

Critical Issues in Implementing and Adopting National e-Health Solutions: Lessons from Australia's MyHealth Record

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Abstract

Globally, healthcare reforms are being initiated to address the tremendous challenges facing healthcare systems. Without exception, these reforms include the implementation of a variety of e-health solutions. Such e-health solutions are complex and have far reaching implications. We argue that while these implementations and adoptions of e-health solutions are necessary, it is essential that an appropriate lens of analysis should be used to maximise and sustain the benefits of IS/IT (information systems/information technology) in healthcare delivery. Hence, in this paper, we proffer Actor-Network Theory (ANT) as an appropriate lens to evaluate these various e-health solutions and illustrate in the context of MyHealth Record, the chosen e-health solution for Australia. The results of this study reveal that the implementation of eHealth is a complex process and approaching it nationally, serves to make it significantly more challenging with enormous barriers.

1. Introduction

Globally, governments are increasingly investing in health information technology particularly in digitalising health records as well as other e-health solutions. This is in response to immense pressures of changing patient demographics, health, financial implications, work force shortages, advancements in medical technologies and their impact on healthcare demand and delivery as well as a move towards a system where interaction between healthcare providers and consumers can achieve maximum output with limited human and financial resources [1].

In a broader context, implementing eHealth systems have been viewed as a potential solution to addressing issues faced in healthcare service delivery,

such as process inefficiencies, high healthcare costs, poor access to high quality of healthcare information, and low patient satisfaction (for example, see [2]). Consequently, there is an impetus towards the use of technology in many areas of healthcare administration and care processes. However, the complexities associated with the coordination, communication and delivery of healthcare services at the point of care, presents challenges for the design and implementation of eHealth solutions. According to surveys conducted by American College of Physicians and American EHR Partners (2013), user satisfaction and usability ratings for Health Information Systems (HISs) decreased between March 2010 and December 2012. During this period, overall user satisfaction decreased by 12% and users who were "very dissatisfied" increased by 10%. Overriding of the system, duplication of documentation, and a reversion to familiar systems such as paper recording has all been reported as work-around strategies used to continue delivery of safe and reliable clinical communication and care in the face of technological solutions that do not meet clinicians' needs [3], [4].

In information systems literature, development and sequential implementation of technology solution have been commonly agreed to be a process of social change involving active and interwoven relationships between the social and technical systems [5]–[7]. Particularly in healthcare, end users and the socio-organisational context have been argued to play a crucial role to success of technology implementation [8]. Among different socio-technical approaches, Actor Network Theory (ANT) [9], [10] has been adopted to develop a rich understanding of the complexity of the heterogeneous network of multiple social and technical actors and the process of social change associated with technology introduction. The objective of this study is to develop an understanding of critical success factors for the MyHealth Record (the Australian national e-health solution) implementation and adoption using the sociotechnical

lens of ANT for the theoretical underpinning of the research study. In so doing the key research question: How MyHealth Record implementation and adoption can be evaluated is answered.

2. Literature review

Many healthcare information systems have been implemented around the globe with mixed results, despite the claims that electronic health records (EHRs) can play a significant role in efficiency and effectiveness of healthcare service delivery. The literature provides evidence of failed clinical systems and lack of adoption by users [11]–[13]. Challenges and barriers to implementation and adoption of electronic health record have been extensively debated. Researchers have divided these barriers into different categories ranging from environmental, social, technical and organisational [14]. These factors can play a very crucial role in the decision-making process of technology adoption [15]. In a healthcare service context, where organisations are now required to work as a networked framework, health information technology implementation and adoption would be a more complex and challenging endeavor because of the different business processes, the available infrastructure, compatibility issues, decision centers, authorization mechanisms and hierarchies, enterprise systems and data semantics [16], [17] and the nature of healthcare system as a Complex Adoptive System [18].

The most commonly discussed topics in healthcare IT transformation include; legal issues, individual privacy, health information security and ethics. A report by American Psychiatric Association (1999) states that invasion of patient privacy can have a negative impact on the quality of patient healthcare service. The report also noted that any technology use without proper security and privacy measures can pose a serious threat to patient-doctor relationships and it can lead to mistrust. Consequently, the patient may withhold important information from a healthcare service provider that can negatively impact healthcare service quality. Further standardisation is important for the setting of security and access rules for the system [19]. This has been identified as a policy issue.

Financial issues such as initial implementation and adoption cost and total cost of ownership have been identified as a significant hurdle in adoption and implementation of health information technology, especially electronic health records [20]–[23]. These issues range from start-up costs to software upgrades and staff training. Lack of incentives, budget over

runs and high time costs are other financial concerns [17], [24]–[26].

IT implementations can cause serious disruptions to service deliveries and impact productivity, healthcare services are one of the very critical areas of services that cannot afford major disruptions [27].

