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Factors that Influence Potential Success of eHealth Standards Adoption in a Low- and Middle-Income Country: a review

Andrew Alunyu Egwar [a, b] *, Joseph Wamema[b,c], Achilles Kiwanuka [b,d], Moses Bagyendera[b,e]

a Busitema University, Tororo, Uganda
b Makerere University, Kampala, Uganda
c African Center for Agro-ecology and Livelihood Systems, Uganda Martyrs University, Kampala, Uganda
d Medical Research Council / Uganda Virus Research Institute / London School of Hygiene and Tropical Medicine Uganda Research Unit, Entebbe, Uganda
e United Nations Children's Fund, Kampala, Uganda

Background: Assessing the potential success of adopted technology, innovation, or standard in a Low and Middle-Income Country like Uganda continues to focus on outcomes of adoption. This study aimed to investigate the potential success of eHealth standards adoption that may arise from the adoption process as well as outcomes of such adoption.
Methods: PubMed and Google Scholar were searched using alternate terms for "eHealth", "standards", "adoption" "success" and "theory". On screening and assessing the quality of publications, only nineteen peer-reviewed publications were included in the review. Both quantitative and qualitative analysis was used to synthesize evidence from the included literature. Thematic analysis was used to develop themes regarding the success of standards/technology adoption.
Results: Constructs from the theories of Diffusion of Innovation Theory (DOI), Unified Theory of Acceptance and Use of Technology (UTAUT), and Internet Standards Adoption (ISA) were used to extend the Success Model of Innovation Adoption. The Success Model for Innovation contributed to the foundational concepts aligned to categorical factors of the adoption process, organizational, environment, and user context that influence the potential success of eHealth standards adoption in healthcare systems. The study identified 13 factors that contribute to the successful adoption of standards for eHealth.
Conclusion: Since the review showed that success of standards adoption starts with assessing readiness to adopt the standards, followed by the standards adoption process and assessment of the lasting outcomes, the study proposes a model for assessing the potential success of eHealth standards adoption. The model has pre-adoption, actual adoption, and post-adoption phases. The proposed model and identified factors have not been evaluated and therefore may not in the current form support eHealth standards adoption processes. Future work is needed to evaluate/validate the model and factors of eHealth standards adoption success. Notwithstanding, the study believes any assessment of the success of standards adoption that uses the identified factors over all three phases of the model is comprehensive to present a true picture of any potential success of standards adoption.

Keywords: Adoption Success, Standards, eHealth standards, LMIC

1 Introduction

Low- and Middle-Income countries (LMICs) including Uganda have realized that the adoption of ICT in health (eHealth) can alleviate their healthcare resource challenges. To benefit from eHealth, it is essential to develop the right infrastructure [1]. Inappropriate infrastructure causes a reduction of speeds which is claimed to be the most important factor of adopting eHealth technologies [1]. But many countries continue to prioritize the allocation of their limited resources to other domains of healthcare interventions over the Information and Communication Technologies (ICT) domain [2], [3]. eHealth implementation in LMICs continues to be plagued by inadequate resources. Despite efforts by the World Health Organisation (WHO)

*Corresponding author address: Busitema University, Tororo-Kampala Road, 236, Tororo, Uganda. Email: aalunyu@gmail.com; Tel: +(256)-(772) (898977)
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to guide eHealth adoption in LMICs, these countries have continued to lag behind High-income countries in their adoption of ICT to support healthcare.

Scholars have identified various challenges to eHealth adoption in LMICs to include high operational cost of eHealth technology, maintenance cost of the eHealth infrastructure, poor internet connectivity especially in the remote areas of LMICs, unreliable electric power supply, and human resource /technical expertise on use of eHealth technologies, among others [2], [4]–[6]. These, including lack of standardization, are infrastructural and organizational challenges that negatively affect the implementation of standardized eHealth technologies to support Health Information Exchange (HIE) in LMICs [7]. Besides, the success of eHealth in LMICs has been hampered by technology challenges like fragmented and proprietary implementations of technologies [8], [9] that results in lack of interoperability of systems, organizational issues and user concerns [8] such as the clinical and economic impact of the eHealth intervention, security and privacy concerns of the use of eHealth technology.

