy will cost £8.1 billion, with all NHS trusts mandated to reach a core level of digitisation by 2024.¹ Progress has been variable. 17% of trusts still rate their digital maturity as medium or low,²

Strengths and limitations of this study

- This study is the first to critically examine the impact of the NHS Digital Academy on high-level digital priorities.
- Using a robust mixed methodology, we enrolled previous candidates, who hold prominent national roles in digital health transformation, to determine spheres of impact.
- Our findings provide a blueprint for the field of digital health leadership including similar digital courses globally
- By highlighting areas that require further examination, we also set future directions in the education of digital health leaders.
- This study is limited to those who have completed the NHSDA course and cannot provide comparisons with the effects of similar courses.

despite the increasing importance placed upon achieving national digital priorities.

The COVID-19 pandemic galvanised the move towards digital solutions, with traditional models of care no longer appropriate. Policies to avoid transmission of COVID-19 have pushed digital solutions for facilitating patient-clinician interaction, transitions of care and the accessibility of healthcare services.³ There is therefore greater need for NHS trusts to attain greater digital capabilities to carry out even routine functions.

Crucial to achieving these aims and enabling local digital transformation is the development of a digitally prepared workforce and a digitally proficient leadership team. The Wachter Review highlighted the importance of establishing a digital workforce and advocated for growth of local digital leaders and the chief clinical information officer (CCIO) role.⁴ The remit of these digital leaders is to oversee the rapid uptake of digital solutions and to guide sustainable organisational transformation in a manner that avoids the mistakes of previous failed attempts. Moreover, leadership must now examine future opportunities such as integrating electronic

health records across providers and the safe application of artificial intelligence.⁵ Ensuring these leaders are qualified and supported with a network of resources is central to the realisation of this vision.

As a response, the NHS Digital Academy (NHSDA) developed its flagship course to provide the necessary training, mentorship and support to these leaders to facilitate meaningful change at a local, regional and national level. Originally commissioned for delivery by Imperial College London, in conjunction with the University of Edinburgh and Harvard University, the programme is divided into two fully accredited components.⁶ The first, culminating in a postgraduate diploma (PGDip) in Digital Health Leadership, uses a blended learning approach to provide a theoretical foundation in key transformational topics including user-centred design, decision support and actionable data analytics. Following the year-long PGDip, candidates are given the opportunity to proceed to a 1 year master's (MSc).⁷ The MSc uses a Dissertation of Practice model to enable project based learning and practicable applications of theoretical constructs to achieve digital transformation. While curriculum evaluations and feedback have focused on individual aspects of the course, little is known about the programme's impact on the delivery of national and regional targets for digital transformation.⁸ The aim of this mixed-methods study is to critically evaluate the impact of the NHSDA Digital Health Leadership course on high-level recommendations in digital maturity and preparedness. This study enables critical understanding of the extent to which the needed levels of digital health leadership have been established within NHS trusts and provides a blueprint for further courses development both nationally and internationally.

METHODS

Recruitment

Participants in cohort 1 of the NHSDA's flagship Digital Leadership were recruited into the study. To assess the impact of the course on attainment of organisational and national digital priorities, the study targeted participants from the first cohort, who completed the MSc. This mitigated recency effects, ensuring that participants had time to apply acquired knowledge. The study diagram is demonstrated in figure 1.

Scoping questionnaire

An online scoping questionnaire was developed (online supplemental material 1), which was mapped to programme learning objectives. The questionnaire focused on assessing impact of the programme on individual skill acquisition, organisational aims and NHS priorities. The survey also encapsulated some aspect of the existing curriculum feedback that participants undergo during the course. This focus supported exploration of the influence of the dissertation project on high-level priorities. Two authors (RCB and AA) developed

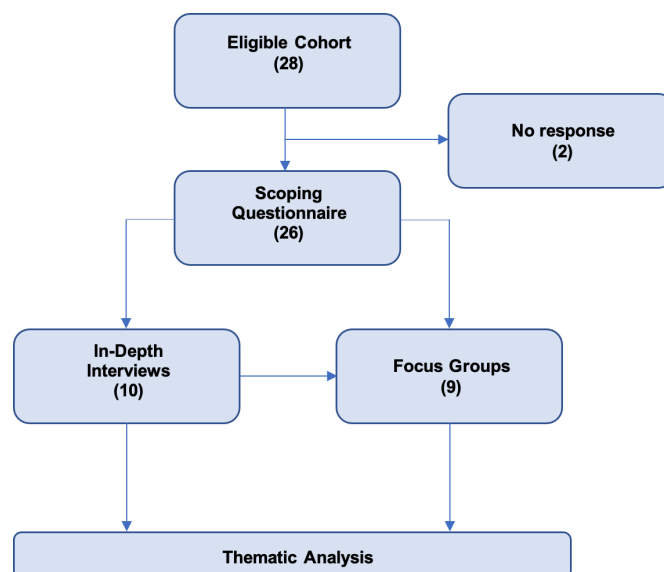


Figure 1 Diagram of the participant flow throughout the study.

the questions of the survey, with a third (AS) independent author was involved to derive consensus and discuss disagreements. All study participants were recruited via an email containing an anonymous link, such that central tendency biases were reduced.

