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Strategies Used in eHealth Systems Adoption

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This is to certify that the doctoral study by

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Abstract

Failure to adopt an interoperable eHealth system limits the accurate communication exchange of pertinent health-care-related data for diagnosis and treatment. Patient data are located in disparate health information systems, and the adoption of an interoperable eHealth system is complex and requires strategic planning by senior health care IT leaders. Grounded in DeLone and McLean's information system success model, the purpose of this qualitative case study was to explore strategies used by some senior information technology (IT) health care leaders in the successful adoption of an eHealth system. The participants were 8 senior health care IT leaders in the eastern United States who successfully adopted an interoperable eHealth system. Data were collected using semistructured interviews following Kallio's five phase interview guide and analyzed using thematic analysis. Six themes emerged: eHealth ecosystem, implementation approach, quality, strategy, use/intent to use, and user satisfaction. A key recommendation from results indicates that further identification and development of strategies based on the DeLone and McLean IS success model might benefit successful eHealth adoption and implementation. Positive social change implications include the potential for senior health care IT leaders to identify a framework to enhance accuracy among eHealth systems to reduce medical errors and improve patient care.

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Dedication

I would like to thank my family (Zoie, Kaya, Ahanu, Joshua, and Amy), all my sisters and my brother, my parents, and my friends for their unwavering support in positively encouraging me to complete this study after 5 arduous years. Their positive reinforcement to complete my study provided the ongoing encouragement needed to get me where I am today.

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Section 1: Foundation of the Study

This section is the foundation for the project and includes the background of the problem, purpose for the study, the problem as seen by current senior health care IT leaders, and the approach used to address the problem. The research design focuses on applicable qualitative methods and designs, while the conceptual framework includes the DeLone and McLean Success model as a means for evaluating the problem. The remaining sections include defined terms needed to understand the context of this project, the interview questions posed to senior health care IT leaders, and the assumptions, limitations, and delimitations for the study. The last components of Section 1 are the significance of the study to current research, current practices, and the positive impact on social change for senior health care IT leaders.

Background of the Problem

According to Uslu and Stausberg (2008), fragmented medical records can exist in multiple locations. Medical providers may cause further fragmentation by not adopting electronic health care systems due to security access concerns, and electronic health care systems may function in isolation prohibiting communication between proprietary systems and the ability to extract the appropriate data at multiple levels (Alberts, Fogwill, Botha, & Chetty, 2014; Khullar, Jha, & Jena, 2015; Nguyen, Bellucci, & Nguyen, 2014). According to Dullabh, Hovey, and Ubri (2013), understanding key influencing factors as part of the implementation process of a health information exchange (HIE) is necessary for the improvement of health care quality delivery. Additionally, the Health Information Technology for Economic and Clinical Health Act of 2009 (HITECH) and the Medicare

and CHIP Reauthorization Act of 2015 set requirements and meaningful use requiring proper HIE (Ginsburg & Wilensky, 2015; Grinspan et al., 2016). Standardization of health information systems (HISs) may enhance health care delivery because it supports interoperability among different HISs and electronic health records (EHRs) to address issues of patient information exchange, mitigate the loss of patient records, and meet requirements of meaningful use (Bosworth et al., 2016; Jardim, 2013). However, extracting the correct information from HIEs has proven cumbersome because of the nonstandardization and the need for knowledge discovery database systems (Cars et al., 2013). As more medical providers migrate to HISs to meet meaningful use requirements, interoperable systems that can communicate and lessen fragmentation are necessary for effective HIE.

Problem Statement

Health care is conducted using multiple systems or enterprise information systems to assist medical providers in the diagnosis and treatments of patients, which increases the difficulty in accessing necessary medical records due to the lack of intercommunication layers of a complete enterprise health system (Weichhart, Guédria, & Naudet, 2016). Interoperability could save more than 70 billion dollars in the United States, as well as reduce medical errors due to the lack of patient information to assist with the diagnosis and treatment process (Nijeweme-d'Hollosy, Van Velsen, Huygens, & Hermens, 2015). The general IT problem was that some health care systems fail to properly exchange health-care-related data because there is a lack of tools, standards, and frameworks to allow health care systems to share information across disparate HISs. The

specific IT problem was that some senior health care IT leaders lack strategies to implement interoperable electronic health care systems across different health care organizations.

Purpose Statement

The purpose of this qualitative case study was to explore strategies used by senior health care IT leaders to implement interoperable electronic health care systems across disparate health care organizations. The sample population included senior health care IT leaders from a health care organization in the eastern United States who used strategies to implement interoperable electronic health care systems among disparate health care organizations. Findings may offer senior health care IT leaders a framework to obtain enhanced accuracy among disparate eHealth systems to reduce medical errors and improve patient treatment.

Nature of the Study

There are three main approaches used in the evaluation of a research problem: qualitative, quantitative, and mixed methods. M. D. Myers (1997) described the qualitative research method as using interviews, observations, and documents to understand and explain a social phenomenon. In the current study, the qualitative method was appropriate for understanding the implementation process of an interoperable HIS. Orlikowski and Baroudi (1991) acknowledged that studies are used to test a theory to comprehend the phenomenon in an amplified, extrapolative manner. Quantitative methodology was not appropriate for the current study because there was no need to develop a theory of or quantify interoperable system adoptions. The mixed-methods

approach involves a qualitative assessment to understand the problem and a quantitative assessment to measure patterns (Snelson, 2016). The mixed-methods approach was inappropriate because the current study did not require quantitative methodology to analyze strategies empirically. Although each method provides a means to evaluate a research problem, a qualitative approach was selected to explore the strategies used by the senior health care IT leaders to implement interoperability of electronic health care systems across disparate health care organizations.

The design used in a qualitative study is specific to understanding the phenomenon. A case study design was ideal to understand the strategies used by senior health care IT leaders. Dhillon, Syed, and Pedron (2016) stated that a case study design is desirable in describing the context of the study to be used for future studies. Additionally, Tsang (2014) stated that the case study method is an excellent way of exploring the interactions of structures, events, human actions, and context for identifying and explaining multiplicative mechanisms. As an alternative, Kwan and Ding (2008) explained that narrative design is an inquiry of the human life experience in addition to the social or institutional context of experiences. Bruce, Beuthin, Sheilds, Molzahn, and Schick-Makaroff (2016) supported this by stating that narrative inquiry is the study of experiences as a story and a way of thinking. However, the narrative design was inappropriate because my goal was not to understand the life experience of senior health care IT leaders but rather to understand their strategies.

Aside from a narrative design, Draper (2015) described ethnographic research as describing people and behaviors as individuals or within groups in the cultural context

and how people are influenced by the culture in which they live. An ethnographic approach was inappropriate because my study was not an attempt to understand the culture of health care IT leaders. In addition to ethnographic and narrative designs, the phenomenological design is used to understand the experience of the phenomenon from the lived human experience to create meaning (Galehbakhtiari & Pouryasouri, 2015). Phenomenology was inappropriate because my approach to this study was not an attempt to understand the living human experience. A case study approach provided a foundation for describing strategies used or employed by senior health care IT leaders to select an interoperable electronic health care system.

Research Question

What are strategies senior health care IT leaders use to implement interoperable electronic health care systems across disparate health care organizations?

Interview/Survey Questions

1. What were current interoperability issues you were working to solve within your organization?
2. How did your organization define success for the interoperable system you implemented?
3. What was your role within the interoperability strategy for your organization?
4. What are the lessons learned from your current strategy?
5. In what way does the selected strategy frame a system that provides for accurate medical data required at any given time?
6. How does the selected strategy provide for quality?

7. How does the selected strategy incorporate the goals and needs of the organization as it relates to access to medical data?
8. How does the selected strategy incorporate external influences/factors as part of the system development process to ensure regulatory requirements are met?
9. How does the selected strategy address the overall issue of interoperability?

Conceptual Framework

The DeLone and McLean success model was selected as the conceptual framework for this study. This framework is used to assess information systems with the interdependencies between the following success categories: information quality, system quality, service quality, intention to use, use, user satisfaction, and net benefits (DeLone & McLean, 1992, 2003; Petter & McLean, 2009). Requirements for DeLone and McLean success model adoption are based on the following: context, clear identification of stakeholders, and the need to study the relationship from a multidimensional perspective and individual paradigms (DeLone & McLean, 2003). The DeLone and McLean success model provided a lens through which to view the strategy or strategies used by senior health care IT leaders in implementing an interoperable eHealth system and the degree of success based on relationships defined in the success categories.

The DeLone and McLean IS success model was used to examine the IT problem by reviewing these categories: information quality, system quality, service quality, intent of use, use, user satisfaction, and net benefits. The review of categories was used to examine the strategies used in implementing an interoperable electronic health care system by the senior health care IT leaders. This approach allowed for interpretation and

understanding of the strategy applied by senior health care IT leaders in an interoperable eHealth system.

Definition of Terms

Electronic health record (EHR): EHR is a software system used by health care providers at all levels that captures, stores, and maintains individual records for patients (Tavares & Oliveira, 2016).

Electronic medical record (EMR): The EMR is the system in which the data of that patient, including the problem list, allergy list, and health history, resides in a digital format (Almunawar & Anshari, 2012).

Health information exchange (HIE): HIE is the electronic movement of the stored data among organizations to effectively deliver care (Strauss et al., 2015).

Hospital/health information system (HIS): The HIS encompasses multiple aspects of technology, people, processes, and support to effectively enhance patient treatment quality (Almunawar & Anshari, 2012; Ismail, Abdullah, & Shamsuddin, 2015).

Interoperability: George and Liviu (2013) defined interoperability as the exchange and understanding of information related to health care data among disparate health care systems.

Strategy: Dahl, Kock, and Lundgren-Henriksson (2016) identified the concept of practice approach to strategy as activities in social interactions among differing actors.

Information quality: According to Serio et al. (2017), information quality has been defined as fitness to use. Laumer, Maier, and Weitzel (2017) stated that information quality refers to the desirable characteristics of information as IS output, such as

completeness and accuracy. Therefore, information quality is fitness and desirable characteristics that are complete and accurate for end-user needs.

System quality: According to McKnight, Lankton, Nicolaou, and Price (2017), system quality relates to technical characteristics in a system that are used in information processing and accessible by the system user.

Service quality: Service quality is described as an outcome based on the evaluated comparison of perceived and expected service along with the degree of superiority of service from an organization (Hapsari, Clemes, & Dean, 2017). DeLone and McLean (2016) defined service quality as the quality of support received from the organization.

Use: Use is described as the degree to which all stakeholders use a system, including intention (DeLone & McLean, 2016).

User satisfaction: User satisfaction is described as the continuance to use from expectations of a system and the perceived usefulness of the system (Hadji, Martin, Dupuis, Campoy, & Degoulet, 2016).

Net benefits: According to Sun and Teng (2017), net benefits are defined as the effect the IS has on the user measured by using the variable organizational performance, perceived usefulness, and the effect on the work process for the organization.

Net impacts: DeLone and McLean (2016) described the net impact as the overall contribution from the system to the organization.

Senior health care IT leaders: In determining the appropriateness of the population, interviews were opened to all eligible participants meeting the requirements of senior level health care IT leaders. All participants were required to have knowledge of

eHealth systems, adoption, and implementation of IT systems and governance practices under an umbrella of information specialists. Senior health care IT leaders included chief information officers (CIOs), executive level managers, and EHR senior leads.

Assumptions, Limitations, and Delimitations

Assumptions

In research, three essential components need to be identified to mitigate bias and understand the phenomenon of strategies as part of conducting research. According to Wolgemuth, Hicks, and Agosto (2017), a research study is conducted to surmise and evaluate knowledge of a topic. Assumptions, limitations, and delimitations are three components needing definition and evaluation as part of evaluating this study. Assumptions are unverified facts, beliefs, or considerations of how something worked and have inherent risks because they affect every step of evaluation (Nkwake & Morrow, 2016). According to Nkwake and Morrow (2016), an assumption may or may not be valid, tacit, or explicit, and may affect processes from the relevance of program implementation to program objectives. In the current study, there were assumptions of concepts in the implementation processes from a development and a conceptual framework perspective. Preconceived assumptions are theoretical expectations directly supporting conclusions based on a preexisting view of the study, including the consideration of the participants and the extent of their knowledge and ability to respond accurately to interview questions on HIS interoperability adoption (Ardagna, Asal, Damiani, & Vu, 2015). The first assumption was that senior health care IT leaders develop, implement, and utilize some form of strategy in the development of an

enterprise framework as part of an implementation process of interoperable health care systems. The second assumption was that the invited participants had knowledge of strategies and a thorough understanding of interoperability implementation. The third assumption was that the perceived successful integration of an interoperable system related to the strategy used in the implementation process.

Limitations

In addition to assumptions, a researcher needs to identify and understand any limitations in a study. Limitations require acknowledgment (Nicholas et al., 2017). Denscombe (2013) stated that research proposals should have an explicit statement about the delimitations of what the researcher can or cannot conclude based on the research.

The first limitation was the small sample of participants from a single case study perspective, which impeded generalizability of findings to other organizations using a strategy to implement an interoperable eHealth system. Organizations that declined identified, in the responses, that they were not able to participate based on proprietary information, concern of discussing internal strategies, and the high workload of the intended audience for health care IT leaders. High workload was significant because recruitment had taken nearly a year time span for all participants.

The second limitation was based on the modification of the member checking protocol. The member checking protocol of having interviews occurred until my understanding fully reflected the participant's response and no new information was discussed. Many of the organizations were actively involved in migration and integration activities for their respective HISs at the time of the interviews. Additionally, the onset of

COVID-19 in early January 2020 made further follow-ups difficult. As a result, member checking as defined was not completed. Only two follow-up interviews were conducted based on the response from and availability of participants. This limitation means that validity and reliability was based on the adjusted interview protocol and one interview round without detailed member checking follow up. The two participant follow-up interviews were completed for verification of the previous two interview and clarification of further statements. Based on the responses from the participants, summary transcripts were sent with no additional responses or interviews conducted.

Delimitations

The qualitative method provides an understanding of the literature study for success measures (Spil & Klein, 2015). Delimitations restrict the scope of study for feasibility and focus (Snelson, 2016). Finally, this study was limited to senior health care information technology leaders who have experience in interoperability implementation in the eastern United States.

Significance of the Study

Findings may provide value to IT practitioners and IT organizations by explaining a strategy or strategies used in the decision-making and selection process of interoperable electronic health care strategies by senior health care IT leaders. According to Mithas and Rust (2016), firms are challenged with developing strategies to decrease the amounts of capital spent to enhance performance from IT by reducing costs, increasing revenue, or and exploiting opportunities and realizing value. Understanding the strategies used in deploying interoperable eHealth systems may enhance IT practice by providing a

reference for which senior health care IT leaders can use to ensure interoperability of electronic health care systems, to reduce costs, and to realize the value of interoperability across systems. Urueña, Hidalgo, and Arenas (2016) stated that understanding the capabilities of the organization includes the post eHealth project implementation necessary to allow for coordinated activities.

Contribution to Information Technology Practice

Strategies for interoperability between systems are a significant component of IT in eHealth. Interoperability permits the exchange of patient data, requiring logical representation (Bosworth et al., 2016). To ensure health data are in an understandable form to communicate between systems, senior health care IT leaders need to define and emphasize the strategic objective of expansion and costs (Mithas & Rust, 2016). According to Winkler, Ozturk, and Brown (2016), senior health care IT leaders need a plan to achieve operational sustainability for pre- and post-integration. Combining a model that defines objectives is a component of strategies used in the implementation of an interoperable system because senior health care IT leaders need to ensure access to all types of health-care-related data. Senior health care IT leaders may use these strategies to enhance communication between disparate systems and assist in obtaining established goals. Finally, the strategies may assist with further research in eHealth interoperability implementation.

Implications for Social Change

The efficient exchange of health information may reduce medical errors, which may contribute to positive social change. The efficient sharing of information within the

interoperable eHealth system may improve the quality of care for medical patients by reducing medical errors (Gheorghiu & Hagens, 2016). Tharmalingam, Hagens, and Zelmer (2016) claimed that interoperable eHealth systems could provide this social benefit while also identifying risks during the delivery of care. For example, patients may experience a negative health care response if there is a need to receive care in another region other than where their primary care facility is located, which may be caused by the lack of access to physical and electronic medical records. The result may be that the appropriate treatment is delayed, or the patient is injured, whereas full access to medical history may expedite the correct diagnosis and treatment.

A Review of the Professional and Academic Literature

This section provides an overview of current literature in the domain of HIS adoption, factors stimulating adoption, and how organizations applied processes of adopting an interoperable eHealth system from strategic and nonstrategic perspectives. The focus of this literature review is on the strategies senior health care IT leaders use to implement interoperable electronic health care systems across disparate health care organizations. As part of understanding strategies, this literature review also emphasizes the DeLone and McLean IS success model as the conceptual framework in evaluating strategies. Also, this literature review encompasses topics on interoperability that are essential aspects of developing strategies.

This literature review comprises 149 of 312 articles, journals, and conference proceedings to be reviewed as part of the strategic implementation. All literature was obtained from the following research libraries: ACM Digital Library, IEEE, EBSCOhost

Computers, Applied Sciences Complete, ScienceDirect, Google Scholar, and ProQuest. A total of 312 articles were obtained for supporting the research and the literature review, and 289 (93%) were peer reviewed. For this study, 271 out of 312 articles (87%) were within 5 years of my anticipated graduation date. The literature was verified using Ulrich's Global Serials; 140 of 149 articles (94%) were peer-reviewed, and 131 of 149 articles (87%) were published within 5 years of my anticipated graduation date.

The following review of literature covers six areas: (a) conceptual framework, (b) EHR adoption, (c) interoperability, (d) HIS at the integration at the IS level, (e) current level of interoperability success, (f) strategies in the implementation of an interoperable system, and (g) health care information exchange at the regional and national level. These areas of focus are foundational for strategy development. The strategy for the literature search was on multiple aspects of EHR adoption. Each article was grouped according to the relevant section of the review. Studies searched using Google Scholar and Thoreau Selections were limited to peer-reviewed articles under the advanced search component to identify potential interoperability of HIS and support of the focus area. Keywords were *strategies*, *implementation*, *health information exchange*, *barriers to adoption*, *interoperability*, and *interoperable system* using the same method and approach as mentioned to identify key studies. To search the focal areas of barriers to adoption and health care information exchange, I used the following keywords: *barriers to eHealth and HIS*, *adoption*, *healthcare information exchange*, *HIE*, *information exchange*, and *DeLone and McLean IS success model*.

Conceptual Framework Literature Review

Providing efficient patient care is necessary to meet the legal requirements for the meaningful use of electronic health technology in the exchange of health-related information aimed at improving health care outcomes (Mennemeyer, Menachemi, Rahurkar, & Ford, 2016). As an example, patient portals linked to a hospital's EMR allow for patients and providers to access pertinent medical information, which may enhance patient activation and positively enhance outcomes, such as improved adherence to treatment, reduction in medical errors, and reduction in adverse drug reactions as part of communication between patients and providers (Kipping, Stuckey, Hernandez, Nguyen, & Riahi, 2016). Applying concepts mentioned by Kipping et al. (2016) may support the requirements as outlined by the HITECH Act of 2009. Additionally, meaningful use of information exchange is a first-level requirement to improve the quality of health care or to promote care coordination among patients in a complex HIS. EHRs are software systems that capture, store, and maintain individual medical records for patients and use for their corresponding care (Tavares & Oliveira, 2016). Due to the complexity of a HIS system, an EHR is a form of enterprise architecture requiring modeling to plan, manage, reconcile, and share information accurately (Nardi, Lentz, Winckworth-Prejsnar, Abernethy, & Carlson, 2016; Niemi & Pekkola, 2016).

This section of the literature review addresses models as tools for the adoption of eHealth systems. The DeLone and McLean success model is a strategic conceptual framework for the evaluation and adoption of complex interoperable eHealth systems. The implementation of eHealth systems by senior health care IT leaders must meet legal

requirements and outline how the success model can be used as a conceptual framework in understanding the strategy, developing the strategy, and applying the strategy based on the successful implementation process aside from being used in pre- and post-adoption evaluations.

Niemi and Pekkola (2016) identifies various models that had been proposed to evaluate the benefits of HIS adoption models, even with limitations such as lack of common understanding in project management, implementation perspectives, and selection of strategies. According to Yeoh and Popovič (2016), IT implementation projects have high-risk profiles, and many are rejected or underused by end users. The importance of selecting a conceptual model used in the evaluation of the successful adoption of an eHealth system requires addressing its flexibility and availability as a strategic component. For example, Orellana, Salas, Solarz, Ruiz, and Rotger (2016) noted that the complexity in the interoperable health care system is due to the dynamic complexities of new information being discovered, details and discovery and relevance of information, and relationships among concepts of systems. Senior health care IT Leaders need flexibility in addressing the complexities of a HIS, evaluating overall needs and satisfaction across the eHealth system, and meeting legal requirements by providing meaningful use of all connected systems. The DeLone and McLean success model provides insight as to its flexibility and use as a conceptual framework in understanding strategies in complex interoperable eHealth system adoption.

DeLone and McLean success model dimensions as a strategy. The DeLone and McLean success model dimensions are an essential aspect of formulating a strategy in

eHealth interoperability adoption. The DeLone and McLean success model has been used in numerous evaluations and successful adoptions of information systems (Berger, Geimer, & Hess, 2017; Bossen, Jensen, & Udsen, 2013; Iivari, 2005). However, many researchers investigated the success of information systems from a pre- and post-adoption perspective. The DeLone and McLean success model may be used as an evaluation tool in adoption, but also each dimension can be useful as part of a strategy in the adoption process of an information system. Hilberts and Gray (2014) stated that the implementation of an eHealth strategy requires substantial, coordinated infrastructure initiatives that are not only technical but also conceptual and contextual. A system's accessibility and successful functioning are possible only when stakeholders are involved in the process of development and measurement (Vedluga & Mikulskiene, 2017). Coordination must occur not only among departmental stakeholders but also among the institution or organization, including coordinated informational models supporting decision support.

For example, China has been integrating access and applications in developing integrated information systems into a single conception of an integrated regulatory platform (Xia, 2016a). Xia (2016a) stated that there had been numerous challenges in establishing a universal service policy, which had been defined in part by objectives, technology solution, support mechanisms, and governance. Xia (2016a) further stated that information systems are intrinsically human artifacts embedded in a larger socioeconomic system. Additionally, Xia (2016a) postulated that the DeLone and McLean success model concepts can be used in analyzing institutional constructs as part

of identifying a different macro level of success from a technical and socioeconomic systems perspective. Finally, Xia (2016b) stated that integrations into a single national system involve adeptness in the context of a single national public program of rural informatization, and require extensive, multichanneled (both regional and localized) information and physical and financial resources with high coordination, compatibility, and well-targeted actions. Each dimension needs to be evaluated against a fit and need as part of a strategy design in the implementation of an interoperable eHealth system by senior health care information technology leaders, and its significance as part of the implementation process and role in a strategy from a macro-level success implementation evaluation.

System quality. As a dimension, system quality is the desirable level of characteristics for which a system is composed for an organization to meet its objectives by measuring perceived ease of use, system features, response time, and flexibility (Ojo, 2017). For efficiency, a system needs flexibility, ease of use, appropriate system features, and effective response time to provide some level of use, user satisfaction, and continued intent to use a system. From a dimension perspective, system quality is a component of a HIS that needs to be addressed for proper support of the information needed in an interoperable eHealth system (Almarashdeh, 2016). Addressing system quality as a component of strategy provides senior health care IT leaders with a means to identify a need to address challenges in the implementation of an interoperable eHealth system.

Information quality. As described by Gopinathan and Raman (2016) and DeLone and McLean (2016), information quality is the resulting output conformed to organization

standards that are desirable characteristics of the organization. According to Wang and Lin (2016), information quality depends on current, accurate, and comprehensible data related to the IS's ability to convey relevant and insightful information to the end users. Including the desirable outputs based on required standards in a strategy further supports the implementation of an interoperable eHealth. The resulting information output of any system requires accuracy and conformity to established standards and needs of the organization; therefore, information quality also needs addressing in an established strategy. McKnight et al. (2017) defined information quality as the level of excellence of the system's information content, which is highly motivating for accuracy to ensure the proper exchange of information between systems. Information quality is another component of the implementation process. Adding and defining information quality can prevent barriers to system adoption and implementation (Kilsdonk, Peute, & Jaspers, 2017). The prevention of barriers to implementation enhances the success of an organization by addressing information quality as part of the accuracy and conformity of standards necessary in organizational goals of true interoperability.

Service quality. The impact that service has within and outside of the organization should be part of strategy development for the implementation of an interoperable system. Service quality is a dimension in which the system users receive measurable support from the organization as a whole and specific departments supporting the implemented system (DeLone & McLean, 2016). Service quality, as a dimension, impacts the level of delivered quality matches and expectations from the users (Tam & Oliveira, 2016). Measuring service quality provides a means by which senior IT leaders

can gauge the influence of a system would have on a user and vice versa. Because measuring delivered services to expectation is difficult in a preimplementation manner, senior health care IT leaders need to prepare a preimplementation method on how measurements should be addressed and what components of measurement are necessary for identifying the effectiveness and correct estimations of service quality. Defining service quality in a strategy helps senior IT leaders measure the overall expected quality from an implemented eHealth system.

Use/Intent to use. The use and intent to use a system are interdependent. Whether a system is used or not depends on multiple variables. According to Berger et al. (2017), the use of a system along with user satisfaction impacts the individual performance as well as the organization's performance. The use of a system, whether negative or positive, either enhances or obstructs organizational goals. The use of a system is dependent on the degree and way a user uses or intends to use a system (DeLone & McLean, 2016). Because of the dependency, the inclusion of use and intent to use as part of a strategy establishes an evaluation opportunity for identifying the success of an interoperable eHealth system. Defining both use and intent to use in a strategy assists in understanding the type of strategy or strategies used in the implementation of an interoperable eHealth system.

User satisfaction. According to Sun and Teng (2017), one issue with current studies is the difficulty in generalization inferred from IS benefits of a single selected system in a single organization in which perceived usage benefits are different (i.e., an email system for fast communication versus knowledge gained in a knowledge

management system). In this context, understanding user satisfaction requires understanding the usage behaviors from the impact of behaviors from both the impact on the IS organization and the individual (Sun & Teng, 2017). User satisfaction is based on the perceived importance of the system. As stated by Almarashdeh (2016), user satisfaction is an essential measure of IS success as well as understanding and analyzing user satisfaction for product improvement and continued use. In any strategy, identified goals should be developed to limit costs and ensure goals are obtained because lack of support or resistance, either at a user or organization level, can lead to implementation failure (Sidek & Martins, 2017). In an interoperable eHealth system implementation, the continued use of a system from a user and organization perspective needs to be identified and evaluated to ensure the continued use of and improvement of an implemented system. Senior IT leaders should include, in the development or use of a strategy, the level of user satisfaction from the perception of the organization and the individual.

Net impacts. According to Putra, Subiyakto, Ahlan, and Kartiwi (2016), an organization's environment influences its project performance, and the success of a project is a combination of the successful management of the project and the product or service itself. Success may be considered as the net impact on the organization. According to DeLone and McLean (2016), the net impact is considered the extent to which the IS provides value (either positive or negative) to the user, organization, and stakeholders to achieve the end goals. For example, Roky and Meriouh (2015) concluded that information quality affects user satisfaction and intention to use a system that affects the individual impact as well as the impact on the organization from a relational

perspective of quality of service and use of the IS. Consideration of net impacts in the development and implementation process of an eHealth system is necessary.

In conclusion, the development of a strategy for implementing an interoperable eHealth system requires understanding and planning. Using a generic strategy in the implementation of a complex HIS is not viable due to the complexity of the systems and the difference between the adoption of a social and health system used for seemingly different purposes (Kenter, de Luca, Illario, & Vollenbroek-Hutten, 2016). For example, the emphasis on the use of a system may differ from organization to organization, as exemplified by Kenter et al. (2016) who identified the implementation and adoption of a social health system among Dutch and Italian users, where the use of the system resulted in different strategies in the context of the region. The strategy needs to fit the needs of the organization and the extent and differences in adoption and implementation. The flexibility of the dimensions established by DeLone and McLean provide flexibility, and flexibility is encouraged (DeLone & McLean, 2016; Petter, DeLone, & McLean, 2013). Each dimension in the DeLone and McLean success model provides not only a measurement of success but also a means of strategy development. Therefore, identifying and defining each dimension as part of strategy development is necessary for the adoption process of an interoperable eHealth system.

DeLone and McLean success model. DeLone and McLean (2003) stated that related factors that contributed to information system success were elusive and unsuccessful in solidifying the dependent variables as part of understanding information system success. The DeLone and McLean IS success model was introduced in 1992 to

measure success or effectiveness in the understanding value of IS management actions and investment. DeLone and McLean (2003) identified the importance of measuring information system success and the need for a definitive dependent variable to avoid speculation of information success in the evaluation of information system practice, policies, and procedures. Understanding the value of an information system requires the use of the DeLone and McLean success model, which posited six dimensions of IS evaluation: System quality, information quality, use, user satisfaction, individual impact, and organizational impact (DeLone & McLean, 1992). As seen in Figure 1, each dimension is an identified category that is used to evaluate the overall success of an IS adoption. Each dimension relates and influences the corresponding dimension from right to left. For example, system and information quality relate, and impact use and user satisfaction (which have a correlated impact on each other), and then both of those dimensions influence the individual user and organization. According to DeLone and McLean, these categories were developed to address five key issues: (a) management information system (MIS) reference, (b) dependent variables, (c) establishing a cumulative tradition, (d) relationship to MIS and technology and MIS practice; and (e) publication of findings (seen in Table 1), identified by Keen (1980), to encourage coherent research in the IS field. These are establishing discipline for MIS research, designing dependent variables to measure, proven and sustainable tradition of evaluation, evaluation of relationship and technology in MIS, and ultimately publication and verifiability of findings over time.