Studies show that existing eHealth implementations in LMICs are characterised by fragmented systems that are unable to share or exchange health information [10], [11]. To achieve the benefits of eHealth in LMICs, existing and future electronic systems must be interoperable. Interoperability is the ability of health information systems to link within and across healthcare organizations, understand each other and use the functionality of each other [12], [13]. ITU [13] argues that standardization is the most critical driver of interoperability. Therefore, the adoption of eHealth standards that support interoperability should be coordinated at all healthcare. In fact, for interoperability to happen, the eHealth systems and technologies must share a common standard [13], [14].

Boore et al. [15] argue that "standardization is one of the most important issues for the successful development and deployment of eHealth systems since many standards are developed independently of the organization originally preparing the standard". Furthermore, Payne [5] recommends that LMICs should "adopt standards for interoperability during the formative period of the ICT infrastructure and health informatics ecosystem". So far LMICs have made little progress to adopt standards for eHealth [15]. Even though various LMICs have identified the need for standardization in their eHealth strategies and policy documents, with clear benefits of adoption, the eHealth standards have not yet been adopted. The slow progress on adoption of eHealth standards are attributed to little participation in international eHealth standards development, lack of a formal standardization process suitable for LMICs to adopt standards for eHealth, unregulated penetration of eHealth systems, delayed eHealth standardization efforts and resource-related challenges among others [6], [7], [16]–[19]. According to Feroz *et al* [3], WHO claims that health systems fail to successfully adopt eHealth technologies due to lack of readiness among healthcare organizations, providers, and communities. A previous study on the adoption of standards for eHealth communication infrastructure [20], developed an assessment framework with 16 metrics for assessing the readiness of health systems in LMICs to adopt standards for eHealth. A readiness assessment helps identify barriers to the successful adoption of a new artefact [6]. Just like perceived benefits of adoption of innovation is a facilitating factor in the adoption of IT by healthcare professionals [21], [22], this study was done on the premise that eHealth standards adoption can also be motivated by the likelihood to realize the lasting benefits of such adoption. Thus making the benefit of the adoption a measure of the success of such adoption.

This study was motivated by the realization that there is no study on success factors of eHealth standards' adoption, presenting a challenge to the successful adoption of eHealth standards by LMICs. Studies have argued that the success of any adoption of a technology artefact is dependent on process, user context, organizational context and community context [23]–[25]. These are informed by several technology/standards adoption theories/models as discussed in the review of theories in Section 2.

Therefore, the study aimed to explore factors of potential eHealth standards' adoption success in LMICs like Uganda. To achieve the objective of the study, the following research questions were explored;

(i). How can the success of eHealth standards adoption be conceptualized?

(ii). What are the major success factors that influence eHealth standards adoption especially in LMICs?

Noting the lack of evidence on studies focused on the success of eHealth standards' adoption, we sought to answer the first question of conceptualizing the potential success of standards adoption. Therefore, the study reviewed four technology/standards adoption theories considered appropriate to inform our study of the potential success of standards adoption.

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2 Literature Review: Theories to inform eHealth Standards Adoption Success

In this section, we review theories that informed our conceptualization of the success of eHealth technology/standards adoption. The study reviewed three technology adoption theories and one standards adoption model i.e. Unified Theory of Acceptance and Use of Technology (UTAUT), Diffusion of Innovation (DOI) Theory, Success Model of Innovation Adoption, and Internet standards adoption (ISA) to conceptualize the dimensions for successful adoption of standards for eHealth in Uganda's healthcare system. These theories were chosen on the basis that they are technology adoption theories or standards adoption models that discuss the process, user, organizational, and community contexts; and or success factors for IT artefact adoption.

2.1 Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh *et al* [26] conceptualized user acceptance of new technology to include intentions to use the technology, individual reactions to using the technology, and actual use of the technology (see Figure 1:). The authors identified four antecedents of the acceptance of information systems. These significant constructs are effort expectancy, performance expectancy, social influence, and facilitating conditions. These were developed from fourteen initial constructs derived from eight competing acceptance theories including the diffusion of innovation theory [26]. Besides, they identified four significant moderating variables that include gender, experience, age, and voluntariness of use.