Interviews

Following completion of the survey, anonymous responses were quantitatively (multiple choice questions) analysed. Two authors (RCB and AS) used the results from these responses to develop topic guides for both semistructured interviews and focus groups (online supplemental material 1). Enrolment to an interview was not dependent on completion of the survey. Interviews were conducted online via Microsoft Teams (Microsoft Corporation, USA) due to the restrictions imposed by the COVID-19 pandemic during the conduct of the study. Interviews were undertaken by an author not affiliated with the NHS Digital Academy or its faculty (AA) to reduce response bias.

Focus groups

Two online focus groups were subsequently conducted by an author not affiliated with the NHSDA (AA). Each focus group involved up to five participants. Participation in the focus groups were not dependent on previous completion of either the survey or interview. Focus groups used open-ended prompts with discussion between participants facilitated to understand shared experiences and to provide a deeper understanding of issues raised in the previous stages of the study.

Analysis

Responses to the survey conducted online using the experience management software, Qualtrics (USA), were aggregated. Frequencies were calculated for each response across each option. Given the relatively

small sample size for this study, no further analysis was conducted on quantitative responses. The response frequency was discussed between authors and used to guide questions in semistructured interviews. Specifically, areas authors felt were contentious, or where there was a strong consensus among respondents were the focus of further examination.

To facilitate analysis of online interviews and focus groups, audio was recorded with the explicit consent of participants. Transcription was conducted using an online tool Descript (USA), with the transcript fidelity verified by the researcher who conducted the interviews (AA) directly following the interview/focus group. Anonymised transcripts were analysed using an established thematic analysis approach, until thematic saturation was reached.⁹ Initially, transcripts were reviewed to provide familiarisation of the data. Transcripts were then coded by two independent authors (AA and RCB) and uploaded to a qualitative analysis tool, MAXQDA (Germany) to facilitate data exploration, for example, by determining the frequency of each code. Codes were aligned with recommendations from the Wachter Review to highlight key areas of impact,⁴ which was the driving force for the establishment of the NHSDA. Subsequently, three authors (AA, RCB and AS) reviewed codes and developed subthemes, and then high-level impact themes drawing together codes into broader areas of impact. These themes were reviewed against the anonymised transcripts and amended as appropriate until there was thematic consensus. Disagreements regarding allocations of codes, themes and subthemes were discussed among authors until consensus was determined. Subthemes that were consistently mentioned by participants, those which aligned with findings from the survey and those that were highlighted as strong determinants were considered more prominent influences. A constructivist approach was used to underpin the conduct of this study paralleling the active learning undertaken throughout the MSc. This paradigm focusses on the importance of learning as an active process of engagement and reflection, influenced by context and motivation.

Patient and public involvement (PPI)

As this study represented an educational evaluation of a novel digital health leadership course, no PPI was involved.

RESULTS

A total of 26 out of 28 eligible participants completed the online questionnaire. A percentage of 34.6 of responses were female. Fifty per cent of respondents to the questionnaire were primarily clinicians, while 26.9% were management focused, and 19.2% were involved in data science or information technology. Interviews were conducted among 10 participants. The demographics of this subgroup were similar to those participating in the original survey, with 40% female and 40% based in

non-clinical roles. Two focus groups were subsequently undertaken, in which 44.4% of the participants had not been interviewed previously.

From the analysis, two broad areas of impact of the NHSDA were elicited: (1) loco-regional digitisation of NHS Trusts and (2) the development of a network of digital change agents. Table 1 demonstrates how the course impacted these areas through quotations from respondents.

Theme 1: loco-regional digitisation

The NHSDA was shown to impact on regional digital development, primarily because of participants' MSc dissertation projects. A percentage of 67.6 of respondents reported their choice of project was influenced by high-level national priorities outlined in documents including the Wachter or Topol reviews. These priorities included the attainment of digital maturity of NHS Trusts by 2023, with 19.4% respondents reporting direct influence of these aims on their project. A description of the dissertation projects for the 28-person cohort mapped to the four main themes from the Wachter Review are listed in table 2. The impact of the course on loco-regional digitisation efforts was further subdivided into direct and indirect influences.