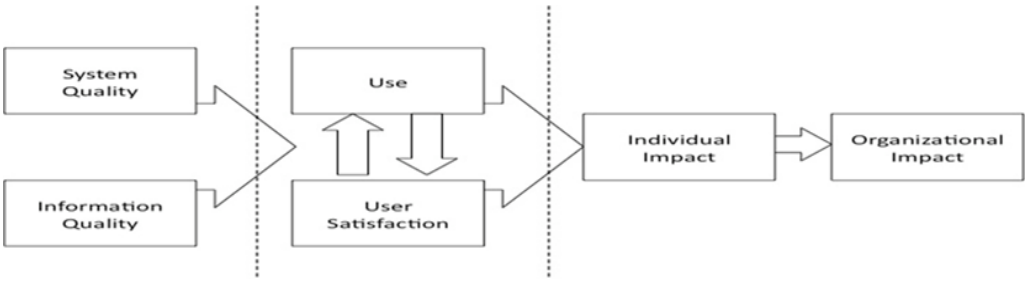

Figure 1. D&M success model 1992 dimensions. This figure illustrates the DeLone and McLean success model dimensions and flow dependency process. DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, *3*(1), 60–95. doi:10.1287/isre.3.1.60. Reprinted with permission.

Table 1.

Peter Keen Issues Identified in the IS Field

Issues as identified	
1	Reference disciplines for MIS
2	Dependent variables
3	Establishing a cumulative tradition
4	Relationship of MIS to technology and MIS practice
5	Publication of findings

Seddon (1997) identified some confusion with the Delone and McLean success model as presented by stating that the initial model was a variance model, and its intention as a model was to be used as a process to represent a concept, not for evaluation. However, DeLone and McLean (2003) clarified further, to evaluate the success of an IS adoption, a variance and process model combination is necessary. Processes are necessary components of IS success evaluation from the point of process understanding and impacts on IS. According to Burton-Jones, McLean, and Monod (2015) the combination of theoretical perspectives is a problem; however, the real

problem is lack of guidance on how to combine the perspectives in order to identify how the model lacks clarity. To fully understand IS and the impacts to IS, conceptual representations and the processes combination is necessary to answer the creation of the system, use of the system, and consequences of the system in identifying the result outcomes regardless of system use of not (DeLone & McLean, 2003). A system not used does not provide any results, whether used intentionally, correctly, or incorrectly. Therefore, to address a non-result when it is important when looking at the model to guide how the reader's thinking should approach understanding the model as a researcher moves from one dimension to another (see Figure 1).

DeLone and McLean (2003) use of net-benefit was to define the benefit of the system and who benefits from the system. Two aspects need to be validated and updated on the DeLone and McLean model in 2003 to identify, define, and understand the net-benefit of a system. First, a level of analysis is required. Then, identification is needed to define whom the system benefits, by first defining the frame of reference for the system and then merging the individual and organizational variables into a single net-benefit variable as a final success evaluator. Secondly, a feedback loop from net-benefit to newly defined categories of Intention to Use and User Satisfaction replaces Use and User Satisfaction to, in a process fashion, identify causality among a more significant positive experience leading to higher user satisfaction (DeLone & McLean, 2003). The updated model is seen in Figure 2 and applies the implemented suggestions of Seddon (1997) and others on the combination of process and variance models.

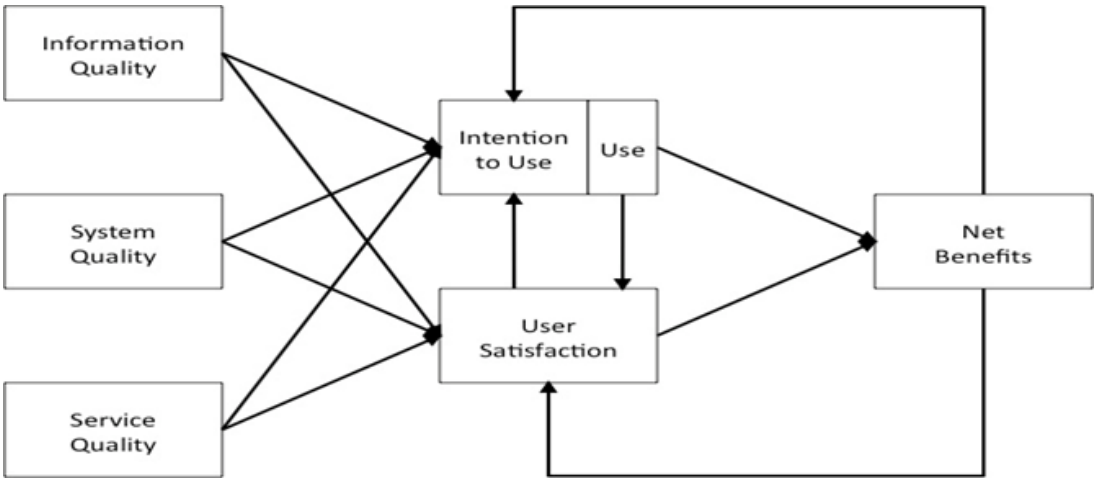

Figure 2. D&M IS success model 2003. The D&M IS success model 2003 updated to include a third dimension 'Service Quality' and changed the dimensions 'Individual and Organizational Impact' to 'Net Benefits.' It also established a loop-back from net benefits to the dimensions intention to use and user satisfaction. Adapted with permission from "The DeLone and McLean model of information systems success: A ten-year update," by W. H. DeLone, & E. R. McLean, 2003. *Foundations and Trends in Information Systems, 2*(1), p. 10. doi:10.1561/2900000005. Reprinted with permission. *Journal of Management Information Systems*, *19*(4), p. 24. doi:10.1080/07421222.2003.11045748. Copyright by M.E. Sharpe. Inc. Reprinted with permission.

User satisfaction is the 'net feeling' one attains by interacting with the system adopted based upon the perception of the importance of system use with the task at hand and is subjective (Seddon, 1997). However, DeLone and McLean (2003) disagreed with the argument that 'Use' precedes impact and benefits and that use is inappropriate for inclusion in a causal model and stated it is appropriate for a measure of success in most cases. The 'Use' variable was added to the variable 'Intention to Use' to adjust the concerns raised on user satisfaction (DeLone & McLean, 2003). Use as a variable must precede user satisfaction in a process; however, a greater definite increase in use leads to greater intention to use and affects use resulting in a perceived net benefit.

Net benefit, as described by DeLone and McLean, is the measure in obtaining the positive or negative impact an adopted system has on all stakeholders and varies based on the measures taken and then validated by feedback loops (DeLone & McLean, 2003). Karlinsky-Shichor and Zviran (2015) further state that the estimation of benefits gained from harnessing an information system to improve business processes is an essential point in assessing the value of its investment in technology. Based upon contribution and validation attempts of their success model, DeLone and McLean updated their 1992 position model by measuring each dimension independently and added a third dimension: service quality to provide an evaluation of information system support. Service quality is a necessary independently measured dimension evaluating the individual influence on the use and user satisfaction of an adopted system resulting in a net benefit (DeLone & McLean, 2003). DeLone and McLean (2016) stated that where impacts require measurement depends on the type of system being evaluated using the 'Net Benefit' category in a dynamic feedback loop to 'User Satisfaction' and 'Intent to Use' and 'Use.' The feedback loop accurately measures whether a positive or negative impact based on iterations of 'Use' and greater or lesser 'User Satisfaction' in the system being evaluated.

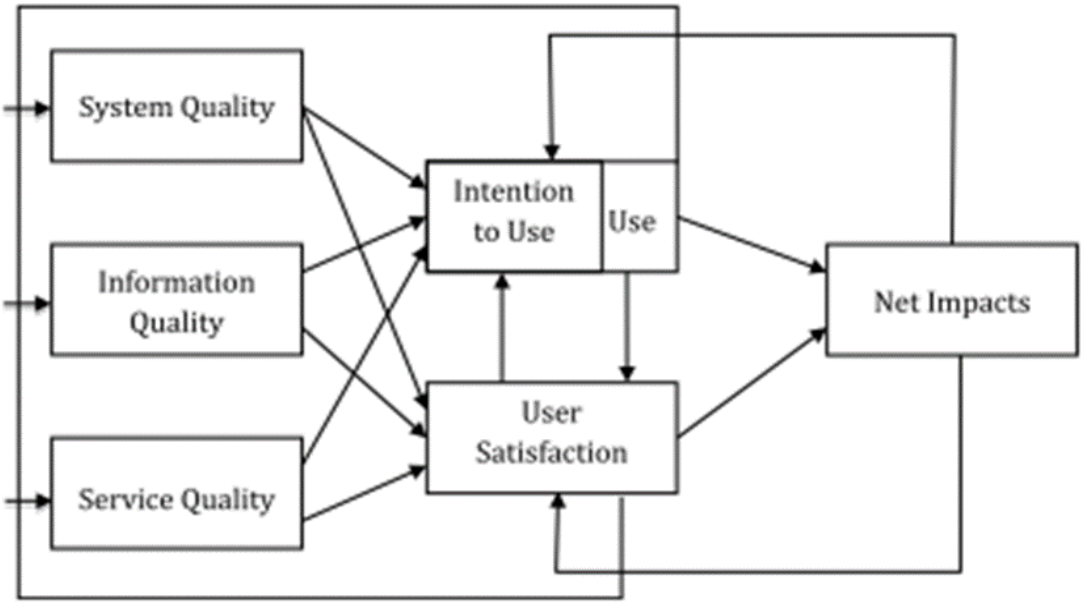

Figure 3. D&M IS success model 2016. The 2016 update to the D&M IS success model modified the 2003 D&M IS success model. Adding a feedback loop to intent to use and user satisfaction as well as showing how the two dimensions further feedback to the dimensions: information quality, system quality, and service quality. Adapted with permission from "Information Systems Success measurement," by W. H. DeLone, & E. R. McLean, 2016. *Foundations and Trends in Information Systems, 2*(1), p. 10. doi:10.1561/2900000005. Copyright by W. H. DeLone and E. R. McLean 2016. Reprinted with permission.

In the 2016 update, DeLone and McLean modified the DeLone and McLean success model to include a second feedback loop and changed the use of 'Net Benefits' to 'Net Impacts' (see Figure 3). The change to 'Net Impacts' is important because of the numerous levels of impact on IS and the need to identify specific measures (DeLone & McLean, 2016; B. L. Myers, Kappelman, & Prybutok, 1997; Seddon, 1997). After peer-reviewed analysis, DeLone and McLean (2016) identified that the use of 'net benefit' was a constraint in the evaluation process due to the 'positive' context of the use of the term benefits. The use of net benefit was contrary to the initial point that both

positive and negative outcomes were possible from a user of the DeLone and McLean model rather than a single positive outcome (DeLone & McLean, 2016). Therefore, net impacts are a necessary dimension as part of the evaluation of adoption success and as a strategic component necessary for eHealth adoption and implementation.

Kilsdonk et al. (2017) used the DeLone and McLean success model combined with the human, organization, and technology-fit (HOT-fit) framework to evaluate the success and the understanding of the factors of how the HIS 'fits' within the organization. As part of a strategy, 'fit' of a HIS is necessary as a final objective in understanding implementation on an eHealth system. Kilsdonk et al. (2017) further explain focusing and creating positive belief factors and negating the negative beliefs in an early stage with involvement can enhance acceptance of systems such as clinical decision support systems as part of a total HIS. The complexity of HIS requires proper fit of information systems, logical design implementation to ensure accurate exchange of information and consistent functionality of all systems with accuracy in information exchange to assist with the daily needs of medical providers. Researchers need to create a comprehensive measurement tool by systematically combining individual measures from IS success categories specific to the system being evaluated (DeLone & McLean, 2003; Rai, Lang, & Welker, 2002). Without a proper fit, design, and implementation, and functionality assurance, medical providers, would not have access to the most accurate health care information necessary for effective decision-making patient care. This next section identifies studies in which DeLone and McLean success model was adopted and modified for evaluating an IS

qualitatively, quantitatively, and in a mixed-methods approach to provide context on its use.

DeLone and McLean IS success model use case mixed methods approach. The success of IS adoption has been used by approaching the evaluation of success from a qualitative and quantitative combination, attempting to understand and quantify the success of the adoption. Van Cauter, Verlet, Snoeck, and Crompvoets (2017) evaluated the use of the DeLone and McLean success model in a mixed-methods approach for understanding IS failure and success and identifying potential additional elements for explaining IS success, and failure not covered by the DeLone and McLean success model. Van Cauter et al. (2017) stated that understanding success and failure is essential to understanding inter-organizational IT projects. What is deemed a success or failure is dependent on personal perceptions (Van Cauter et al., 2017). Rana, Dwivedi, Williams, and Weerakkody (2015) state studies have used the DeLone and McLean success model by extending additional factors and integration of the DeLone and McLean success model to make it more robust for understanding factors influencing and adoption of and satisfaction in using the system. The DeLone and McLean success model provides a means to understand the success of adoption by individualized approaches to understanding the successful adoption of an IS system based upon research identified parameters as part of a framework for system evaluation (Ali, Tretiakov, Whiddett, & Hunter, 2017). Additionally, Tam and Oliveira (2017) proposed applying the DeLone and McLean success model in a mixed-methods approach, modified with Hall's cross-cultural dimensions in the inclusion of cultural characteristics and its influence in the evaluation

of system design in mobile banking. Therefore, applying the DeLone and McLean success model to obtain feedback, understand the influence on the system and use and mitigate negative issues may enhance a senior health care IT leader's strategy as part of an interoperable HIS implementation.

DeLone and McLean IS success model use case qualitative approach. As another example of the flexibility or customization in the use of DeLone and McLean success model, Mohd Salleh, Zakaria, and Abdullah (2016) use of the model was adapted to fit the needs of evaluation of system quality characteristics in health care providers' performance in understanding quality factors in predicting the performance of EHRs. Mohd Salleh et al. (2016) case study focused on confirming attributes of system qualities, excluding aspects not under evaluation or in need of measure in understanding in the system quality measurements needing to be estimated. According to Mohd Salleh et al., the generalities of the DeLone and McLean success model provides little in the measurement of specific information system characteristics; therefore modification of the model is needed to measure the success of the system properly. As an example, the category 'use' was ignored because 'use' of the system was mandatory as well as user satisfaction. The exclusion was necessary due to the inclusion of system quality and individual impact measurements in user satisfaction, and the study's purpose was to confirm system attributes of system quality as an individual unit of measure analysis (Mohd Salleh et al., 2016). In addition to the omissions made above, Mohd Salleh et al. replaced individual impact with health care provider performance. This change was

necessary to identify the degree of belief in which an EHR system assisted with obtaining goals and enhanced the performance of patient care.

Next, Mohd Salleh et al. (2016) identified system interoperability as a necessary category of the model to evaluate due to the vital importance of cost efficiency, the effectiveness of data exchange, and patient treatment. Adequate infrastructure was selected as another category variable to evaluate based upon the essential need to rely upon IT resources in all clinical processes as part of the adoption process (Mohd Salleh et al., 2016). Perceived security control was selected as another category measurement due to the criticality of operating a HIS and the protection of HIE. Finally, Mohd Salleh et al. selected system compatibility for evaluation based upon perceived usefulness and trust, as described as ease of system use of all system components. Focused selection allowed Mohd Salleh et al., to select only necessary dimensions specific to evaluate the success of an IS specific to the characteristics identified.

Aside from individualizing categories of the DeLone and McLean success model, it has been used in field studies as part of a direct observation study. LeRouge, Garfield, and Hevner (2015) use of the DeLone and McLean success model was to explore quality attributes for telemedicine encounters. LeRouge et al. (2015) adopted specific constructs of the DeLone and McLean success model to fit the needs of the stakeholders and criteria necessary for evaluating the quality attributed needed in an effective telemedicine encounter. The use of the DeLone and McLean success model is used in identifying the successful telemedicine encounters as opposed to adoption directly. However, results concluded that the success of the encounter relates to the adoption of the telemedicine

system and vice versa. LeRouge et al., use of fit in this context are related to the needs of the stakeholder as an important aspect of evaluating adoption success. Other studies, such as from Hadji et al. (2016) indicated that the selection of a model, needs to be determined by the phase of deployment in any system. This selection of a model and phase of deployment merely is 'fitting' the context of the model in a specific adoption phase.

In many cases, the fit is identified as one of many potential phases of the eHealth development processes. For example, DeLone and McLean success could be applied to different components to identify the strengths and weaknesses of IS adoption (Al-Shargabi & Sabri, 2016). According to M. Scott, DeLone, and Golden (2016), the creation and selection of appropriate information system success model dimensions is critical, adapting the success categories to measure the specific needs and level of adoption to the IS success model effectively. M. Scott et al. application of the DeLone and McLean success model was to contribute to the perceived value of the DeLone and McLean success model- net benefit dimension as part of a framework developed in measuring efficiency and effectiveness in understanding the success of eGovernment systems. Shachak et al. (2013) further support the flexibility of DeLone and McLean success by adapting as part of the original conceptual framework to understand the relationship between the end-user and the success of EMR adoption due to the success of evaluation in additional studies as a conceptual framework. The flexibility of model use, in this case, the DeLone and McLean success model, may provide support in understanding the successful adoption of an interoperable eHealth system.

In another example, Kivinen and Lammintakanen (2013) conducted a study on describing perspectives in the availability of information and use among management information system (MIS) users using components of the DeLone and McLean success model in a semistructured interview case study. In this study, an analysis was conducted using four categories: system quality, user intent and user satisfaction, development of information culture (not considered one component of the DeLone and McLean success model), and information quality to determine perspectives on information availability and use. The results of the study concluded the lack of apparently planned implementation and use of MIS as a tool in a strategic manner for the studied health organization (Kivinen & Lammintakanen, 2013). According to Kivinen and Lammintakanen, it is possible to see that based upon the given responses and the subsequent evaluation, the implementation was not entirely successful due to the lack of planning and the use of the MIS as a tool. Further recommendations by Kivinen and Lammintakanen suggest focus is needed on community perspective information culture and strategic information management as part of the implementation of HISs.

DeLone and McLean IS success model use case in a quantitative study.

Research studies on HIS adoption using the DeLone and McLean success model did not focus solely on the interoperability issues or to understand the success of HIS adoption. A study conducted by Chung, Lee, Lee, and Koo (2015) utilize the DeLone and McLean success model in a modified form with the expectation-confirmation model (ECM) to measure the decisions tourists make based on beliefs, attitudes, and intentions and the relationship between quality of the website the tourist has visited. Chung et al. (2015)

attempted to understand any corelationship between qualities of a destination website and continued use intention and any potential influence on subsequent effects on the users' intent in visiting the website. The first measure pertained to the qualities of the site with a hypothesis that qualities such as system, information, and service had some form of a preceded contribution to user expectation before acceptance and the future continued use of the destination site.

Opposing Conceptual Frameworks and Evaluation of Contrasting Theories

Strategic frameworks. According to Winkler et al. (2016), despite substantial investment from both government and private funding initiatives, effective sustainability for HIE has been limited due to a lack of HIE standards, security issues, and economic loss to the competition. Winkler et al. (2016) further stated data showing the payments made for meaningful use, 30% of hospital providers and 10% of ambulatory practices were participating in some form of an HIE entity due to the inability to identify sustainable models for long-term needs at regional levels versus state or local levels. Mithas and Rust (2016) support this by stating that there is a relationship or correlation between IT investments and firm performance based on the IT strategic emphasis and level of IT investment commitment. Therefore, senior health care IT leaders need to identify and craft an IT strategy as part of the implementation process. Application of a strategy is necessary as part of effectively implementing an interoperable eHealth system to ensure the sustainability of the long-term needs of the organizations at a regional and national level versus solely from a local perspective.

Adoption frameworks. Adoption frameworks are necessary to provide senior health care IT leaders with relevant information on the success of an interoperable eHealth system adoption in a pre- and post-implementation sense. Technology acceptance model (TAM) and its extension technology acceptance model 2 (TAM2) provide an alternative evaluation to the adoption of eHealth systems. TAM2 is the more recent theory offering a different approach to exploring the adoption of an information system based on the behavior and intention to use from the end-user and perceived usefulness (PU) and perceived system ease of use (PEOU) (Hadji et al., 2016; Hadji & Degoulet, 2016). Similar to the DeLone and McLean success model, TAM2 evaluated the adoption of the technology-based model upon three antecedents: subjective norm, perceived usefulness, and perceived ease of use and the indirect effects of each resulting in usage intention (Okazak, Blas, & Castañeda, 2015). In addition to TAM and TAM2 evaluating adoption based on behavior of the end-user, and perceived usefulness of the system, the expectation-confirmation model (ECM) is a modeled framework used in testing the continued use of a technology service or system from a behavioral context and is used in the predictability of use on many cases, such as automobile repurchasing (Bhattacherjee & Lin, 2015). The unified theory of acceptance and use of technology are used in system adoption by evaluating use based on three direct behavioral determinants: performance, effort, social influences; two direct technology determinants: intention and conditions; and four overarching contingencies: gender, age, experience, and voluntary (Martins, Oliveira, & Popovič, 2014; Venkatesh & Zhang, 2010). These frameworks look at behavior as an evaluation of adoption success. However, the dimensions of the DeLone

and McLean success model was used in the evaluation of an interoperable implementation, not just in the evaluation of the successful adoption of an interoperable HIS. As a strategy, inclusion of the DeLone and McLean success dimensions as part of a strategy is necessary for the development of a successful framework and ultimately identifying strategies lacked by senior IT health care leaders in the successful adoption of an interoperable eHealth system.

EHR and HITECH Act Movement to Adoption

An EHR within an organization includes a HIS connected to multiple Clinical Information Systems (CIS) to provide health care to patients and enhance workflow and the quality given across institutional systems (Heart, Ben-Assuli, & Shabtai, 2017; Petrides et al., 2017). Additionally, Saoli and Barki (2017) stated the main objective of health IT is to improve access to health care to facilitate the integration of patient health history to enhance the planning of patient care. Clinical information systems provide providers with the required medical-related data across systems supporting the enhancement of medical care. Enhancing workflow requires increasing efficiencies and decreasing complex workflow, and while implementation of a CIS such as a LIS is not required to meet the meaningful use requirement, organization choose to implement them as part of supporting the enhancement of an EHR for patient care (Petrides et al., 2017). A CIS is specific to the workflow within the specific department it supports, which in-turn provides medical providers with the necessary information of patient-related data in an efficient manner.

Exchange of information is needed for all system devices and components to effectively communicate as intended, providing safe and reliable cohesive information (Weininger et al., 2016). Health information systems are complex, and promoting efficient HIE different devices, people, and systems (including subsystems), interoperability is an essential aspect of an enterprise information system (Weichhart et al., 2016). According to Shiau (2015), in the early stages of IS, business functions relied on systems to support processes and information specific to that process causing standalone systems that do not communicate with each other, ultimately isolating the information and leading to inefficiencies for the organization. The multiple organizational ISs inevitability leads to information fragmentation making it more difficult for organizations to locate information necessary to support the business processes (Shiau, 2015). Therefore, the implementation of an interoperable eHealth system requires a methodological plan of action built on multiple components to develop a working strategy and use of science in the implementation process. Enterprise architecture (eHealth) system use and the capacity in which it is used to maintain patient-related safely, data, interoperability in the eHealth domain requires various health information technologies to connect, communicate and exchange health-related data (Mohd Salleh et al., 2016; Zakaria & Mohd Yusof, 2016). Proper exchange of data in a precise context is to safely assist and enhance the treatment of patients.

In conclusion, both financial push and patient care enhancement might be identified as motivation and reasons for movement to EHR adoption. Financial motivation perspective is significant because an organization that fails to meet any

requirements outlined in stage 1, 2, or 3 of the meaningful use clause established by Centers for Medicare and Medicaid Services (CMCS) could lose any financial incentives negating the adoption of an EHR (Nambisan, Kreps, & Polit, 2013). Additionally, the adoption of eHealth may improve preconsultation history, transform decision-making needs, and information sharing and patient education (Car, Tan, Huang, Sloot, & Franklin, 2017). Failure to meet the requirements of CMCS is both a legal and financial motivation in that the financial penalties are also a legal requirement. Additionally, any enhancement to the decision-making process and patient treatment could be financially motivating under the CMCS requirements.

Barriers to Adoptions of HIS

Frameworks, regulations, funding support, financial, and security have been named as barriers to eHealth adoption (Faber, van Geenhuizen, & de Reuver, 2017). According to Sebetci and Çetin (2016), HIS is an integrated information system essential in supporting work in hospitals by using appropriate information systems. HISs are considered complex and multifaceted systems that involve people, technology, processes and are necessary for decision-making processes, administrative support, and organizing and enhancing medical practices (Alharbi, Atkins, Stanier, & Al-Buti, 2016). Glasgow, Phillips, and Sanchez (2014) state there have been over 60 IS frameworks developed to address health services across various diversity issues to help design more rapid and relevant research by studying multilevel eHealth implementation context, participation processes, and intervention effects. To assist with a successful adoption, identifying and evaluating strategies is a necessary step for the implementation of these complex systems.

Adoption of an interoperable eHealth system can come in many forms based upon many various concerns and issues: behavioral, technical, organizational, and economic (Tang, Ash, Bates, Overhage, & Sands, 2006). Abubakre, Ravishankar, and Coombs (2015) identify that adoption of any IS and the failure for many organizations is related to the ineffective use of the system from lack of motivation or resistance to use systems thereby, not wholly to engage honestly in use and to limit diffusion of a system. Nambisan et al. (2013) identify studies that show nearly 80% of EHRs fail after implementation 19% of those are uninstalled after deployment, and another 30% are underutilized among other destructive adoption conditions along with lack of engagement and resistance.

The business management side has contributed to the failure due to overspends, organizational buy-in (from a policy standpoint), and interoperability of all existing systems (Tursunbayeva, Bunduchi, Franco, & Pagliari, 2016). Yu and Qian (2018) claim that EHRs have many potential benefits, yet EHR projects can take significant funding, long implementation periods, and face multiple obstacles. Barriers may contribute to overall failures and further hinder the adoption process. Therefore the development of a useful theoretical model survey instrument to measure perceptions about EHR implementation success can support the decision-makers to develop timely, targeted interventions to address challenges and ensure implementation success (Yu & Qian, 2018). Therefore, understanding barriers may be a necessary part of mitigating challenges and ensuring implementation success.

HIMSS EMRAM Model (HIMSS Analytics Stages)

To identify the degree of interoperability implementation required, an organization needs to identify and measure the level of information technology implementation. The Health care Information and Management Systems Society (HIMSS) Electronic Medical Record Adoption Model (EMRAM) is a more common eight-stage maturation model to evaluate the EMR capabilities of organizations EHR from paper-based to fully digital record environment capabilities (Van Poelgeest, Heida, Pettit, Leeuw, & Schrijvers, 2015). The use of this model may provide some foundational understanding of the current level of EHR capability and guidance in the implementation of EMR functionalities of EMR tool presence (Van Poelgeest et al., 2015). Chituc (2017) stated that interoperability is the use of computer tools to facilitate and coordinating work and information flow among the disparate system. Chituc (2017) further describes interoperability as the capacity of two or more systems to exchange information as defined by IEEE. Bhartiya, Mehrotra, and Girdhar (2016) and Agostinho et al. (2016) further define interoperability as when multiple systems can exchange information effectively and efficiently at all levels to include data, network layers, software, and hardware cooperating among current and legacy systems. In this study, interoperability is further expanded to be described as two or more enterprise level systems, and all subsystems.

Khalfallah, Figay, Ferreira Da Silva, and Ghodous (2016) state that data interoperability has three levels; syntactic, structural, and semantic. However, there are four levels of total identified; the technical level of interoperability is the fourth (Rezaei,

Chiew, & Lee, 2014). Each level of interoperability is a challenge that must be addressed in the adoption of a HIS. In the health care industry, there are similarities in that different systems are pieced together, such as legacy systems with newer laboratory systems and vice versa, and scaled many organizations (Marcos, González-Ferrer, Peleg, & Cavero, 2015). The four levels of interoperability provide a foundational context to this study as part of understanding strategies used in the adoption of an interoperable eHealth system and are detailed in the following section.

Levels of Interoperability In eHealth systems, medical data is generated, processed, stored, and transmitted depending on the type of information. It is necessary for platforms that communicate at varying levels to collaborate efficiently and effectively in the treatment process. For example, there are patient-generated records for billing and standard notes in a clinical or non-clinical setting from separate systems. Additionally, data is produced to supplement patient treatment: imagery, laboratory and another ancillary internet of things technologies (IoTs). Ganzha, Paprzycki, Pawłowski, Szmeja, and Wasielewska (2017) stated that IoT is perceived as succeeding on the web because numerous sensors and actuators from all types of devices are consistently connecting and transmitting machine-readable and machine-interpretable data from device to device or device to systems and vice versa to enhance the experience or business value for organizations. Additionally, Flott, Callahan, Darzi, and Mayer (2016) stated that interoperability of systems for stakeholders is vital to the systems' effectiveness for achieving patient centricity; however, research has shown HIEs are faulty with reduced ability to communicate effectively. Therefore, synching and alignment of data is essential for communication. Marcos et al. (2015) highlights that synching and aligning data from multiple devices must be supported at semantic and synaptic levels with each using the same protocols and data formats and meaningful understanding among different systems with differing parameters, vendor-proprietary syntax, and medical devices with different formats. Due to these issues of proprietary systems, it may be essential to identify and understand the various levels of interoperability to define an adoption strategy adequately. Hence, the need for semantic ontologies to facilitate interoperability among

eHealth systems is important to relate patients to data stored in disparate systems (Ganzha et al., 2017). In the health care domain as in other domains, various systems are implemented as part of providing medical services for a patient for greater supportive treatment in the health care domain,

Syntactic and semantic interoperability are constructed in HIS implementation that is essential in providing a useful and accurate exchange of health data among disparate systems that incorporate syntactically descriptive uniform data to process the data efficiently and semantically interpret that information before processing (Bhartiya et al., 2016). Identifying the levels of interoperability is necessary to establish an interoperable eHealth system amongst disparate systems regardless of the generation of the patient record data (Legaz-Garcia, Menárguez-Tortosa, Fernández-Breis, Chute, & Tao, 2015). Therefore, syntactic, and semantic interoperability levels are the focus of defining and evaluating for this section and defined below.