This study applied UTAUT to explore factors that influence acceptance of eHealth standards in the following ways;

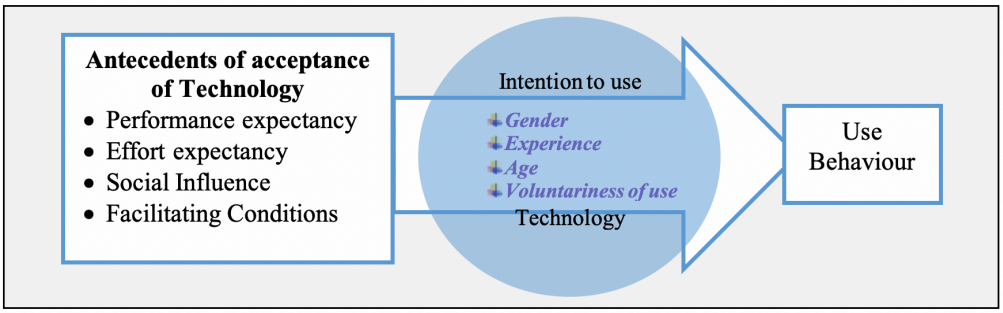

Figure 1: Constructs in the UTAUT [26]

(a) Performance expectancy is the degree to which an individual believes that using the system (in this case standardized eHealth system) will help attain gains in job performance [26]. This was developed from other constructs such as perceived usefulness for Technology Acceptance Model that lends to the study of the use of standards in eHealth setting accounting for its success.

(b) Effort expectancy refers to the degree of ease associated with the use of the system [26]. In the context of a standard, it should refer to ease of interpretation (ease to understand) and implementation of the standard. Signifying the standards is not too complex to understand by implementers/users and therefore can be successfully implemented. These greatly affects the first use of standards but becomes less significant with continued use of standards by health care organizations.

(c) Social influence is the degree to which an individual perceives how others view their use of new technology [26]. The perception that others positively view the use of a new system encourages the user to apply it more. This study believes that positive perception of the adoption of eHealth standards will encourage use both internal and across healthcare systems resulting in success form such standards adoption. The role of social influence in technology acceptance decisions is complex and subject to a wide range of contingent influences [26] that may also be true for acceptance of eHealth standards further reducing any possible success.

(d) Facilitating conditions refers to the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system [26]. With support from WHO, many LMICs including Uganda have developed national eHealth strategies and policies [27] to guide the adoption of eHealth. Among the strategies is the need for contextualized standards for eHealth.

 J Health Inform Afr. 2020;7(1):24-37. DOI: 10.12856/JHIA-2020-v7-i1-274

However, infrastructure for eHealth continues to experience challenges [4], [6] as previously enumerated presenting a negative facilitating condition for eHealth standards implementation. The resource component such as limited resources to participate in global standards development [4], [17] continues to be a big hindrance to eHealth standards adoption in LMICs.

The intention to use technology relates to user characteristics such as gender, experience, age, and voluntariness of use. Similarly, the use of adopted standards is influenced by these user characteristics that have a significant influence on user behaviour.

2.2 Diffusion of Innovation Theory (DOI)

To understand the concept of success in the adoption standards for eHealth, the study adopted the Diffusion of Innovation Theory (DOI). Diffusion is the process where adopters become aware of the standards over time and consider it for adoption [28]. DOI is a process that occurs as people adopt a new idea, product, practice, and philosophy [29]. The process begins with an initial few who adapt to the use of innovation, technology or standards, then with the increase in their perceived usefulness and perceived ease of use, more people and organizations are driven to adopt its use. Whereas DOI covers the technological context (all technologies that are relevant to the organization), characteristics of an innovation (attributes that determine the rate of adoption) [30], and adopter characteristics (degree of being early or late adopters of innovation) [28], [31]; this study focuses on the innovation-decision processes i.e. the stages through which an individual or a decision-making unit passes, that is, from initial knowledge of an innovation to its adoption or rejection and a final confirmation of such decision [28] as seen in Figure. Adoption success depends on the adopter's capacity to follow the rigorous stages of diffusion, also known as the innovation-decision process [24]. In this regard, the success of eHealth standards adoption requires rigour in the decision process by eHealth stakeholders.