There are many organisational barriers to implementation and adoption of eHealth technologies in organisations reported in the literature - for example, poor governance, organisational culture and proper management of the change process that could harm the flow of transformation [23], [28], [29]. These issues can aggravate the resistance to the change process, and complicate the dissemination of the ehealth technology. Due to the complexity of healthcare delivery systems, assimilation of information technology in healthcare needs a deeper understanding of organisational and environmental aspects of technology adoption and use [30], [31]. Technological issues can also exacerbate the resistance to the adoption of health information technology. The lack of infrastructure, and standards and protocols results in a fragmentation of healthcare information systems and this contributes to creating a very complex situation for coordination [17], [23], [32]. The lack of interpretability between different healthcare delivery and management systems can hinder the expansion of the use of this technology and its sustainability [14], [16], [23]. Pre-implementation and post-implementation vendor support is another key concern for organisations [27], [33]. Lack of technical resources and experience with information technology implementation within healthcare settings are other problems faced by many [34]–[36]. The accuracy of data obtained through a health information system and its ability in sorting, querying and validating data in some cases is very poor and is considered as a barrier for HIT adoption [37], [38].

People issues, ranging from user acceptance [39], [40], perceived ease of use [41], lack of knowledge about the system [35], [42], [43], lack of training, lack of stakeholder consultation [44], lack of willingness to assimilate the technology in to daily routines and processes [45], [46], conflict between system and user embedded values [45], [46], complex and complicated user interfaces [31], conflict between physician activities and training schedules [42], [47], [48] and complications in patient-provider communications are some of the major concerns. It is paramount that the systems are user centric and have a good fit with user values as well as existing healthcare systems.

3. Methodology

Based on the criteria given by [49], the choice of methodology for this research study is a qualitative single-case study methodology because this is an exploratory study of a new phenomenon of healthcare information system implementation and explores how MyHealth Record can be successfully implemented and adopted in Australia to transform the healthcare sector of Australia for smooth, affordable and efficient healthcare service and delivery.

It is also important to note that the project of MyHealth Record implementation and adoption in the Australian context is still a new phenomenon. Given that the scale and scope of this project is so large and that the unique aspects of two-tier healthcare system in Australia serve to make it even more complex it should be expected to be a challenging project which also meant it was difficult to have access to many different groups of people at the same time.

A total of 14 semi-structured face-to-face interviews, including Government representatives, NEHTA¹ representatives, eHealth experts and implementation partners in the MyHealth Record implementation adoption and use were conducted in Melbourne Australia to validate the initial conceptual framework.

Individuals for this study were selected based on their participation in the project of the MYHEALTH RECORD, their expertise in health information systems implementation and development, and their availability for the interview for this study. Initial contacts with key informants for interviews was established through email and then with a follow up phone call. Additional contacts were identified by using the snowball or chain sampling techniques, where interviewees provided further references to the person who can provide more details about the issue under investigation [50]. On ethics approval, key informants were provided with a detailed description of the project and an informed consent document about their right to refuse the interview and ability to withdraw from the study at any time.

4. Theoretical foundations of the study

Healthcare systems are complex systems especially when they integrate information technology. The challenge of this study is further

¹ NEHTA was the government task force commissioned to oversee the design, development and implementation of the Australian national ehealth solution.

complicated by the interaction of different human and nonhuman actors that mainly lead to failed technology based healthcare interventions and implementations. As a result, failure rates are unsurprisingly high, costly and have far reaching impacts (Cresswell et al., 2011). Thus, it becomes necessary and important to evaluate these interventions with theoretically informed techniques to enable a deeper understanding which in turn can facilitate a successful development implementation and adoption of health information technology such as MyHealth Record (Cresswell et al., 2011).

We believe that the lens of ANT with structuration theory can provide the foundations for a better understanding of MyHealth record implementation and adoption and its evaluation. Furthermore, it can also enhance our understanding by providing a mechanism to study the relationships between technology organisation, people, social and financial factors that influence the success of MyHealth record application development as well as implementation and adoption. We believe that a viable healthcare system can only be improved if these considerations are jointly optimised.

Our goal here is to investigate this in the specific context of MyHealth Record, in Australia. The initial analysis and literature to date shows that the processes underlying the development, implementation and adoption of MyHealth Record are inherently socio-technical in nature. A socio-technical approach of study therefore will allow more flexibility in evaluation of the system.

5. Data analysis and discussion

Various issues concerning the MyHealth Record implementation and adoption were identified from the literature, and based on those issues combined with the critical factors identified in the conceptual framework, interview data was collected. Then thematic analysis was applied for the analysis of interview data as it provided a systematic way of understanding the process [51]. Once ethics clearance was obtained the semi-structured interviews were conducted face to face and were audio recorded, then these interviews were transcribed and codes were identified from transcriptions. These codes were mapped with the data gathered through the literature review, then these themes were analysed under the lens of ANT. At the completion of the analysis, several emergent themes were identified.

To assist with the analysis of this rich data this research has drawn upon Actor Network Theory

(ANT) [9] to inform interpretation of the results. The summary of the key findings is presented below.