Syntactic, semantic, structural, and technical interoperability. Syntactic interoperability is simply the defined syntax that enables transporting across disparate systems (Kohli & Tan, 2016). According to Rezaei et al. (2014), syntactic interoperability refers to data formats or defined syntax. Defining is necessary at platform and interface levels to ensure collaborative functions of data sharing (Bhartiya et al., 2016). Kohli and Tan (2016) describe semantic interoperability as data encoding standards that ensure messages sent from disparate systems are consistent and are correctly interpreted among all connected systems. Rezaei et al. further describe semantic interoperability as related to the definition of the content and the human interpretation, for example, a blood pressure

reading is the same across systems regardless of which medical provider reviews the values. Semantic interoperability allows for HIE among disparate health care professionals across disparate systems (Pahl et al., 2015). Structural or organizational interoperability is the ability of any medical organization to communicate and exchange health information in an efficient manner (Rezaei et al., 2014). Rezaei et al. (2014) further state the importance of organizational reliance on syntactic, semantic, and technical interoperability to provide effective communication of meaningful data. Rezaei et al. define technical interoperability as associated with both hardware and software components, systems, and platforms for the machine to machine communication. Technical interoperability is an essential aspect of that communication protocols and infrastructure are important components of implementing interoperable eHealth systems.

Standards. The implementation and use of standards are a foundational framework component in implementing interoperable eHealth systems to communicate effectively. However, various countries and HIS developers are complicating the adoption of a truly interoperable eHealth system by implementing different types of standards: HL7, ISO EN 13606, DICOM, and SNOMED, are among the more common according to Fragidis and Chatzoglou (2017). The differing standards in health information data are causing clinical information among distributed disparate systems that are syntactically and semantically incompatible, which makes the development of compatible standards crucial (Martínez-Costa, Menárguez-Tortosa, & Fernández-Breis, 2010). Assurance of effective interoperability among distributed disparate systems requires standards that are syntactically interoperable, properly defined data formats and

syntax for transportation of messages, and semantically interoperable (data encoding) defining the meaning as one level of synchronization (Kohli & Tan, 2016). Syntactically and semantically mapping data is key to addressing the issues outlined here. Due to the complications and lack of proper mapping in using multiple standards, providers might have multiple duplicated records to sift through or inaccurate data context assigned, which would impact the decision-making process (Hosseini et al., 2017). Due to flexibility in a framework like HL7; organizations have varying CCDs, which increases data duplications and additional workloads, potentially leading to errors.Ellouze, Bouaziz, and Ghorbel (2016) proposed a solution to integrate semantic dimensions into archetypes known as archetype definition language (ALD) for the interoperability of EMRs at the initial modeling stage of development. It is necessary to implement clinical archetypes that provide control and validation to data in guiding patient treatment (Ellouze et al., 2016). An architecture based on a reference model and an archetype model as a dual approach is proposed by ISO/EN 13606 and OpenEHR to model the semantics of data with the later formalized clinical concepts and knowledge (Ellouze et al., 2016). This was a methodology that provides information system designers with an approach and tools necessary for the integration of semantic scopes into ENR based upon OpenEHR standards.

According to Ellouze et al. (2016), ISO/TR 20514 identifies agreement of a standard reference model, standardized interface reference models, a standardized set of concepts related to domain-specific modeled domains, and standardized terminology as four preconditions to any EMR semantic interoperability. Ellouze et al. (2016) further state that classical EMR modeling was based on a single-level architecture, which was hard-coded domain concepts, directly into the software and database models, which limits scalability due to the complexity of EMRs. Ellouze et al. concluded within the context of their study that it is possible to exploit semantic management of archetypes and provides a solution in creating their ontological source to annotate archetypes. Thereby, using ALD at the initial modeling stage, developers of HIS can assist in establishing common standards before the requirement of addressing interoperability post-development of a HIS at the semantic level.

Legaz-García, Martínez-Costa, Menárguez-Tortosa, and Fernández-Breis (2016) further hypothesized that achievement of semantic synchronization is possible by the use of semantic web technologies that understand the meaning of and infer information by using automated reasoning to identify the relationships between the disparate systems. Framework identification is then required in the development phase and may be necessary to enable the use of ontologies for semantically interoperable eHealth systems. Also, identified and implemented frameworks as part of the development process provide an outline for addressing interoperability issues of disparate eHealth systems. The use of semantic provides a conceptual mapping. For health data to accurately be mapped regarding context and meaning, proper alignment of both syntactic and semantic aspects

requires proper defining and implementation at the framework level. The conceptual alignment is also noted as being pragmatic (logical) interoperability in which there are similar expectations of context and effect of the exchanged message (Neiva, David, Braga, & Campos, 2016). Syntactic and semantic mapping alignment is essential to ensure a system can identify the correct meaning and labeling for health-related data.

HIS Integration at the IS Level In traditional eHealth systems, providers and support staff were required to work with multiple systems and in standalone systems, which are unable to exchange data in any form (Van Velsen, Hermens, & Oude-Nijeweme d'Hollosy, 2016). According to Ellingsen, Christensen, and Silsand (2014), many systems, such as ERPs, maintain clinical content in free text, limiting the semantic and syntactic levels of interoperability. HIS integration requires the connection of multiple proprietary systems internally and externally to overcome adoption barriers. Akhlaq, McKinstry, Muhammad, and Sheikh (2016) identified several barriers to implementing proper health information exchange; these are costs, incomplete patient data, usability, organization and workflow, and technical barriers. Of the above mentioned barriers, usability, organization, and workflow barriers are significant because of the need to have different logins due to the competitive nature of the health care industry and use of proprietary systems and the difficulty in gaining access to shared data of competing systems (Akhlaq et al., 2016; Akhlaq, Sheikh, & Pagliari, 2017). Specifically, due to the competitive nature within the health care industry and lack of perceived value in proper HIE, along with the use of different standards, multiple systems are developed and used from various proprietary systems (Akhlaq et al., 2016). The use of proprietary systems provides a level of perceived value and in some cases a competitive advantage to a health care system developer and motivates the search for HIS integration at all levels.

Current Level Interoperability Success

The current level of interoperability success is mixed with limited success. According to H. Zhang, Han, and Tang (2017) and Y. Zhang, Qiu, Tsai, Hassan, and

Alamri (2017) there have been numerous issues plaguing the successful adoption of an interoperable HIE: from the lack of exchange standards, unreliable business models, and high-risk investment in health information technology (HIT) and design issues with regards to big data. Ben-Assuli (2015) supports that there is both successful and unsuccessful adoption of HIE for various reasons, from technical to organizational and environmental contexts. According to Dwivedi et al. (2015), evaluation of the success of an IS means defining the success based on the context of the IS and its stakeholders. With the constant demand to increase and improve patient quality of care and safety, organizations have implemented various technologies to support dynamic ways of obtaining information (Portela, Miranda, Santos, Abelha, & Machado, 2017). Oliveira, Ferreira, Ferreira, and Cruz-Correia (2016) identified the success of interoperability success in Portugal as chaotic with multiple levels of integration with systems in ad-hoc conditions connecting disparate systems in temporary or rudimentary levels. Oliveira et al. (2016) further state interactions of software system vendors are more complicated due to varying degrees of costs and complexity and become even more complicated as more systems are integrated. Given the complexity of HIS and the need to exchange accurate information effectively, the current level of interoperability is still in need of a multitude of approaches to ensure success. One significant example of the complexity and need for the approach is evident with the use of new technology in patient care management and the need to integrate the multitude of information systems mentioned in this section effectively. Each information system is complex within itself, containing various technologies that connect to provide various levels of data.

According to Y. Zhang et al. (2017), there are challenges from various technologies due to technology growth in health care and the need for management data, storage, and processing of health-related data. Y. Zhang et al. (2017) identified four components of the challenges to an interoperable eHealth system: large-scale, rapid generation, various structures, and low value. Each component of the information exchange challenge provides a level of complexity for an interoperable eHealth system to overcome, primarily when each system within each hospital group uses different technologies and, in some cases, proprietary systems. Akhlaq et al. (2016) identified the need to overcoming barriers by incentivizing any financial barriers, the establishment of policies and promotion of data sharing awareness enhancement among stakeholders, providing technical facilitation by the organization of workflow by using regional Extension Centers as established in the HITECH Act, addressing technological needs, and curbing the competitive environment and promoting trust towards HIE.

Strategies for Implementation of an Interoperable System

Strategic planning is used in many facets of life, from business to military operations to personal life situations and choices. From a business perspective, information systems have been identified as critical among nearly three-quarters of business leaders (Hoque, Hossin, & Khan, 2016). According to Walsh (2014), businesses today are information technologies implemented as part of guaranteeing immediate access to relevant strategic information in support of business objectives and goals. Additionally, as part of technology implementation, the impact of technology readiness must be understood clearly to understand user preferences and perceptions (Chen, Liu, &

Lin, 2013). R. Scott and Mars (2015) stated there has been significant investment in eHealth solutions globally, with little understanding of what solutions should be invested in as part of the implementation and in the adoption and implementation of an eHealth system.

Baker, Gustafson, and Shah (2014) stated eHealth is an attempt to enhance health service delivery through modern information technology, and due to the rapid change in technology, and tested results are outdated due to the improved technology. Strategies are necessary to increase the pace of research and produce higher-value results (Baker et al., 2014). According to Gheorghiu and Hagens (2016) there were numerous potential positive benefits to the adoption and use of EHRs in quality improvement, improved efficiency in access to care and historical data, and overall health care data management. According to R. E. Scott and Mars (2013), world organizing bodies, such as the World Health Organization and other similar named organizations are pushing for the development of strategies not specific to the needs of a region or country.

A strategy, as defined in this study, is an action plan to achieve a specific goal in a predetermined state. A strategy described and defined the mission and vision along with objectives and the achievement of objectives (Ahonen et al., 2016). Adopting a strategy using this definition invites potential issues when a specific end goal may be unique or different to a user or organization. The use of policy statements and simple frameworks or roadmaps are insufficient to address the needs of an organization (R. E. Scott & Mars, 2013). Therefore, the use of a general strategy in a complex eHealth system is insufficient in obtaining positive goals. The concept strategy used is part of a framework for

determining success in HIS adoption. Therefore, defined strategies in the adoption process may help also produce a successful eHealth system.

As defined in the original problem statement, some senior health care IT leaders lack strategies in implementing interoperable eHealth systems. Consequently, a supporting theory to the problem is senior health care IT leaders not only lack strategies, but the majority also do not use a formal strategy as formulated and pre-staged before the adoption of an interoperable eHealth system. Instead, senior health care IT leaders use multiple tactics randomly implemented to achieve the stated goals. These multiple tactics are selected as necessary to move the stated goals, eventually forming an unintentional strategy of applying what could be described as a goal-directed trial and error strategy theory. Defining strategies and then implementing a formal strategy is essential for successful adoption of an interoperable HIS mainly due to the continued use and success of a system that meets requirements of meaningful use as outlined in many regulations and financially incentivized (Le Pape, Suárez, Mhayi, Haazen, & Özaltin, 2017; Sligo, Gauld, Roberts, & Villa, 2017). Therefore, the DeLone and McLean success model provides a lens through which to evaluate an organization's success of a strategy or to identify a lack of a strategy in the implementation process.

Hadji et al. (2016) theorized that HIS usage is related to the increase in improved patient care workflow and outcomes. Due to the increase in HIS usage, identifying that the more satisfied a user is, the more likely they are to use the HIS, enhances patient care (Hadji & Degoulet, 2016). The use of a properly developed strategy in the implementation process may contribute to the continued use of a HIS. In an eHealth

system adoption and implementation, the act of a decision-making process includes weighing multiple aspects of the systems being evaluated. Van de Velde et al. (2016) define frameworks as classification of determinate overviews of computerized clinical decision support systems (CCDSS), and according to Marco-Ruiz et al. (2016), a CCDSS is acknowledged as contributing to improve health care, reduce costs, and support access to the latest evidence.

A framework is part of an analytical concept used in the development, analysis, adoption, and implementation of an interoperable HIS. Frameworks are an essential component of strategies in building an interoperable eHealth system. This section focused on the established frameworks used in the adoption of HIS. However, these frameworks simply provide context to the adoption process and support for this study by explaining underlining reasons for adoptions of HIS and alternative evaluation for acceptance of an interoperable eHealth system. Frameworks in this context are the structure or blueprint in the development of a strategy. Evaluation of a HIS requires measuring properties to discern the appropriate system to be used. According to Eslami Andargoli, Scheepers, Rajendran, and Sohal (2017), what to measure is a point of contention about what is necessary to establish a set of guidelines for HIS evaluation. The complexity of the health care field requires the use of the framework as part of the decision-making process in the implementation stage. Per Eslami Andargoli et al. (2017) the framework used needs to reflect the who, what, how, when, and why in the evaluation of activities.

The evaluation of strategies is a necessary component in identifying the benefits of a HIS, as it relates to the perceived benefits in using the HIS in achieving work goals

and the net impacts on the organization and patients (Sun & Teng, 2017). Strategic planning is part of a framework for ensuring that work goals are identified and met, which impacts the workflow of the organization. Kodama (2005) identifies a corporation's strategic behavior as an essential point that relies upon the innovation of the value systems of individual stakeholders and the knowledge they have. Hoque et al. (2016) further describe the strategy as an essential aspect of information systems strategic information systems planning (SISP), as part of a systemically implemented steps consisting of: (a) awareness, (b) analysis, (c) concept, (d) formulation, and (e) implementation, adding a caveat of a hybrid approach to using SISP in health care information technology implementation in developing countries. Therefore, the application of a strategy may mitigate against failure and depend on the needs of the organizations, which may need modification to ensure successful adoption processes and consider organizational factors (AL-Hadban, Yusof, & Hashim, 2016). The factors are the known and potentially unknown barriers, and developers need to include them as part of the strategy development process.

An additional case study by Hellberg and Johansson (2017) described the development and implementation of eHealth by identifying discourse amongst the impetus in Sweden for HIS, specifically at the role of IT as part of the policy level. This study provides another perspective that needs to be considered as part of the strategic framework in the adoption process for an interoperable eHealth system. Hellberg and Johansson (2017) stated that personal health records in portable and electronic format can promote advances in health care on many levels and then identify four aspects to which

they can enhance: (1) access and increased time with caregivers, (2) innovation within the health care sector promoting further health care from both the provider and self-management, (3) transfer of ownership of records to patients, thereby enhancing self-management, and (4) cost reduction and health care delivery improvements. These studies, such as Hellberg et al. and others, can further support strategies as part of a framework, which can be added to the DeLone and McLean model to evaluate the success of the strategy from a post-implementation perspective.

Furthermore, strategies used for implementation require different perspectives and approaches as part of the overall implementation process. As such, Wu, Kao, and Sambamurthy (2016) highlighted that organizations need to understand the effects and performance of information technology and capabilities. AL-Hadban, Hashim, and Yusof (2016) supported the need to understand that adoption of complex systems is challenging and requires careful planning and consideration of all important factors that influence the adoption process. To assess these factors, Wu et al. (2016) identified a model that can evaluate the effects of three eHealth variables: (1) compatibility, (2) synergy, and (3) integration as part of performance measures. As part of strategies' evaluation, review of effects, and performance are another necessary component to establishing a strategic framework. Therefore, a model that provides an understanding of effects and performance provides another tool, which provides the necessary evaluation of strategies. These tools or models can then be applied in-part to the decision-making process. The interoperable adoption process is an important component of the overall strategy in eHealth adoption. As part of the interoperable adoption process concepts, according to

Ramtohul (2015), five main components, three identifiable triggers, and readiness of technology contribute to the decision-making adoption process of eHealth technology. Understanding the process for the adoption of an interoperable eHealth system of senior health care IT leaders is another important component of establishing a strategy. Therefore, understanding the strategy undertaken in implementing interoperable electronic health care systems across different health care organizations is necessary as part of the final framework.

Current strategies in numerous literature reviews can be considered superficial, with no formal strategy identified other than a specific end goal. According to Fragidis and Chatzoglou (2018), national policy context and anticipated benefits have shaped initial strategies. Grisot, Vassilakopoulou, and Aanestad (2017) identified the development of a comprehensive strategy to include vision planning and definitions of future enhancements to the HealthNorway eHealth system post-implementation, in a bid to develop a roadmap. Based on the comprehensive strategy, it would be prudent to place examples, such as these, as "tactics" to obtain the goal of an interoperable eHealth system. Systems, such as those identified by Grisot et al. and others, were implemented as random tactics as further enhancements or as needs were identified. Implementing changes to a system in an "as we go" or incremental fashion rather than in a strategic manner proves to be costly because of the inability to identify all necessary factors and then continually moving the end goal to accommodate for the failure. AL-Hadban, Yusof, and Hashim (2016) and AL-Hadban, Hashim, and Yusof (2016) highlight an important point of HIS adoption, the buy-in from health care staff as part of the overall adoption to

avoid failure and wasting funds that should never be allocated twice similar to any investment that has been classified as a failure. A significant failure can be something as complex as total employee buy-in. Therefore, a formal strategy is a comprehensive formal strategy essential for the adoption of an eHealth system.

Health Information Exchange at the Regional and National Level

Njoroge, Zurovac, Ogara, Chuma, and Kirigia (2017) state adoption of eHealth promises numerous potential benefits to the health system, including improved quality of care, costs reductions, health system governance, which can then extend health care beyond its current limitations. Abdulnabi et al. (2017) supported this and added that difficulties in ensuring global connectivity, interoperability, and security concerns have hampered true HIE at national levels. The exchange of health-related data among health care providers is an essential component in the complex treatment of patients during long-term care and can be hampered by the lack of efficient HIE among providers and the securing of such sensitive data to ensure privacy meeting the needs and requirements of the patients (Esmaeilzadeh & Sambasivan, 2017). Therefore, it is crucial to identify and evaluate the extent of connectivity among HIEs across geographic regions to accurately appraise digital maturity rather than just one-off exchanges of information (Flott et al., 2016). Cross and Adler-Milstein (2017) identify recent initiatives in policies, such as coordination and adoption of technology in improved sharing and bundled savings as part of enhancing value in the exchange of health information. As part of the initiative, incentives were established to offer rewards, and as such, the degree of the adoption was related to the proportion of practices serving Medicare beneficiaries (Rittenhouse et al.,

2017). Therefore, with proper eHealth system adoption, it may be possible to see improvement in the health care domain for patients and providers.

A more recent trend in the eHealth domain is to take advantage of the incentives is to establish local and regional communities based on policy, community exchange networks (CENs), enterprise exchange networks (EXNs) and EHRs. The purpose of collaborative communities is to promote everyday platform use and support governance practices that enhance security and data exchange rules amongst community members (Downing et al., 2017). Ultimately, collaboration can provide enhanced communication and support the exchange of health-related data efficiently. Downing et al. (2017) focused on HIE policy decisions and the impact on the volume of similar electronic health record platforms based upon automatic querying, its impact, automatic linkage to patient data, patient consent, as it relates to automated query and volume impact, and understanding the impact of local organizational decisions on volume HIE. Still, another study by Esmaeilzadeh and Sambasivan (2017) focused on the consent issue in the use of HIE and perception from the consumer. Despite the overall differing outcome, both authors, in this case, identify consumers (patients specifically) as contention or issue in exchange when it relates to permission or consent of exchange of health-related data.

Gibson (2017) identified semantic interoperability as a significant challenge, and current literature does not identify what is recommended versus what is considered a nicety with regards to common reference terminologies and how to locate them. The study conducted by Gibson (2017) provided an inclination as to a barrier to the adoption of HIS, CENs, EXNs, EHRs, use of HIE communities, and the proper exchange of

health-related data from a technical aspect. These components of adoption require additional research evaluation to promote further interoperability of eHealth systems. Additionally, more research is needed to understand the societal components of adoption, adoption value, and the policy decisions in community based HIE. Studies should also focus on the CENs and EXNs at local and regional levels and the decisions used in their implementation because of the more than $29 billion in investment from the U.S. Department of Health and Human Services along with other public and private investments (Tremblay, Deckard, & Klein, 2016). Societal components, value, and policy are behavioral aspects of eHealth adoption requiring further exploration due to the investment required at multiple levels from within an organization to external factors from government requirements.

Value is a significant aspect of research in HIE exchange for organizations in the adoption process of an eHealth system. As part of the understanding value, identification of system adoption is verified by evaluating strategies using the DeLone and McLean success model based on three dimensions: quality of IS, information quality, and service quality (Roky & Meriouh, 2015). Roky and Meriouh (2015) further state that identifying and understanding (that use of) these three dimensions can positively influence the adoption of an interoperable eHealth system, thereby assisting with an understanding value of IS management and actions taken in management processes.

HIE Outside the Organization

Exchange of information is not solely constrained to an organization. In many cases and ideally, the exchange of information outside of an organization is the goal per

meaningful use guidelines established by The Center for Medicare and Medicaid. According to M. Heath, Appan, and Gudigantala (2017), the information technology component is the aspect of HIE across organizations and describes HIE as bringing together all the stakeholders within the organization to govern to enhance care within the community. According to Esmaeilzadeh and Sambasivan (2017), HIE is an important component of HIT infrastructure to facilitate patients' health information among health care organizations. Within the organization, the stakeholders can be considered everyone who has legitimate claims to the health care-related data and the use of it in the care of a patient. For example, this could be each department within the hospital, including the administrative offices that perform or process health insurance claims. Each department has some degree of exchange needed to conduct business.

M. Heath et al. (2017) stated the organization is responsible for establishing a functional and governance structure, processes, and technology to move patient data among disparate systems in conjunction with other organizations in Regional Health Information Organizations (RHIO) supporting regional projects. Governance structure, processes, and proper technology assists in addressing harmonization concerns and developing business rules (Heath et al., 2017). As such, specifically, the use of data mining and supporting technologies are required. For example, Volk, Bosse, and Turowski (2017) stated the US National Institute of Science and Technology (NIST) definition of big data as meeting the four V's (volume, variety, velocity, and variability) as characteristics necessary in scalability, storage, manipulation and analysis supported by technology for storage and processing. Because of the need for harmonization

amongst the massive amounts of patient-related proper governance to move patient data amongst systems, as mentioned by Heath et al., proper governance is essential. As stated by Hovenga and Grain (2013), information governance ensures the effective and efficient use of information so that the organization can achieve its goals. Therefore, an organization needs to have a proper governance structure that includes proper information governance to ensure the proper exchange of information.

The exchange of health care-related data essentially requires the use of proper big data applications and technical architecture development to process and store data properly (Volk et al., 2017). According to C. Schmidt and Sun (2018), data mining is a process utilizing large databases for automatic discovery of potentially useful and valuable data patterns. Therefore, the use of standards, like Cross-Industry Process for Data Mining (CRISP-DM), assists in standardized data mining as a necessary part of information exchange as part of integrated services (Peixoto, Ribeiro, Portela, Filipe Santos, & Rua, 2017). Peixoto et al. (2017) describe CRISP-DM as organizing data mining in six phases: (1) business understanding, (2) data understanding, (3) data preparation, (4) modeling, (5) evaluation, and (6) deployment as a framework when data mining as an overview of the lifecycle of a data mining project. These phases and information exchanges are aspects of parameters, features, and or text that are considered essential to fully tell the state of a patient (Van Poucke, Gayle, & Vukicevic, 2018). For example, Van Poucke et al. (2018) posited that time may be saved daily if [medical hospital] rounds were to require only the interpretation of presented and preselected therapeutic data on a dashboard based on the data trends. Application of data mining

techniques could essentially offer medical providers and patients saved time at least if parameters, text, or features are considered adequately that fully tells the story of a patient.

Transition and Summary

An interoperable eHealth system designed by senior health care IT leaders requires a strategy for successful implementation. Therefore, it is important to understand five concepts necessary for successful implementation: interoperability, current strategies, frameworks, barriers to adoption, and health care information exchange at regional and national levels. These components are foundational structures of formal strategies used to implement an interoperable eHealth system. In Section 2, an analysis was completed evaluating current strategies used by senior health care IT leaders. As part of the analysis, the strategy used was evaluated by using the DeLone and McLean IS success model. Section 2 identifies the purpose of the study, the role of the researcher and the participants in the study.

Section 2: The Project

In this section, I address my role in the study. This section includes information on bias, ethics, data, data collection, methods, and approaches necessary for defining and developing my study. The participant section addresses the steps taken to obtain and protect participants. The research method section indicates the research method used in the evaluation of my research question and problem. The population and sampling section details steps taken to select my population for this study, and the approaches taken to obtain sampling size in developing and conducting the study. Finally, the data, data collection, and validity sections include steps taken to obtain data, protect data, and ensure trust and confidence in the data and data analysis of my study.

Purpose Statement

The purpose of this qualitative case study explored strategies used by senior health care IT leaders to implement interoperable electronic health care systems across disparate health care organizations. The sample population included senior health care IT leaders from health care organizations in the eastern United States who used strategies to implement interoperable electronic health care systems across disparate health care organizations. The findings may offer senior health care IT leaders a framework to obtain enhanced accuracy among disparate eHealth systems, which may reduce medical errors and improve patient treatment.

Role of the Researcher

The researcher has numerous roles in conducting qualitative research. Arriaza, Nedjat-Haiem, Lee, and Martin (2015) noted that part of qualitative research is the

establishment and maintenance of rigor in data collection to represent the voices of participants. In qualitative research, rigor is an essential component of a researcher's role to provide accuracy of voice to participants of the study (Arriaza et al., 2015). To accurately depict participants, it is essential to convey coherently and cognitively the research being presented for the reader to accurately judge trustworthiness based upon the following: credibility, transferability, dependability, confirmability, coercion, adequacy, substantive validation, and ethical validation (Hays, Wood, Dahl, & Kirk-Jenkins, 2016). Hays et al. (2016) further noted that a researcher should use various strategies in strengthening research: trustworthiness, the complexity of analysis, and referential adequacy for protecting participants morally and ethically. Credibility, transferability, dependability, and confirmability were applied in the current study as part of a strategy in trustworthiness. To ensure that appropriate and accurate voice was given to participants, I defined and established protocols as part of an overall strategy to protect the participants and all data collected during this study.

Bias in Research

In qualitative studies, a potential problem is the risk of overinvolvement or bias from the researcher and the inability to professionally detach from the study (De Massis & Kotlar, 2014). How a researcher identifies their personal beliefs and views during a study is important for the credibility of the study (Fusch & Ness, 2015). Charmaz (2015) stated that qualitative researchers bring their methodological backgrounds, biographies, perspectives, and standpoints to research. Detachment and mitigation of bias from the study as one of many roles was necessary for providing credibility. My role as the

researcher in this study included designing the study, collecting, and analyzing data, and presenting conclusions of strategies or lack of strategies used by senior IT health care leaders in interoperable eHealth adoption.

Disclosure in Research

According to Giofrè et al. (2017), there appears to be an increase in nonreplicable research findings, perhaps due to questionable practices. Giofrè et al. (2017) further stated that these questionable research practices could be described as employing purposeful presentation practices of biased evidence in favor of assertion, such as relevant variable exclusion for the sake of obtaining desirable results reducing confidence. The issue of confidence in my study was mitigated with the adoption of research disclosure statements. Another aspect of research disclosure is professional and personal disclosures in research. Hofmann and Barker (2017) posited that it is essential to understand reciprocal interaction between the knower and the known. There is a need to address influence between the researcher and the participants and how the participants and findings influence the researcher. Hofmann and Barker further stated that it is necessary to participate in reflexivity by reflecting on experiences to explicate issues that might arise while conducting the study. Professional and personal disclosures are a significant part of conducting research in studies, including identifying sponsors and conflict of interests (Santos et al., 2017). The need to identify the extent of the relationship to the current topic at hand is important. My professional experience includes over 20 years of medical health records maintenance, use of multiple disparate HISs in maintaining the health care needs of patients, and adoption and migration of physical

records to electronic medical records as part of duties as a health services technician for military organizations. Also, my current residency is in the target area of the eastern United States. I did not have any previous connection to the potential participants besides a mutual colleague who had completed contractual work for one organization and colleagues in another organization. I never had any direct personal or professional relationship with any participants in the study.

Additionally, as part of the disclosure, it is important to identify and abide by the three ethical principles as outlined in The Belmont Report by the Department of Health, Education, and Welfare (1979): respect, beneficence, and justice. In conducting ethical research in my study, I respected the rights of all participants (Department of Health, Education, and Welfare, 1979; Santos et al., 2017). Protecting Human Research Participants training was completed and is shown in Appendix B.

