Case Study: Design of an Approach for Assessing a Novel Health Capability Maturity Model

Lemai NGUYEN[a,1], Paul COOPER[b], Bronwyn TAYLOR[c], Imran MUHAMMAD[b] and Sandeep REDDY[b]

[a]*Deakin University, Information Systems and Business Analytics, Australia*
[b]*Deakin University, School of Medicine, Australia*
[c]*Victorian Department of Health, Australia*

ORCiD ID: Lemai Nguyen https://orcid.org/0000-0003-3695-7245, Paul Cooper https://orcid.org/0000-0001-8521-8946, Imran Muhammad https://orcid.org/0000-0002-1926-8520

Abstract. Capability maturity models have been developed and are widely used within healthcare aiming to assess the degree of digitization of the organization, but empirical assessments of the models themselves has been undertaken infrequently. We present a mixed-method approach to assessing a novel health capability maturity model developed by a state government responsible for the management of 86 health services. The approach was designed to be suitable for system level assessment of services and pooled the wisdom and experience of subject matter experts and key stakeholders using a combination of survey and interviews to test and tune the proposed assessment approach and parameters. We applied the approach to assess the target capability model across a number of public health services in Victoria, Australia. The result showed sufficient validity to be able to generate recommendations for further improvement of the capability model and the assessment approach to enable broader application within Australia.

Keywords. Digital health, maturity model, digital health maturity assessment, capability assessment, validity study

1. Introduction

Health services are increasingly embracing digital technologies and transforming their service models and capabilities in an adoption cycle often called digital maturation [1]. Digital maturity can be considered as an organization learning journey to "*respond appropriately to the emerging digital competitive environment*" [2]. Major acute healthcare service providers that desire to measure and increase their digital maturation frequently employ a range of proprietary digital maturity frameworks and assessment models such as HIMSS [3]. Selecting the most appropriate digital maturity assessment model represents one challenge, but at a broader system level, such as where a health network operates many health services, or a government department manages many healthcare facilities, there is a further challenge of determining which model is right to their quest for increased overall digital maturity.

In 2019 the Victorian Government Department of Health (DoH) which manages 86 public health services developed a digital capability maturity model called VDHMM (Victorian Digital Health Maturity Model) that was intended to be used at a state-wide

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[1] Corresponding Author: Lemai Nguyen, email: lemai.nguyen@deakin.edu.au.

system level and to reference Australian-specific national capabilities such as the My Health Record. They desired to test the validity of the model before wide deployment within all entities under management and for this purpose engaged Deakin University as a funded research partner.

Most sectors of the economy have now experienced large-scale digital transformations in anticipation of operational efficiency, organizational performance, and strategic impacts [4]. In line with achievements in other sectors of the economy, there has been an expectation that digital transformation would bring about substantial efficiency and quality and safety improvements in healthcare [5]. In 2009, the Health Information Technology for Economic and Clinical Health Act (HITECH) was reported to have provided more than $30 billion in stimulus funds for practitioners to adopt Health Information Technology [6]. Because of such investment, the introduction and adoption of Electronic Medical Record (EMR) systems has been dramatic. The Australasian Institute of Digital Health's summit in 2020 noted that around 65 per cent of Australian public hospitals had implemented EMR systems, having increased from 56 per cent in 2018 [7]. However, despite this digitalization, it has been difficult to reliably assess the benefits from such enormous investments, in part because of a lack of clear direction in how to undertake the evaluations and even due to different interpretations of the language of 'benefits' compared with the clinician's usual language of 'evidence' [8].

Given the uncertainties of benefits arising from digital transformation in healthcare such as the large-scale adoption of EMR systems in acute health service settings, there has been interest in capability maturity models for digitalization in healthcare that could increase the certainty of providing a clearer pathway to achievement of benefits.

Capability maturity models (CMM) often consist of a model structure (dimensions, assessment questions and maturity levels), an assessment mechanism (tools, methods, and a scoring mechanism) and supporting documentation and guidelines combined in an assessment framework. The organization receives a score indicating their overall maturity level across various capabilities, i.e., dimensions of maturity. Maturity assessment was found to be expensive and burdensome to organizations due to the complexity of the methods and manual nature of collecting substantiating evidence [9].

2. Methods

We designed a general assessment approach building on the principles in evaluating capability maturity models developed by Becker et al. [10]. We expanded upon these core principles in the context of a sector-wide health care environment that comprised 86 health services. The final set of our evaluation principles were:

E1. Knowledge base principle: The model structure has a knowledge base comparable to, or referenceable to other CMMs in the literature.

E2. Socio-technical principle: subjectivity of the digital health maturity assessment should be examined because social and technological components are interrelated and mutually influencing each other in digital health. Ideally, the evaluation should be independent of stakeholders involved, or if independence cannot be achieved, this should be declared, and mitigating actions elaborated.

E3. Validity principle: Content of the model (dimensions, assessment questions, and maturity levels) should serve the assessment purpose and be assessable. Presence and clarity of design: including definitions should be assessable.