5.1. Actor's interactions through the MyHealth Record

The Using ANT made it possible to understand the multiple interactions of human and technology actors about the MYHEALTH RECORD. Importantly these interactions took place at the micro, meso and macro levels, as shown in Figure 4.3. This figure gives an overview of macro, meso and micro level actors, including public, health authorities, MYHEALTH RECORD, service providers, implementation partners, healthcare service processes and practices and governing bodies including government and NEHTA. It can be seen here that the MyHealth Record is present at all three levels and serves to connect and bridge all three levels of domains.

What our analysis shows is the importance of the interactions between all three levels highlighted in figure 4.1 which are critical for the success of this implementation and ongoing use. Specifically, it was possible to observe activities that satisfied the three tenants of being patient-centred i.e.

1. Patient focus- screens and views are designed to highlight patient issues.
2. Patient activity- patients can add and change data to show how they progress with a specific treatment plan.
3. Patient empowerment- it is possible for patients to access information to help them make informed decisions related to their health and wellness.

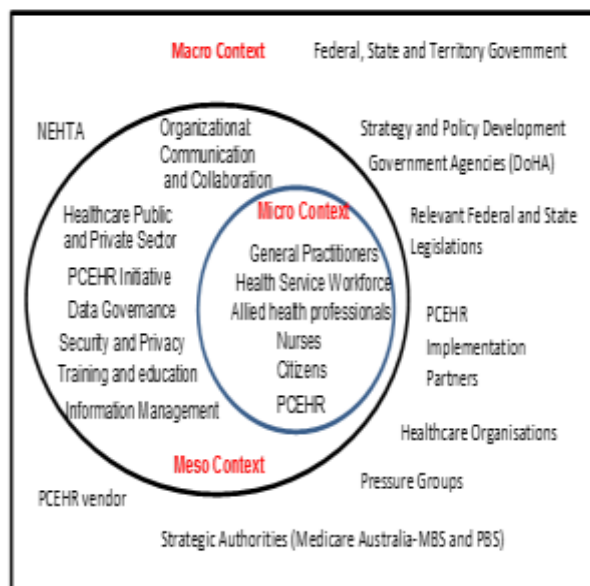


Figure 1: Actors interactions through the MyHealth Record (adapted from Muhammad et al., 2013)

The current practices of ICT use in the healthcare sector of Australia before the implementation of the MyHealth Record vary from practice to practice. These practices have a huge impact on the MyHealth Record implementation and adoption. For example, if GPs are currently using communication technologies they are more inclined towards adoption as they think it would be a lesser learning curve for them and was also the case for patients.

The interviews, conducted for problem investigation, revealed and projected potential issues and service providers and experts' reactions to the proposed MyHealth Record solution when the actant 'Paper based Documentation' leaves and will be replaced with a new actant the MYHEALTH RECORD. The participants expressed their concerns about their professional autonomy and trust in the new actor, their skills to use the MYHEALTH RECORD, how flexible the MyHealth Record would be to support their decision-making and complex healthcare services tasks, and how it will be interfaced with other existing actors (Doctors, Medical Devices, and existing systems used in GP practises and hospitals). Some of them felt that such a tool is long overdue and will be very useful tool for healthcare services.

Healthcare providers were more positive about the MyHealth Record and found more anticipated benefits as compare to consumers. Service providers thought with the availability of the MyHealth Record they will be able to take more holistic approach about the diagnosis and further the availability of complete and up-to-date information about patient health status and medication will help them in better decision making. Another benefit mentioned by service providers was that the legibility of the MyHealth Record and its power of reduction of risk of errors in diagnoses and medication prescription. Further it was expressed that in emergency situations such as accidents or sudden unconsciousness of patients; the MyHealth Record can be very useful tool to identify patient and access his record about his health and medication and allergies. There was gap in perceptions of benefits between rural service providers and service providers running services in metropolitan areas. Lack of the availability of information about patient information was less concern of rural service providers and cost associated with the MyHealth Record implementation and adoption was more of a barrier for them.

Figure 1 provides a representation of interactions between different key actors involved in the

MyHealth Record implementation adoption and use. This figure is a product of document analysis of different reports on the MyHealth Record. The analysis reveals service provider's reactions and factors that would influence their acceptance and usability of the MyHealth Record. This actor "MyHealth Record" is currently not connected with Medical Staff Doctors, Allied Health, and existing technologies.

Different set of actors including healthcare service providers, Patient, MyHealth Record, service provider local clinical systems and Medical Devices, different repositories and security and access controls and communication channels and their relations. Using this, one can examine roles of engagement and possible changes to healthcare service providers and the MyHealth Record other user's roles and practices, as modelled from the diagram, and service providers' reactions to the new actant (MyHealth Record). one can examine service providers in more detail by making it a black box with different types/roles of actors GPs, specialists, pharmacists and allied healthcare service providers and/or examine the technology actant the MyHealth Record by making it a black box with internal actor's terminals, provider portals, provider local clinical system, consumer portal, health identifier services, different repositories and securities and access controls. Each of these internal actors has its own set of functionalities visible to different service providers' roles (users). The 'Paper based Documentation' non-human actant is an out-going actor, so the relationships between this actant with other actors will be broken in long run and will be replaced with automated health record. In current scenario, the relationship between Patient and Paper based Documentation is a weak relationship; patients are not allowed to have access to their health record and access to this information is considered as Patient's unauthorised access to the clinical information. This relationship will change with the introduction of the new system the MyHealth Record, as patients will be allowed to have access to their record and can control the access of their health record. This can present lot of benefits to both service providers and patients but it is a constraint in terms of service provider adoption as they can see this as a direct challenge to their autonomy, thus it is much more complex at least from the service provider perspective.