The majority of projects were focused on increasing engagement of healthcare professionals (11.7%). This was greater than those concerning service user engagement (10.3%) or organisational barriers to digital transformation (9.7%). Fewer projects aimed to develop de novo digital processes with 9.4% of respondents reporting that integrating care through digital technology was a project priority. Key to the projects aiming to improve engagement was the effect of the MSc on candidates' perceptions of digital transformation in their organisations. One CCIO of a tertiary service had 'previously trialled everything' to transform outpatient services. Within the MSc project, however, the participant found 'it [the NHSDA] made me realise it's not about persuading them [consultants] with data...but ask for explicit reasons'.

Similar themes were appreciated by participants trying to engage healthcare professionals in non-clinical scenarios. Following the development of a shift suggestion engine to address workforce shortages, one participant recalled that 'the knowledge from the MSc made me understand the motivating factors that made people pick up additional work'. As such, this impact on candidates' perspectives had the potential to improve the outcomes of digital transformation targets. As one of the informaticians examining 'bring your own devices' noted, rather than resisting contrary opinions, understanding 'there is a real reason why people think what they think...and valuing that, drove a better digital product'.

The NHSDA course also had indirect influences on digital transformation. Several respondents reported how the lessons from their MSc projects were used as templates in other areas. One CCIO noting they were 'able to take my research and go to NHSI and say this

Table 1 Demonstrating the breadth of impact in across areas, with participant interview quotes highlighting the main themes and subthemes elicited

Theme	Subtheme	Quote
Loco-regional digitisation	Direct impact on digitisation and transformation	<i>'My project was about looking at the whole process...here's a technology we could employ but how do we deliver that in a tangible way? What am I missing about it?'</i> Interviewee 1
		<i>'We previously trialled everything protocols SOPs. For me it was a lightbulb moment, it [the NHSDA] made me realise it's not about persuading them [consultants] with data...but ask for explicit reasons'.</i> Interviewee 3
		<i>'The knowledge from the MSc made me understand the motivating factors that made people pick up additional work'.</i> Interviewee 4
		<i>'I'm used to a lot of improvement projects, but for my thesis I did a particular project around outpatients. It [the MSc] was good to give me time to dissect in real detail why things did or didn't work'.</i> Interviewee 3
		<i>'The NHSDA helped be more strategic on projects. My project [on electronic access for discharge teams] helps our aim to go paperless and digitize by 2023'.</i> Interviewee 2
	Indirect impact on digitisation and transformation	<i>'The important bit about the project was I was able to take my research and go to NHSI and say this is what I've done with NHSDA... can we deliver a wider digital solution'.</i> Interviewee 4
		<i>'My project [on Bring Your Own Device] was picked up by NHSX...I wanted it to be practical and useful...project helped shine a light on the fact these policies aren't always easy to read'.</i> Interviewee 8
		<i>'I've been able to bring some national recommendations and reports around that [video conferencing]. That all started from the MSc project... I also used it in the Getting it Right First Time (GIRFT) national project'.</i> Interviewee 10
	Barriers to impact	<i>'My dissertation was about the implementation in one service... that will be scaled up throughout the organization based on the results from that in all different specialties. I also have had conversation with other Trusts who want to implement off the back of our experiences'.</i> Interviewee 7
		<i>'I did have executive coach buy-in...and the corporate team saying it's a great idea... but we didn't have the resources'.</i> Interviewee 2
A network of digital leaders	<ul style="list-style-type: none"> ▶ Development of a network ▶ Benefits of a network ▶ Influence of a network on digital transformation efforts 	<i>'Across my organization, I'm the only one who's network across the UK...everyone sharing practice and sharing experiences...all those are invaluable'.</i> Interviewee 2
		<i>'Suddenly I was surrounded by people who thought about the digital ecosystem... you're getting this constant stream of stuff like here's an opportunity, here's this, have you seen this report. That feeling of community was really important from the diploma'.</i> Interviewee 3
		<i>'The positive impact of the MSc is around community. Although digital informatic has been growing it hasn't had direction or focus, as they hadn't had people who understand transformation in the way that the MSc has put it across'.</i> Interviewee 4
		<i>'By demonstrating the value of the network I've created, the organisation has meant I'm pulled into bigger and bigger projects'.</i> Interviewee 5
		<i>'A network of people, that is the number one thing that is useful on a weekly, if not daily basis... I'd see silos being broken down because throughout the course we were working closely'.</i> Interviewee 8
		<i>'The peers on my MSc, we give each other daily support...we send each other documents so we don't have to try and reinvent the wheel...it makes it easy. When I reach out to another organisation, I immediately ask who does X. If I don't know their CIO it takes me a second to find out, although 9/10 times it's someone I know. We then get things together, share resources, connect and make things work'.</i> Interviewee 9