Researcher Role in Data Collection A researcher in qualitative studies can be considered as an always developing instrument requiring the plan of study to be developed and altered as the study progresses (Sanjari, Bahramnezhad, Fomani, Shoghi, & Cheraghi, 2014). A researcher's role in data collection requires the proper and clearly defined design to be defensible and consistent with the approach to the study (Twining, Heller, Nussbaum, & Tsai, 2017). As a researcher, it is imperative that all aspects of the design must be considered as part of the collection method (Ivey, 2017). My method of establishing data collection was matched to my research question to obtain the maximum amount of variation in richness and depth with a minimum amount of error, and to identify any threats to the accuracy and validation of my data as part of mitigating bias and ensuring validation. An active role of the researcher is to clarify any judgments made of interests in data collection and analysis (Twining et al., 2017). According to Robinson (2014) there are four points approached in qualitative sampling: (a) define the sample universe, (b) decide on the sample size, (c) devise a sample strategy, and (d) source the sample. My study included the use of interviews, sampling size, sampling strategy, survey as a data collection of an instrument, and proper organization and contextual descriptions to provide a detailed, rich description of the data.

Interviews and Research The implementation of individual interviews was applied to my study. According to Brinkmann (2016), the use of qualitative research interviews is the most popular method of inquiry. Individual interviews provide for more detail with regards to personal thoughts, feelings, and world views rather than a focus group, which provides for more significant data (Guest, Namey, Taylor, Eley, & McKenna, 2017). Guest et al. (2017) further stated that although both collection methods generate similar items, the data collection process for groups is long and difficult to schedule, among other issues, while individual interviews are efficient in data collection and more effective in generating a larger breadth of data. Additionally, Constantinou, Georgiou, and Perdikogianni (2017) stated that the sampling size for an interview and the current suggestion for interview size includes five or more but depends on the scope of the study. Constantinou et al. further stated that saturation is evidence that the data collected are sufficient to meet the criterion of dependability. Researchers should explain the approach used for coding and analysis to help decide on the exact sample size. Individual interviews were used for the collection of data in my study because the richness and details of individual interviews may provide a better explanation of the phenomenon.

As part of bias mitigation and to ensure the credibility of data obtained from the interviews, I used an interview protocol and transcribed audio/video recordings of the interviews. Interviewing entails numerous challenges of gaining knowledge, including asymmetric power relationships characterized by strangers engaging in an interview of a specific topic governed by the interviewer (Brinkmann, 2016; Haahr, Norlyk, & Hall, 2013). Englander (2012) postulated that it is possible to meet with participants in a

preliminary meeting to provide an opportunity to review ethical considerations, sign consent forms, and review research questions allowing the participant to ponder the questions to aid the researcher in obtaining detailed descriptions. Anyan (2013) suggested that the interviewer may perceive the interview situation from several perspectives to reflect dynamism within the circumstances of the interview. The data collection for my study included individual interviews consisting of a protocol and technology tools. As part of selecting tools and establishing protocols, I employed the recommendations outlined by Brinkmann (2016) and Anyan (2013) as guidance through each stage of the data collection cycle. My study centered around what to record, why, and what instruments to use and the circumstances of the interview.

I developed questions to obtain data saturation on strategies or lack of strategies used. Identifying and understanding the lack of strategies did not require additional fieldwork or analysis prior to the interview to understand the context of activities performed. The use of interview sufficed in understanding the strategies used by at least three organizations. Instruments used interview recording included Microsoft Teams, Zoom, Atlas.ti, and Google built-in recording functionality and the use of transcription software and natural language processing programs. The software Atlas.ti with built-in transcription service was my primary means of transcribing the interview, while Google and Temi transcriber software were used to ensure the mitigation of bias as a secondary transcription service.

Woo, O'Boyle, and Spector (2017) stated divergent thinking in data collection planning is recommended to identify ways the data may be utilized for inductive,

abductive, and deductive purposes. Academic disciplines require a balance of inductive or exploratory discovery, explanatory or abductive with feasible theories, and deductive or confirmation for testing and validity of the presented theories (Woo et al., 2017). Woo et al. suggested using data collection strategies in an organizational survey. By doing so, the researcher can add extra variables, allow for room expansion, theory build in a systematic manner, and select what information to harvest when looking at large data volumes. To capture the most important data ensures the highest value of the study. Data collection approaches include using web platforms like Twitter to conduct surveys (McCormick, Lee, Cesare, Shojaie, & Spiro, 2017). Data collection should be specified and detailed to provide insightful knowledge, data collection optimization, contextual transfer to avoid mistakes, and awareness of potential varying depths of and quantitates affecting data analysis (J. Heath, Williamson, Williams, & Harcourt, 2018; McCrorie, Walker, & Ellaway, 2018). I developed a guide (see Appendix A and C) for data collection in my study to obtain the highest possible value for my study. This guide served as part of a data management plan to organize and enhance credibility.

Researcher Role in Interview Protocols

I developed interview protocols prior to conducting interviews to mitigate bias and provide validity and reliability. According to Murphy, Klotz, and Kreiner (2017), a researcher needs to use a flexible interview protocol tailored to the research question. A flexible approach to probing and listening is known as an open-ended interview, which comprises a standard list of questions offering validity and reliability, yet allows for ad hoc questions as the interview evolves (Blijleven, Koelemeijer, & Jaspers, 2017; Weller

et al., 2018). Yates and Leggett (2016) stated that detailed recordings are a necessary component of interviews as the basis for analysis. As a researcher in the interview process, my role was to develop open-ended questions in a semistructured way to validate and allow for further questions to enhance the depth of knowledge.

The interview protocol (see Appendix A) also served to mitigate bias. As stated by Murphy et al. (2017), confirmation bias, which is a tendency to select and use evidence from existing literature or secondary sources, needs to be avoided, and the participant's language and experiences need to be prioritized. The data collection and coding approach of existing sources at the early stage was avoided to mitigate my personal bias. After data are obtained, it is necessary to consider an approach to coding by adopting guidelines to establish intercoder reliability (Blijleven et al., 2017; B. Smith & McGannon, 2018). As part of my role as a researcher in the interview process, I developed an interview protocol to serve as a guide in mitigating bias and ensuring internal validity of my study.

Participants

Participants in this study were required to be senior health care IT leaders in the eastern United States. The selection of participants was based on their ability to provide a detailed description of the explored phenomenon. Notably, senior health care IT leaders were selected based upon knowledge of adoption and implementation processes and their ability to provide their experiences in addressing an interoperable issue of an eHealth system. Access to the selected participants was completed by colleagues (gatekeepers) with knowledge of participants meeting the predetermined requirements. Selection of

participants can be achieved by various targeted approaches, such as, phone calling and emailing potential participants (F. P. Carter et al., 2017). Gatekeepers are solely participating as the connection to the potential participant. To determine criteria, the researcher needs to define the participants, develop a strategy, identify the benefits to the participants, address confidentiality concerns, and explain the efficiency of the interview process (Høyland, Hollund, & Olsen, 2015; Peticca-Harris, deGama, & Elias, 2016). In selecting participants, participant numbers are reflected upon the balance of representatives and response quality (M. Saunders & Townsend, 2016). For example, if the purpose were to establish the possibility of something, a single qualitative interview is arguably appropriate; whereas, if the purpose were to establish commonalities or comparisons, the larger interview populations were required (M. Saunders & Townsend, 2016). Participants for my current study were selected on the following criteria: (a) senior IT level with adoption understanding and experience of IS specific to the healthcare industry interoperability and, (b) participated in a regional HIE implementation.

Senior healthcare IT leaders are considered as those individuals in an IT management or executive position who participate and or make decisions about HIE, HIS adoption, and HIS integration. Exclusions to my study were participants outside the technology department—participants in positions without IT or HIS adoption knowledge at the executive management level. Participant limitations were senior healthcare IT leaders, senior executive managers, and CIO title roles who had experience with adoption and implementation strategies of an interoperable eHealth system within the past five years. At a minimum, one year in a senior role at their current location or prior

experience as a team member on adoption was acceptable, as long as the experience was in the healthcare field with at least two years' experience as an IT professional and the individual had a role in developing strategies.

Institutional Review Board (IRB) approval was necessary and approved to ensure mitigation of risks to participants, the weighted balance of risks to benefits to the participants for the study, and the proper consent of the participants in the study being conducted (King, Bivens, Pumroy, Rauch, & Koerber, 2018; Liberale & Kovach, 2017). According to Weissman et al. (2018), the intent of the IRB is to protect the ethical rights and welfare of a subject from risk by review and guidance of established research protocols under federal regulations. IRB approval was obtained before communicating with potential participants in this study. IRBs, applied at the institutional level, are established to facilitate the interpretation of federal guidelines at the project level, functioning under the auspice of the US Department of Health and Human Services Office of Human Research Protection (Hom, Podlogar, Stanley, & Joiner, 2017). In complying with IRB requirements, consent forms to participate to be recorded by means of audio and video in the study were required and sent to participants, and the common rule was adhered to with communication notified and documented.

Research Method and Design

This section described the research method and approach adopted for my study. According to Tracy (2010), manifested qualitative research is a worthy topic of study; it is highly rigorous, ensures credibility, resonates with readers, provides a significant contribution, is ethically conducted, and provides meaningful coherence. As part of the

explanation, this section further details the use of the qualitative method case study selected and reasons why this was necessary for understanding the research problem presented abiding by the criteria presented above. Finally, I expand further on the reasons for not selecting another approach to evaluate the research problem.

Research Method

Qualitative and quantitative methods are evaluated according to differing indicators: credibility, transferability, dependability, confirmability (Constantinou et al., 2017). These lead to rigor, offer a contribution, and to ensure ethical standards while providing both internal and external validity, reliability, and objectivity (Constantinou et al., 2017). The qualitative method was selected to evaluate strategies, or lack of strategies used by senior healthcare IT leaders due to qualitative ability analysis, which allows for systematic review methods of identified criteria in minimizing bias from which consistent findings can be drawn and decisions made (DeJean, Giacomini, Simeonov, & Smith, 2016). According to Houghton, Casey, Shaw, and Murphy (2013), qualitative research is being promoted as valuable based on the differences between quantitative research and the unique, imaginative approaches to assessing quality. As such, to understand whether a senior IT healthcare leader used or did not use a strategy in the implementation process requires a unique approach as described further in this section. For example, according to Chan (2015), in trying to understand organizational impacts from the use and implementation of information technology, alternative perspectives can lead to different dependent variables. Despite the need to provide quantifiable measurements, the value of IT may be misunderstood if the use of qualitative measures is not used in understanding

the phenomenon. The use of a qualitative approach can assist in fully understanding the value of IT and the impact of whether a strategy or lack of strategy assisted in the successful adoption of an interoperable eHealth system. Carnevale (2016) described qualitative studies as guarding against assumptions endeavoring to understand the phenomenon within the context of a specific domain. Therefore, the context requires researchers to immerse themselves in the research setting by knowing what their position is in the context of the research (Pelzang & Hutchinson, 2018). Pelzang and Hutchinson (2018) further stated in their analysis of qualitative studies, research using qualitative methods meet some basic criteria: fit, credibility, auditability, confirmability, and triangulation. As such, understanding the strategies used by senior IT healthcare leaders in the implementation of an interoperable eHealth system requires a unique approach to be reviewed systemically under specific criteria to allow conclusions to be drawn and a decision to be made. The use of quantitative and a mixed methods approach was considered but not selected for a few reasons. First, the selection of mixed methods would use both qualitative and quantitative approaches in an identified order to understand the phenomenon context of multiple (2 or more) organizations and not simply just components of both (Nassaji, 2015; Venkatesh, Brown, & Bala, 2013). Venkatesh, Brown, and Sullivan (2016) furthered this use of mixed methods research by stating the use of mixed methods as pragmatic, critical realism, and transformative emancipatory in analyzing both narrative and numerical data as part of the holistic analysis. Mixed methods research can involve both qualitative and quantitative, and this could be in case studies containing one or more participants or among similar related studies. Johnson,

Onwuegbuzie, and Turner (2007) cited three reasons for combining both quantitative and qualitative research: triangulation of the theories presented and studied, enabling or developing an analysis of richer data, and promoting new modes of thinking from both data sources. Second, quantitative has been identified more for testing theories to allow a researcher to explore and confirm a specific research question. Qualitative has been identified more with building theory and exploration (Dasgupta, 2015). Venkatesh et al. (2013) further suggested that quantitative studies do not offer a thorough understanding of the implementation of an IS. Understanding a single organization's concept of a strategy or lack of strategy in the adoption processes is the essential aspect to be studied first to establish a foundation for future analysis and, eventually, a strategic solution to the adoption process. Mixed methods or quantitative, although appropriate in analyzing or understanding the problem that some senior IT healthcare leaders lack strategies in adopting an interoperable eHealth system, however quantifying the success is out of scope for this study. Therefore, the use of a qualitative method was selected as ideal to understand the strategies or lack of strategies used by senior healthcare IT leaders in the adoption of an interoperable eHealth system.

Research Design

Qualitative case study analysis research has been used by a researcher to approach the evaluation of a problem (Cibangu, 2013). Multiple approaches can be applied individually or concurrently as necessary to achieve research goals. However, the selection of a case study design for this study was appropriate to understand the problem that some senior healthcare IT leaders lack strategies to implement interoperable

electronic healthcare systems across different healthcare organizations. According to Levitt, Motulsky, Wertz, Morrow, and Ponterotto (2017) case studies, as part of a qualitative approach tend to require a small number of participants and can consist of a single person or case emphasizing experiences from mapped variations within the phenomenon being studied adding new perspectives to literature. The use of case studies can set the context of a study and then be applied to future studies (Dhillon et al., 2016). Even though this single case study only reviews the experience of a single organization and the strategy used or not used, it could still provide a new perspective to the future literature on strategies used in general. The objective to obtain from conducting this qualitative case study is to understand the strategies or lack of strategies used in the adoption of an eHealth system. As such, Abubakre, Ravishankar, and Coombs (2017) describes the use of single case studies as offering the opportunity to explore IT adoption from an IT cultural perspective while analyzing the data without the complexity of over-analysis or oversimplification, yet providing rich description of the phenomenon, which is a requirement of qualitative case studies in general. A single case is exploring the strategy or lack of strategy used by senior IT healthcare leaders in understanding their cultural perspectives in the adoption process. A case study allows for in-depth exploration within the context of the situation, understanding the phenomenon, and the influence on the adoption process as well as the levels of analysis in the adoption process (De Massis & Kotlar, 2014). De Massis and Kotlar (2014) described that the selection of a case study is guided by the overall objective and each can be described as exploratory or descriptive. Exploratory case studies are usually necessary to understand dynamics

within an organization; whereas, a descriptive case study is necessary when a researcher wants to establish the relevancy of a phenomenon. Based on these descriptions, it is necessary to employ both case study approaches, to explore the influence of the adoption process and still provide relevancy to the importance of the phenomenon in the adoption process. There were additional approaches that were considered but not selected for this study. Ethnography researchers are, according to Dicks (2006), situated in a society with all types of multimedia to use in the research process. In a traditional sense researchers do not participate actively unless, according to Baskerville and Myers (2015), they use a design ethnography approach, where engagement with the participants is an essential aspect of bridging research and practice. Ethnography research was earlier described by Draper (2015) as people and their behaviors, whether individual or collective influence or is influenced by the culture they live in and fully engages the researcher in the data collection by using numerous points of data collection. Ethnographic studies can be considered specialized, focusing on the long-term cultural aspects of the organization, including significant amounts of participant observation data (Sharp, Dittrich, & de Souza, 2016). While culture is important to understand the adoption of an interoperable eHealth system, the senior IT healthcare leader's perspective of the adoption strategy and process is also important besides the cultural aspect of the adoption process over a period of time or multiple stakeholders outside the senior IT healthcare leaders.

Phenomenology, such as hermeneutic phenomenology, is both interpretive and descriptive and focused on lived experiences and disregards the need to suspend personal assumptions and engage in self-reflection (Galehbakhtiari & Pouryasouri, 2015). Similar

research approaches were descriptive, focusing on the essential structure of experiences and interpretative perspective only focusing on sensory awareness (Galehbakhtiari & Pouryasouri, 2015; Willis, Sullivan-Bolyai, Knafl, & Cohen, 2016). According to Mohajan (2018), phenomenological research involves a subjective investigation of the phenomenon. Therefore, the phenomenological approach is inappropriate due to time constraints, and an exploration everyday life experience of participants to understand the strategy used in the adoption process is unnecessary. Narrative qualitative research occurs when a researcher wants to use stories to make sense of the participant's experience, which can also be used as the basis for theory building (Avison, Malaurent, & Eynaud, 2017; Faulkner, 2016). According to Haydon, Browne, and van der Riet (2018), narrative inquiry explores the experience of an individual, how the physical, social, and cultural environments shape their individual experiences. Mohajan (2018) further supported this and narrative research provides a unique perspective into procedural and impalpable aspects of the participant experience, allowing for unique context-based evaluations that reveal how changes occur or evolve form a personal point of view. While each of these research approaches offers unique opportunities to explore the strategy used in the adoption process, these approaches would not allow for simplifying data analysis and also provide reasons on why understanding strategies in the adoption process are relevant to the adoption process itself. Therefore, the use of a case study design was selected.

Population and Sampling

The population and sampling consist of senior IT healthcare leaders in the Eastern United States. Selection of senior IT healthcare leaders is contingent upon having 2-3 years or more of experience in the adoption of an eHealth system, their knowledge, and participation of implementation of multiple information systems as part of a holistic interoperable eHealth system and meet the defined context of a senior healthcare IT leader. The estimated population of senior healthcare IT leaders would be no more than three in each organization limited to those senior leaders with direct involvement in the development and use of a strategy.

In interview-based research, the perceptions and experiences need to be represented in ways the researcher can understand, whose purpose can be implicitly or explicitly stated (Thomas, 2016). Proper population sampling is based on specific characteristics necessary to ensure data saturation and detailed description. Specifically, it involves the selection of participants who are knowledgeable in the area of the study being conducted and are available and willing to contribute (Palinkas et al., 2015). According to Emerson (2015), statistical inferences are based on probabilities, which are more accurately predictive with higher sample success. Data saturation refers to the point at which the collected data becomes repetitive and, therefore, does not provide any additional context (Hennink, Kaiser, & Marconi, 2016; Nelson, 2016). Tamim and Grant (2016) stated that saturation is evident when there is no new data being collected, and variability in a sample provides detailed descriptions.

Palinkas et al. (2015) stated that the use of population sampling must be consistent with the assumption associated with the method used and, in qualitative studies, to provide more detailed information. As part of the sampling strategy, the researcher must consider the appropriateness of participants, sample population, and data saturation (Hagaman & Wutich, 2016). Data saturation was broadly defined as the point at which no new insights, themes, or issues were identified and how saturation is reached depends on the number and complexity of data, number of coders, research team size, experience, and fatigue (Elo et al., 2014; Hagaman & Wutich, 2016; Tran, Porcher, Falissard, & Ravaud, 2016). The selection of population sampling and the process for selecting needed to follow the assumption associated with qualitative approaches to analysis. The data begins to become redundant when data saturation has been reached.

B. Saunders et al. (2017) broadly stated saturation as the criterion for discontinuing data collection and analysis in a study. Additionally, B. Saunders et al. (2017) proposed that saturation has differing relevance, different meaning depending on the role of theory, the analytical approach adopted, and may serve differently for different types of research and assumptions about it representing a distinct event or ongoing process. For this study, data saturation continued in the interviews until no new themes or variations were found. Each interviewee answered the initial questions, and then follow-up questions were asked until no additional meaningful information was contributed. Additionally, data saturation was determined and achieved when all obtained documentation related to IS implementation provided no additional themes or variations in identifying the implantation process.

According to Nascimento et al. (2018), the psychocultural transference from the participant environment to the researcher environment is necessary to explain the factors involved by enabling the establishment of the validity of the data sets. Additionally, Nascimento et al. (2018) offer five procedural steps to follow in determining theoretical saturation: (a) Recording of raw data, (b) Immersion in data; review of data obtained through interviews, (c) Compilation of themes to be identified, (d) Theme allocation and statements in a single chart; and (e) Theoretical data saturation obtained through the absence of new elements. James (2018) noted that to ensure validity of data collected it is important to associate member checking and triangulation. I conducted a review of data obtained from interviews performed analysis to ensure data saturation was met using the procedural steps identified previously as a guiding framework to ensure dataset validity.

Sampling Approaches

The sampling approach used aligned with the qualitative method used, the research question asked, and the approach and research question in my study to adoption and implementation strategies (in a formal capacity). Sampling focused on the use of strategies as part of guaranteeing meaningful variation within the sample, such as combining two-approach strategies to identify the group and then narrow to individual participants (Seixas, Smith, & Mitton, 2017). According to Hennink et al. (2016), the sample size is mostly based on recommendations the researcher might make to answer the problem being studied fully. Simou and Koutsogeorgou (2014), state that the inclusion criteria for participants should include all participants of interests. Morse (2015) further supported that the sample size in qualitative studies is dependent upon the

phenomenon and how concrete the phenomenon is versus how subjective it is along with the scope and complexity of the phenomenon being studied. The complexity of the phenomenon would offer both depth and degree to the interview and interviewer in describing the phenomenon, which is essential for accountability in qualitative studies (Morse, 2015; Tobin, Nugroho, & Lietz, 2016). HIS systems are complex in nature, and the knowledge, costs, and degree of disparateness require diligent planning (Kim, Coiera, & Magrabi, 2017; Sligo et al., 2017). Therefore, due to the degree of complexity, the need for solid knowledge and depth of support is crucial to the success of the system implementation.

Sampling Alternatives

Purposeful, probabilistic, snowball, census, total population, expert, and random sampling approaches are strategy types used in qualitative studies and have been considered for this study. Purposeful is used for the identification and selection of detailed-depth information in cases with limited resources, and the term has potential for ambiguity due to the potential for deliberative sampling to be considered purposeful (Gentles & Vilches, 2017; Palinkas et al., 2015). Gentles and Vilches (2017) further stated the term purposeful sampling has been used to include random sampling, initial or priori sampling, and, therefore, should not be used unless clearly defined. According to Benoot, Hannes, and Bilsen (2016), purposeful sampling involves deliberately selecting participants based on knowledge of individuals and groups that are proficient and well informed on the research subject to learn a significant amount of rich in-depth details of the case. Purposive sampling approaches, the use of total population, and expert sampling

were also considered; however, sampling decisions are not necessarily made priori to the data collection process.

Snowball sampling is useful when a small number of initial participants occur, and they recruit other participants (Valerio et al., 2016). Griffith, Morris, and Thakar (2016) state snowball sampling is a purposeful sampling design that is used to recruit nonprobability-based convivence sampling, which involves initially (seeded) participants and initiate contact with additional participants to be required for participation in a study. Snowball sampling was rejected because it is not appropriate for this study. In snowball sampling, it is possible to have others recruit participants in which the participants can be gathered and possibly, or easily, influence or skew results by introducing uncontrolled factors potentially from the same locations, ideals, status, or other factors of similarity possibly skewing results (Emerson, 2015). As additional options for sampling strategies, probabilistic or randomization was considered. Random sampling requires the sample design be as random as possible, and all labeled data is equally treated, which helps with greater randomization the greater the asymptotic approximations (Liang et al., 2017; Tillé & Wilhelm, 2017). According to Setia (2016), random sampling is when there is an equal chance for each participant in the study to have an equal and independent chance of being selected for participation. The approach in this study does not require randomization of the data to understand strategies nor to obtain an understanding of strategies. In this study, there is no independent or equal chance in the selection process; participants need to have experience as outlined in the criteria. Therefore, these two strategic approaches were not used.

According to Robinson (2014), there are four approaches to qualitative sampling; define your sample universe, decide on your sample size, develop a strategy, and source the sample. Researchers need to decide on the sample and sample frame for contacting individual participants (Peticca-Harris et al., 2016). Sampling may be defined as the selection process of an individual or sampling units from the sample frame, which is applied as a specified strategy in advance to avoid affecting the sample size estimation (Martínez-Mesa, González-Chica, Duquia, Bonamigo, & Bastos, 2016). For the sampling universe and sample size in this study, the population to be interviewed consists of approximately two to five senior healthcare IT leaders in the IT department with experience in adoption processes from eight organizations. As part of defining the sampling universe, the more specific inclusion and exclusion criteria used, the more homogenous the sample universe becomes (Robinson, 2014). The sampling population cannot be outside the senior healthcare IT leadership with adoption experience or with no experience in the adoption of eHealth systems. In developing a strategy, my study has already reviewed possible alternatives. The following sampling strategy identified for this study was census sampling, and the strategy in identifying potential participants was through my primary contact.

Census Sampling

The use of census sampling is appropriate in studies because the target population is small enough to represent the entire population (Mose, Shukla, & Mbabazize, 2015). Whittingham, Barnes, and Dawson (2016) further support that census sampling is obtainable through a high access target population. According to Martínez-Mesa et al.

(2016), whether or not the samples represent the target population, census-based estimates are preferred when possible. In census sampling, research subjects are readily available, are part of a target population and meet certain practical criteria in close location to where the researcher is located (Martínez-Mesa et al., 2016). Eligibility in sampling is based on whether the participants meet the required criteria and consent to participate in the study (Setia, 2016). As such, the population sampling target would be senior IT leaders in different aspects of the adoption process within a healthcare organization. The use of census sampling was appropriate because of the small population and the overall preparation needed in the adoption process of an eHealth system and because of the existing relationship to identify knowledge experts willing to participate in meeting the established criteria.

Ethical Research

Ethics in research involves protecting participants, and as such, researchers need to maintain confidentiality of participants and act in professional ways in making decisions, especially in situations where there is potential for close relationships among participants and other researchers (Wilson, Kenny, & Dickson-Swift, 2017). M. D. Myers and Venable (2014) defined ethics as either knowledge of moral principles or moral principles governing or influencing conduct. As such, researchers in qualitative studies must uphold these definitions as part of the study by using appropriate protocols (Haahr, Norlyk, & Hall, 2013; Sanjari et al., 2014). In conducting my study, the processes and procedures were adhered to, acknowledging confidentiality and associations measured against known guiding moral principles. I used protocols and ensured ethical standards

were maintained. The use of the IRB is mandatory in ensuring mitigation of risks, benefits of the study, proper selection, informed consent, and protecting privacy and confidentiality (Cook, Hoas, & Joyner, 2013; Weissman et al., 2018). I completed the National Institute of Health (NIH) course and received a certificate of completion for protecting human participants (see Appendix B). My final doctoral manuscript includes the Walden IRB approval number 02-25-19-0511520. Additionally, I ensured my study does not include names or any other identifying information of individuals or organizations that participated, and data will be stored securely for 5 years.

According to Lamoureux, Judkins-Cohn, Butao, McCue, and Garcia (2013) the U.S. Department of Health and Human Services' Office of Human Research Protections for protecting human subjects, researchers are to adhere to rules by drafting a letter explaining the aim of the study, participants rights, and how it is voluntary without any incentives to the participant. Assurance of patient protections and confidentiality was supported by use of Certificates of Confidentiality to use as a reassurance measure of protecting participants (Beskow, Check, & Ammarell, 2014; Hudson & Collins, 2017). Anonymity and privacy rights of participants are necessary to avoid unintentional disclosure and mitigate harm to participants; all data is required to be kept securely and then destroyed when no longer necessary (Mealer & Jones, 2014). In keeping with the IRB requirements for any participants, informed consent is required as outlined by the IRB, will be collected electronically written and verbally as acceptable, and all participants can withdraw at any point.

In my study, informed consent was for respect for privacy and the rights of the participants and the disclosure of any information during the study. Informed consent notifies participants of risks to allow the participants to control what information is disclosed (Mealer & Jones, 2014). Privacy of all obtained data from surveys, interviews, and recordings that provide for identifying information were identified as part of the risks as related to the revised rules under the Common Rule. An exemption is allowed regardless of the potential consequences of disclosing the information, if an adequate review and implementation are completed to ensure the privacy and confidentiality of participants (Colemane, 2017; J. D. Smith et al., 2017). In my study, all identifying information was securely stored on a local drive encrypted, and password protected using AES-256 encryption, using Boxcryptor and then destroyed by using multiple writes.

Data Collection

Instruments

Data collection consists of multiple tools to use in the evaluation of a qualitative research problem. Data collection tools range from observations, experimentation, interviews, focus groups, to documentation (Flynn, Albrecht, & Scott, 2018; Gravlee, Maxwell, Jacobsohn, & Bernard, 2018). Data collection method instruments are selected by the research and undertaken in observations, both formal and informal unstructured and semistructured interviews and in unique approaches in context to an area. However, according to Ivey (2017), the selection of a collection method must be carefully considered and match the study question and the specific goal of the study at hand (Grant, 2016). Semistructured interviews, use of an interview protocol (see appendix A and

appendix C), recorded responses to the interview, sample documentation, and documented responses in a field journal were used as a supplemental data collection technique. Data collection is simply more than the tool used, and it requires identifying everything about the researcher, all participants present and relationships among them along with the context of the research and location and how the data collection process evolved, if any, over the course of the study (Twining et al., 2017). I was the primary data collection instrument for my study and ensured reliability and validity, as outlined in this section.

According to Kavoura and Bitsani (2014), interviews in a qualitative study provide insightful points of view with regards to experiences which can be potentially verified by administrative documentation. However, as Twining et al. (2017) point out, there is danger in accepting interviews at face value, and researchers should both collect data and analyze it concurrently and iteratively. Kallio, Pietilä, Johnson, and Kangasniemi (2016) stated that developing a qualitative semistructured interview guide contributes to the integrity and validity of studies. Therefore, the selection of a semistructured interview using a guiding framework was necessary for my study to further contribute to integrity and validation.