5.2. Organisational change

Wherever Health information system implementations are said to enhance the work flow and speed up the care process in healthcare services

settings [1], [52]; But these interventions are not simple and easy propositions. These interventions need very thoughtful process reengineering and change management. Users can and will resist any change in the form of new technology implementations especially in-terms of healthcare services as these systems are known as complex adaptive systems and process is very rigid and deep rooted [1]. The general perception is that one can get around the technology and make it work, but the bigger issue is the change and adoption with regards to people issues. It's not the technology alone that fails the system because technology can make things work, but more compelling issues are about sociotechnical and socioeconomic issues, thus it is important to address people issues and try to find the answers usually project managers would hear from staff some of these questions are:

- What is in it for me?
- What am I going to get as a consumer or as a provider of healthcare?
- How difficult it is going to be?
- Is it going to affect my workflow in my practice as a specialist, a GP, a doctor in the hospital, or an allied health professional, or a nurse?
- How difficult it is going to be?
- Do I have the right tools and how do I do it?"
- What if I don't use the system?

These are simple but important questions and need to be addressed for the satisfaction of the MyHealth Record consumers. To address these challenges the government, need to introduce and define the policies so the system can be successfully implemented and adopted and then can be meaningfully used.

As one eHealth expert explains if there is lack of clarity and the masses are not widely accepting the system then system will lack in proper and complete information, so to make sure that there is a wide spread of system adoption, policies need to focus on change and adoption models. Further, for service providers, unless the information is regularly coming and updating the system, they will be reluctant to adapt the system and they might abandon the system along the way. Thus, it is important for government to have proper policy in-place for the widespread acceptance of this system.

Consumers were very frustrated because of poor understanding of the problem, even though the actors were identified, but their interests and needs were not identified and/or properly framed. Therefore, it was observed that identifying the primary actor was very hard – as can be seen in Australian government's

policy where they have mainly focused on service providers in hope that they will adopt the system and then will convince their patients to register for the system, this policy clearly not worked and NEHTA has failed all his targets in terms of consumer registrations [53].

It was also highlighted during data analysis that data entry and information retrieval from/to the MyHealth Record is very slow because of the difficulty in finding the correct information, selecting the correct charting place, difficult user interface, multiple screens, difference in terminologies and lack of inter-migration with other healthcare IT systems. These issues slowed down the delivery of healthcare, leading some users to dislike the system right from the beginning, creating uncertainty and poor clinical documentation.

Appropriate change processes are needed in key organisational activities within healthcare organizations for the system to be truly beneficial and meaningful.

The Victorian government's response to the MyHealth Record concept of operations illustrates that the intention of the MyHealth Record implementation is reasonably sound, but not sufficiently focused on clear outcomes. It is assumed that majority of users (clinician and patients) have the necessary technology skills to navigate through the system. So, the real concerns with the MyHealth Record implementation are two-fold. Firstly, Government has not realised the scale of the project. Secondly, the government tends to think of the MyHealth Record as being at the center but the researcher's analysis shows that the MyHealth Record is clearly complimentary to the core of healthcare delivery and operations. To be truly patient centered it must also provide the necessary structures and support for patients.

The researchers' analysis also shows that the critical factor for the use of the system were the availability of technology support staff. Stakeholders expressed their concerns that they might need help with system use and understanding of its work flow.

Another concern expressed was the simplicity of registration process for healthcare service providers, as one of the management staff expressed his concerns about the complexity of the process and how it is a hindering the registration process. Their perceptions are that if a properly thought out system is implemented and the process is made easy, uptake of system at least in terms of adoption, can be radically increased.

There are many key questions that need to be answered about the implementation processes, and

the way people are enrolled. Further, there still are many issues with specifications.

The process of transferring users from a local system to the national ehealth system indicated the complexities of change process. This was observed specifically at one of the trial sites.

5.3. Adoption model opt-in or opt-out

The analysis shows that the MyHealth Record adoption model used is likely to have a long-lasting impact on the MyHealth Record implementation and adoption. As the success of the MyHealth Record is dependent on both healthcare service providers and consumers registering with the MYHEALTH RECORD; the chosen opt-in model of the Australian eHealth system is proving to be a failure. It has been argued that giving people the choice of opting-in to this system could be a fundamental flaw in eHealth policy as it may take time to reach the critical masses needed to make the system viable. For this analysis when the researcher asked a question to the key informants about their views on opt-in model, many of them thought that this model is a key hindrance to the system adoption.