Table 2 Cohort dissertation topics mapped to Wachter review main themes

Dissertation topic	Engagement change and culture	Leadership development	Workforce development	Skill development
App to schedule extra shifts	x		x	x
Bring your own device	x		x	
Building digital maturity skills and capacity while improving retention	x		x	x
Population health management supply and value chain	x	x	x	
Population health initiatives	x	x		x
Deployment of an electronic observations system	x	x	x	x
Board level digital readiness	x	x		x
Blueprint for digital excellence in the development of a new hospital		x		x
EHR Implementation	x		x	x
Implementing recommendations of Topol review	x		x	x
Impact of digital working on patient care	x		x	x
Improving performance of cardiorespiratory outpatients department	x	x	x	x
App to reduce harm suicide and improve safety and clinical outcomes in mental health	x		x	x
Mobile app to support point of care results review and acknowledgement	x		x	x
Standards and processes for sharing data across platforms and organisations	x			x
Blueprint for digital first GP	x	x	x	x
Participant preferences for contact and clinical research study enrolment	x			x
Nursing utilisation of the EPR optimised to facilitate transfer of care	x	x	x	x
Implementing SNOMED CT	x		x	x
Evaluating impact of digital maturity on effectiveness and efficiency of care in adolescent inpatient mental health units	x	x		
Digital transformation of epilepsy care and monitoring	x	x	x	x
Implementing SNOMED-CT coding into an EHR for clinical decision support, data sharing and medical pathway transformation	x	x	x	x
Direct online advice from consultant psychiatrists to GPs	x		x	x
Returning health professionals living with cancer to work via a digital resource	x	x	x	

Continued

Table 2 Continued

Dissertation topic	Engagement change and culture	Leadership development	Workforce development	Skill development
Blueprint for initiating and sustaining HEPMA in a non-global digital exemplar environment		×	×	
Digital clinical engagement strategy	×	×		
Ways to improve data quality in primary care, scotland	×		×	×
How does the correlation between leadership and cultural engagement impact performance			×	

App, Application; EHR, Electronic Health Record; EPR, Electronic Patient Record; HEPMA, Hospital Electronic Prescribing and Medicines Administration; SNOMED CT, Systematized Nomenclature of Medicine Clinical Terms.

is what I've done with NHSDA... can we deliver a wider digital solution'. As such the impact of the course was not limited to directing digital transformation in isolated organisations or fields. A CCIO involved with the implementation of an advice and guidance platform for GPs, mentioned that with organisational support the project was to be 'scaled up throughout the organization...in all different specialties'. It was also mentioned that 'other trusts who want to implement it off the back of our experience', highlighting indirect impact.

The extent to which these projects could be integrated on a wider scale, and even within organisations, however, was context dependent. As one participant, who was head of information at their Trust noted, 'you can't broad scale culture change', finding that with a more forward-looking project, 'you need to find a way to bring everybody together to discuss first'. Logistical issues also curtailed the impact of the projects, with a divisional nurse informatics lead noting, despite 'executive coach buy-in...and the corporate team saying it's a great idea... we didn't have the resources'. It was noted that was 'before COVID...now I think it will be easier for us [the organisation] to reach our goal'. Which is contrary to another CCIO who found 'when COVID hit...I was suddenly overwhelmed and couldn't do it [implementing the project] justice'.

Theme 2: a network of digital change agents

In addition to the impact on digitisation efforts, the NHSDA also led to the development of a network of digital leaders. When asked of the main lessons from the course, only 4.4% of survey respondents mentioned of the alumni network. However, throughout focus groups and interviews, the importance of the network was apparent, suggesting an unintended effect of the course. This, according to one CCIO, was fostered by 'the residentials in which networking was at the fore'.

This network directly impacts how programme alumni undertake their roles. One respondent noted that having 'a network of people, that is the number one

thing that is useful on a weekly, if not daily basis'. By leveraging shared experience, respondents improved task efficiency for those in leadership roles. One CCIO said, 'when I reach out to another organisation, I immediately ask who does X. If I don't know their CIO it takes me a second to find out, although 9/10 times its someone I know. We then get things together, share resources, connect, and make things work'. As a result of this network, individuals have access to a breadth of experience from not only CCIOs, but informatics and data leads, 'with a shared understanding of digital to allow transformation at pace'. The value of this was also being recognised by organisations. One CCIO said, 'by demonstrating the value of the network I've [they've] created', they were being 'pulled into bigger and bigger projects' by their Trust.