Data Collection Technique

Kallio et al. (2016) stated that the rigorous development of a qualitative semistructured interview guide contributes to the objectivity and trustworthiness of studies in making the results more plausible. Semistructured interviews are a popular data collection method and advantage is the versatility and flexibility of the data collection

and reciprocity between the interviewer and participant, allowing the improvement of questions through follow-up interviews (Kallio et al., 2016). However, Kallio et al. (2016) stated several issues need to be considered using semistructured interviews when preparing the interview guides because of the lack of uniformity and general advice on the development of an interview guide. Therefore, Kallio et al. (2016) suggested the use of a five-phase process: identification of requirements, identification of previous knowledge and retrieval, formulating an interview guide, pilot testing of the interview framework, and present the completed framework to support justifications of the decisions made. Therefore, the following five phases addressed below are a necessary aspect of developing my guiding interview framework protocol. In this section I present the interview framework protocol and provide support as to my decision in the development process. My study was first piloted with my peers and committee to align and validate my questions and techniques. Finally, this section describes my organization and analysis techniques used as part of my study. My interview questions, interview protocol, and survey questions are in Appendix A.

Interview and interview protocol. The semistructured, open-ended interview questions are listed as part of my interview protocol. Each answer may be followed up with another question depending on the responses, allowing for flexibility in the interview process. The selection of using a qualitative interview collection technique is appropriate because of the study necessary within the context of understanding strategies (Brinkmann, 2016). Interviews are conducted in an interactive manner (Malli & Sackl-Sharif, 2015). According to M. Saunders and Townsend (2016), qualitative interviews

offer greater ecological validity, rich and insightful accounts of the phenomenon leading to and assisting in understanding the complexities of organizational realities. Additionally, the use of open-ended questions in semistructured qualitative interviews allows for the exploration of new topics and themes versus the use of open-ended questions, which cannot provide a greater depth of detail (Bengtsson, 2016; O'Keeffe, Buytaert, Mijic, Brozović, & Sinha, 2016). O'Keeffe et al. (2016) further supported this by stating that semistructured interviews are based and organized around a topic guide versus a fully structured interview containing only a serious of set questions. Based upon the detailed knowledge of the senior IT healthcare leader, the concrete level of success, the complexity of an interoperable eHealth system, and whether the adoption of an interoperable eHealth system was successful, may provide a more detailed account of the reality of the use of a strategy in the adoption process. Exploring all additional topics and themes in a semistructured interview format may allow the participant to shape the discussion of the topic from the participants' own understanding. A qualitative interview with a properly developed matrix identifying and aligning interview questions to research questions would support the data analysis of the interview technique selected for my study. Additionally, I used open-ended questions in a semistructured interview in my research protocol. I remained flexible during the interview process to allow for new topics or themes that arise from the sample participant experiences. In the following paragraphs, I defined the phases of the semistructured interview guide development that was used in the development of my interview protocol.

Defining Phase 1 appropriateness and requirements. This phase is the identification of all requirements. The first part of this phase was to conduct a systematic methodological review to understand senior healthcare IT leaders' strategies in implementing an interoperable eHealth system by developing a qualitative semistructured interview guide, to improve the trustworthiness of qualitative research for my study. The research question explored was: 'What are strategies senior healthcare IT leaders use to implement interoperable electronic healthcare systems across disparate healthcare organizations?' This phase required the identification of how and why a semistructured interview was appropriate for my study. As Kallio et al. (2016) stated, semistructured interviews are found to be appropriate when there is a need to determine some areas of the phenomenon based on previous knowledge or to understand the complexity or emotional, sensitive issues of the problem about subjects which participants were not used to talking about, and in situations that allow the participant to focus on topics that were meaningful and allowed for a breadth of themes to emerge (Kallio et al., 2016). The focus of my study is to understand the complexity or even sensitivity issues of the problem in adopting an interoperable eHealth system. Due to the complexity of an eHealth system, participants can focus on the topic of meaningful use of HIS interoperability and implementation.

Defining Phase 2 knowledge. This phase is the retrieval of knowledge aspects. Kallio et al. (2016) mentioned, this phase aims to gain a comprehensive and adequate understanding of the subject and requires critical appraisal of previous knowledge and the possible need for complementary empirical knowledge. Kallio et al. (2016) further stated

to gain a comprehensive understanding of the subject, drafting of a literature review and contacting consultants and industry experts on the research topic was necessary. Therefore, conducting a thorough literature review on interoperability, implementation of eHealth systems, and current trends and regulations in eHealth adoptions is a significant aspect of supporting the outlined research question and study problem being researched.

Defining Phase 3 formulation. The formulation of interview guidelines is the process of this phase. Kallio et al. (2016) stated it is necessary to develop the preliminary interview guide itself as a data collection tool to generate spontaneous answers and in-depth responses at two levels: main themes and follow-up questions consisting of specific topics to address initial questions and follow-up questions to the initial questions to further elicit details. This phase supports my study by establishing a guiding framework and then was applied to the interview protocol from which I followed to further support validity.

Defining Phase 4 testing. Pilot testing phase. The fourth phase is piloting of the guiding framework and fully developed interview protocol to ensure coverage, accuracy, identification, and adjustments to questions, and integrity for improving ethics in the study by internal testing, external assessment, and field testing of the questions (Kallio et al., 2016). The phase served as guidance in how I proceeded in my study to test for accuracy and ensure the integrity and avoid bias, among other aspects, to support a fully developed research study.

Defining Phase 5 presentation. In the fifth phase, Kallio et al. (2016) state it is important to present the complete guide in the study to provide support in the scrutiny for

the thought and processes taken in developing the semi-structured interview framework. This phase is the concluding phase of the development process of the guiding framework. This phase describes the processes taken in the previous phases and support the overall guiding framework.

Interview protocol. As identified by Kallio et al. (2016), the rigorous development of a semistructured qualitative interview guide contributes objectivity and enhances the trustworthiness of the conducted study by providing more plausible results. The interview protocol, as briefly described in the previous section, consists of predetermined open-ended questions in a semistructured interview format with participants, and the interview protocol functions as a guideline and rules used while conducting interviews during a qualitative study (Dikko, 2016). The interview protocol may include script, reminders, and interview questions (Dikko, 2016). My interview protocol lists all the initial questions I asked and supports phase 1, 2, and 3 as outlined in the previous paragraph by identifying the importance of the topic, aligning questions to elicit relevant themed responses on eHealth adoption and implementation formally establishes a written guide to use in the initial processes. Additionally, the use of an interview protocol can be used to mitigate ethical challenges to researchers and participants (Bromley, Mikesell, Jones, & Khodyakov, 2015). Specification of the participant role, and distinction between the researcher and the participant role set the stage for obligations of each in a trust-based manner, which are foundations for ethics (Bromley et al., 2015). The interview guide protocol listed includes comments on what the role of the participant and researcher is and helps support the idea of obligation to the

participant in ensuring mitigated risks to participants. Abildgaard, Saksvik, and Nielsen (2016) state an interview guide allows for the researcher to cover both contextual factors and intervention implementation. My interview protocol also outlines my script in the interview process and identifies that participants are allowed to withdraw at any point, how I collected the information, the steps in obtaining permission for the interview process, and the overall additional contextual factors as part of interviews in my research study. Additionally, interview protocols can be used as starting points in the conversation, allowing for themes to emerge (Shapka, Domene, Khan, & Yang, 2016). As mentioned, the initial questions listed were used as the starting points, and then information furthered elicited by using follow-on questioning. In conclusion, it was necessary to apply an interview protocol to guide my research process during the interview, validate questions, and assist in protecting my participants by following a script and guide outlined in my protocol to help ensure validation of questions and protection of participants. The interview protocol included my introduction, all pertinent information related to the study and the interview process, the process of my study, and all follow-up related information.

Member checking. It is important to impose the use of member checking to ensure the accuracy of comments, statements, and responses. Member checking is the follow- up to research participants to ensure accuracy and proper representation of responses (Perrotta, 2015). According to Thomas (2016), member checking refers to sending interview respondents transcripts of the interview, a copy of emerging findings, and a draft of the research report for review, comment, and or correction. Therefore, I

sent copies of draft summary findings to participants. Trustworthiness and credibility of a study's findings is supported with the use of member checking and is the back and forth and review of results of a study with research participants as part of the collaboration process (Birt, Scott, Cavers, Campbell, & Walter, 2016; Turner & Thompson, 2014). Bell (2015) further supports this by stating to ensure reliability, trustworthiness, credibility, and accuracy of the study, the use of member checking is necessary for researchers (Bell, 2015; Birt et al., 2016). Therefore, the use of member checking is an important aspect of qualitative studies.

I interviewed my participants and reviewed their responses for accuracy as part of the review process. During the initial interview it was discussed that summary findings would be sent for review and accuracy of the interview. Due to current integration and migration HIS activities and the onset of COVID-19 in early January 2020, follow-up interviews became difficult due to decreased availability. For validation and reliability, interview summaries were sent for review; however, detailed follow-up interviews as part of the required member checking process were not completed. Two participant follow-up interviews were completed that reviewed previous interview statements. Further statement details were provided during these two interviews, and then summary transcripts were sent.

Data Organization Techniques

The organization of data is possible by many forms of medium today. The use of unstructured templates for taking notes, recording interviews, cataloging, and various

types of journals are used in research (Morgan, Pullon, Macdonald, McKinlay, & Gray, 2016). The interviews conducted in this study consists of written questions and recording of the interviews using online technologies, such as Skype, Microsoft Teams, or equivalent. Additionally, the use of a narrative log was used to identify personal understandings, observations, and insights into the processes of eHealth adoption to identify appropriate themes. Any data collected by means of a physical journal was scanned and aligned to any electronic journal entries and participant data. The use of a journal allows for the organization of thoughts and reviews of context at a later time (Chang & Lin, 2014). Therefore, I employed the use of a spreadsheet to organize myself and the data collected and to readily make it available for the data collection tools used as part of the analysis later in my study. Broman and Woo (2018) state that a spreadsheet is a multipurpose tool used for data entry, storage, analysis, and visualization. Broman and Woo (2018) further stated the organization of the data should be structured with the planned use of computers in mind for analysis by being consistent with the labeling and structure of data. Rogers (2018) stated the coding connects the qualitative data collection phase with the data analysis phase of a study. Therefore, to ensure proper analysis, I employed consistent categorical values by labeling all participants as ‘Participant’ in sequential order. For example, all participants were labeled: Participant1, Participant2, Participant3, (P1, P2, P3), etc.… until all participants from each organization were labeled. I continued with the same structure for labeling the participants corresponding organizations, as necessary. To ensure avoiding errors, I labeled all missing data fields with consistent value, for example, the use of Not_Applicable to avoid confusion. My

data tables naming scheme included the organization label given along with the date, for example, HospitalParticipant_1_Month_Year. Finally, I need to be consistent in my notes phrasing and avoid the use of spaces; this enhances search abilities later in the data analysis.

All the data obtained, including organization documents (privately and publicly accessible written strategies, frameworks, reports, and matrices) and recorded interviews, were stored on an independent hard drive encrypted and password locked for five years and then destroyed. All data, once digitized, was stored, and grouped according to organizations and aligned to the participants. Atlas.ti, as a qualitative data analysis software, is useful in analysis and project management of research (T. M. Paulus & Bennett, 2017). Denneson et al. (2017) further supported the use of Atlas.ti for transcript organization and allows for a thematic analysis approach to use preexisting research questions to assist with analysis. T. Paulus, Woods, Atkins, and Macklin (2017) further stated the use of qualitative data analysis software provides for a more transparent analysis of the data. Upon manually sorting and organizing my data, I used Atlas.ti as a form of project management, organization, and analysis throughout the remaining aspect of data collection and analysis.

Data Triangulation

The use of data triangulation was used to ensure data legitimacy with my data collection methods. Data triangulation is the use of multiple methods or data sources as part of qualitative research to fully understand the phenomenon (N. Carter, Bryant-Lukosius, DiCenso, Blythe, & Neville, 2014). According to N. Carter et al. (2014), data

triangulation is identified in four forms: data, investigator, theoretical, and methodological triangulation. Data triangulation is the use of different data, or observational sources. The investigator is allowing another researcher to collect and analyze data and theoretical triangulation is the use of one or more theoretical positions, and methodological uses quantitative and qualitative research (N. Carter et al., 2014). Leech and Onwuegbuzie (2007) and Hussein (2015) state the use of multiple qualitative data analyses supports the researcher by using each qualitative data analysis tool or combination of methodological approaches, theoretical perspectives, data sources, or investigators in to understand the phenomenon better. Leech and Onwuegbuzie (2007) further stated the reason is that the researcher is able to generate more meaning, overall enhancing the inferences by using multiple tools such as within-method complementary of checking data results from another selected tool, convergence or corroboration of results from with-in method triangulation application on the same data, with-in method – expansion by expanding the range of inferences, and with-in method development by using results of one approach to inform another approach. Data triangulation for my study includes multiple data sources, tools and begins with demographic questions, interviews, and document analysis (not limited to frameworks, IT documents, emails, public/private accessible matrices, reports, and/or strategic documents, meeting notes, data dictionaries, IT documents, etc.) for domain analysis as part of data triangulation.

Theme Development

Atlas.ti and natural language processing software were used as tools to assist with theme development. Automated data analysis tools, such as Atlas.ti, can be used in

organizing data electronically, enhancing the reliability of findings, and mapping the data to the research question by supporting content analysis and auto coding (Gold, Kunz, & Reiner, 2017). The use of Atlas.ti allows for the organization of the data, defining and modification of the thematic theme data based on the data collected, and exportation of the main themes to support the writing process (Jarvis, Wachowiak, Walters, & Kovacs, 2017). The use of Atlas.ti assists and assisted in the overall writing process of this study by providing a reliable way to use thematic analysis based on the data obtained, the degree of density or grounding, and proper coding of the data. The use of an NLP LIWC and Atlas.ti was used to explore themes, text, and visualize data to identify relationships as well as address one part of triangulation.

According to Renz, Carrington, and Badger (2018) methods triangulation, as one of the four triangulation approaches is when two data collection procedures are within the same research design as part of data analysis triangulation by combining qualitative text analysis and quantitative statistical method utilized for an intra-method data triangulation approach. The use of conventional content analysis and natural language processing (NLP) as a method of data analysis triangulation can enhance the inferences from the data collected (Renz et al., 2018). Varpio, Ajjawi, Monrouxe, O'Brien, and Rees (2017) stated that data theme emergence implies that themes inherently reside in the data itself, but it is the researcher that interacts with the data and brings forth thematic identification. Researchers must reflexively engage in the research process and apply language transparency to reporting by including active voice (Varpio et al., 2017). Therefore, my questions were analyzed initially to describe the experience of the senior healthcare IT

leaders and then further explore meanings derived from the NLP and eventually evaluated against other data collection tools. The following documents were needed and analyzed; planning documentation with identified goals, available network architecture drawings, agreements with regional HIE, any standard operating procedure used with the HIE, training material for the HIE, and systems design documentation (e.g., data dictionaries, project planning, frameworks, IT documents, emails, public/private accessible matrices, reports, and strategic documents, meeting notes, and IT documents) to determine semantic relationships to uncover the overarching domains. These documents and use of approaches were used as part of data triangulation to enhance the legitimacy of data in my study.

Reliability and Validity

Reliability and Validity

Establishing protocols and processes is one part of developing a strategy used in ensuring the respect and protection of participants and the reliability and validity in this study. According to Qin, Li, Zha, and He (2017), validity is the of empirical measurement reflecting the concept of the true meaning. The appropriate tools, processes, and data lead to the desired outcome based upon the selected methodology for answering the research questions, design validity for the methodology, sample and data analysis appropriateness, and sample and context validity is supported by the results and the conclusions of the study (Leung, 2015). Proper respect and protection of participants require that a study has proper reliability and validity (Vanclay, Baines, & Taylor, 2013). Reliability and validity correlate to participant protection; as such, my study employed

the use of data triangulation as a process within validity to ensure that participants are protected. Data triangulation is one way of many to discover multiple levels of the phenomenon in a study and ensure reliability and validity by employing various external collection methods and analysis within the study (Bjorgvinsdottir & Halldorsdottir, 2014). Therefore, to ensure the trustworthiness of this study, credibility, transferability, dependability, and conformability are further described here as aspects of reliability and validity of this study.

Credibility

Credibility in qualitative research is essential in order for any substantial findings to be utilized as a foundation to establish confidence that the results are true (Forero et al., 2018). Felt, Igelsböck, Schikowitz, and Völker (2013) remarked that research should also encourage collaboration with non-scientific partners as part of finding solutions to societal problems, not just as in concepts of translational research. Forero et al. (2018) further state assessment of creditability and confirmability by use of Four Dimensions Criteria (FDC) established by Lincoln and Guba as part of assessing rigor and quality in establishing trustworthiness. The quantitative analysis offers empirical results and is the truth in data from the participant views and representation as presented by the researcher (Cope, 2014). As part of credibility, it is important to identify all possible interpretations, understandings, or misunderstanding in research to avoid omission, which could minimize credibility and reduce the overall credibility of the study being conducted and potential those studies that do not omit contextual studies (F. L. Schmidt, 2017). Therefore, credibility in qualitative research requires techniques as part of strategies as in

providing credibility of given research, such as prolonged engagement with participants, observation as detailed or limited as necessary, debriefing, reflection, and verification followed by a reevaluation of data in an iterative process (Connelly, 2016). Credibility in research is more than just ensuring the legitimacy of data; it is essential to view credibility from differencing aspects to provide legitimacy to the research being conducted (Hays et al., 2016). As such, it is essential to depict the participants and their strategy used accurately and well as identifying the strategies not used in supporting the credibility of the research results in identifying the strategies used by senior IT leaders in eHealth adoption. My role as a researcher is to mitigate any misunderstandings during the interview process. Additionally, a review of recorded interviews, transcription, and recheck was applied to ensure bias was avoided and corrected, as necessary. Finally, to address this section on credibility and my role, it was necessary to have my peers review my interview questions by establishing a review panel to ensure alignment with my study and they do not contain any hint of bias that would have resulting to the invalidation of my research. As part of the panel review process, it was necessary to establish an interview protocol that not only reviews the interview questions but also establishes the framework in conducting member checking as part of bias mitigation.

Transferability

Transferability is another aspect of the role of the researcher. Houghton et al. (2013) refer to transferability as the ability to ‘transfer’ findings of one research analysis to another and still maintaining the meanings and inferences. Also, Morse (2015) noted transferability as transferring the conclusion of a study to another context or research.

According to Connelly (2016), transferability in qualitative research is the ability to focus on participants and the story being told without lumping all participants in one study as part of rich, detailed description of the participants while being transparent with regards to the conclusions of the study. Transferability is an important part of strategically approaching rigor in qualitative research as one aspect of the framework. Therefore, the transferability of this study requires the ability to apply the findings of this study to another study yet maintaining the appropriate context of the study. It was necessary to ensure that the conclusions of the strategy used or not used are coherent or explicitly stated, along with the steps identified that were taken to conduct this and ensure it is reproducible.

Dependability and Confirmability

Houghton et al. (2013) explained the concept of dependability in qualitative research as the reliability of the data in the analysis. Therefore, to support reliability, replication is an important aspect of conducting studies (Gall & Maniadis, 2018). Dependability is an essential strategic component to ensure the validity of the analysis from the data obtained. As such, according to Constantinou et al. (2017), to meet dependability in qualitative research, it is necessary to describe the design, data, coding, and analysis in a manner that is repeatable by other researchers. Data collected in this study must be dependable to validate research theories and concepts accurately, or else erroneous results may prevent furthering of proposed concepts and conclusions identified. Therefore, data collected was appropriately designed to be reproducible in the future in identifying strategies used by senior healthcare IT leaders. For my study, data

was securely organized in the following categories: interoperability issues, experience, belief, and knowledge of implementation of interoperable HISs.

Confirmability relates to the data collected, and assuring the responses is that of the respondents and not the bias of the researcher, which can be supported by detailed conclusions from the respondents in the form of direct and indirect quotes (Cope, 2014). Confirmability is essentially objectivity in the study (Constantinou et al., 2017). Confirmability is the assurance of the collection of data in a neutral capacity and is auditable of the collection and analysis process of the study (Carnevale, 2016). Confirmability is yet another strategic aspect of research applied during data analysis. Therefore, researchers need to ensure confirmability by mitigating personal bias and utilizing strong supporting themes proposed by participants in the study. This study required the assurance of audibility of the data collected and analysis of the interviews conducted on strategies. While it is not possible to negate complete bias, it is important to recognize the bias that was brought into the study from my experiences serving in the U.S. Coast Guard. However, attention to detail, leadership roles, and the experience working in the medical field and the oaths taken, such as the Hippocratic Oath, play an integral part in how my study was conducted. Therefore, it was necessary to seek peer-reviewed evaluation of my protocols in mitigating bias and that the questions and the data collected confirm by means of objective review and the data collection and analysis is auditable.

Transition and Summary

Section 2 detailed my research approach, identified my data collection methods and approaches, and addressed ethics and protection of data in my study. Section 3 further describes my study, my findings, and the analysis of the data collected in section 2. Section 3 first presents my findings explore further on my themes obtained in my data collection process and all relationships in understanding the adoption strategies of senior healthcare IT leaders and its implications for social change, application to professional practice, and recommended actions. Finally, section 3 outlines my recommendations for future study with regards to my findings, reflections of my study process, and final summary and conclusions.

Section 3: Application to Professional Practice and Implications for Change

My study addressed strategies in the adoption of interoperable eHealth systems by senior IT health care leaders to identify how current organizations use the strategies in the adoption process. Moreover, I explored whether a formal or informal strategy was used in the adoption process, or whether the strategy was developed based on criteria discussed in committee and then used to develop a strategy as the implementation adoption process proceeds. This section includes an overview of the study, presentation of the findings, applications to current professional practices in the adoption process, implications for social change, recommendations for further research, reflections on the study, and a conclusion.

Overview of Study

The purpose of my qualitative case study was to understand how senior health care IT leaders applied and implemented the interoperable electronic health care systems across disparate health care organizations. Data were collected from senior health care IT leaders at health care organizations in the eastern United States who had experience with implementing interoperable electronic health care systems across disparate health care organizations. The results indicated the degree of acceptable integration based on levels of predefined strategies for each of the participant organizations, the degree of external/internal factors and the requirements for variations of interoperable HIS implementation, the HIS needs, and the type of formal or informal strategy used as part of the implementation process. Some participant organizations have indicated that implemented HIS systems are not meeting organizational goals based on predetermined

limitations and needs. Other participant organizations have reported that implemented HIS systems are meeting organizational goals based on predetermined limitations and needs. Some participant organizations are transitioning to a more integrated HIS or are reviewing and enhancing recently implemented interoperable HISs. Finally, participants indicated that a defined formal strategy at the beginning of the implementation process varied in definition and degree of strategic planning. The lack of a defined strategy does not mean that a strategy or strategies are not in use in the implementation of an interoperable eHealth system. In many cases, the participants' strategies were developed to varying degrees and needs (but not formally defined) among the organizations as the implementation process proceeded. The strategies were based on multiple stakeholder communications throughout the HIS implementation process. The lack of thorough, comprehensive planning and a comprehensive structural HIS negates optimal outcomes for the implementation of an interoperable HIS.

Presentation of the Findings

In this section, I discuss the six themes identified in my study. The purpose of the study was to answer the following research question: What are strategies senior healthcare IT leaders use to implement interoperable electronic health care systems across disparate health care organizations? Identifying whether a strategy was defined, adopted, and followed versus developed and discussed during the implementation process may provide useful knowledge to senior IT leaders before the adoption process. Participants reported that they had a strategy, although in some cases it was not formally defined. Additionally, all participants reported shortcomings in the implementation of the

needs of the current system. These shortcomings then became lessons learned in many cases and prompted further discussion of the need to address these previously unknown or realized shortcomings post-implementation. I used a semistructured interview protocol to collect data on the adoption process, strategies (formal or informal), success, characteristics or criteria needed or established for the adoption process, and the implementation of an interoperable eHealth system. Interviews were conducted with senior IT management, including directors, CIOs, senior vice presidents, and project management staff.

An interview summary (with additional questions as needed) was sent to all eight participants. Two additional follow-up recorded interviews were conducted for data saturation. Data triangulation included member checking and documents requested from all participants in the study. Additional publicly accessible documents specific to the participant organizations were searched using Google and other search browsers. Due to contractual obligations and accessibility issues, many documents could not be provided for review. Document searches in Google were based on key terms related to the participants, (e.g., *names, HIS, interoperability, adoption, IT frameworks, meaningful use, governance, implementation practice*, and similar terms). Terms were then mapped in combination with DeLone and McLean's IS success dimensions (i.e., name + system; quality + data + governance + strategy). Searches revealed 14 usable documents. Available documents included research documents, presentations, after-action review documents, publicly accessible planning documents, and government reports. The

inclusion of documentation was used as a methodological triangulation approach to verify accuracy of data collected.

A review of all documentation in Atlas.ti was conducted, including 14 documents from online databases plus 10 transcribed interview documents. According to Friese (2016), codes can be descriptive and conceptual and can be developed from a list or developed from scratch as the researcher reviews the data. For each document, I scanned for the following keywords: *strategy*, *integration*, *interoperability*, *issues*, *happy*, *problems*, meetings, discussions, success, formal, informal, stakeholders, patients, workflows, quality, information quality, service, service quality, health information systems, system quality, EHR, reporting, reports, plans, meetings, approach, satisfaction, matrices, health reporting, user experience, use, user intent, EHR documentation, networks, factors, external, internal, regulations, and infrastructures. Keywords, sentences, and paragraphs were highlighted and marked when they were of high interest. Search and review of the listed keywords led me to see similarities among the identified keywords, phrases, sentences, and paragraphs.

After condensing and combining similar codes, I identified the following themes: (a) eHealth ecosystem, (b) implementation approach, (c) quality, (d) strategy, (e) use/intent to use, and (f) user satisfaction. These six themes provide insight into components that frame strategies for implementing or adopting an interoperable eHealth system. Among the themes that emerged, quality (service, system, and information), use/intent to use, and user satisfaction are dimensions of DeLone and McLean's IS model. The final condensed themes were evaluated against each other, using the

cooccurrences feature in Atlas.ti to understand and identify the overlapping themes. Atlas.ti allows for identifying coded themes in an overlapping manner with a frequency grounded count of the cooccurrences and is beneficial for looking at the frequency count as part of exploring the data (Friese, 2019). Additionally, the grounded count relates to the density of themes. The densities in Atlas.ti indicate how the code qualities of themes relate to one another and the other elements (Friese, 2019). Identifying overlapping codes was important in comparing the interview statements from P1-P8 and the accessible documents to understand how organizations were approaching the implementation of eHealth systems with strategies.

Additionally, the c-coefficient is another analysis tool in the cooccurrence table tool in Atlas.ti that indicates the strength of the relationship between themed codes like a correlation coefficient. The c-coefficient is calculated as $c = n12/(n1 + n2 – n12)$ with a range of 0 (codes do not cooccur) and 1 (two codes cooccur when used) but is only valid in cases in which there are large data sets or large numbers of quotations per case (Friese, 2019). The cooccurrence table is ideal for understanding the overlapping themes, and the use of c-coefficient is appropriate to use based on the 600 plus quotations identified across the data set (eight interview transcripts, two follow-up interview transcripts, and 14 accessible documents).

As part of the analysis, eHealth ecosystem, implementation approach, and strategy were adopted as new dimensions in the DeLone and McLean conceptual framework attempting to explain relationships among themes and confirm success in the adoption and implementation of an interoperable eHealth system. The flexibility of the

DeLone and McLean success model includes identifying and suggesting dimensions necessary to provide an evaluation of benefits and success to users (Shim & Jo, 2020). Figure 4 illustrates how in the DeLone and McLean success model, the net benefits are influenced by the original dimensions and how the dimensions are relatable to both the implementation approach and the strategy. Figure 4 also illustrates how both are influenced by the overall perceived net benefits.

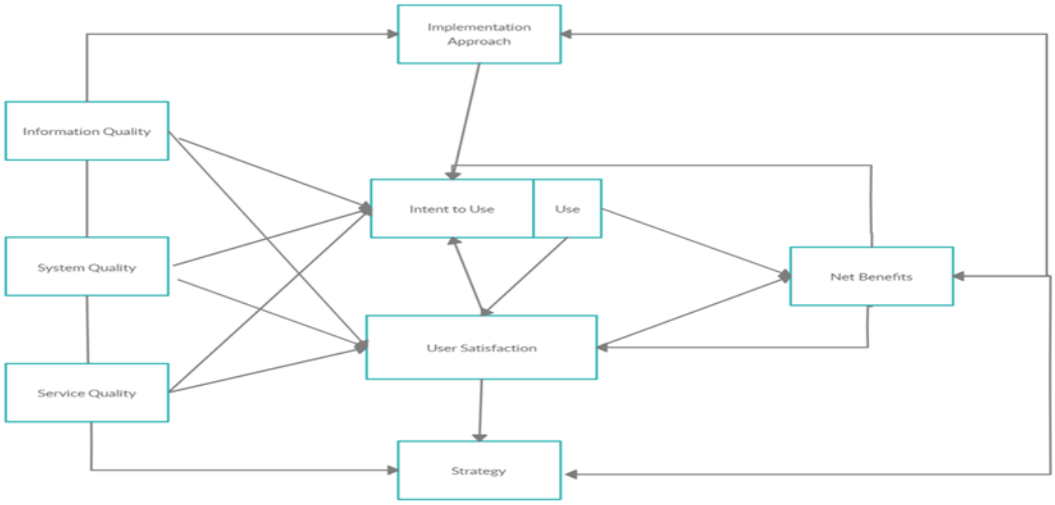

Figure 4. D&M IS success model 2016 update. This model has been further adapted to show the feedback between implementation approach and intent to use, the three qualities to implementation approach, how the three qualities feedback to strategy, and how both strategy and implementation approach feedback to net benefits. Adapted with permission from "Information Systems Success measurement," by W. H. DeLone, & E. R. McLean, 2016. *Foundations and Trends in Information Systems, 2*(1), p. 10. doi:10.1561/2900000005. Copyright by W. H. DeLone and E. R. McLean 2016. Reprinted (adapted) with permission.

