

Developing a benchmark survey to measure digital health capabilities from an end-user perspective: a Delphi study protocol

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Abstract

Introduction

Measurement of digital health and electronic health record (EHR) capabilities are vital for benchmarking progress. Existing assessment tools fail to measure the capabilities available to end-users, or their functionality for enabling effective, high quality, and safe care. We aim to produce consensus on a set of questions for systematic benchmarking of digital health capabilities in the NHS, from the perspective of clinical end-users.

Methods and analysis

Workshops held with the support of professional organisations will be used to discover key digital capabilities. Attendees from multiple clinical disciplines will be recruited to an online Delphi process over two rounds. Questions will be presented via e-questionnaire, and retained if they meet consensus rating thresholds. Final questions will be incorporated into a digital assessment survey for future validation.

Ethics and dissemination

No patient data will be collected, responses will be fully anonymized. An ethics proposal is under review by the Imperial Research and Ethics Committee. Results will be disseminated through publications, presentations, and workshops, presented to a patient and public focus group, and published on an independent website.

Strengths and Limitations

- Existing digital maturity assessments focus on technological function and organisational strategy.
- We are creating a survey for digital maturity assessment that focuses on capabilities and functionality from the view of healthcare workers that use electronic health records and digital technology.
- This study, and the survey it develops, are cross-disciplinary.
- The survey will help regulatory and policy stakeholders, as well as provider organisations, measure digital health from a previously unseen ‘shop floor’ view. Results can inform digital transformation benchmarking, quality and safety assessment, and research into clinical workflows and patient outcomes.
- Views of those outside of this Delphi study may differ from our panelists

Introduction

Twenty years on from the National Programme for Information Technology, the National Health Service (NHS) has experienced a transformational shift from paper to electronic health record (EHR) usage across primary and secondary healthcare providers. National policy, as laid out in the NHS Long Term Plan and the Five Year Forward View, have outlined a future where health systems are fully digitized with anticipated positive effects on quality of care, patient safety, cost-effectiveness, and ability to utilise healthcare data at a population scale^{1,2}. However, digital transformation remains heterogeneous³⁻⁵. Primary care has seen relative success, with nationally interoperable infrastructure based on a small number of vendor solutions⁶. In contrast, while some hospital Trusts tender for digital platforms and interconnected EHR contracts worth hundreds of millions⁷, others have not yet implemented electronic prescribing systems⁸.

The measure of a healthcare organisation's ability to use EHR and other digital technology is known as 'digital maturity'. Measurement of digital maturity systematically, and over time, contributes to successful digital transformation in several ways. Firstly, a central, unified view across the country allows mapping of progress, and identification of areas of excellence and areas of need, with implications for policy and funding decisions. Secondly, longitudinal data can facilitate continued benchmarking against a 'gold standard', such as the NHS X "What Good Looks Like" framework⁹, and regulatory assessment with relevance to impact of EHR and digital technologies on quality and safety of care¹⁰. Thirdly, the cost-effectiveness of locally driven processes to achieve digital transformation can be assessed in comparison to other regions or a national benchmark. Finally, such data is necessary for robust analysis of digital capabilities and patient-level outcomes^{4,11,12}.