The major challenge with the opt-in model is that people have very limited knowledge about the system and if they don't know much about system they will not feel comfortable to sign in. The point here is if the government want a critical mass to adopt and use this system they should register everybody and let them opt-out on their own decision. Even making it mandatory and linking Medicare incentives with the adoption and use of the MyHealth Record is another proposal given by study participants. A good example is from Italian model. What Italy did was they had opt-in model and then they linked the healthcare incentives both for consumers and service providers with their ehealth card, which means if someone is not enrolled and does not have ehealth card, then he/she will have to pay some portion of the treatment from their own pocket. If the patient possesses an ehealth card the government will cover the expenses. So, they had 95% people signed in. This policy has proved to be a success as far as adoption is concerned.

Even those people who think that opt-in model is fine now but thought in the long run the government had to change its policy to an opt-out model. A NEHTA representative thought the opt-in model can make life easy for service providers and the government because if people sign for the system then they should know what they are consenting for and there will be less privacy issues raised by consumer groups.

The complexity of this model further complicated things when it comes to service provider participation, policy makers I think are not realising that, the health provider is also opt in, so they can choose not to participate and that can be real problem for government. The key point here is that most participants thought that the opt-in model for the consumer is fine but for service providers it is real worry.

Thus, the experts thought that if the government is going to focus on this model they need to have a very intense thought about policy and how they are going to convince service providers to register. The suggestions were to offer some incentives for service providers to sign in and have them send health summaries through the MYHEALTH RECORD.

In contrast, this the findings are showing that the government has not chosen that path and that is one of the many reasons of the slow up take of the MYHEALTH RECORD, which indicates a basic policy flaw. Regarding consumers, initial observations are that consumers have a lack of knowledge about the system and they don't know if any ehealth system is been implemented.

5.4. Privacy, information security and governance

Legal, individual privacy, health information security and governance were critical issues identified for the successful transformation and ehealth reform of health services in Australia. The breach of privacy was the common concern among consumers and privacy advocates despite the draft's (Personally Controlled Electronic Health Record Act 2011) emphasis on the security and privacy of electronic health record of individuals as well as any information that is protected by law. Consumers were scared that their information can and would be used other than health services. Despite the placement of many privacy and security requirements and standards, it was observed that the language is vague, that can cause more confusion and raise concerns among both healthcare providers and consumers. This has been identified as a policy issue.

The study participants had very strong views about the governance framework of the MYHEALTH RECORD. Managers and implementation partners thought there is too much governance or government interference. There is lot of bureaucratic hierarchy that slows down the progress of user adoption.

Participants in this group thought that there is disconnect between what is happening on the ground and what is happening in actual sites, they thought that sites should contact DoHA rather than NEHTA

because NEHTA himself is vendor, and this give them space because if NEHTA do not deliver doable on time they can go back and say to NEHTA we do not deliver because you have not deliver and that really can slow down things. Most participants thought the governance framework is important and a critical enabler for the MyHealth Record implementation and adoption, and all of them had consensus that this framework needs to be reviewed and streamlined. Clinicians had their own concerns about governance and the governance framework, they thought the government is focusing too much on design, build, and implementation and less on clinical governance. Most service providers were mainly concerned about the safety incident reporting system and its mechanism. They think there should be a robust and critical incident and clinical incident reporting system which should be built into the MYHEALTH RECORD, that can be seen by both consumers and service providers, that can enable them to go to a page on their portal and have an audit report of their health record and those reports go through to the system. There is a need of an appropriate group of people that have credentials of monitoring, reporting and resolving the issues and to give feedback.

Implementation partners and management people thought government is stressing too much about privacy and security. They think consent and privacy model is very difficult and has delayed the progress of the MyHealth Record implementation. The service providers thought legislation was very rigid and need to be relaxed if the government wants to optimise the chances of wide spread adoption of the MYHEALTH RECORD.

Trust is a key factor. If people don't trust the system, they absolutely won't use it. In terms of trust building, the government had put lot of effort, they made the process of development of the MyHealth Record quite transparent. They consulted with different stakeholders and experts and then published their responses which contributed to trust building.

The results of this study revealed that implementation of the MyHealth Record is a complex process and approaching it nationally makes it more challenging with enormous barriers to be overcome. The Australian Government has been keen about the MYHEALTH RECORD's potential benefits with continuous budget investment despite the slower uptake of the MyHealth Record than expected during the first year. It is understood that the potential benefits will not be obvious immediately and it may take many years to realise the impact of the MYHEALTH RECORD. Meticulous planning has been done in the implementation of the MyHealth

Record in the system's conceptual, legal, healthcare provider's incentives and training areas. Different concerns are raised in the system model and its supporting frameworks by stakeholders and eHealth experts as evaluated in our analysis. The results of this study support the argument of using theoretically rich and informed analysis techniques presented by [1], [20], [54], [55]. The mapping of emerged themes with ANT and structuration theory provided a deeper understanding of the interaction between people and technology. Further analysis of emerging themes indicates that there are many driving forces for the MyHealth Record adoptions but there are many success factors for the MyHealth Record specific to Australian context that needed to be considered. These factors were found to be significant and in agreement with the identified factors through the literature review presented in section 3. The informants of this research provided significant suggestions and strategies to overcome the barriers of implementation and adoption of the MyHealth Record in Australian context.