Theme 1: eHealth Ecosystem

The first theme was eHealth ecosystem. Four components of an eHealth ecosystem were identified: regulations, providers, patients, and systems. P1-P8 identified and addressed each component of the defined eHealth ecosystem theme from a self-

applied strategy for implementation and adoption of an interoperable eHealth system. For example, P3 noted that

> external stakeholders are a big influence on ensuring that we are using and utilizing the system as an organization in the way it was intended to meet design, the application of design, and how those application designs were intended to be used and met the global regulatory landscape.

During the analysis of interviews and documentation, initial theming started with identifying and highlighting the correlation of crucial implementation concepts that cooccurred as part of what the participants defined as a strategy as part of the implementation process. The highlighted themes were then grouped, defined, and condensed under a single theme for a more concise theme organization: eHealth ecosystem. Table 2 identifies the associated eHealth ecosystems coded themes with correlation to all identified themes from the study analysis.

Table 2.

Cooccurrence Table for Theme 1: eHealth Ecosystem

	Grounded count	Coefficient
Implementation approach	73	0.28
Information quality	3	0.02
Interoperability issue	26	0.14
Net benefits	5	0.03
Service quality	1	0.01
Strategy	53	0.17
System quality	11	0.06
Use/intent to use	22	0.10
User satisfaction	10	0.05

The grounded counts of each theme in the grounded count column list the number of times each of the themes appeared across the curated data, and the coefficient column lists the c-coefficient describing the depth of strong correlation of the coded themes to the overall eHealth ecosystem theme. Identifying the ground count and the coefficient indicated how much similarity and density there was among the themes listed in the eHealth ecosystem theme. The eHealth ecosystem was identified as a theme after combining multiple identified quotes and codes of similarity with coding occurring 132 times across P1-P8 documentation and interviews.

Table 3 shows the absolute and relative frequency coding for the eHealth ecosystem theme. The code-document table includes the participants' discussion on each

component as part of the implementation of an interoperable eHealth system. Table 3 shows that all participants discussed concepts listed under the theme eHealth ecosystem; however, P1, P2, P3 (Interview Transcript 2), P4, P5, P8, Document 1, Document 5, Document 6, and Document 12 showed higher grounded with a minimum of 10 codes on the lower end and 45 on the high end. Only one document did not include eHealth concepts as part of the discussion.

Table 3.

Code-Document Table for Theme 1: eHealth Ecosystem

Participants= 132	Absolute	Table-relative
Participant_1_interview_transcript (gr=40)	10	7.58%
Participant_2_interview_transcript (gr=18)	2	1.52%
Participant_3_interview_transcript1(gr=7)	1	0.76%
Participant_3_interview_transcript2(gr=13)	10	7.58%
Participant_4_interview_transcript (gr=12)	9	6.82%
Participant_5_interview_transcript (gr=17)	5	3.79%
Paticipant_6_interview_transcript (gr=4)	1	0.76%
Participant_7_interview_transcript (gr=7)	2	1.52%
Participant_8_interview_transcript (gr=25)	4	3.03%
Document1 gr=11	10	7.58%
Document2 gr=1	1	0.76%
Document3 gr=7	7	5.30%
Document4 gr=1	1	0.76%
Document5 gr=21	5	3.79%
Document6 gr=15	11	8.33%
Document7 gr=2	2	1.52%
Document8 gr=5	5	3.79%
Document12 gr=203	45	34.09%
Document14 gr=10	1	0.76%
Totals	132	100.00%

In Figure 5 below, the semantic linkage describes the density of all coded themes identified to the eHealth ecosystem theme. The density takes the grounding and shows the depth of the relationship of the themes to the specific theme eHealth ecosystem. In Figure 5, it is important to note three main themes: implementation approach, strategy, and interoperability issues related to the eHealth ecosystem theme. The implementation approach theme has a semantic linkage density of five with a grounding of 201. The theme interoperability issues have a grounding of 86 and a semantic linkage density of four. Finally, the theme strategy has a grounding of 237 and a semantic linkage density of five. The selection of the three themes is justified and described here: the theme implementation approach is considered a part of an eHealth ecosystem, the theme interoperability issue is considered associated with an eHealth ecosystem, and theme strategy is considered a property of the eHealth ecosystem theme. The three strongly related cocoefficient themes, implementation approach (0.28), interoperability issue (0.14), and strategy (0.17), all have a direct relationship to the eHealth ecosystem.

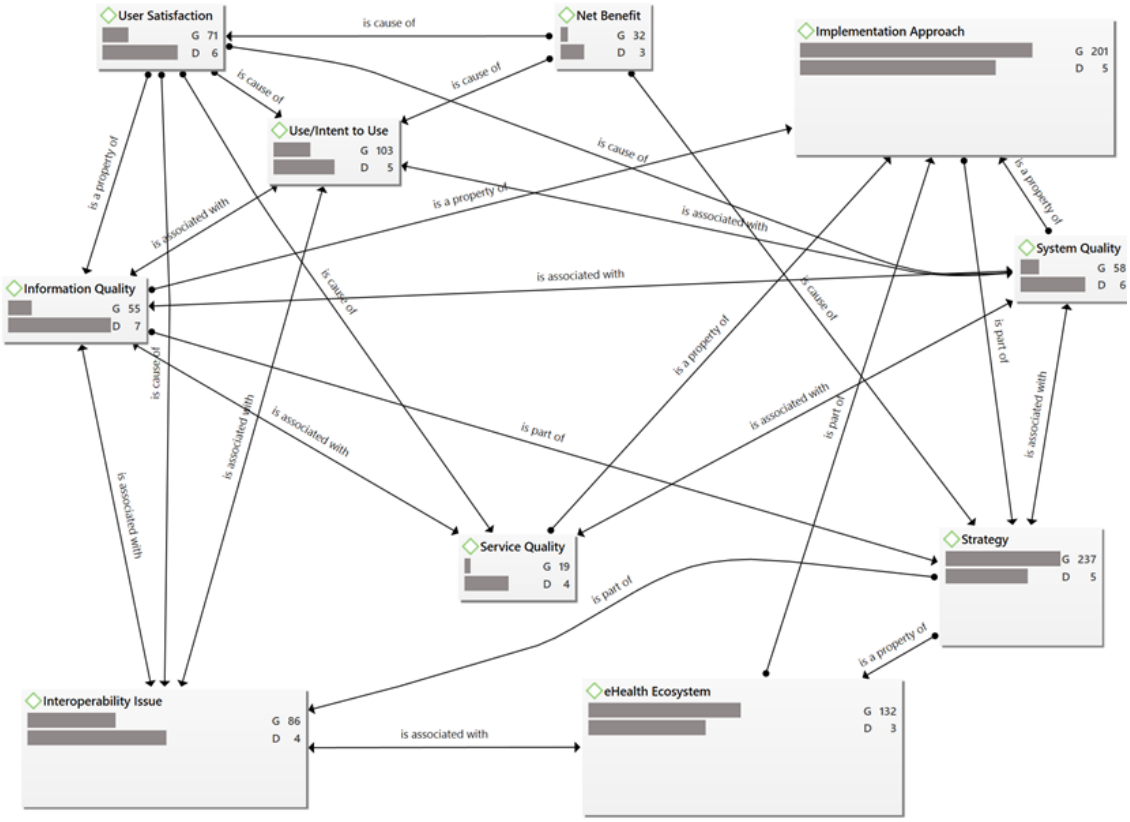

Figure 5. eHealth ecosystem semantic linkage. The semantic linkage shows the grounding and density of the linkage between eHealth Ecosystem (with a density of 3) and all remaining themes. Each of the themes identifies the grounding (total quotations) in each theme.

Regulations. A strategy incorporates concepts and ideas needed to reach a goal: the successful implementation of a HIS. Information governance correlates to the regulation concept of the theme eHealth ecosystem. Regulations directly correlate to covering the healthcare data of patients by healthcare providers and how they support the theme eHealth ecosystem. There are many unique factors and dependencies on the external system or processes that can inhibit successful adoption and the realized benefits of an eHealth system if not adequately addressed (Metcalf-Rinaldo & Jensen, 2016). For example, according to Coffey, Starr, Lardner, and McKeeby (2018), robust data

governance policies that included technical and policy decisions as part of the information governance program are necessary to support the implementation process. For example, P4 noted,

> there are a number of federally mandated rules and regulations on how to handle medical records, the appropriate handling form a security perspective and other regulations and agreements form insurance payers requirements that take into account how you strategize the implementation process.

Therefore, data governance was and is an essential part of strategic planning, development, and implementation of a HIS.

Interviews and documentation curated and further reviewed from the P1-P8 participants, including the 14 searched documents, identified varying degrees of frameworks, discussions on data governance, data capture needs, business plans, and the need to follow regulations established locally and nationally. P8 noted external influences such as government regulations requirements. From a high-level perspective, there were and are overarching issues for each component of the eHealth ecosystem, especially regulations. Participant 1 noted, “external factors are really critical” and “got us a jump-start” in interoperable HIS adoption. P1 confirmed regulation as part of the discussion by noting, “so, the first thing that got-us [is] a kickstart, was definitely regulatory.” P4 noted that there were several “federally mandated rules and regulations on how to handle medical records and the appropriate handling from a security standpoint.” Noted by P2, “…the degree of regulations was identified as a complication” and “that our IT security

team had to ensure it met federal requirements" for HIPAA and Privacy regulation in healthcare. P2 noted the degree of regulations that exist around HIS implementation. P2 further stated, "and you know, that's a big external force that you need to account for when developing strategy." P3 noted there are "State and Federal mandates and legislations, for example, from the Center for Medicare System (CMS)." P4 further notes, from a stakeholder perspective, regulatory goals outlined are a big influence on how the system is designed and used. Participants listed key concepts as components of the eHealth ecosystem theme, which are essential concepts of a strategy that needed to be addressed in the implementation of their respective HIS. Therefore, addressing these regulations was discussed among the various stakeholders and participants during the implementation process. Regulations are an essential influence on the adoption process and what must be identified before the implementation process.

Providers and patients. In addition to regulatory teams and technical teams, providers and patients are additional components of the eHealth ecosystem. P3 noted, "there was a need for implementation, internal alignment from multifunctional areas; engagement from all departments was necessary/required." HIS is a multilayered healthcare tool used to manage multiple facets of a patient's healthcare needs. For example, aspects of a HIS include disparate hospital data, utilized for a diversity of tasks, departmental preferences, philosophies of the developer (UI/UX, connectivity, layout, and other similar perspectives), and legal and administrative aspects from internal and external influencers (Bouidi, Idrissi, & Rais, 2017). As identified during the interviews with P1-P8, discussions across patients and providers were identified as top priorities in

the successful adoption and implementation process of an eHealth system. Noted by P3, "patient safety is key; therefore, it was important to know everything about the system and that training and support were implemented." Discussions and collaboration among multiple stakeholders were conducted and separated, depending on the needed level of involvement in the discussions. As P2 noted, technical teams and senior-level stakeholders benefited from the discussions because of the need and understanding of the underlying system requirements for the system development. P2 additionally identified that the success of the focus groups was attributed to the efforts of interdisciplinary teams that helped manage the process. P2 further supported that there was a high level of engagement from participants as they "felt they were being heard about what their requirements and needs were." P4 noted, "…there is a lot of dependency on external, knowledge-based stakeholders." P3 noted, there are "different stakeholder groups, ranging from clinical and nonclinical" as part of the strategy development process. Fundamentally, any feedback, satisfaction, ease of operations, improved patient outcomes from stakeholders must be a mandatory factor when creating an eHealth system. Therefore, providers and patients fit as a component of the eHealth ecosystem theming.

Systems (network). There are two crucial aspects to the implementation of an interoperable eHealth system from a systems perspective. Participants must consider the implementation of the current systems limitations, use, and third-party vendor integration. For example, P8 noted, "exchange of patient medical data is not seamlessly done (electronically), meaning there is faxing and or printing involved in many situations." With vendors, systems were either limited or robust, depending on the

organizational goals and costs. Some of the participants had limited options from vendors. Even with limited vendor selections, many participants were able to modify options to meet organizational goals. P2 noted that there was not the option of selecting a specific system "because the EHR vendor was selected under contract, and the selected vendor already developed the identified level of interoperability components." Additionally, some of the P1-P8 noted the organizations did not have the option of selecting an EHR due to the selection limitations of EHR vendors and, ultimately, the goals established at different department levels and not always with input from the information technology department within the organization. Other participants, for example, P2, P7, and P8, further noted vendors were evaluated based on needs and goals.Not all system functionality can meet the needs of the organization. P3 noted, "it is not realistic for once the system is implemented for all components of the system to be used and that is why it is important to ensure basic functionality and workflow is used based on planning." In many cases, the vendor provides an off the shelf version with basic functionality, which can be altered and enhanced to meet goals established by the organization. However, P2 further noted that "it was important to look for is usability and that they were easy enough to be used." When functionality and usability situations arose among the participants, it was noted and documented by P1-P8 that there was a need to match the workflow of the third-party vendors' system yet customize the system to meet the participant's needs and goals. For example, for P2, "some of the off-the-shelf functionality can and cannot be used, as an example, pay systems, so modification was necessary." The points identified by the participants are part of the selection process,

regardless if there was input from all stakeholders. Therefore, identifying systems as part of a strategy show a strong positive association with the eHealth ecosystem theme as a whole and the importance of including it for the implementation process of an interoperable eHealth system.

Publicly accessible online P1-P8 documentation, including research studies and organization studies, identify the importance of governance, regulatory compliance, and patient needs. For example, Lardner (2017) identified that patient portal access is a component of the meaningful use regulation requirement and that use of patient portals shows some limited promise with improved outcomes. For example, P3 identified that in the planning stages, there were a lot of discussions and decisions on the configuration of the EMR systems to ensure compliance and use." Schoenbaum (2019) further identifies that due to the pressure from ONC regulation requirements, the healthcare landscape is developing delivery models that hold providers accountable for the coordination of patient care. As discussed here, the components of the eHealth ecosystem theme (systems, regulations, providers, and patients) are necessary to assist with the implementation process.

eHealth ecosystem theme support. Current literature identifies that interoperable eHealth systems are comprised of core systems collecting various types of data, deriving information to support patients and providers in efficiently and effectively providing health care services (Dobrow, Bytautas, Tharmalingam, & Hagens, 2019). The eHealth ecosystem is comprised of many components that senior leaders need to identify, then address as part of a strategy in the adoption and implementation process of a HIS. The

DeLone and McLean IS success model dimensions of service quality, information quality, system quality, use/intent to use, and user satisfaction are meant as means to evaluate implementation success. Therefore, the use of the dimensions to measure against the eHealth ecosystem can help frame a successful system that can be implemented supporting the data needs and achieving the goals of all stakeholders. Before the adoption and implementation of an interoperable eHealth system, organizations need to develop a detailed plan encompassing all stakeholders, selection of all technologies, financials, regulations, and goals to support access and structure a solid foundation for the implementation of an interoperable eHealth system (Stratis Health, 2020). According to The HCI Group (2020), early and detailed planning with clear defined scopes, governance, and detailed documentation are essential aspects of the implementation process. Along with education and understanding that there are existing flowcharts, checklists, and implementation templates by which organizations can begin to organize and frame an interoperable eHealth system is part of the strategy development. Even in situations among the participants where developed plans were limited based on predetermined levels of interoperability needs and implementation discussions, key listed topics mentioned were identified.

Lambley and Kuziemsky (2019) suggest that the health ecosystem is comprised of human and social diversity, the organizational culture which cannot be separated from the implementation strategies of a HIS, and the technology associated with these systems. Essentially each HIS needs to be created and developed with interoperability in mind. Each component of the eHealth ecosystem (systems, regulations, providers, and patients)

correlates, to some degree, to the theme codes identified as part of and a requirement of the implementation process. As another example of support for the theming, the Maryland Health Care Commission was created and commissioned a report from key stakeholders in the adoption and implementation of a prescription medication history for patients. Each suggested recommendation from the report identifies systems (in the form of vendors technology), regulations, and provider input, with the end goal of patient support and enhancement (Maryland Health Care Commission, 2019). The use of the eHealth ecosystem theme applies to listed components that are necessary for the implementation of a HIS.

Theme 2: Implementation Approach

Information quality, interoperability issue, net benefits, service qualities, strategy, system quality, use/intent to use, and user satisfaction are used as dimensions in the analysis of the implementation approach. The implementation approach was identified as a theme with coding occurring 201 times among the combined participants in the conducted study and documentation reviewed. P1-P8 identified multiple factors as part of the implementation process. One specific component of HIS implementation among P1-P8 from documentation reviewed, identified that all payers regulated by the CMS are required to share health data with patients through an electronic system and promoting patients' ability to access their health-related data via an electronic portal. P8 noted that there were "granular and tactical decisions made at the onset, especially when a patient is transitioned to our care; it is necessary to identify and develop proper provider workflow in HIE." Participant 7 stated, "because you were concerned about physicians using the

system as well as the patient using the system," patient and providers perspective were prominent in the implementation process. This section will describe how the identified themes support the implementation approach as a theme in adopting an interoperable eHealth system. Table 4 identifies the cooccurrence coded themes with correlation to the identified themes from my analysis

Table 4.

Cooccurrence Table for Theme 2: Implementation Approach

	Grounded count	Coefficient
eHealth ecosystems	73	0.28
Information quality	17	0.07
Interoperability issue	26	0.10
Net benefits	8	0.04
Service qualities	3	0.01
Strategy	151	0.53
System quality	20	0.08
Use/intent to use	33	0.12
User satisfaction	18	0.07

The most substantial relationship for the theme implementation approach is seen between the themes, eHealth ecosystems (0.28), strategy (0.53), interoperability issue (0.10), and use/intent to use (0.12). While the other themes are essential, they have a weaker bond attraction at less than (.10) closer to zero to the implementation approach of a HIS system. For example, P5 stated that the "strategy used was just a culmination of different discussions that helped identify a solution for any type of known current interoperability issues." P7 noted that implementation is "driven by the strategy of the organization to get better data, to make better decisions, to provide better care, so it makes sense to have data streamlined." Furthermore, in reviewed documentation it was

noted improving interoperability impacts usability of a system. Table 5 describes the absolute and relative frequency coding for the Implementation Approach theme describing the significance and lists the participants' discussion and documented importance on each component as part of the implementation process. Implementation approach as a theme occurs relative highest among P1 (4.98%), Document1 (5.47%), Document11 (6.97%), and Document12 (47.26%).

Table 5.

Code-Document Table for Theme 2: Implementation Approach

Implementation approach gr=201	Absolute	Table-relative
Participant_1_interview_transcript gr=40	10	4.98%
Participant_2_interview_transcript gr=19	2	0.99%
Participant_3_interview_transcript_2 gr=13	1	0.50%
Participant_3_interview_transcript_1 gr=7	1	0.50%
Participant_4_interview_transcript gr=12	2	0.99%
Participant_5_interview_transcript gr=17	2	0.99%
Paticipant_6_interview_transcript gr=4	0	0.00%
Participant_8_interview_transcript gr=25	5	2.49%
Participant_7_interview_transcript_2 gr=16	3	1.49%
Participant_7_interview_transcript_1 gr=7	4	1.99%
Document1 gr=11	11	5.47%
Document2 gr=1	1	0.50%
Document3 gr=7	7	3.48%
Document4 gr=1	1	0.50%

(*table continues*)

Table 6. Code-Document Table for Theme 2 Implementation Approach (continued)

Implementation approach gr=201	Absolute	Table-relative
Document5 gr=21	4	1.99%
Document6 gr=15	9	4.48%
Document7 gr=2	2	0.99%
Document8 gr=5	3	1.49%
Document6 gr=15	9	4.48%
Document7 gr=2	2	0.99%
Document8 gr=5	3	1.49%
Document9 gr=12	9	4.48%
Document10 gr=8	8	3.98%
Document11 gr=14	14	6.97%
Document12 gr=203	95	47.26%
Document13 gr=11	2	0.99%
Document14 gr=10	5	2.49%
Totals	201	100.00%

The semantic linkage of all the theme implementation approach to the frequency of the coded theme is seen by viewing Figure 6. The semantic linkage is important in describing the density of the themes to each other. The density takes the grounding and shows the depth of the relationship of the themes to the specific theme implementation approach. In Figure 6, the main themes are: eHealth ecosystem, service quality, information quality, and system quality as they relate to the implementation approach theme. The implementation approach theme has a semantic linkage density of five with a grounding of 201. The selection of the theme service quality is considered a property of

the implementation approach. The theme information quality is a property of the implementation approach. The theme eHealth ecosystem is a part of the eHealth Implementation approach theme. The implementation approach theme has a density relationship of five to eHealth ecosystem, service quality, system quality, and information quality themes. These four main themes have relationships in some form to another theme: system quality is associated with use/intent to use, which is a property of the implementation approach and is associated with service quality. Additionally, service quality has an association with information quality, which has an association with the interoperability issue, which is then associated with eHealth ecosystems. The Implementation approach theme is a part of a strategy that is also associated with qualities. For example, P1 noted that service quality was important to ensure support of the system, communication, and knowledge to users. These themes are further discussed as they relate to the implementation processes in this section.

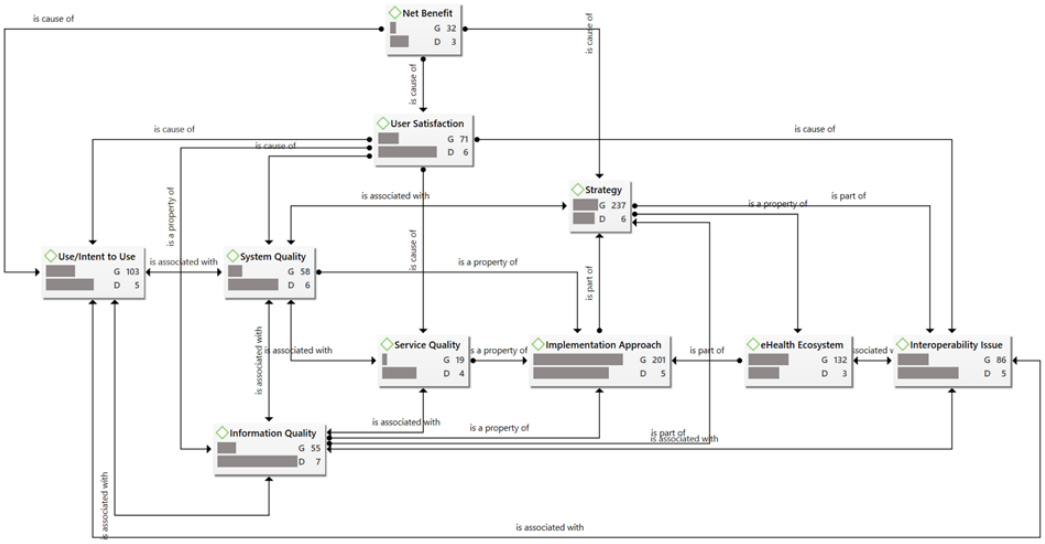

Figure 6. Implementation approach semantic linkage. The implementation approach semantic linkage shows the grounding and density linkage between the theme, implementation approach (with a density of 5), and the remaining themes. Each of the themes identifies the grounding (total quotations) in each theme along with the c-coefficients.

P1 noted, "we had a vision of how we wanted the interoperable information to be used, ensuring the proper technical requirements with user-defined workflows, and the right technology in place with proper knowledge and usage and support process." The implementation approach of a HIS is unique to each organization with possible similarities, and variations in documented details, as well as differences in perspectives among organizations' participants and the participant levels in the organizations (National Rural Health Resource Center [The Center], 2012). In all cases, participant organizations were aware of goals and, in some cases, significant awareness of and identified aspects of what they wanted or needed in a system. For example, P2 noted, "we did not have to build any special interfaces; it was part of the same system, which saved time and costs and was easier to manage." According to The HCI Group (2017),

understanding your HIS structure and planning before developing a strategy is the essential aspect of implementation, specifically when building records. P5 stated it was essential to "gather all the possible information to determine what EMR was the best solution for all." In all cases, participant organizations in this study were aware of goals and, in some cases, significant awareness of and identified aspects of what they wanted or needed in a system. For example, P2 noted, "we did not have to build any special interfaces; it was part of the same system, which saved time and costs and was easier to manage."

As part of the implementation approach, stakeholder communication is essential in an ongoing basis with regular identification of goals (Chesapeake Regional Information System for Our Patients [CRISP], 2009). For instance, P4 noted, HIS implementation is not a frequent occurrence, so there is a significant dependency on external knowledge and communication with stakeholders." Publicly accessible online P1-P8 documentation identified the significant importance of communication that correlates to understanding the level of interoperability for the organization, stakeholder engagement, customization of systems, and the drivers in HIE promoting interoperability. Planning and design and implementation of an architecture type to meet implementation needs are essential (Wong, 2018). For example, P5 noted, one part of the strategic approach "was to roll out over time to different centers allowing for flexibility and assistance to other centers."

The commonality for P1-P8, communication of system implementation, was centered around discussions from stakeholders in a step-by-step process or general

discussion mapped to the necessary levels of implementation goal achievement. P1 noted, "we started with little bits of pieces of data to ensure that we had that correct… a handful of data so that we can exchange before we started adding additional data, like results." Customization of systems is important (The HCI Group, 2017). The system implementation process was specific to meet individual needs for many of the participants. P3 noted, "[We] had to ID specific components and find workarounds for other aspects where integration was not possible." In similar, P1 noting, "taking special effort to make sure that there is alignment with the goals of the implementation." The achievement of goals mentioned by P1 is identified by the development of policies and procedures guidelines. For example, Chesapeake Regional Information System for Our Patients (CRISP) outlines specific policies and procedures that include definitions of users, access, passwords, systems operations and specifications of data for organizations that intend to participate in the exchange of health information among disparate hospital systems (CRISP, 2019b). The use of a policy and procedure manual is, therefore, an important component of the implementation process and identifies the alignment of goals with the implementation process.

Implementation should be evaluated from a pre- and post-implementation perspective for misalignments, and continuous business and system improvements (Peng & Nunes, 2017). Participant 3 noted, "internal alignment of multifunctional areas and engagement form all departments was necessary as part of the implementation process." P2 and P4 noted, matrices were monitored to ensure alignment and success. According to Nugroho and Prasetyo (2018), the DeLone and McLean Success model is to identify and

help the organization frame the implementation process and determine the post-implementation success by evaluating and understanding the needs and values of users to maximize functionality and net benefits. P1-P8 and documentation reviewed identified that providers and patients, or users of different types should be involved in the implementation process to ensure success by identifying satisfaction. According to P1-P8, this can also include "provider workflow refinements." Therefore, the implementation approach from the perspective of the conceptual framework can define success based on the attributes evaluated.

Theme 3: Quality (Information, Service, and System Quality)

Quality was the third theme that emerged from the research analysis. Quality encompasses three components: information, service, and system quality. P5 noted, "accuracy in the database of all the providers and their notes [patient information]." P8 noted, "everything is sort of framed around service quality." P1 noted, "getting the right patient information- that was really important." Table 6 displays the cooccurrences and grounding of the coded themes for quality. There have been 55 identified cooccurrences of information quality, 19 cooccurrences of service quality, and 58 cooccurrences of system quality across the participants. The grounded counts of each theme in the grounded count column list the number of times each of the themes appears across the curated data, and the coefficient column lists the c-coefficient describing the depth of strong correlation of the coded themes to the overall quality theme. Identifying the ground count and the coefficient determine how much similarity and density there is for and among the themes listed in the eHealth ecosystem theme.

Table 7.

Cooccurrence Table for Theme 5: Quality

	Information quality grounded count	Coefficient	Service quality grounded count	Coefficient	System quality grounded count	Coefficient
eHealth ecosystems	3	0.02	1	0.01	11	0.06
Implementation approach	17	0.07	3	0.01	20	0.08
Interoperability issue	9	0.07	1	0.01	13	0.10
Net benefit	6	0.07	1	0.02	5	0.06
Strategy	11	0.04	6	0.02	11	0.04
Use/intent to use	30	0.23	9	0.08	33	0.26
User satisfaction	25	0.25	10	0.13	24	0.23

All three themes show association to each other with near close densities (7, 4, and 6). The densities of the three themes also show relation to user satisfaction (6), use/intent to use (5), strategy (4), implementation approach (4), and net benefits (3). The density takes the grounding and shows the depth of the relationship of the themes. The main themes that describe the most grounding to the theme quality include implementation approach, strategy, use/intent to use, and user satisfaction. In Figure 7, the themes user satisfaction and use/intent to use relates strongly to the theme quality. Figure 7 describes the degree of relation to one another, and each identifies the frequency count for the coded emerging theme quality overlapping the other themes. This section further describes the role of all three qualities as part of strategic development in the implementation of an eHealth system.