In the NHS, national assessments have been undertaken through the Clinical Digital Maturity Index (CDMI), sent to secondary care organisations in 2015/2016 and 2017³. CDMI offers statements about organisational capabilities for scoring on a Likert scale of ‘Strongly Disagree’ to ‘Strongly Agree’ (*Table 1*). CDMI covers themes of organisational readiness, capabilities, and infrastructure, but survey responses represent only a high-level organisational view. Responses are also given by responsible officers in circumstances where CDMI scores were used to direct central funding through the Global Digital Exemplar and Fast Follower programmes. Considerable score variations between 2015/2016 and 2017 survey results (*Figure 1*) raised concerns about observer bias from question interpretation or financial incentivization of maturity scores^{13,14}. Complementing the CDMI, the Clinical Software usability Scale was used in 2016 to gather end-user views on quality, safety, and usability of EHR. This used a simple methodology, consisting of five questions to survey users on the overall digital software offerings for an organisation, thus creating a high level and comparative view of usability across organisations and domains¹⁷. While neither survey has been repeated since, NHS X contracted KLAS Research (*Utah, United States*) in 2021 to produce a survey on EHR usability¹⁵. Questions assess user experience, as well as perceptions of organisational training and values (*Table 1*). Whilst undoubtedly valuable¹⁶, survey responses are unable to map and measure specific EHR and digital technology capabilities. Finally, we make note of the Healthcare Information and Management Systems Society (HIMSS) Electronic Medical Record Adoption Model (EMRAM), an internationally recognised score with eight stages of maturity¹⁸. EMRAM focuses exclusively on software technological capabilities, without consideration of translation to real-world function for the end-user¹⁹. EMRAM additionally carries additional monetary cost for providers who desire

HIMSS assessment and rating, and many NHS providers do not have an official EMRAM score⁵.

NHS Clinical Digital Maturity Index	“When using digital records, health and care professionals can find what they need quickly and easily.”
	“Health and care professionals rely on digital records for the information they need at the point of need.”
	“Health and care professionals have digital access at the point of care to the information they need from other local healthcare providers.”
KLAS 2021 secondary care provider survey	“This EPR makes me as efficient as possible”
	“I directly enter (type) a significant amount of my documentation”
	“This EPR improves care coordination”

Table 1 – example questions from existing benchmarking tools related to digital records and interoperability. Both surveys ask respondents to rate on a Likert scale of Strongly Disagree to Strongly Agree.

While these approaches offer value, an important, functional, view of digital technology from the ‘shop floor’ remains missing from existing assessments. We also note that existing approaches remain very ‘doctor-centric’. Different clinicians (which include doctors, nurses, pharmacists, and other allied healthcare professionals) make use of different EHR and digital technology capabilities in their roles, such as clinical documentation, accessing remote patient data (or ‘interoperability’), medication related tasks, and electronic observation recording. The advent of remote care applications, clinical decision support, and artificial intelligence tools add to an increasing number of digital capabilities whose functionality for the end-user may have direct and plausible impact on quality and safety of patient care.

The NHS is in the process of reforming digital maturity assessment, with focus on integrated care systems, and use of external assessors to prevent ‘gaming’ of maturity scores²⁰. However, re-focusing assessment to an even higher level of organisational structure must be balanced by a view from EHR and digital technology facing clinicians. In this paper, we outline a Delphi study protocol aimed at producing consensus on survey questions for systematic measurement of EHR and digital technology capabilities from an end-user perspective. We aim to produce standard question-sets that can be applied to a wide range of clinical roles in primary and secondary care, that can produce indicators of capabilities and functionality, for comparison between sites and over time. We discuss how well-designed questions can be employed within a unified approach for longitudinal data collection in the NHS, and potentially in other healthcare systems, to guide care quality regulation, and complement higher-level organisation assessments.

Objectives

The proposed study aims to develop a survey containing key questions targeted at clinical end-users of EHR and digital tools, used to identify key digital capabilities and measure end-user perspective of their function, in primary and secondary care (including community and mental health provider settings).

We aim to produce a set of questions that address gaps in existing assessments. A final survey must therefore fulfil the following objectives: (1) mapping national digital characteristics across primary and secondary care; (2) identification and measurement of key EHR and digital health capabilities; (3) coverage of capabilities that have plausible impact on workflow, quality of care, and safety of care; (4) obtain

answers that can be used as objective indicators of function from the perspective of the end-user, allowing benchmarking and comparison between sites and over time; (5) measurement of capabilities with relevance to clinical end-users across multiple disciplines; (6) ease of interpretation and answering for survey respondents.