Participants did acknowledge the ongoing development of a formal professional community of informaticians and CCIOs independent to the NHSDA. They found the course provided accessibility not previously available, with one clinical manager noting 'digital health was a very lonely place before the PG Dip from a provider point of view'. Moreover, they suggested since the NHSDA, this group of digital leaders is now setting the agenda for change. As one CCIO noted, the community previously lacked 'direction or focus, as they hadn't had people who understand transformation in the way that the MSc has put it across'. As such, the network provided not only a forum to facilitate digital transformation locally, but a way to set and support wider priorities. These wider projects and priorities can be more effectively undertaken as a result of the MSc, as it has helped to harmonise perceptions of digital transformation and given an identity to digital leadership. One informatician noted 'we've got a real understanding of who the leaders [in digital] are now, and the PG dip really helps with identifying those [leaders]'. This suggests the NHSDA course has positively impacted the NHS's wider digital agenda.

DISCUSSION

This research is one of the first mixed methods studies to demonstrate the impact of a focused programme on digital health leadership on the attainment of national digital priorities. Findings show this impact can be broadly categorised into two themes: loco-regional digitisation and the wider digital health leadership. By integrating a dedicated period of research within an MSc year, the NHSDA provides a unique opportunity for candidates to directly lead digital projects within their organisation. The focus of these projects varies greatly, including healthcare professional engagement (11.7%), service user utilisation (10.3%), organisational barriers to transformation (9.7%) and digital care integration (9.4%). The successful adoption of these projects has been suggested to act as a template to transformation efforts in other fields and regions. However, this impact was variable among participants and was largely context dependent. We also found unexpected outcomes that may facilitate longer term digital transformation beyond the completion of the course. Most notable of these was the development of a network of digital leaders and change agents, who leverage their shared experiences to improve the efficiency of transformation. This first cohort of MSc alumni are now being recognised as digital leaders and appear to be setting the directions of the regional and national digital agenda.

The drive towards achieving digitally enabled healthcare has been a long-standing priority for the NHS.¹⁰ The COVID-19 pandemic has greatly accelerated this push, not only through necessity, but by changing the perceptions of what can be achieved through digital care.¹¹ As recovery from the pandemic continues, digital leaders must facilitate the adoption of technology in a way that is sustainable and benefits relevant stakeholders. According to the Five Year Forward Review, the NHS Digital Academy was developed to upskill digital leaders, in order to increase the chances of successful adoption of new technologies.¹² This evaluation shows that this 2-year flagship course has directly achieved this aim by providing an opportunity for candidates to undertake a local transformation project. These projects directly align with national benchmarks set for Trusts, such as improving accessibility of healthcare records and using data to improve population health outcomes, thus assisting regional digital transformation.¹³ By enabling participants to focus on the needs of their organisation, and undertake the project while faculty support is available, these projects are able to drive organisational change at pace. This organisational and system transformation is augmented by the theoretical foundation established during the first-year diploma in digital health. The combination of didactic and practical learning appears to improve the likelihood of project success. For example, the project on outpatient services succeeded where previous attempts had failed by acknowledging alternative perspectives of users.

This appreciation of user-centred design, a module during the PGDip, was an important lesson for many

participants. Almost a quarter of projects from the cohort centred on user (clinician or patient) engagement. Moreover, several interviewees attributed the successes of local adoption of projects to their newfound ability to integrate user perspectives. This is one of the most important, and potentially, long-lasting influences of the course. Prominent failures in digital adoption, such as the National of Program for IT, have often been ascribed to a lack of engagement.¹⁴ This is particularly important as the freedom afforded to digital initiatives by users during the unprecedented COVID-19 response subsides, and the need for longer term adoption strategies grows.¹⁵ By not only teaching but having future digital leaders use this learning in their practice, the course may help avert the costly mistakes of the past.

In addition to the impact of the dissertation projects, one of the most notable long-term effects of the NHSDA, though not by intention, has been a network of digital leaders. By incorporating writing residencies and collaborative work groups, the course has fostered the formation of a highly supportive and engaged digital leader collaborative. As stated in the NHSDA's scoping report, one of the limitations of a didactic course is its ability to affect leaders from vastly different organisations.⁸ By developing a network of change agents, however, digital leaders can share ideas, translate digital successes and appreciate the setbacks of other organisations. This network, therefore, helps to breakdown silos and help regional digital assimilation, in way that integrated care systems will aim to build on.¹⁶ Unlike the Global Digital Exemplar programme, however, this shared learning is purely born out of collaboration and support, as opposed to competition.¹⁷