In the innovation-decision process, at first, an adopter organization (Uganda's health system) becomes aware of the existence of the standards. Any lack or incomplete knowledge about standards may mean suitable standards are not adopted. In the second stage, decision-makers of the adopter health systems may need to get persuaded about the importance of such standards since lack of knowledge may mean such standards are not recommended for adoption. The third phase allows the adopter to visualize the present and future standard environment and decide to experiment or not with the standard. This is followed by the full use of the standard at stage four, and lastly, a final decision to continue with the use of the standard, review it or discontinue its use at stage five. The existence of such a structured adoption decision process within the adopter health system may provide a significant measure of their readiness and potential success in adopting standards for eHealth.

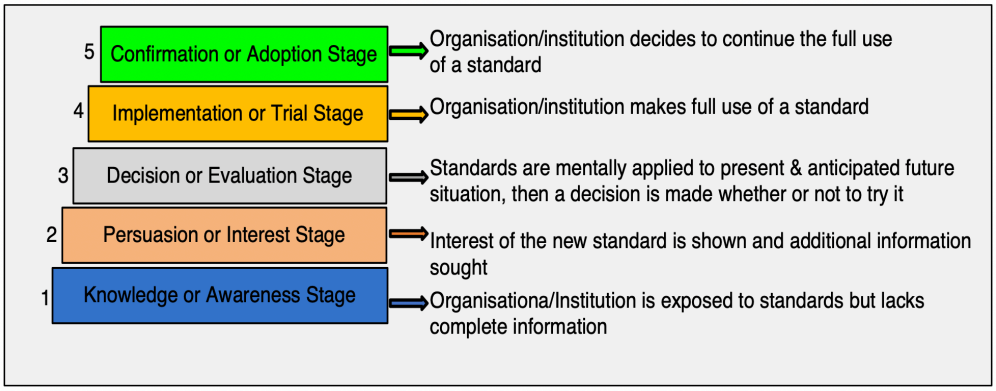

Figure 2: Relating Stages in the DOI to eHealth Standards Adoption

In addition to the decision to adopt a standard, the organisation needs to apply and continue the use of the standard [24]. It is useless to adopt the standards (post-adoption behaviour) if it cannot be put to the proper use. The use completes the adoption process. According to Leonard [32] the factors that can be used to measure the duration of the effects/influence of adoption include the amount of training before and during

 J Health Inform Afr. 2020;7(1):24-37. DOI: 10.12856/JHIA-2020-v7-i1-274

transitions, the amount of resistance to change or industry experience in using technology or innovation, the amount of buy-in (or contribution) from stakeholders, the level of reporting on the outcomes measured during and after implementation of standards, and the level of effectiveness in dealing with the "breaks" (i.e. gaps between the introduction of and full use of the standard, a period when implementers seem reluctant to commit to the changes caused by the new introduction).

A huge disadvantage of using DOI to aid the adoption and diffusion of eHealth standards in fostering stakeholder participation. Kiwanuka [23], argues that DOI is not likely to be a strong predictor of adoption readiness in situations where adoption is compulsory; consequently, we use concepts from DOI to develop a model for assessing eHealth standards adoption success in Figure .

2.3 Internet Standards Adoption (ISA)

According to Hovav *et al.,* [33] standards adoption is represented by the ISA model (see **Error! Reference source not found.**) as a function of the utility of the standard's characteristics (individual perspective) and the environment in which the adopter operates (community perspective). The ISA framework acknowledges that besides the features of the standard having high utility (useful features), successful adoption requires an adoption environment that is conducive [33]. Both dimensions must be of high quality for the standard to be fully adopted and low quality for the standard to be rejected by an organization. It should be realized that the useful features of a standard may appeal differently to potential adopters. Although the ISA exhaustively explores the adoption of environmental influencing factors such as adoption by other organisations and a large base of existing or related technologies, it does not consider other factors that may infulence successful adoption. Therefore, it can only complement other contributing factors of successful standards adoption.