Methods and Analysis

Study overview

The study employs a Delphi process to achieve consensus on key survey questions that fulfil the described objectives. The Delphi will be preceded by a series of workshops to guide development of an initial question-set. The Delphi study itself will be conducted through online questionnaire distribution, taking place over several stages that follow panelist recruitment.

Workshop stage

In the initial stage, the protocol authors will perform a rapid review of medical literature using search terms related to ‘EHR’, ‘digital health’, ‘benchmark’, and ‘outcomes’ to discover evidence for key digital health and EHR capabilities that might impact on workflow and patient care. Informed by results of this review and collective real-world experience of digital healthcare, including design and implementation, a set of proposed capabilities relevant to different end-user categories (*Table 2*) will be developed. These will be brought to online workshops run with the support of professional organisations with coverage of the United Kingdom. These include, but are not limited to, the Faculty of Clinical Informatics (*London, United Kingdom*), Royal College of Nursing (*London, United Kingdom*), and Royal Pharmaceutical Society (*London, United Kingdom*).

Role	Setting
Hospital Doctor (general)	Secondary care
General Practitioner	Primary care
Registered Nurse	Secondary care
Pharmacist	Secondary care
Pharmacist	Primary and community care

Table 2 – currently identified EHR end-user groups for panelist recruitment and targeted question design

Workshops will be publicized at the organisation level, with open and free sign-up, and will be led by protocol authors. Workshop participants will be presented with the hypothesis that proposed digital capabilities are most relevant to effectiveness of care within their professional role, and will be asked to challenge this hypothesis, or propose other key capabilities. Using online polling, we will also note preferences for survey length, and acceptable number of questions, from workshop participants.

Informed by workshop results, the protocol authors will design a comprehensive set of survey questions that fulfil the described objectives. Subsets of questions will be designed to face specific end-user disciplines, including primary and secondary care doctors, nurses and pharmacists (*Table 2*), with the intention that an eventual survey respondent will encounter particular questions that are relevant to their role. It should be noted that end-user disciplines are subject to change, depending on breadth of recruitment and involvement of additional professional organisations. All questions will be mapped to current benchmarking themes from CDMI, and the NHS X “What Good Looks Like” framework.

Panelist recruitment

Delphi panelists will be invited from the range of end-user disciplines that are intended survey respondent groups (*Table 2*). For each clinical role, panelists will include both ‘domain experts’ and ‘non-experts’. We define ‘domain expert’ as a professional with development, implementation, regulatory, academic, or policy experience in digital health.

We adopt two primary strategies for Delphi panelist recruitment. The first is via workshop sessions. We anticipate that both experts and non-expert panelists will be discovered in this process. As a secondary strategy for insufficient panelist numbers, we will adopt ‘snowball sampling’²¹, where panelists will be asked to suggest digital technology end-user colleagues from the same profession. We aim to recruit at least 10 domain expert panelists, and 30 non-expert panelists through a combination of these strategies, spread across the range of professional roles outlined in *Table 2*. These numbers serve as a ‘floor’, and if additional end-user disciplines are identified through workshops and discussions with professional organisations, recruitment will increase to take this into account.

Delphi study

The Delphi process will take place over two rounds. Proposed questions developed by the protocol authors will be sent to all panelists via an online questionnaire hosted by Qualtrics (*Seattle, Washington, United States*). Panelists will be required to enter their clinical role (e.g. doctor, nurse, pharmacist etc), but no other identifiable information will be collected. Questions will be presented alongside guidance notes that outline any rationale or plausible impact on an outcome measure. The study

protocol will be made available, with the option of joining a discussion to clarify the study process via an online conference call.