6. Conclusion

The need for IT based interventions in healthcare services delivery is well recognised all around the globe to improve information and communication flow. Different e-health solutions are being implemented with mixed results [13], [29]. Therefore, it is important to evaluate these technologies with theoretically informed approaches. The purpose of this study was to understand the need for an ehealth system in Australia and to evaluate the proposed system keeping in mind the complexities of healthcare delivery system of Australia. This paper has outlined an exploratory research study undertaken to evaluate the implementation and adoption of the MyHealth Record by identifying the critical success factors important for the implementation and adoption.

This study also contributes to theory by highlighting the importance of the use of sociotechnical theories for the analysis of the data gathered for the MyHealth Record evaluation. While there may be many other studies using ANT to provide a theoretical lens of analysis we contend that ANT is useful but should be used in conjunction with other theories such as structuration a Activity theory in order to have a truly robust lens of analysis that can adequately identify all critical issues in dynamic and complex healthcare scenarios.

The fact that to date there are still so many failures and of the success still too many key stakeholders are not totally satisfied leads us to

believe this can only be addressed by using a richer lens of analysis as an alternative.

The use of ANT in combination with structuration theory to study a healthcare IT implementation and adoptions issues is contribution to the theory.

This paper highlights that healthcare is complex and dynamic and greatly impacted by the structure of the healthcare system e.g two-tier in Australia. It is important to consider these when examining such large scale e-Health solutions. Moreover, lessons from one country can be useful in another irrespective of differences in healthcare delivery. Today in all OECD countries we are viewing various adoption and implementation of numerous E-health solutions, so the focus and considerations identified in this paper are relevant to all countries and if appropriately addressed would ensure a better implementation and adoption of eHealth applications as well as better delivery of health care services globally.

In closing, the researcher contends that understanding the key facilitators and barriers to the implementation and adoption of the MyHealth Record in Australian context is very important for the success of the system. The real-time collection of health information and then distribution and access is only possible if widespread adoption of the MyHealth Record is achieved because any system without meaningful and useable data is not going to have any impact on service provider's adoption decision. A seamless health data sharing between clinical professionals and health services appears to be critical for many areas in healthcare where complex and high-risk decisions must be made based of available information. The MyHealth Record will only succeed if government properly support its reform agenda, and directly involve key stakeholders identified in this study as it is evident that the numerous planned e-health solutions either fails to deliver their promises [56] or end up shutting their operations due to the failure of realisation of healthcare information system implementation complexities.

6. References

- [1] I. Muhammad, N. Wickramasinghe, and M. Zwicker, "Using ANT to Understand Key Issues for Successful e-Health Solutions," in Proceedings of the [46th] Annual Hawaii International Conference on System Sciences, Manoa, Hawaii, 2013.
- [2] P. J. Edwards, K. P. Moloney, J. A. Jacko, and F. Sainfort, "Evaluating usability of a commercial electronic health record: A case study," *Int. J. Hum.-Comput. Stud.*, vol. 66, no. 10, pp. 718–728, Oct. 2008.