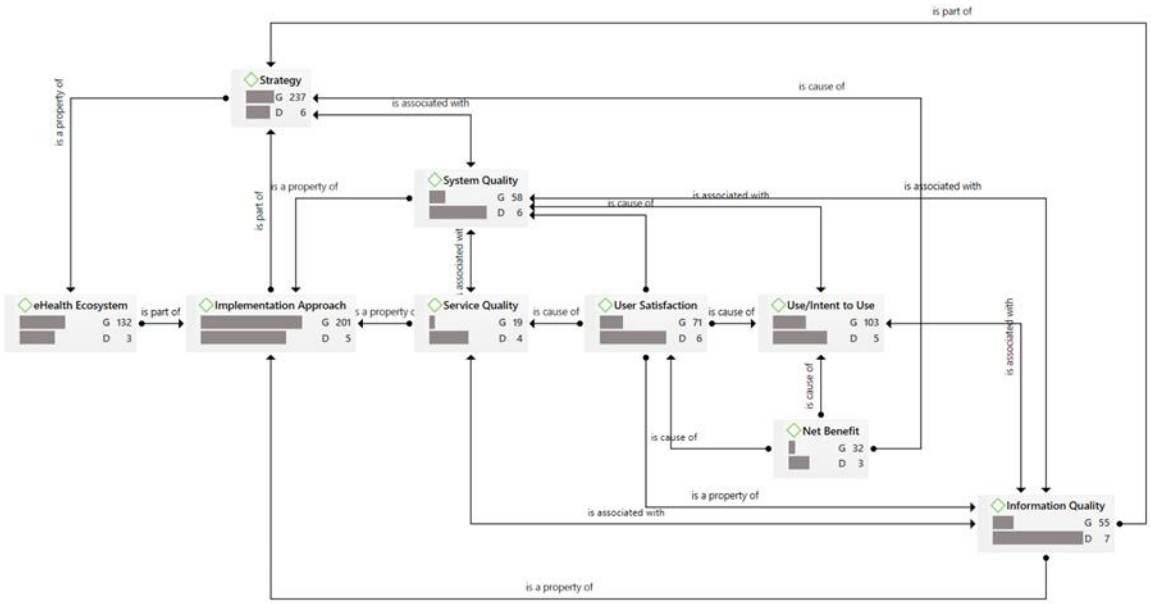

Figure 7. Quality semantic linkage. The quality theme semantic linkage shows the grounding and density linkage between System Quality, Information Quality, and Service Quality (with a density of 6, 7, and 4 respectively) and the remaining themes. Each of the themes identifies the grounding (total quotations) in each theme and c-coefficient.

P8 notes, “everything is sort of framed around service quality and being mindful of providing a high degree of service in the context of the interoperability discussions.” P1 further supports this by stating, “system quality, it was critical because we want to make sure that we got the right matching of patients.” P1 further states, “so identity, patient matching was probably a high priority if you will. Service and System quality were an essential component within the adoption process and had an association with use/ intent to use, the strategic implementation of a system hence the significance to discuss together. Service and System quality components of HIS implementation have association use/intent and use and can be identified as having an impact or is a cause of user satisfaction. According to Daghouri, Mansouri, and Qbadou (2018), service quality elements are reliability, assurance, tangibility, empathy, and responsiveness of support to

the system to the users. Wei, Tang, Kao, Tseng, and Wu (2017) further stated that information and system and service quality all made positive impacts on user satisfaction. Additionally, both system and service quality have been identified as having a property of the implementation approach. For example, P1 notes, "… in the workflow, getting the right patient information that was really important." Workflow relates to the system setup and retrieval and the importance of being able to obtain accurate patient data. P2 noted, "having a system that gives them, provides them with the information on services that they need and in a timely manner is important." A significant amount of time, discussion and resources ensuring system quality, was identifying the workflow of the vendor and then matching the workflow of the vendor.

Gaardboe, Nyvang, and Sandalgaard (2017) identify there are several studies on the adoption and use of a HIS in which a positive relationship between system quality and user satisfaction exists. Service, system, and information quality play a significant role in the implementation process. Also, because of the importance of getting patient information correct, the two themes show a density of four and an association with strategy and the implementation approach taken. Figure 7 shows the impact on the system implementation from both the system quality and the information quality because the system and information quality have a density of seven and six, as identified in the analysis process. The significant cooccurrence count system quality (count of 58) and information quality (count of 55) show the close grounding to one another. It was noted that system quality was typically identified and applied in the discussion and post-implementation phase as part of the verification of information quality. P1 noted, "system

quality it was critical because we want to make sure that we got the right matching of patients." From the limited obtained documents, the discussion centered around ensuring workflow matching, which relates to patient data quality, which this supports system quality as a theme in the adoption and implementation process. Publicly accessible online P1-P8 documentation, including research studies and organization studies, identify the importance of quality for patient data and information. For example, in the study conducted by Schoenbaum (2019) system quality is asserted as important and in order to have a quality system understanding of provider workflow, system capabilities, and limitations for proper development if a system. The discussion centered around quality at various levels supports system quality as a theme among multiple hospitals in the U.S. and global implementation processes.

R.-Z. Kuo (2018) stated in his discussion results that perceived system quality in part with perceived information quality positively influences both perceived usefulness and user satisfaction, which would lead to positive influences on system adoption. Information quality was an important consideration. In many cases, it was post-implementation where specific considerations were identified, evaluated, and applied. Information quality was approached from two different perspectives. One perspective was the accuracy of data from a system. The other perspective was from a provider perspective on quality. P1 noted, "when we implemented the patient portal and we, we knew that we were going to be sending documentation and results from the EHR into the patient portal for patients to see immediately" therefore, the quality of notes was a concern. P1 then also noted that they "did have to monitor and test and make sure that the

documents … results that we said were actually going into the portal from the EHR [was accurate].” Quality is an important theme to be evaluated as part of the evaluation strategy, use/intent to use, user satisfaction, and the implementation approach are important considerations in determining the system quality, information quality, and service quality, as components of quality. Identified in this study, strategy (count of 11), use/intent to use (count of 30), user satisfaction (count of 25) and implementation approach (count of 17) show a density of greater than 5 with themes having an association with and properties of information quality.

According to Gezici, Tarhan, and Chouseinoglou (2019), the DeLone and McLean IS success model identifies system quality as dimensions that characterize accuracy, meaningfulness, timing, and service quality has been characterized as the effectiveness of services provided as part of success measure for an IS. P1 supported the need for service and system quality in strategic planning in the implementation process by recognizing the need for asking questions such as, “how do we get in touch [tech support], or how does our help desk if a provider calls, know what to do, or even push information about new workflows.” According to Aldholay, Isaac, Abdullah, Abdulsalam, and Al-Shibami (2018), DeLone and McLean indicated that system usage was among the most important needs in implementation processes are defined as easy to use, easy to learn and is a key precursor to system usage. Therefore, information, service, and system quality are important dimensions in the analysis of an implementation system to evaluate from the lens of the DeLone and McLean IS Success model and are necessary components in the strategic planning of a HIS implementation process. Information,

service, and system quality support for users of the system was specifically important when updates happen, enhancements needed or completed, or errors are identified. P5 further noted, “one of the biggest goals is to communicate, obtain patient data, and to get accurate information back.” All three qualities support inclusion in the quality theme and are important because of the need to provide assurances to the users of the system. Each component of quality is an important measure to evaluate in the implementation process and is appropriate to include as part of the theme Quality.

Theme 4: Strategy

Strategy emerged as theme four during analysis. Strategy incorporates information quality, eHealth ecosystem, interoperability issue, net benefits, service qualities, system quality, use/intent to use, and user satisfaction which are used as dimensions in the analysis of the strategy as a component of adoption and implementation of an interoperable eHealth system. P1-P8 identified each of the themes as important aspects of their HIS implementation process. P7 says that it is important for “providing better care, and some of our patients are not on the same instance, it makes sense for having data streamlined, so everyone’s on the same page.” Each one of the dimensions mentioned impacts patient care and provider system usage and is identified as part of strategic development. Stakeholder engagement, use/intent to use, and user satisfaction, for example, support inclusion because, ultimately, the importance of using an implemented system. Information quality, eHealth ecosystem, net benefits, service quality, and interoperability issue are inferred in the P7 quote because of how the system designed, built, and implements relate to the very core need of providing patient care and

being on the same page if patients are seen at different locations. Table 7 identifies the cooccurrence associated coded themes to theme strategy. The grounded counts of each theme in the grounded count column list the number of times each of the themes appear across the curated data, and the coefficient column lists the c-coefficient describing the depth of strong correlation of the coded themes to the strategy theme. Identifying the ground count and the coefficient determine how much similarity and density there is for and among the themes listed in the strategy theme.

Table 8.

Cooccurrence Table for Theme 4: Strategy

	Count	Coefficient
eHealth ecosystems	53	0.17
Implementation approach	151	0.53
Information quality	11	0.04
Interoperability issue	11	0.04
Net benefits	10	0.04
Service quality	6	0.02
System quality	11	0.04
Use/ intent to use	36	0.12
User satisfaction	25	0.09

The strategy theme was identified with coding occurring 237 times among the combined participants and accessible documentation in the conducted study. Among P1-P8 and supporting documentation, discussions centered on systems and interoperability of all levels of information technology to define, adopt, and implement a system that meets organizational goals needs. The semantic linkage of the theme strategy to all the coded themes frequency is seen by viewing Figure 8. It is notable that strategy has a density of six, with net benefit, system quality, information quality, and implementation

approach, all having a direct relationship to the theme strategy. Strategy is noted as being a property of the eHealth ecosystem, a part of information quality and implementation approach, with net benefits being a cause of strategy, and is associated with system quality.

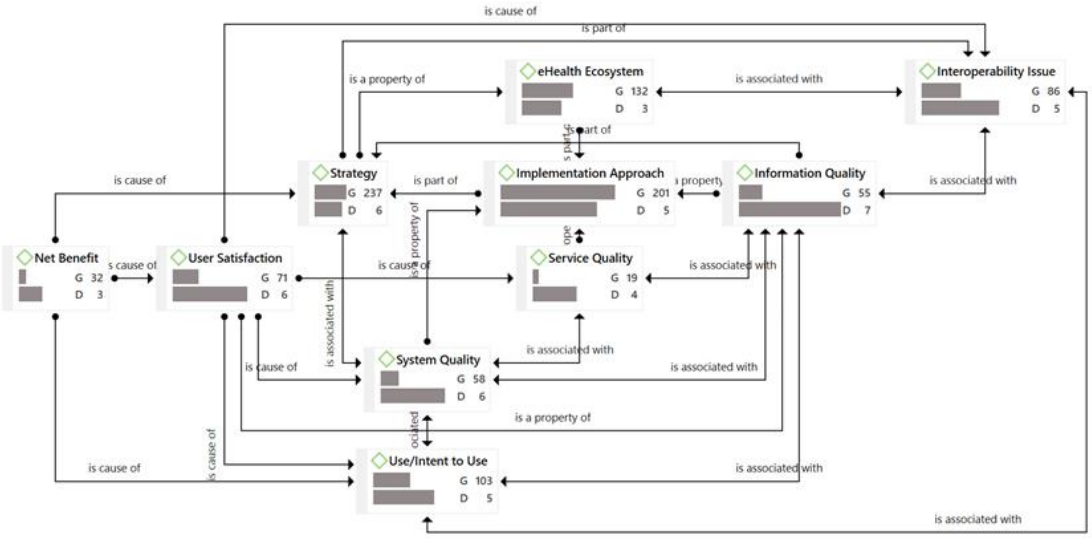

Figure 8. Strategy semantic linkage. The strategy theme semantic linkage shows the grounding and density linkage between strategy (with a density of 6) and the remaining themes. Each of the themes identifies the grounding (total quotations) in each theme and c-coefficient.

Strategies varied and were limited or numerous from participant organizations depending on the degree of implementation and adoption of an interoperable eHealth system. Publicly accessible online P1-P8 documentation including research studies, guiding frameworks, strategy outlines with focus points, and organization studies identify the importance of both the identification and implementation of a strategy to guide the implementation process is the first part of the implementation process. P8 noted, “the HIE strategy, the ability to access external records and bring those into our, you know,

common enterprise-wide medical records system, that is less well defined right now because of priorities and guidance from vendors." Strategies are important to improve and help shape future needs and goals (University of Maryland Medical Center [UMMC], 2014). A strategy is among the more important characteristics in the adoption process needing to be analyzed to identify and ensure success in the implementation process (The HCI Group, 2014). For P1-P8, the strategy is the approach taken and not formally defined. For example, P8 notes a "fairly detailed roadmap to be able to bring all of our sites of care, all of our hospitals and all of our clinics onto a common medical record is, was, well underway with defined milestones. This section provides more detail and context as strategy relates to the adoption and implementation and the conceptual framework as part of defining the strategy for implementing an interoperable eHealth system.

According to Dowsett and Harty (2019), the use of the DeLone and McLean IS model as a framework is beneficial for an organization to investigate the implementation of technology by determining the success factors from a strategy design perspective to improve the project team and implementation process. Interestingly, participants inadvertently applied DeLone and McLean IS success model dimension concepts. For example, P7 noted, "in order to get some of the functions that we want for everyone; we have to get onto the next version and time is of the essence, [it is important to] make sure that we make decisions in an organized fashion, communicate that appropriately and then get that [user requests] into the system so it can be part of upgrade and consolidation." The inference is that from identified success factors and user requests, system

improvements are made to ensure use/intent to use of a system. According to Mudzana and Maharaj (2017), DeLone and McLean's support for the assessment of IS success is essential if there is a need to understand the value and usefulness of investment and implementation of an IS. For example, P1 noted from an implementation perspective "we wanted to benefit the patient as well as the provider and make sure that the provider had the right tools in the workflows in order to get the right information at the right time." Identifying contributing components in the adoption process and the perceived success of individual users as part of a strategic design can support more effective strategies (Mudzana & Maharaj, 2017). P1 further noted, "you need to ensure that you have a process in place." As an example, CRISP (2019a) developed a policy of data sharing based on the need to facilitate improved care and improved patient outcomes and specifies the sharing of information for those entities that are HIPAA compliant. Therefore, an organization that identifies the important contributing components in the adoption process, along with the perceived successes, can help contribute to the overall design for a successful HIS implementation.

According to Feldman, Schooley, and Bhavsar (2014), as part of the implementation of HIE, understanding the guides developed by the organization would have helped mitigate challenges in the implementation process; in addition communication with the vendor(s) to ensure understanding of the complexity of the implementation was essential for success. For example, P1 identified in HIE, "it would be trying to match up with that [vendor] workflow" as part of the implementation process. As such, these are concepts that are typically included as part of a strategy. Accessible

documentation and interviews showed that P1-P8 used various strategic approaches as an evolving framework from which they guided the implementation process to meet their needs and goals. Publicly accessible online P1-P8 documentation, including research studies, operating procedure frameworks, and organization studies, identify the importance of alignment with organizational goals. Strategic alignments for some were defined in a Standard Operation Procedure or (SOP) that outlined and defined the scope and multiple components of the HIS implementation. P3 noted, "understanding challenges were important requirements and frameworks were needed." For some of the participants' projects requested have business plans developed and then analyzed close alignment to the implementation strategy.

Other participants more closely strategically developed alignments as part of the implementation process. For example, according to Landi (2017) the University of Maryland Medical System (UMMS) was identified as meeting Stage 6 on the Healthcare Information and Management Systems Society (HIMSS) Analytics' Electronic Medical Record Adoption Model (EMRAM) in 2017 by making significant investment and commitments for near-full automated/paperless medical records. As such, UMMS has begun strategically aligning implementation technologies and processes with other organizations that achieved the same level of Stage 6 practices (Landi, 2017). For example, P6 established goals to "disseminate as much information as we could because it is very hard to communicate across all the different institutes, and they communicate among each other very differently." Strategy as part of the adoption and implementation of an information system looks at the entirety of the system for an organization, any

interoperability issues, how to overcome them, and then frame them as part of the implementation approach to ensure information quality and ultimately use and user satisfaction of a system.

P4 noted, “timing is a good indicator of how well groups are utilizing the workflow if things are very slow, that means that they really don’t know what they’re doing, they may need some assistance to help refine their workflows or follow the prescribed workflow.” According to El-Jardali and Fadlallah (2017), there is an importance of aligning policies, organizations, methods in health systems to realize quality improvement and patient safety in a strategically combined manner. Therefore, developing a strategy that aligns policies and goals should be framed and applied in the implementation process. Vest and Kash (2016) further suggested enabling access to data in a consolidated EMR was a strategy employed by many senior IT leaders but only one aspect of overarching organizational goals related to financial models, quality benefits, and other broader organizational strategies. Identifying factors that contribute a successful implementation should be studied to help administrators or senior IT leaders develop strategies for more successful implementations and use of systems (Cheng, Chan, Chen, & Guo, 2019; Thorvald & Case, 2018). The use of strategies as a dimension is supported in current literature from the perspective of use of a strategic approach influences and measures; information quality, system quality, use/intent to use, and user satisfaction. These dimensions mentioned were outlined by DeLone and McLean in evaluating EMR implementation success. Further, the use of the theme strategy is supported by variations in detailed planning and scoping by all participants in the study.

Theme 5: Use/Intent to Use

Use/Intent to Use emerged as theme five from the analysis in this study. Use/Intent to Use incorporates information quality, eHealth ecosystems, interoperability Issues, net benefits, service qualities, strategy, system quality, and user satisfaction as dimensions in the development of a strategy as part of HIS implementation. P1 noted, "we had technical requirements, defined user workflow requirements and the technology in place, people who understood it from a user as well as IT support [perspectives]. use/intent to use was identified as a theme with coding occurring 103 times among the combined participants and accessible documentation in the conducted study. Table 8 identifies the associated coded themes to use/intent to use in which P1-P8 identified as important aspects of their implementation process.

Table 9.

Cooccurrence Table for Theme 5: Use/Intent to Use

	Count	Coefficient
eHealth ecosystems	22	0.10
Implementation approach	33	0.12
Information quality	30	0.23
Interoperability issue	16	0.09
Net benefits	24	0.22
Service quality	9	0.08
Strategy	36	0.12
System quality	33	0.26
User satisfaction	65	0.60

The grounded counts of each theme in the grounded count column list the number of times each of the themes appear across the curated data, and the coefficient column lists the c-coefficient describing the depth of strong correlation of the coded themes to the

overall use/intent to use theme. The semantic linkage of the theme Use/Intent to Use to the frequency of the coded theme is seen by viewing Figure 9. The use/intent to use theme has a semantic linkage density of five with a grounding of 103. The four strongly related c-coefficient themes, information quality (0.23), net benefits (0.22), system quality (0.26), and user satisfaction (0.60), all have a direct relationship to the use/intent to use. Across all participants, Use/Intent to use was an important factor in the implementation process.

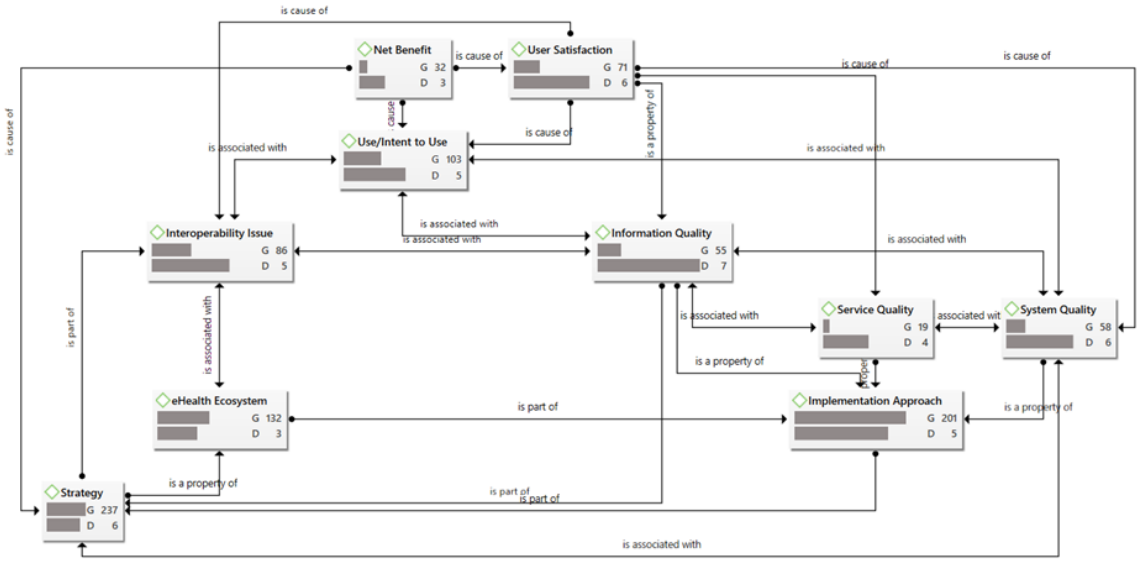

Figure 9. Use/Intent to Use semantic linkage. The use/intent to use theme semantic linkage shows the grounding and density linkage. Each of the themes identifies the grounding (total quotations) in each theme and c-coefficient.

According to Chirchir, Aruasa, and Chebon (2019), there is evidence to identify that system performance is at its best when the perceived system is more useful and easy to use. Use/Intent to Use emerged as theme 5 in the research analysis based on the overall use and intent to use, of the system, for participants interviewed. For example, P2 noted, " when we implemented the patient portal, we knew that we were going to be sending

documentation and results from the EHR to the patient portal, there were concerns of quality and patient understanding of the results." Participant 2 further noted, "So we had to make sure that that system can be leveraged and used in a way that would work for us and for our setting and for our patients and customers." According to Almaiah and Alismaiel (2019), many researchers confirm that intent to use has a high association with system acceptance and use. Use/intent to use was seen in the discussions during the implementation process as an important, and multiple documented reports (Documents 12-14) identified the need to address the intent/use and use as part of the adoption and implementation process. According to Wimmer and Aasheim (2019), the use of DeLone and McLean Success model intention to use is an acceptable alternative to measurement and important in understanding whether the system would be used. Lwoga and Sife (2018) further support this use/intent, use, and understanding of the system use by stating that DeLone and McLean updated the IS success model to include the dimensions use and intent to use as part of the continued evaluation of the perceived acceptance of the IS. Additionally, Mardiana, Tjakraatmadja, and Aprianingsih (2015) identify that DeLone and McLean suggested system usage is an appropriate variable measure in measuring IS success to understand whether a user might use a IS appropriately in the future or not before implementation. Therefore, use/intent and use as an attribute in the implementation process is an important component to add as part of the strategy development.

Stakeholder use and intent to use of a system are dependent upon many factors. From the perspective of a HIS, intent to use is theoretical in that senior IT leaders are

logically guessing that stakeholders will use the system. Whereas, use is actual (tangible) in that stakeholders are or are not using a system. Kisekka and Giboney (2018) identify that health information technology functionality and use by patients influence the patient quality and that information, system, and service should positively influence the intention and decision to use health information technology. Kisekka and Giboney (2018) further state that when users engage with a system and that system helps them achieve their goals, satisfaction with system use increases. Multiple studies have been completed to understand user intent and use of a system about the influence and adoption of information technology systems such as HIS and expert systems. Alshare, Alomari, Lane, and Freeze (2019) support this further in trying to understand factors both external and internal in the use and intent to use of technology adopted by an organization. Therefore, use/intent to use is an important concept to understand in the implementation process.

Use/intent to use was discussed many times among P1-P8 as part of the implementation process. P1 identified that use from a provider perspective having dedicated support teams involved having streamed services and "made for better continuity and better knowledge amongst our own team." Publicly accessible online P1-P8 documentation, including research studies, frameworks, and organization studies, identify the importance of use/intent to use to guide the implementation process. Use/intent to us is necessary to understand when users might not use an off the shelf system, and changes must be made. Changes had to be made to mitigate any potential lack of use, as P2 noted: "we kind of had to find ways to work around that so that our customers didn't begin to think that maybe they did have to pay a bill." P3-P8 identified

use/intent to use as part of the implementation discussion. P3 identified that the use of operational measures was in place to identify the use of a system based on the workflow timing. Use/Intent to Use is an important component to plan for and evaluate in a pre- and post-implementation process to identify continued use and satisfaction. Creativity during the implementation was applied to address some potential concerns and prevent misuse or lack of use, along with supporting literature to justify the reasons for specific developments and components within the implemented system. In some cases, this was altering portals and systems to limit confusion among patients.

Theme 6: User Satisfaction

The User Satisfaction theme emerged as the fifth theme from the analysis. The User Satisfaction theme was identified as a theme after combining multiple identified quotes and codes of similarity with coding occurring 71 times across P1-P8 documentation and interviews. The analysis started with highlighting concepts, quotes, and themes related to use, satisfaction, and what was identified as success and satisfaction, then further condensed into the theme of user satisfaction. The cooccurrence Table 9 identifies the associated coded themes to user satisfaction in which P1-P8 identified as important aspects of their implementation process. The grounded counts of each theme in the grounded count column list the number of times each theme appears across the curated data, and the coefficient column lists the c-coefficient describing the depth of strong correlation of the coded themes to the overall user satisfaction.

Table 10.

Cooccurrence Table for Theme 6: User Satisfaction

	Count	Coefficient
eHealth Ecosystems	10	0.05
Implementation approach	18	0.07
Information quality	25	0.25
Interoperability issue	13	0.09
Net benefits	22	0.27
Service quality	10	0.13
Strategy	25	0.09
System quality	24	0.23
Use/ user intent	65	0.60

The semantic linkage of the theme User Satisfaction is seen by viewing Figure 10, in which the density of all coded themes identified relates to the depth of user satisfaction. Each of these themes is a significant aspect of a HIS adoption and implementation process. Across all participants, Use/Intent to use was an important factor in the implementation process and user satisfaction. User satisfaction among the participants was important for the adoption process; however, it was not until post-implementation was it evaluated across providers and patients. Some participants identified the need to evaluate using matrices established pre-implementation while other participants identified post-implementation the need for surveys and follow-up to determine the extent of user satisfaction. For example, P3 identified the need to establish matrices that are measurable regularly.

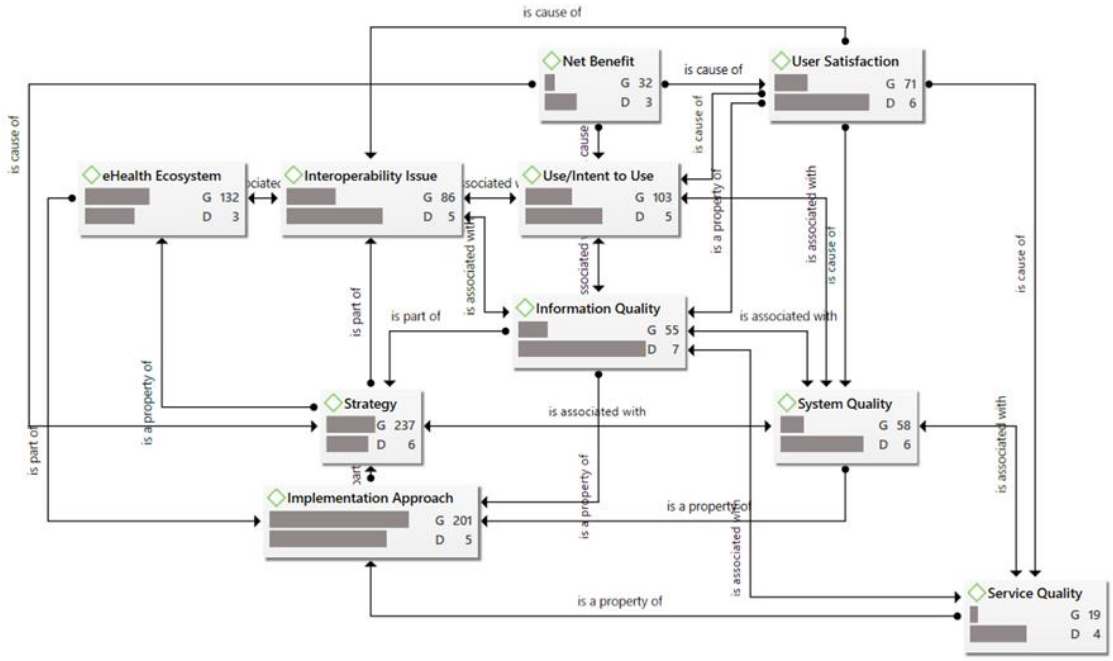

Figure 10. User satisfaction semantic linkage. The user satisfaction theme semantic linkage shows the grounding and density linkage between user satisfaction (with a density of 6) and the remaining themes. Each of the themes identifies the grounding (total quotations) in each theme and c-coefficient.

Many of the initial discussions, strategies, and processes in the implementation goal is to provide for user satisfaction from all user perspectives. Perspectives can be from both the providers and the patients as well as the technical teams of the system. Widiastuti, Haryono, and Said (2019) suggest that user satisfaction and a system's usage can have a positive impact on the success, and measurement of success or effectiveness of information systems is essential for value of IS management activities and investments. P2 noted, "our customers or stakeholders all felt very engaged and felt like they were being heard about what their requirements and needs were so that the process we used was we kept lines of communication open." Engagement from primary end-users is a crucial need because, ultimately, it is them that need to use the system daily. Lack of

satisfaction may lead to nonuse and potential errors, causing a cascading effect from providers to patients. As part of the implementation, testing and updating to ensure many aspects of the system, from quality to ease of use, does not hinder a lack of satisfaction. As P2 also noted, "We do a lot of testing with our IT testing team to make sure that when we have a new result, it is reported accurately." User satisfaction is strategically vital for administrative managers to comprehend and identify HIS attributes perceived and scrutinize by users' perceived performance of those attributes post-implementation (K.-M. Kuo, Liu, Talley, & Pan, 2018) Testing is an essential aspect of the user satisfaction attribute for end-user experience and continued use. User satisfaction was supported as a theme in recent literature due to the focus on satisfaction in the adoption process to identify, predict, and determine the successful implementation of a health information system. Therefore, supporting DeLone and McLean IS Success model, User Satisfaction is a vital matrix to identify in the adoption process in a pre- and post-implementation strategy.

Publicly accessible online P1-P8 documentation, including research studies and organization studies, identify the importance of user satisfaction in the planning, adoption, and implementation process. Patient care and the use of a system is an aspect of meaningful use as identified under the HITECH Act (Lardner, 2017). For example, P5 noted, "…our providers want to make sure to get in the most recent information, they're not using it like they need to." Primarily, the user (providers in this case) avoid using a system or misuse it if they are not happy with the system. All participants identified both patient and provider satisfaction as an important aspect of adoption and implementation

of an interoperable HIS and that the quality of the system, implementation approach, and information quality were high priorities as part of the discussions and strategy sessions to ensure continued usage of the system. Sebetci (2018) noted that the adaption of information systems in current literature reveals that user behavior and intentions are associated with satisfaction of the systems, and the levels can explain the future intention of continued use. User satisfaction is a significant component in the adoption process that needs to be addressed at all levels in the adoption process to ensure the use and continued use in pre- and post-adoption settings. Therefore, significant literature identifies the importance of user satisfaction to understand post-implementation and provides some prediction of use in the pre-implementation of a HIS.