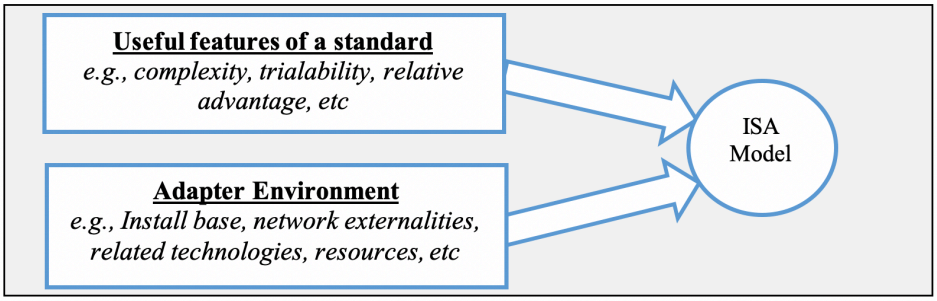

Figure 3: Model of Internet Standards Adoption [33]

Useful features of the standard that are considered by the ISA model informs the standards adoption process guiding the standards selection process. Only applicable standards need to be adopted and or contextualized. Also, the adopter healthcare system can contextualize standards to their needs (based on unique functional requirements) as advised by Payne [8].

The adopter healthcare environment represents the community context for the implementation of the standards. For a successful implementation and collaboration among eHealth standard implementation organizations, there is a need for a broad base of implementers, available resources to support standards implementation, and a supportive network of technical personnel to advise on implementation and monitoring of compliance among others [34].

2.4 Success Model of Innovation Adoption

Rajiv & McLean [24] introduces two constructs of the success of adoption of IS innovations (see Figure). One, "*success of adoption*" that deals with the success of the adoption process itself. Two, "*success from adoption*" that deals with any form of success from adoption outcomes. Their conceptualization of the full scope of success starts from the adoption process and extends to the outcomes of such adoption. To them, IS innovation adoption process is successful when innovation is successfully adopted and used by most, or all, of the adopting units within the community of potential adopters. The community of users consist of a

 J Health Inform Afr. 2020;7(1):24-37. DOI: 10.12856/JHIA-2020-v7-i1-274

community of practice/network externalities, that collaborate and or support each other in the implementation of an IS system. In this case, would be the implementation of eHealth standard.

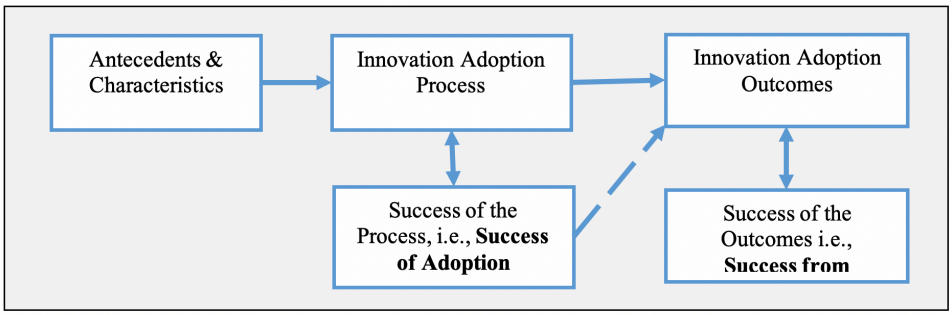

Figure 4: Success Model of Innovation Adoption [24]

However, this study argues that successful adoption in the complex healthcare environment starts with proper preparation before adoption, that is the preparations to adopt a standard. The problem owner's early involvement in problem identification and scoping, identification of the requirements/need for a standard cannot be forgotten as a factor of success in any IS/standards adoption. Success should include consideration of the positive antecedents and characteristics of a health system readiness to adopt standards. Therefore, the study identified this as a construct that is missing from the success model for innovation adoption.