- [3] D. Dowding, N. Mitchell, R. Randell, R. Foster, V. Lattimer, and C. Thompson, "Nurses' use of computerised clinical decision support systems: a case site analysis," *J. Clin. Nurs.*, vol. 18, no. 8, pp. 1159–1167, Apr. 2009.
- [4] J. Viitanen, H. Hyppönen, T. Lääveri, J. Vänskä, J. Reponen, and I. Winblad, "National questionnaire study on clinical ICT systems proofs: Physicians suffer from poor usability," *Int. J. Med. Inf.*, vol. 80, no. 10, pp. 708–725, Oct. 2011.
- [5] Emile Silvis and Patricia M. Alexander, "A study using a graphical syntax for actor-network theory," *Inf. Technol. People*, vol. 27, no. 2, pp. 110–128, May 2014.
- [6] O. Hanseth, "Integration-complexity-risk: the making of information systems out-of-control," *Risk Complex. ICT Oslo Edw. Elgar*, 2007.
- [7] T. Iyamu and T. Sekgweleo, "Information Systems and Actor-Network Theory Analysis," *Int. J. Actor-Netw. Theory Technol. Innov. IJANTTI*, vol. 5, no. 3, pp. 1–11, Jul. 2013.
- [8] T. Timpka, M. Bång, T. Delbanco, and J. Walker, "Information infrastructure for inter-organizational mental health services: An actor network theory analysis of psychiatric rehabilitation," *J. Biomed. Inform.*, vol. 40, no. 4, pp. 429–437, Aug. 2007.
- [9] B. Latour, *Reassembling the social: an introduction to Actor-Network Theory* Oxford University Press, Oxford., vol. 2005 SRC-GoogleScholar. .
- [10] J. Law, "Networks, relations, cyborgs: on the social study of technology," 2006.
- [11] P. Basch, "Electronic Health Records and the National Health Information Network: Affordable, Adoptable, and Ready for Prime Time?," *Ann. Intern. Med.*, vol. 143, no. 3, pp. 227–228, 2005.
- [12] C. DesRoches et al., "Health Information Technology in the United States, 2008 - RWJF," *Mass. Gen. Hosp. Sch. Public Health Health Serv. George Wash. Univ.*, Jun. 2008.
- [13] D. Protti, "Comparison of information technology in general practice in 10 countries.," *Healthc. Q. Tor. Ont.*, vol. 10, no. 2, p. 107, 2007.
- [14] B. André, G. Inger Ringdal, J. H. Loge, T. Rannestad, H. Laerum, and S. Kaasa, "Experiences with the Implementation of Computerized Tools in Health Care Units: A Review Article," *Int. J. Hum.-Comput. Interact.*, vol. 24, no. 8, pp. 753–775, 2008.
- [15] Z. Huang and P. Palvia, "ERP implementation issues in advanced and developing countries," *Bus. Process Manag. J.*, vol. 7, no. 3, pp. 276–284, Jan. 2001.
- [16] L. S. Liu, P. C. Shih, and G. R. Hayes, "Barriers to the Adoption and Use of Personal Health Record Systems," *Analysis*, pp. 363–370, 2011.
- [17] M. C. Trudel, "Challenges to personal information sharing in interorganizational settings: Learning from the Quebec Health Smart Card project," *THE UNIVERSITY OF WESTERN ONTARIO*, 2010.
- [18] L. K. Leykum, J. A. Pugh, H. J. Lanham, J. Harmon, and R. R. McDaniel, "Implementation research design: integrating participatory action research into randomized controlled trials," *Implement. Sci. IS*, vol. 4, p. 69.
- [19] S. Hoffinan and A. Podguski, *Finding a cure: The case for regulation and oversight of electronic health record systems.*, vol. 22 SRC-GoogleScholar. 2008.
- [20] J. Aarts, J. Ash, and M. Berg, "Extending the understanding of computerized physician order entry: implications for professional collaboration, workflow and quality of care," *Int. J. Med. Inf.*, vol. 76, pp. S4–S13, 2007.
- [21] J. Aarts and R. Koppel, "Implementation of computerized physician order entry in seven countries," *Health Aff. (Millwood)*, vol. 28, no. 2, pp. 404–414, 2009.
- [22] K. Ashish, "Use of electronic health records in U.," *Hosp. Med. Benefits Doi 101056NEJMSa0900592*, vol. 25, no. 10 SRC-GoogleScholar, pp. 4–9, 2009.
- [23] B. L. Kennedy, "Exploring the Sustainment of Health Information Technology: Successful Practices for Addressing Human Factors," *NORTHCENTRAL UNIVERSITY*, 2011.
- [24] H. A. DePhillips, "Initiatives and Barriers to Adopting Health Information Technology: A US Perspective," *Dis. Manag. 38 Health Outcomes*, vol. 15, no. 1, pp. 1–6, 2007.
- [25] A. Boonstra and M. Broekhuis, "Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions," *BMC Health Serv. Res.*, vol. 10, no. 1, pp. 1–17, 2010.
- [26] K. Cohn et al., "Engaging physicians to adopt healthcare information technology.," *J. Healthc. Manag. Coll. Healthc. Exec.*, vol. 54, no. 5, p. 291, 2009.
- [27] J. Kralewski, B. E. Dowd, T. Zink, and D. N. Gans, "Preparing your practice for the adoption and implementation of electronic health records.," *Physician Exec.*, vol. 36, no. 2, pp. 30–3, Apr. 2010.
- [28] M. L. Bernstein, T. McCreless, and M. J. Côté, "Five constants of information technology adoption in healthcare.," *Hosp. Top.*, vol. 85, no. 1, pp. 17–25, Winter 2007.
- [29] T. Greenhalgh and R. Stones, "Theorising big IT programmes in healthcare: Strong structuration theory meets actor-network theory," *Soc. Sci. Med.*, vol. 70, no. 9, pp. 1285–1294, May 2010.
- [30] L. Catwell and A. Sheikh, "Evaluating eHealth Interventions: The Need for Continuous Systemic Evaluation," *PLoS Med*, vol. 6, no. 8, p. e1000126, 2009.
- [31] M. M. Yusof, J. Kuljis, A. Papazafeiropoulou, and L. K. Stergioulas, "An evaluation framework for Health Information Systems: human, organization and technology-