As shown within our findings, such a network also helps delineate the identity of digital health leaders in the UK. This is also facilitated by the prominence of the work of many of the candidates, such as the NHSX adoption of 'bring your own device' or through academic publications on SNOMEDCT.^{18 19} The output however is highly variable, and as with similar digital leadership courses, the impact is mediated by external factors. A number of candidates echoed sentiments from other publications, suggesting that factors such as resource limitation and governance inevitably have a greater effect on the adoption of digital technologies than leadership.^{20 21} While the network can impart learning, without the appropriate infrastructure and recognition, digital leaders will not be able to effectively enact change. Organisational support and adequate credentialling of digital leaders, therefore, remain important barriers to impact and transformation.^{22 23} While courses such as the MSc in Digital Health Leadership provide an accredited qualification, this does not yet necessarily translate into professional certification for those in NHS management positions.²⁴ This is beyond the scope of this manuscript, however, which aims to examine wider impact only. Future work will examine the influence on personal progression and professional identity that such courses have on current and prospective digital health leaders.

Despite a robust methodology, this study must be considered in relation to its limitations. First, this evaluation represents the experiences of only a proportion of individuals that have undertaken the course, which is now entering its fourth year. While this affects the generalisability of the results, the use of a mixed methods approach, including an anonymised survey distributed to a larger group, does mitigate this limitation. The response rate to this survey was high, with 26 from 28 eligible candidates answering (92.9%). This would ensure that the breadth of experiences from candidates was included within the current evaluation. This high response rate would also reduce the effect of response biases, seen in similar qualitative assessments. While there is still potential for such selection biases to impact on the study's findings, as the demographics of the interviewees were similar to the wider cohort, this reduces the influence of these effects. The study also reduced recency biases by ensuring that only individuals who had completed the course at least 6 months previously were recruited.

CONCLUSIONS

Despite these limitations, this study has shown the relative successes and shortcomings of the NHSDA 2-year course on the attainment of wider digital priorities. Through a blended approach incorporating didactic and practical aspects, it is possible to directly and indirectly impact on the digital transformation efforts of the NHS at a loco-regional level. This is principally achieved through a dissertation project that is directly relevant to candidates' organisations. Resource and cultural barriers, however, continue to hinder digital transformation. Future work should examine how such courses can help overcome these challenges, as well as how they affect individual learning and the professional development of digital leaders. In this way, a holistic view of such courses can be understood, which will in turn facilitate the creation of a digitally prepared workforce.

Contributors AA, AS and RCB were all involved in the study design, conduct and data analysis. AA and RCB drafted the manuscript with AS involved in editing and review of the submission. RCB is the guarantor of the study. AD provided infrastructural support that enabled the study to occur and oversaw study conduct.

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Competing interests AD is the codirector of the NHS Digital Academy. RCB is the programme head of the MSc Digital Health Leadership. Both authors acted independently during the conduct of this study.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Consent obtained directly from patient(s)

Ethics approval Ethical approval was sought from the Institutional Review Board at Imperial College London (EERP2021-026a). All participants provided informed consent prior to taking part in any stage of the study and provided written consent. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

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*Supplementary Material: Questionnaire**NHS Digital Academy Scoping Questionnaire*

Q1 The gender that I identify with is

- ☐ Male (1)
 - ☐ Female (2)
 - ☐ Non-binary / third gender (3)
 - ☐ Prefer not to say (4)
-

Q2 What is your age?

- ☐ Under 35 (1)
 - ☐ 35 - 45 (2)
 - ☐ 46-55 (3)
 - ☐ Over 56 (4)
-

Q3 My current job role is principally...

- ☐ Clinical (1)
 - ☐ Technical, Data or Technology (2)
 - ☐ Programme Manager, Business or Administration (3)
 - ☐ Other (4)
-

Q4 The Wachter Review informed my dissertation

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Disagree (4)
- ☐ Strongly disagree (5)
- ☐ Not applicable (6)

Q5 Please select the high level priorities, goals or benchmarks from The Wachter Review that impacted your dissertation.

- ☐ A long-term engagement strategy to promote the need for healthcare digitization among end users. (1)
- ☐ Development of a workforce of clinician-informaticians; with growth of the role of the CCIO and health informatician in clinical care. (2)
- ☐ The achievement of digital maturity of Trusts by 2023. (3)
- ☐ Linking National Funding according to the digital preparedness of Trusts, local Implementation plans, and key deliverables including user engagement, workforce support, and regional interoperability. (4)
- ☐ Organization of digital learning networks to aid digitization, implementation and local problem solving. (5)
- ☐ Achieving interoperability to support clinical care, innovation and research, including the development of key principles to aid integrated workflow such as governance frameworks. (6)
- ☐ The development of robust independent evaluations of regional and national practices. (7)

Q6 The Topol Review informed my dissertation

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Disagree (4)
- ☐ Strongly disagree (5)
- ☐ Not applicable (6)

Q7 Please select the high level priorities, goals and benchmarks from The Topol Review impact your dissertation.