E4. Usability principle: Clarity of all aspects of the model should be assessable. The assessment tool and guidelines should be easy to use/follow.

E5. Practicability principle: Time, expertise and resources required to conduct the assessment should be sufficient for expected purpose.

E6. Value principle: content and presentation of the assessment result should be relevant, useful, and result in insights for the target audience.

E7. Reliability principle: the framework should be assessable in terms of whether it can generate consistent, reproducible, and non-subjective assessments.

E8. Progressive principle: the evaluation should inform future model improvements as well as the assessment strategies and implementations. The model itself should be assessable in terms of ability to be extended and modified.

Our evaluation approach consisted of four phases. **Phase A** involved a literature review to compare the available key maturity assessment framework against related frameworks. The aim was to identify similarities and differences between the assessment framework under study and others thus aiming to address the E1 principle. **Phase B** was a content validity study to address the E3 principle (Validity). Validity has been defined as "the extent to which any measuring instrument measures what it is intended to measure" [11, p.2]. Validity is often evaluated through a survey with a professional expert panel consisting of scholars or practitioners selected based on their publications or work experience respectively. Experts were asked to review the proposed assessment model and rate their structural elements based on a number of criteria such as relevance, essential/necessity, clarity, and comprehensiveness [12]. **Phase C** was a survey study to evaluate the model through lens of stakeholder assessment which includes:

- a two-stage survey to evaluate the model, assessment tool, process and resources. The first stage was a questionnaire conducted immediately after the assessment is completed to capture the experience of the stakeholders going through the assessment. The second stage was a questionnaire conducted after the results are communicated to the organizations for whom an assessment was conducted. This survey aimed to capture what the stakeholders think of the assessment results and values of the assessment.

- a series of interviews with stakeholders using a socio-technical lens of the assessment process, structure and people, assessment tool, organizational context, assessment results and values.

In **Phase D**, findings from the previous phases were integrated and recommendations to improve the maturity model and future implementations were reported to the commissioning agency.

We applied the 8 evaluation principles and approach described in the previous Section to evaluate the VDHMM framework. In Phase A, we conducted relevant literature reviews; in Phase B, we conducted a validity survey with 12 subject matter experts (5 Practitioners, 3 Policy makers, and 4 Scholars); Phase C consists of stage 1 survey with 22 health services (via questionnaire), and stage 2 survey with 13 health services (8 questionnaire responses and 5 interviews) using Qualtrix survey tool and focus groups conducted by a subset of the research team (without DoH representation being present).

The collected survey data was quantitatively analyzed [12] (Phase B & C). The interview and focus group data were thematically analyzed (Phase C). Subsequently, in

Phase D, the findings were integrated to provide the DoH with guidance on areas of improvement of the capability maturity.

3. Results

Considering the 8 evaluation principles, our study methodology did not fully satisfy all principles. It was incomplete with respect to E2 (sociotechnical) in that we did not achieve full independence of all stakeholders since the stakeholders in health services were in a partial regulatory, or funding power relationship to the commissioning agency (DoH). Our mitigation approaches were to have full transparency of all stakeholders and their relationships. The relationships of scholars were fully independent.

E4 (Usability) was directly examined through all aspects of the evaluation process. E5 (Practicability) was satisfied through sufficient time and resources being made available to complete all aspects of the evaluation without undue haste. E6 (Value) was met through design of the survey and interview process where questions of value were asked and responded to in a variety of ways. E7 (Reliability) was only satisfied within the dimensions of this study: further studies will provide a more complete satisfaction of this principle. To more completely satisfy principle E7, a reliability testing study would be desirable to assess the consistency between results of repeated assessments [11]. This form of reliability testing was not practical in the current project due to resource constraints. Principle E8 (Progressive) was satisfied through identifying pathways for improvement of the model.

4. Discussion

Using our assessment approach on the VDHMM, we were able to formulate specific findings and generate recommendations for the DoH which do not form the subject of this paper.

VDHMM was found useful to suggest multiple paths for an organization to select and develop capabilities relevant to how they plan to position themselves in the 'market'. We noted that the responders (from large metropolitan to small regional health services) found this aspect to be beneficial to them i.e., that they were not being rated on a specific level or forced through a specific 'maturity gate' but rather they were assessed on a range of capabilities in a manner that they thought was appropriate and balanced.

The VDHMM was assessed as going beyond the focus on the level of technology 'penetration' often seen in previous digital health maturity models and that with localization modifications it would be applicable for other jurisdictional use.

5. Conclusions

Our study offers a new approach to evaluating digital health capability models suitable for use at a system-wide level and the approach was demonstrated empirically. The invitation from the State of Victoria provided a unique opportunity to assess a model through full access to the model, the stakeholders and subject matter experts. The assessment approach we developed was found to be useful and robust in evaluating

VDHMM. There are limitations to our study, in particular the inability to assess the model reliability due to the limited resource to repeat assessments. Future research can test the generalized assessment approach on a larger range of capability models in the marketplace.

Acknowledgments

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