- fit factors (HOT-fit).,” *Int. J. Med. Inf.*, vol. 77, no. 6, pp. 386–98, Jun. 2008.
- [32] S. Hoffman and A. Podgurski, “Finding a Cure: The Case for Regulation and Oversight of Electric Health Record Systems,” *Harv JL Tech*, vol. 22, p. 103, 2008.
- [33] K. Cohn et al., “Engaging physicians to adopt healthcare information technology,” *J. Healthc. Manag. Coll. Healthc. Exec.*, vol. 54, no. 5, p. 291, 2009.
- [34] P. Torda, E. S. Han, and S. H. Scholle, “Easing the adoption and use of electronic health records in small practices,” *Health Aff. (Millwood)*, vol. 29, no. 4, pp. 668–675, 2010.
- [35] P. Bath, “Health informatics: current issues and challenges,” *J. Inf. Sci.*, vol. 34, no. 4, p. 501, 2008.
- [36] D. McReavy, L. Toth, C. Tremonti, C. Yoder, and C. The, (June). s role in implementing EHR systems: The experiences of a Florida health system point to 10 actions that can help CFOs manage the revenue risks and opportunities of implementing an electronic health record., vol. 63. 2009.
- [37] H. Kimaro and J. Nhampossa, The challenges of sustainability of health information systems in developing countries: Comparative case studies of Mozambique and Tanzania., vol. 1 SRC-GoogleScholar. 2007.
- [38] D. L. Rosebaugh, “Getting Ready for the Software in Your Future,” *Home Health Care Manag. Pract.*, vol. 16, no. 3, pp. 228–234, Apr. 2004.
- [39] R. Agarwal and J. Prasad, “The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies,” *Decis. Sci.*, vol. 28, no. 3, pp. 557–582, 1997.
- [40] J. Frame, J. Watson, and K. Thomson, “Deploying a Culture Change Programme management approach in support of information and communication technology developments in Greater Glasgow NHS Board,” *Health Informatics J.*, vol. 14, no. 2, pp. 125–139, 2008.
- [41] S. Al-Azmi, N. Al-Enezi, and R. Chowdhury, “Users’ attitudes to an electronic medical record system and its correlates: A multivariate analysis,” *HIM J*, vol. 38, no. 2, pp. 33–40, 2009.
- [42] B. André, G. I. Ringdal, J. H. Loge, T. Rannestad, H. Laerum, and S. Kaasa, “Experiences with the implementation of computerized tools in health care units: a review article,” *Intl J. Human–Computer Interact.*, vol. 24, no. 8, pp. 753–775, 2008.
- [43] B. Kaplan and K. D. Harris-Salamone, “Health IT success and failure: recommendations from literature and an AMIA workshop,” *J. Am. Med. Inform. Assoc.*, vol. 16, no. 3, pp. 291–299, 2009.
- [44] C. M. Showell, “Citizens, patients and policy: a challenge for Australia’s national electronic health record,” *Health Inf. Manag. J. OnLine*, vol. 40, no. 2, 2011.
- [45] J. Cash, “Technology can make or break the hospital-physician relationship,” *Healthc. Financ. Manag. J. Healthc. Financ. Manag. Assoc.*, vol. 62, no. 12, pp. 104–9, Dec. 2008.
- [46] S. E. Ross, L. M. Schilling, D. H. Fernald, A. J. Davidson, and D. R. West, “Health information exchange in small-to-medium sized family medicine practices: Motivators, barriers, and potential facilitators of adoption,” *Int. J. Med. Inf.*, vol. 79, no. 2, pp. 123–129, Feb. 2010.
- [47] M. Yusof, L. Stergioulas, and J. Zugic, Health information systems adoption: Findings from a systematic review., vol. 129 SRC-GoogleScholar. 2007.
- [48] B. Kaplan, “Evaluating informatics applications--some alternative approaches: theory, social interactionism, and call for methodological pluralism,” *Int. J. Med. Inf.*, vol. 64, no. 1, pp. 39–56, Nov. 2001.
- [49] R. K. Yin, *Qualitative Research from Start to Finish*. Guilford Press, 2010.
- [50] M. J. Salganik and D. D. Heckathorn, “Sampling and Estimation in Hidden Populations Using Respondent-Driven Sampling,” *Sociol. Methodol.*, vol. 34, pp. 193–239, Jan. 2004.
- [51] R. Boyatzis, “Transforming qualitative information: Thematic analysis and code development,” 1998.
- [52] M. Mort, T. Finch, and C. May, “Making and Unmaking Telepatients: Identity and Governance in New Health Technologies,” *Sci. Technol. Hum. Values*, vol. 34 SRC-GoogleScholar, pp. 9–33, 2009.
- [53] R. Reeves and I. Seccombe, “Do patient surveys work? The influence of a national survey programme on local quality-improvement initiatives,” *Qual. Saf. Health Care*, vol. 17, no. 6, pp. 437–41, Dec. 2008.
- [54] K. Cresswell, A. Worth, and A. Sheikh, “Implementing and adopting electronic health record systems: How actor-network theory can support evaluation,” *Clin. Gov. Int. J. Pp*, vol. 16, no. 4 SRC-GoogleScholar, pp. 320–336, 2011.
- [55] N. Wickramasinghe, J. Schaffer, C. Series, D. Washington, IBM, and Government Improving, “Realizing Value Driven e-Health Solutions,” *Bus. Of*, 2010.
- [56] R. Rozenblum et al., “A qualitative study of Canada’s experience with the implementation of electronic health information technology,” *CMAJ*, vol. 183, no. 5, pp. E281–288, Mar. 2011.