- ☐ Education of patients and carer organisations to increase engagement with digital healthcare technologies. (1)
- ☐ Optimising the clinical utilization of genomic information resources including developing frameworks for their governance, user training and dissemination. (2)
- ☐ The co-creation and adoption of digital technologies and AI systems with stakeholders, using robust governance and validated frameworks for implementation. (3)
- ☐ Review compliance requirements for new digital technologies, learning from other organisations and using evidence-based technological change programmes. (4)
- ☐ Supporting workforce training to increase engagement; through accredited career pathways, knowledge sharing and collaboration with academic organisations and industry partners. (5)
- ☐ Development of an infrastructure for learning, adopting a multi-professional collaborative approach with resources to support professional regulatory bodies, educators, specialist teams and the future workforce. (6)
-

Q8 The Five Year Forward Review informed my dissertation

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Disagree (4)
- ☐ Strongly disagree (5)
- ☐ Not applicable (6)

Q9 Please select the high level priorities, goals or benchmarks from the Five Year Forward Review that impacted your dissertation.

- ☐ The upgrade of prevention and public health through incentivization of healthier behaviours, targeted prevention and supported workplace health to address future health demand. (1)
- ☐ Increasing patient empowerment, control of their health needs and provision of care, for example by increasing access to an electronic health record or online appointment system. (2)
- ☐ Breaking down the barriers between healthcare providers, using of interoperable digital systems to leverage shared information that balances centralized and local needs. (3)
- ☐ Accelerating digital innovation and research such as remote monitoring, through the use of test-bed and green field sites, potentially funded by the decommissioning of legacy technology. (4)
- ☐ Developing new models of integrated care for example Multispecialty Community Provider and Primary and Acute Care systems care to drive efficiency. (5)
- ☐ Transparency of performance and audit data to tailor healthcare support for the individual, as well as allowing professional comparisons and informed commissioning decision-making. (6)

Q10 The Lord Darzi Review of Health and Care informed my dissertation

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Disagree (4)
- ☐ Strongly disagree (5)
- ☐ Not applicable (6)

Q11 Please select the high level priorities, goals and benchmarks from The Lord Darzi Review of Health and Care that impacted your dissertation?

- ☐ Click to write ChoA new 'National Quality Strategy' developed with clinical staff and patients to close the care and quality gap and improve access to care. (1)
- ☐ Identifying efficiency savings to address the potential future funding gap to meet the healthcare needs of the next generation with respect health and social care. (2)
- ☐ The potential for digital innovation to address the funding gap, whilst maintaining high quality care. (3)
- ☐ A commitment to an integrated, preventative and personalised healthcare system deliverable in the short and longer term to aid social health. (4)
- ☐ Addressing staffing gaps, declining morale and engagement to ensure a suitable health and care workforce. (5)

Q12 Please let us know of any other high level policy documents that directly informed your dissertation

Q13 Please select the high level priorities, goals and benchmarks that your project incorporates in order to move your organisation towards digital readiness and or digital maturity

- ☐ Increasing system interoperability (1)
- ☐ Governance of digital technologies and care pathways (2)
- ☐ Utilisation of big data (3)
- ☐ Utilisation of artificial intelligence including natural language processing (4)
- ☐ Utilisation of telemedicine or telehealth (5)
- ☐ Policy Revision (6)
- ☐ Developing New Frameworks for Emerging Areas (7)
- ☐ Digital workforce planning and training (8)
- ☐ Increasing digital engagement with healthcare workers (9)
- ☐ Increasing digital engagement with patients and carers (10)
- ☐ Addressing organizational and cultural barriers to digital maturity (11)
- ☐ Scaling of digital innovation and processes (12)
- ☐ Developing multi-dimensional digital networks (13)
- ☐ Single System redesign (14)
- ☐ Single Process redesign (15)
- ☐ Integrating care through digital means (16)
- ☐ Improvement in system performance (17)

☐

Adaptive development of a digital innovation through evaluation/feedback on performance (18)

Q14 Please select the elements your project seeks to inform or improve in the areas of patient safety, patient outcomes or patient experience.