Besides, the success of any innovation is also dependent on its diffusion and infusion [24]. They argue individual adopter organisations must adopt the innovation (diffusion) and that infuse highly amongst individual members (infusion) for success to be measured. Satisfaction with innovation is related to the diffusion of innovation construct of perceived usefulness or relative advantage and infusion are assessed by evaluating the scope of use and intensity of use of an innovation [35]. These concepts of diffusion and infusion of artefacts are also missing parts of the Success Model of Innovation Adoption that is addressed by the proposed Success Factor Model for eHealth Standards' Adoption in Figure 6.

2.5 Contextualizing Success Factors for eHealth Standards Adoption

There exists no single technology/ standard adoption theory to explain the successful adoption of eHealth standards. Borrowing from the discussions of other authors, that argues that success of any artefact adoption depends on the adoption process, the user of such adopted artefact, the organizational context of deployment, and community of practice [23]–[25], this study conceptualized context of the success of eHealth standards adoption (see Figure 5).

To answer the question of conceptualization, the study likened standards adoption to technology adoption. Just like any new technology/innovation, the challenges to adoption of a new artefact are similar across different organizations. Therefore, embracing the dimension of adoption success as applied to eHealth technologies standards adoption is dependent on the success of the adoption process, the organizational context, user context, and community context [3], [24]. The determinants presented in Figure 5 are described in the categories of;

(a) *Adoption process*: Standards adoption success depends on the capacity of the health system to follow the rigorous stages adapted from the diffusion of innovation theory, known as the innovation-decision process [24]. The involvement of healthcare stakeholders in the process of standards adoption reflects the broader inclusion of their expectations of ICT in health and a greater possibility of acceptance of the outputs of the adoption team. It should be realized that the adoption process is influenced by the resource capacity of the adopter organization. A limited resource setting may impact the type, quality, and suitability of standards adopted.
(b) *Organizational context*: Both public and private healthcare organizations play a key role in any healthcare system [2]. Similarly, their role is to align the eHealth standards' needs to respective national healthcare policies, such as Uganda's national eHealth strategy and policy [27]. Successful contextualization of global eHealth standards to a country's needs is, therefore, their responsibility.

 J Health Inform Afr. 2020;7(1):24-37. DOI: 10.12856/JHIA-2020-v7-i1-274

(c) *Community Context*: This is a group of healthcare organizations or health facilities that collaborate in the provision of healthcare. Just like with technology, the willingness of eHealth users to uptake and adhere to standards for eHealth may be slow. Therefore, it is the responsibility of the adopter community to collaboratively enforce implementation and monitor adherence with the agreed-upon standards for eHealth.

(d) *User context*: Just like with technology/innovation adoption success, where user acceptance and use of technology is the most important factor of success [22], acceptance of the use and adherence to standards contribute to the successful adoption of standards [21]. When introducing eHealth standards, the goals and aims of healthcare providers should be incorporated for them to adapt to the use of such standards

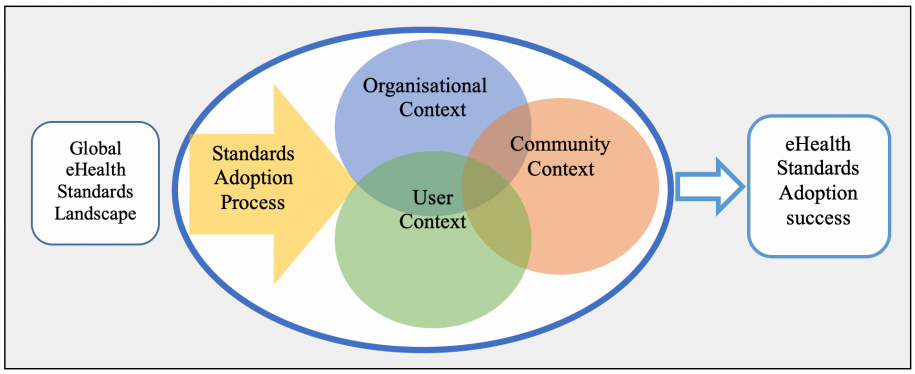

Figure 5: Contexts that Contribute to the success of eHealth Standards Adoption

The relationship between the standards adoption/ contextualization process, the organizational policies, healthcare stakeholders' roles as a community of implementers, and user context is a predictor of the standards' possible success. Therefore, the study assumed that the four determinants represent dimensions of success of eHealth standards adoption in resource-constrained settings like Uganda's health system.