Applications to Professional Practice

Implementation of eHealth systems is increasingly essential, and for healthcare professionals, genuinely national and global implementation of an eHealth system is challenging. Strategies are a necessary aspect of eHealth implementation, and to properly develop strategies, it is essential to understand roles, relationships, organizational structures, and their influence on eHealth services (Hägglund & Scandurra, 2017). As such, the healthcare professional role is necessary as part of strategy development to improve implementation and care as part of IS improvements (Rocha & Malta, 2018). According to The Office of the National Coordinator for Health Information Technology (2020), national strategies have an improvement in usability and a reduction in burden to providers and implementation of an interoperable eHealth system. The application to professional IT practice from this study may benefit healthcare professionals, senior IT

leaders of all types in the adoption and implementation of an eHealth system. Identifying, understanding, and applying a strategy in the implementation process allows for a successful holistic eHealth system that when evaluated using DeLone and McLean IS Success model will provide evidence of a genuinely interoperable eHealth system that meets not only the need of the organization but multiple organizations and customers of all types.

The results of my study can be used as a guide to identify the strategy components in the implementation of an interoperability eHealth system—further strategy development in adoption evaluation and success of the adoption process. By understanding organizational goals, the degree of the interoperable eHealth system to be implemented and then developing a strategy using a formal strategic process and identifying the DeLone and McLean measures pertinent to the organization as a framework may provide senior IT leaders with an outline to implement a functional eHealth system successfully. The findings for this study were significant in that many organizations claim success to a degree only to realize some additional components or needs should be addressed post-implementation. Therefore, the findings could provide senior IT leaders with suggestions in developing formal strategic approaches to implementation before adoption and implementation. Also, the findings could help set a standard by encouraging senior IT leaders into thinking and establishing the use of the DeLone and McLean success IS attributes as an additional measure in the development of a strategy and framework to adopt and then implement a successful interoperable eHealth system.

Implications for Social Change

The implications of this study's findings for positive social change and the strategies applied may offer senior healthcare IT leaders a framework to obtain enhanced accuracy among disparate eHealth systems potentially reducing medical errors and improving patient treatment. Noted by Shull (2019), Partners HealthCare in Boston, Massachusetts, spent $1.2 billion implementing and upgrading their existing EHR in 2015/2016 to decrease errors and align workflow of disparate systems. In addition, the adoption of international syntax standards, such as fast health interoperability resources (FHIR), logical observation identifiers names and codes (LOINC), and SNOMED CT may provide more accurate readings which then relates back to accuracy in interoperability. According to Adams et al. (2017), there are some interoperability challenges associated with EHRs receiving data from other HISs versus obtaining information from the EHR. Therefore, the alignment of standards is necessary and important in the strategic planning of adoption and implementation. Further noted by Maher et al. (2019), the lack of a strategic approach for patient safety improvement leads to extensive waste and time. A proper strategic approach may provide and deliver medical services at any time, any place, track ongoing medical conditions, and provide intervention management, which may improve overall medical services through health service systems (Cai et al., 2019).

According to Sittig, Belmont, and Singh (2018), laying safety responsibility solely on the HIS developer and has no control over how the system was designed and built, will not lead to overall success and safety. Shared responsibility and properly

formally developed strategic adoption and implementation plans are essential. Additionally, support from a national and international government groups must lead in the discussion to stimulate shared responsibility (Sittig et al., 2018). The results of this study may raise awareness of the need to implement strategies and measure success before the adoption and implementation of an interoperable eHealth system. Lack of formal strategies may impact a senior IT leader in the implementation of a holistic interoperable eHealth system that may assist in preventing medical errors of numerous types and causing harm to patients. The findings of this study add to existing knowledge of literature by identifying the need for strategies and then a way to measure the success of an interoperable eHealth system. Additionally, the findings serve as a basis for positive social change by taking into consideration the needs and safety of patients and being good stewards of both patients and stakeholders within the organization as part of the strategic planning, adoption, and implementation of an interoperable eHealth system.

For society, this study provides insight into how organizations generally approach the adoption and implementation of an eHealth system to meet their immediate needs and goals based on limited interoperability. The study shows how all participants agree on the importance of discussions and participation from stakeholders in the implementation process to ensure maximum use and success based on current needs and abilities. However, the lack of formal strategic planning may hinder a holistic adoption of an interoperable eHealth system that truly might mitigate medical errors. Specifically, the lack of a formal strategy obtains the goal for the organization. However, the actual holistic interoperable eHealth system that includes all types of HISs, LISs, radiology,

EMRs, etc.., and multiple disparate organizations that could mitigate near all potential medical errors is still elusive.

Recommendations for Action

The first limitation was the small sample size of participants from this single case study perspective. This impedes the ability to apply general findings to other organizations that use strategies as part of the implementation of an interoperable eHealth system. A recommendation for action would be to increase the sample size of participants from each organization to allow for greater generalizability and transferability to strengthen the reliability and validity of the data. Study participants were limited to senior IT healthcare leaders of organizations, considering there are many potential participants who are external in positions of authority drafting regulation and developing technologies that should also be considered potential knowledge experts.

The establishment and use of protocols and processes is one part of the strategy to ensure the respect and protection of participants as well as to ensure the reliability and validity of data in this study. The second limitation resulted in the modification of the member checking protocol. Detailed member checking interview follow-up was not completed. The lack of detailed member checking interviews for all participants limits true validation and reliability. As a recommendation, video or audio follow up interviews should be required regardless of confirmation acknowledgment of the summaries but within the confines of professional respect to avoid harm to participants. As part of working with the gatekeepers, it is important to obtain agreement of the member checking protocol and the requirement of at least two interviews for all participants until

the researcher's understanding is complete and there is no new information. Additionally, to encourage participation less demanding interview study approaches should be developed to obtain data and support reliability and validity of the data obtained in interviews.

Recommendations for Further Study

Recommendations for further study include conducting more research into formal strategies used in project management enterprise and or governmental project management. Identify and apply the DeLone and McLean IS Success model and dimensions to evaluate and analyze the use as part of the development process of formal strategies to adopt and implement an accurate, holistic interoperable eHealth system successfully. Identify the most optimal DeLone and McLean success model dimensions needed for evaluation of success. Additionally, identifying organizational goals and formally defined levels of interoperability are important. Finally, identify what organizations formally define as success in the adoption of a HIS to frame a holistic eHealth system.

The success of the HIS adoption was perceived in individual instances and based on several internal and external factors influencing the adoption scope and goals. Future studies might want to look quantitatively and qualitatively on the degree of interoperability for organizations, what they identify as fully interoperable, and what are total success measurements evaluated using DeLone and McLean IS Success model. For example, in the case of the recent global pandemic (at the time of this study writing still happening not even two months in), what is all the data truly needed to define an

interoperable eHealth system. For example, are travel data, global connections necessary, especially when needing to manage global pandemics (Yaraghi, 2020)? It might be beneficial for global governments in consensus to define and conduct analysis on the degree of interoperability desired and needed for true interoperability adoption and implementation of eHealth systems. A global consensus is critical, especially based on the recent interoperability issues that have been preliminary identified and yet to be identified from the COVID-19 pandemic.

Additionally, further studies should look at developing a universally defined strategic plan that includes findings and definitions from various governments on strategic needs. For example, HHS has identified strategies and recommendations that are being considered for mitigating EHR burden on providers (The Office of the National Coordinator for Health Information Technology, 2020). The strategic categories are Clinical Documentation, Health IT Usability, and User Experience, EHR Reporting, and Public Health Reporting, with each of the defined categories having specifically defined strategic approaches (The Office of the National Coordinator for Health Information Technology, 2020). These are just one aspect of the overall adoption strategic framework. Future studies might consider and possibly identify commonalities among all EHR adoption-related issues globally, map the issues to identified success and then further define and frame a universal framework that is the strategic approach to interoperable eHealth adoption. This study simply looked at strategies currently used among a small population but appears to be common among many organizations upon further review of topics related to implementation goals.

Reflections

As part of my reflection on this study, I see the potential for a formal strategy to be developed and used as a formal framework that will assist organizations of all sizes in adopting and implementing a fully interoperable eHealth system that provides value and enhances patient care and treatment. From a research perspective, there is a concern of bias introduced into a study, even though I have twenty years prior experience in the healthcare field utilizing healthcare technologies, health information systems of varying types, managing physical records. I do not have a personal or direct professional connection to anyone in this study. I am grateful to all the participants in this study for their time and extensive knowledge on this important topic. Their guidance has imparted unknown knowledge and experience to me, which I will use to expand my understanding.

Conducting a study requires small steps to understand the problem entirely. For example, my research goal was to understand strategies or lack of strategies used by senior healthcare IT leaders. However, other research components need to be identified and further researched that are outside the scope of this study. It is not possible to answer everything in this single case study. Therefore, studies such as these need to be broken into smaller, more detailed studies that can show the progression and support future research. Additionally, participants have their own perceptions of success, and it is not always possible to plan for those perceptions in a methodological manner to ensure more optimal responses. This limitation was noted post research and should be mitigated in the future.

Summary and Study Conclusions

Adoption and implementation of an interoperable eHealth system require strategic planning and execution to avoid abandonment, or failure and realize success (Sligo et al., 2017). According to the Office of the National Coordinator (ONC) for Health Information Technology (2019), there are two steps for the successful adoption of an EHR, pre-implementation, and implementation. These steps include established governance, project planning, communication developed workflows, education, and training, as part of the pre-implementation; and then system tailoring, change management, support of the system, staff needs, and encouragement. The self-applied success of these adoptions is based on the scope and goals of the organization.

Jason (2020) states, “The spread of the COVID-19 pandemic has put the importance of health data exchange and interoperability under a microscope” (para. 1). Additionally, Yaraghi (2020) states, “The COVID-19 pandemic highlights the crucial importance of health information technology and data interoperability” (para. 1). These two statements alone sum up the need for interoperable eHealth systems. My hope is that it is understood that many organizations have discussions and a framework to meet their overarching goals, but the use of a defined universal formal strategy focused on individual implementation aspects is still very minimal at times and limited to specific needs, goals and perceived top limitations to satisfy stakeholder needs, concerns, and objectives. Many senior IT leaders have strategic planning, frameworks they work from, and goals to meet; however, there are, at times, limited selection in HISs from national and global perspectives to the limited and proprietary vendors providing. This limitation

curbs the overall strategy of providing a holistic interoperable eHealth system and requires modification of off the shelf systems from vendors to meet specific individual, organizational goals at the level of acceptable interoperability established.

In addition, many organizations post-implementation realize there are certain limitations and certain new goals to realize. It is thereby requiring additional reworking, planning, and further implementation of new systems or, in some cases, modification of existing systems to achieve new requirements. The use of DeLone and McLean analysis of dimension attributes information quality, system quality, service quality, use/intent to use, user satisfaction, net benefits, and the new theme inclusion eHealth ecosystem, implementation, and strategy apply to any and all organizations. An organization should clearly define strategically the implementation and adoption that incorporates the goals of the organization and specifically defines individual components that encompass identified attributes of the implementation that can be measured to evaluate the overall success of adoption and then implementation of the selected eHealth system.

In conclusion, interoperability adoption and implementation of an eHealth system have many different factors, external and internal, all that act on the process at different levels. There are many other factors, including privacy, security, ethics, and financial, that need to be addressed in addition to ongoing collaboration (CRISP, 2009). This study has convinced me that many factors will influence the adoption and implementation process. Additionally, at the time of this study, the global pandemic coronavirus shows the significant importance of connecting multiple types of data to build a patient's holistic healthcare record. Therefore, the need for societal guidance at a regional,

national, and global authority level is a necessary component that includes ongoing collaboration representing all sectors of healthcare and government to realize full implementation of an interoperability of eHealth systems properly and successfully.

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Appendix A: Interview Protocol

ASPECTS OF INTERVIEW PROTOCOL	
1	Question alignment with research question
2	Conversation
3	Feedback on protocols
4	Piloting protocols

PHASE 1: ALIGNMENT OF THE INTERVIEW QUESTIONS TO THE RESEARCH QUESTION, WHICH WILL BE ACCESSED USING A MATRIX.

PHASE 2: CONVERSATION BEGINS WITH OVERVIEW OF THE STUDY, REVIEW OF THE CONSENT TO PARTICIPATE, AND REVIEW OF ADDITIONAL QUESTIONS. ADDITIONALLY, PHASE 2 INVOLVES IDENTIFICATION OF THE RESEARCH QUESTION AND THE SUB INTERVIEW QUESTIONS.

PHASE 3: FEEDBACK ON THE INTERVIEW PROTOCOL IS TO ENHANCE ITS RELIABILITY AS AN INSTRUMENT IN RESEARCH. THEREFORE, FEEDBACK WILL BE SOLICITED AMONGST COLLEAGUES. FEEDBACK WILL THEN BE INTEGRATED INTO THE PROTOCOL.

PHASE 4: INVOLVES ACTUALLY CONDUCTING A TEST RUN OF THE SURVEY/INTERVIEW PROCESS IN SIMULATION AS REALISTIC AS POSSIBLE.

GATEKEEPER SCRIPT:

HELLO, I WANTED TO REQUEST IF YOU ARE ABLE TO IDENTIFY ANY POTENTIAL CONNECTIONS YOU MAY HAVE WITHIN THE LOCAL HEALTHCARE INDUSTRY? SPECIFFICALLY, I'M REQUESTING IF YOU ARE CONNECTED WITH A SENIOR HEALTHCARE IT LEADER-A CIO, CISO OR IT EXECUTIVE WHO OVERSEES THE IMPLEMENTATION OF HEALTH INFORMATION SYSTEMS AMONG THE HOSPITAL AND ANY

DISPARATE FACILITIES THAT MIGHT PARTICIPATE IN THE CARE OF PATIENT. IF YOU ARE AWARE OF A POSIBLE PARTICIPANT, WOULD IT BE POSSIBLE TO REQUEST AN INTRODUCTION? AS PART OF THE STUDY I WOULD BE ASKING THE PARTICIPANT TO DESCRIBE THEIR PROCESS IN ADOPTING AN INTEROPERABLE EHELATH SYSTEM. AS PART OF THE PARTICIPATION THEY WOULD ONLY NEED TO PARTICPATIPATE IN AN INTERVIEW AND IF WILLING PROVIDE AS MUCH SUPPORTING DOCUMENTATION AS POSSIBLE THAT IDENTIFIES THE IMPLEMENTATION PROCESS. THESE DOCUMENTS CAN INCLUDE, TRAINING DOCUMENTS, GENERAL NETWORKING ARCHITECTURE, PLANNING DOCUMENTS, DATA DICTIONARIES, ETC… THAT ARE RELEVANT TO THE IMPLMENTATION PROCESS.

SCRIPT:

PRIOR TO ACCEPTING THE SURVEY/INTERVIEW YOU COMPLETED A CONSENT FORM INDICATING THAT I HAVE YOUR PERMISSION TO AUDIO RECORD OUR CONVERSATION VIA SKYPE

ARE YOU STILL OK WITH ME RECORDING OUR CONVERSATION TODAY?

IF YES:

THANK YOU! PLEASE LET ME KNOW IF AT ANY POINT YOU WANT ME TO TURN OFF THE RECORDER OR KEEP SOMETHING YOU SAID OFF THE RECORD.

IF NO:

THANK YOU FOR LETTING ME KNOW. I WILL ONLY TAKE NOTES OF OUR CONVERSATION.

BEFORE WE BEGIN THE INTERVIEW, DO YOU HAVE ANY QUESTIONS?

IF ANY QUESTIONS (OR OTHER QUESTIONS) ARISE AT ANY POINT IN THIS STUDY, YOU CAN FEEL FREE TO ASK THEM AT ANY

TIME. I WOULD BE MORE THAN HAPPY TO ANSWER YOUR QUESTIONS, ADDITIONALLY, PLEASE LET ME KNOW IF AT ANY POINT YOU WISH TO WITHDRAW FROM THE INTERVIEW AND THE STUDY AS A WHOLE.

ADDITIONALLY, I WILL BE FOLLOWING UP WITH YOU TO PROVIDE A SUMMARY OF THE INTERVIEW, ALLOW YOU TO REVIEW THE SUMMARY OF RESPONSES, AND ALLOW FOR ANY CLARIFICATION, SECONDARY RESPONSES, OR FURTHER RESPONSE TO THE QUESTIONS.

INTERVIEW INTRODUCTION:

AS YOU ARE AWARE, THIS IS A STUDY BEING CONDUCTED TO EXPLORE STRATEGIES OR LACK OF STRATEGIES USED IN THE ADOPTION PROCESS OF AN INTEROPERABLE EHEALTH SYSTEM. IT IS TO UNDERSTAND THE TYPE OF STRATEGY USED, YOUR SUCCESS IN THE ADOPTION PROCESS AND HOW THE STRATEGY ASSISTED IN THE ADOPTION PROCESS. THIS STUDY IS SPECIFICALLY FOCUSED ON UNDERSTANDING THE STRATEGY STRATEGIES USED IN ADOPTING AN INTEROPERABLE EHEALTH SYSTEM. ANY AND ALL RESPONSES WILL BE KEPT CONFIDENTIAL AND ALL ATTRIBUTED COMMENTS AND RECORDED DOCUMENTATION WILL NOT BE ATTRIBUTED TO YOU OR YOUR ORGANIZATION.

RQ:	What are strategies senior healthcare it leaders use to implement interoperable electronic healthcare systems across disparate healthcare organizations?
DEMOGRAPHIC/ GATEKEEPER QUESTIONS	
1.	Are you able to potentially identify a Senior healthcare IT leader- i.e. CIO, CISO

	that oversees a healthcare group that participates in a regional HIE program?
2.	Are you able to identify a Senior healthcare IT leader- i.e. CIO, CISO that oversees a local hospital group that implemented some type of localized HIS implementation to efficiently exchange health information among local offices under a healthcare group?
INTERVIEW/SURVEY QUESTIONS	
1.	What were current interoperability issues you were working to solve within your organization?
2.	How did your organization define success for the interoperable system you implemented?
3.	Please describe the strategic approach you and your organization took in preparing and implementing the adoption of an interoperable eHealth system.
4.	What was your role within the interoperability strategy for your organization?
5.	What are the lessons learned from your current strategy?
6.	In what way does the selected strategy frame a system that provides for

	accurate medical data required at any given time?
7.	How does the selected strategy provide for quality?
8.	How does the selected strategy incorporate the goals and needs of the organization as it relates to access to medical data?
9.	How does the selected strategy incorporate external influences/factors as part of the system development process to ensure regulatory requirements are met?
10.	How does the selected strategy address the overall issue of interoperability?
SUB/ FOLLOW-UP QUESTIONS	
QUESTION 1	1. You mentioned you have some interoperability issues within your organization; how was system quality an impact or influence to solving your identified interoperability issues?
	2. How did information quality impact or influence your solution to your identified interoperability issue?
	3. What about service quality and impact or influence to your interoperability issue?
	4. Did user intent (Intent to use) of a system by end users play a part in the selection of an interoperable system?

	5. How did User Intent (Intent to Use) or Use, influence your solution to address your interoperability issue?
	6. Can you describe what you considered or identified as the net benefits as part of developing your strategy?
	7. Can you describe how user satisfaction or any net benefit impact influenced your solution to address your interoperability issue?
QUESTION 2	1. You defined success in the following way…____; please describe how system quality factored in your measure of success?
	2. In what way was information quality applied as a determinant measure in success of your implemented success?
	3. How was IS service quality considered as a success measure in your implementation of an interoperable system?
QUESTION 3	1. You mentioned you did have an official strategic approach in preparing and implementing an interoperable eHealth system; Describe how system quality was

	addressed within your strategy so as to ensure success of an interoperable eHealth system.
	2. What about information quality? How did you identify assurance and success of information quality in interoperable eHealth system?
	3. Did your organization define or determine how service quality with or with a strategy as part of the implementation process?
	4. What about intent to use or Use, did the strategy or lack of strategy impact the success measure for intent or use?
	5. Finally, how did the strategy or lack of strategy impact or identify user satisfaction and overall net benefits to your organization?
QUESTION 4	1. You mentioned your role was in developing a strategy…____; Describe your process in defining success and implementing an interoperable eHealth system?
	2. How did you measure and finally evaluate success?
	3. Was system quality, information quality, intent to use/ use, user

	satisfaction, and net benefits a component of your overall strategy?
QUESTION 5	1. Please describe any lessons learned from the strategy used in implementing an interoperable eHealth system?
	2. You described this as a lesson learned… how does it relate to system, quality, intent to use, use, net benefits, and information quality?
QUESTION 6	1. You describe that…____ the selected strategy frames a system that provides for accurate medical data required at any given time, how does that….
QUESTION 7	1. Your selected strategy provides for quality…_____, in what way did you consider it a success and was pre or post implementation the measure?
QUESTION 8	1. You mentioned…____ as a selected strategy incorporated the goals and needs of the organization as it relates to access to medical data, was system quality, information quality, net benefits, intent to use/ use and service quality factors considered as part of

	those goals, if not can you describe your goals….?
QUESTION 9	1. Describe how…____ your selected strategy incorporated external influences/factors as part of the system development process to ensure regulatory requirements are met from the point of net benefits
QUESTION 10	1. Finally, you mentioned...____ your selected strategy addressed the overall issue of interoperability, how was that determined and measured for success?
QUESTION MATRIX	

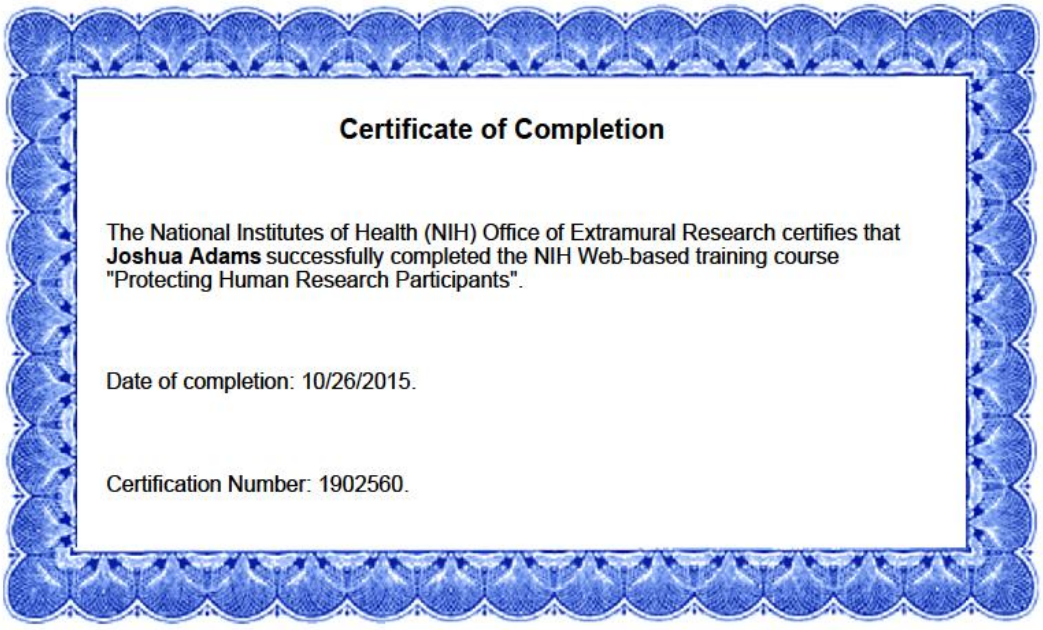
	Background	RQ
Q1	X	
Q2		X
Q3	X	
Q4		X
Q5		X
Q6		X
Q7		X
Q8		X
Q9		X
Q10		X

CHECK LIST- INTERVIEW PROTOCOL			
ASPECTS	Yes	No	Feedback
INTERVIEW PROTOCOL STRUCTURE			
BEGINNING QUESTIONS ARE FACTUAL IN NATURE			
KEY QUESTIONS ARE MAJORITY OF THE QUESTIONS AND PLACEMENT IS BETWEEN BEGINNING AND ENDING QUESTIONS			
REFLECTIVE QUESTIONS WHICH PROVIDE PARTICIPANT AN OPPORTUNITY TO SHARE CLOSING COMMENTS			
SMOOTH TRANSITIONS BETWEEN TOPIC AREAS			
INTERVIEWER CLOSES WITH EXPRESSED GRATITUDE AND ANY INTENTS TO STAY CONNECTED OR FOLLOW UP			
OVERALL, INTERVIEW IS ORGANIZED TO PROMOTE CONVERSATIONAL FLOW			

WRITING OF INTERVIEW QUESTIONS & STATEMENTS			
QUESTIONS- SPELLING FREE			
ONE QUESTION AT A TIME ASKED			
ASKED TO DESCRIBE EXPERIENCE			
OPEN-ENDED			
DOCUMENTATION REQUEST***[1]			
FEEDBACK	TBD		
INTERVIEW SIMULATION	Date/ Time/ Method		
MEMBER CHECKING			

[1] HIE documents, Roadmaps, Planning documents, Training Documents, Security documents, implementation plan, data/ network architecture documents, etc…

Appendix B: NIH Protecting Participants



Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Joshua Adams** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

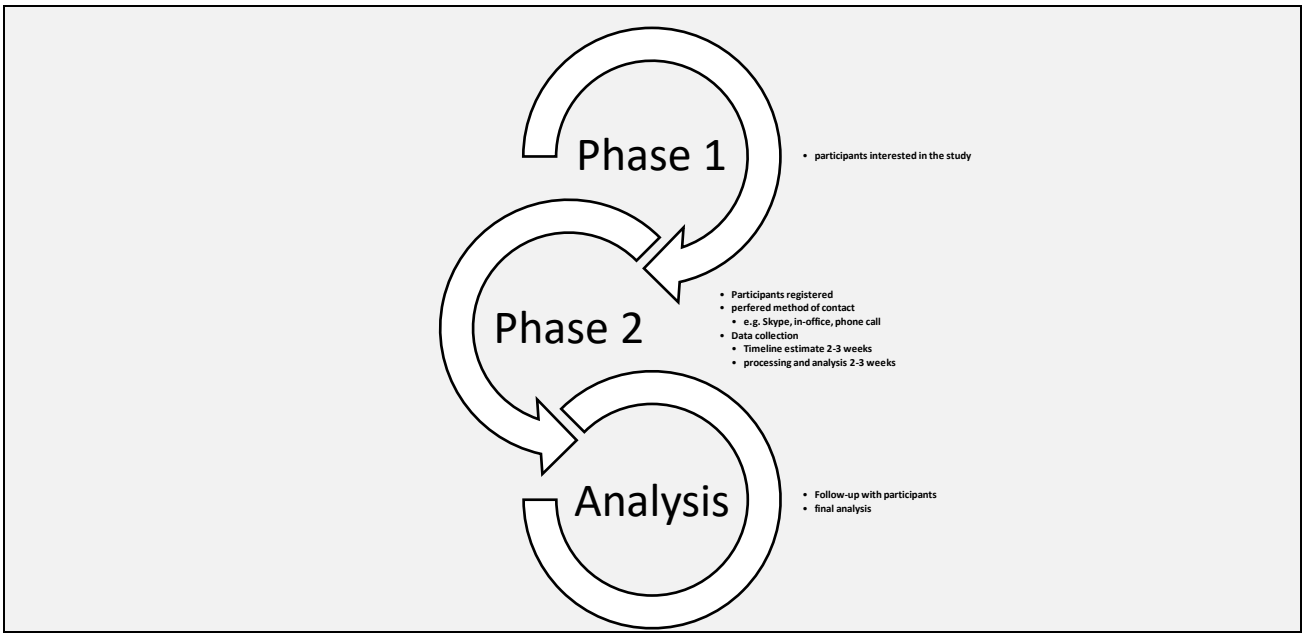
Date of completion: 10/26/2015.

Certification Number: 1902560.

Appendix C: Data Collection Protocol

DATA COLLECTION PROTOCOL	
1	Flow
2	Access
3	Timeline
4	Diagram

1. **FLOW: THIS WILL COMPRISE OF RECRUITMENT AND REGISTRATION**
2. **ACCESS: THIS CONSISTS OF PARTICIPANT ACCESS AND LOCATION ACCESS (HOW I WILL ACCESS THE PARTICIPANT TO CONDUCT THE INTERVIEWS) AND HOW I WILL STORE AND SECURE COLLECTED DATA**
3. **TIMELINE: CONSISTS OF THE TIMELINE FOR PHASES IN THE STUDY, STARTING WITH FLOW AND ENDING WITH DATA COLLECTION CYCLE ESTIMATES**


Phase 1
• participants interested in the study
Phase 2
• Participants registered
• perfered method of contact
• e.g. Skype, in-office, phone call
• Data collection
• Timeline estimate 2-3 weeks
• processing and analysis 2-3 weeks
Analysis
• Follow-up with participants
• final analysis

Appendix D: Final Interview-Document Check List

FINAL INTERVIEW-DOCUMENT CHECK LIST			
ASPECT	Yes	No	Feedback
INTERVIEW QUESTIONS			
DOCUEMNTS REQUESTED			
FOLLOW-UP INTERVIEW SCHEDULED			
DOCUMENTS SECURED			
DATE IDENTIFIED DOCUMENTS STORED			
DOCUMENTS REDACTED FOR SECURITY/ PARTICIPANT PRIVACY			
DATE DOCUMENTS DESTROYED			
FEEDBACK	TBD		
	Date/ Time/ Method		