☐

Reduce waiting times (1)

☐

Prevent patient admission or re-admission (2)

☐

Provide patients access to their health data (3)

☐

Allow patients to report their own health data (4)

☐

Provide clinician access to data/patient journey (5)

☐

Improve clinician task-efficiency (6)

☐

Prevent workforce shortfalls (7)

☐

Increase accuracy of health data (8)

☐

Improve time to diagnosis (9)

☐

Improve time to investigation (10)

☐

Improve patient referral pathway efficiency (11)

☐

Increase patient access to healthcare services (12)

☐

Promote preventative health measures/behaviours (13)

☐

Tailor clinical resource/care according to patient need (14)

☐

Enhance understanding of caregiver experiences (15)

☐

Improve relevance of outcome measures to patients (16)

Q15 Would you consider any of the following additional training options in Digital Health Leadership or a related field within the next 2 years?

☐

Individual short courses (1)

☐

Seminars (2)

☐

Certificates (3)

☐

Another Master's degree (4)

☐

Doctoral level programme (5)

☐

A Massive Open Online Course or MOOC (6)

Q16 Which modules from the PG Diploma were highly influential for your dissertation? Check all that apply

☐

Module 1: Essentials of Health Systems (1)

☐

Module 2: Implementing Transformational Change (2)

☐

Module 3: Technology Strategy and Health Information Systems Implementation (3)

☐

Module 4: User-Centred Design and Citizen Driven Informatics (4)

☐

Module 5: Decision Support Management and Actionable Data Analytics (5)

☐

Module 6: Leadership and Transformational Change (6)

Supplementary Material 2: Interview Guide

Interview Topic Guide

1. Welcome

Welcome and thank you for volunteering for this study. I recognise that you are a busy professional and your participation is greatly appreciated.

Your participation in this individual interview will contribute to our evaluation study, exploring themes and quality factors in the PG Diploma in Digital Health Leadership, and its follow-up MSc dissertation module.

You have been asked to participate because I am interested in your experiences of the NHS Digital Academy. Your participation in this study has the potential to inform the curriculum of the programme, which will benefit the experiences of future participants.

2. Introductions

I'll start it off... my name is [*I will introduce myself and explain my role at IGHI and my role in the study*]. An assistant facilitator may also be present, who will introduce themselves and explain their role.

3. Anonymity and right to withdraw

- The discussion will be audio and video-recorded, via Microsoft Teams but I'd like to assure you that the discussion will be anonymised.
- After the discussion, the recordings will be transcribed and analysed. Unanonymised recordings are transcribed/anonymised as soon as possible and then deleted with the

anonymised transcripts stored securely according to Imperial College protocols (for 10 years after last use or publication).

- The recording files will be kept safely on a secure server and will be kept in accordance with research governance policies.
- During this study, you will be assigned a participant number so will therefore remain anonymous.
- I would also like to remind you that you have the right to withdraw from the study at any time with no penalty to yourselves. A withdrawal letter has been supplied, which can be completed and returned should you choose to.
- If you do not wish to answer a question, you do not have to.

4. Ground rules

- The events we are focusing on here are limited to your experiences studying on the Postgraduate Diploma in Digital Health Leadership. I only want you to describe *how it was for you* at the time, what you did, what you learnt from your experience on the Digital Academy programme. Remember, I am only interested in your personal experiences and reflections.
- You are requested to respect the confidentiality of others present in the group.
- Everything that you say in this room will be anonymised. While we will be reporting the findings in general, your personal anonymity will be maintained.
- There are no right or wrong answers, everyone's experiences and perspectives are valid.

Finally, do you have any questions you would like to ask me about this study before we begin?

5. Your NHS Digital Academy experiences

The interview is designed to further explore three key themes and areas of the study

- 1) What are the most impactful aspects of the MSc and how have they influenced your thinking as a digital leader? [priority question]

Prompts for follow up:

- a. Do you work/approach things differently?
 - b. Prompt: Has your perception of your role changed?
 - c. Prompt: Have you changed roles?
 - d. Prompt: Have responsibilities changed?
 - e. Prompt: If yes, did the MSc influence the change?
 - f. Prompt: How has the MSc influenced your personal future goals?
- 2) How has your experience in the MSc impacted your colleagues and organisation? [priority question]
 - a. Prompt: Do you see national impact as a result of your project?

- 3) How would you evaluate your project against national goals and priorities in digital readiness and digital maturity? [priority question]

Time Permitting:

- 4) What critical skills, competencies, attitudes and values did the MSc help you develop?
- a. Prompt: Career, identity development, life goals, leadership development, confidence, what are you going to do next
- 5) What are the next steps for your project and how will you take that forward?

6. Next steps

Thank you for participating. I think this has been a very successful discussion. Your descriptions of experiences and suggested educational recommendations have made a valuable contribution to the study.

7. Conclusion

I would like to remind you that any comments featured in this report will be anonymous. Thank you for your participation in this study.