In the first Delphi study round, panelists will be asked to provide categorical ratings for 'agreement' along a 5-point Likert scale (1 - "strongly disagree" to 5 - "strongly agree"), with a white-space box for unstructured comments. In particular, panelists are encouraged to comment if they disagree with the question, to suggest changes, and to comment on ease-of-interpretation. White space will also be provided at the end of the questionnaire for panelists to suggest new questions. Questions that apply to specific professional roles, with intention of only being implemented for those identifying as a certain clinical role, will be clearly indicated, but responses to these will be welcomed from all panelists. Questions that are rated 'strongly agree', or 'agree' from >75% of panelists are seen to meet consensus²². These questions will be taken into the final survey (and excluded from round 2 re-testing) if requiring no alteration, or if requiring only minor alterations based on panelist comments. For questions targeting a specific professional role, we require consensus to be met in >75% of panelists from that professional discipline (in addition to overall consensus).

The second Delphi round will contain (1) questions that did not meet consensus in round 1, that have been revised in line with panelist comments; (2) any questions that were seen to benefit from substantial revision based on panelist comments; and (3) new questions suggested by panelists. All responders in the first round will be sent an updated questionnaire, along with fully anonymized reporting of item scoring and comments. Items that achieve consensus in this round will be incorporated into the final survey, with minor alterations if required. Items that do not meet consensus will be dropped from the survey.

Patient and public involvement

While this Delphi study is focused on healthcare workers, the resulting survey, its roll-out, and any future survey results, will be of interest to patients and public. Once a survey has been produced, we aim to show results to a focus group to (1) highlight the purpose of this work, (2) discuss implementation in the NHS, and (3) gather views on how future data from the survey should be presented to patients and public. We will also make a summary of study results public, via a new website.

Ethics and dissemination

No patient data will be involved in this study. An ethics submission is currently under consideration by the Imperial College London Research & Ethics Committee. The panelist recruitment process is designed to ensure sufficient representation of different professional roles. While we do not adopt an active strategy for gender and ethnic diversity, we will offer the opportunity for characteristics to be self-reported by panelists, and results will be reported transparently.

Panelists will be consented for inclusion, with the understanding that any responses are anonymized. Panelists can withdraw consent at any time. The Qualtrics survey platform is quality-assured and approved for use by Imperial College London. All data handling abides by the UK General Data Protection Regulations, with personal data deleted as soon as no longer required. The final draft of any report will receive approval from all members of the panel, who will be acknowledged in the publication materials as part of a National Clinical Informatics Collaborative involved in survey design. The Delphi results will be presented in a peer-reviewed publication, in a conference, and presented in additional workshops.

Implications

To our knowledge, this study will represent the first systematic approach to defining questions for digital capability measurement from the perspective of end-users, with a view to benchmarking longitudinal indicators of digital and EHR function. A consensus set of questions forms the first step for setting up systematic digital assessment across the NHS. We propose a deployment pathway, where a survey is tested and validated, both locally and nationally. Validation exercises can also be conducted in healthcare systems outside of the NHS.

Key considerations for successful and continued deployment include effectiveness of questions for fulfilling objectives, end-user (survey respondent) participation, end-user incentivization with direct benefits from any data collected, and utility of subsequent data for academics, providers, national policymakers, and regulators. Additional work is therefore occurring in parallel to the Delphi study, with a view to (1) trialing the effectiveness of a consensus question-set locally in at least two NHS providers and connected primary care locations; (2) forming a grassroots collaborative made up of clinical professionals and professional bodies, that will help disseminate surveys, and guide modifications and additions to future question-sets; (3) collaboration with NHS stakeholders, including national regulatory bodies such as the Care Quality Commission, to ensure that data will be suitable for centrally defined regulatory frameworks; (4) arrangements to make any survey data and reporting open access, such that data can be used freely for research and service improvement. Over time, the survey produced by this Delphi study may sit alongside organisation-level digital maturity assessment in guiding national digital transformation in accordance with the NHS X “What Good Looks Like” framework.

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[figure_1.jpg]

Figure 1 – showing distribution in delta for NHS Clinical Digital Maturity Index scores (change in score) between 2015/2016 and 2017, for NHS secondary care providers in England. Three themes and total scores are represented. Plot shows median, 1st to 3rd quartile, 5% to 95%, and outliers. Generated from public, raw NHS CDMI datasets³ using Python 3.8.