3 Methods

A structured review of the literature was done to identify success factors that influence the adoption of eHealth standards/technology. At the start of the study, we consulted seven eHealth stakeholders drawn from the Ministry of Health, Ministry of ICT, Uganda Bureau of standards, four top health system levels in Uganda. The decision was influenced by the research field, that these stakeholders represent the views of problem owners and therefore helped identify pertinent issues to the success of eHealth in Uganda. The stakeholders helped conceptualise the context of success in the adoption of eHealth standards. They refined the objectives to focus the study proper preparation mapping, adoption process, and standards adoption outcomes.

Search strategy: To perform a full search, articles for this review were gathered from PubMed and Google scholar. The choice of PubMed and Google scholar is based on the argument that one, they provide free access allowing researchers to retrieve full papers of all relevant publications. Two, almost all (very percentage) health informatics publications are indexed in PubMed. Since 91% of all PubMed content is indexed in MEDLINE the database of all medical publications and a study by [36], reveal that a combination involving MEDLINE and Google scholar can achieve a recall of not less than 98.3%. Therefore, the study believes that these two databases are suitable to retrieve relevant literature regards factors that influence potential eHealth standards adoption. The search strategy included three categories of keywords: (i) "adoption" OR "adoption success"; (ii) "electronic health" OR "e-health"; and (iii) "standard" OR "technology" OR "innovation". Synonyms of the keywords were used to perform an exhaustive search of relevant literature.

 J Health Inform Afr. 2020;7(1):24-37. DOI: 10.12856/JHIA-2020-v7-i1-274

Study Selection and Data Extraction: An article was included if it satisfied the inclusion criteria: (1) peer-reviewed publication in English; (2) has a full-text status; and (3) discusses success factors or enables of technology/standard adoption and or implementation in health. Evaluation of the success factors is not a requirement for inclusion. After removing duplicates, the studies were screened for inclusion/exclusion, and only nineteen peer-reviewed publications remained to be used in the extraction of information that was used in the analysis.

The following information was extracted into a spreadsheet: first author surname and year of publication, type of study, type of study country, theory/model/standard, constructs of the theory/components that guided the study, success factors that inform/influence successful adoption/contextualization of standard, and for the standards: where they have been implemented, and results of success (if evaluated). Analysis qualitatively explored the concept of eHealth standards adoption success and success factors of eHealth standards adoption.

4 Results

To answer the two research questions, data from papers that were included in the review were extracted into a spreadsheet. Three phases of eHealth Standards Adoption success were considered.

First, to answer the question of how to conceptualize the success of eHealth standards adoption, the study identified constructs of technology adoption theories as used to assess the successful adoption of technology. This study adopted the Success Model of Innovation Adoption [24] as its foundation model for the development of the success factor model for eHealth standards adoption (see Figure 6). Constructs from UTAUT [23], DOI [24], and ISA [33] were used to extend the Success Model of Innovation Adoption.

A summary of the constructs and pre-conditions to successful adoption of eHealth artefacts is presented in Table . Various applications of technology adoption theories to assess success have used organizational, human, technological diffusion/infusion constructs. Besides, these studies recommend readiness assessment, adoption process, organizational and user acceptance and use as conditions to successful adoption of eHealth artefacts.

Table 1: Constructs for Assessing Successful Adoption of eHealth Artefacts

Constructs of the theory that inform successful adoption of eHealth artefacts	Success Requirements	Pre-conditions for Successful Technology/standards adoption
• **Organizational, facility or community dimension [2], [3], [7], [21], [28]–[30], [37]** • **Human/User dimension [2], [21], [26], [37]** • **Technological context [21], [26], [29], [30], [37]**	• Diffusion and Infusion [23], [24], [28], [35], [38]	• Readiness assessment focusing on health system as organisation, availability of the resources, willingness of healthcare providers and users [3], [6], [20] • Adoption environment and or adoption process [24], [33] • Characteristics of the technology/standard [33] • Organisations' acceptance [2] • User acceptance and use [26]

The authors used identified constructs to study the adoption of eHealth artefacts in the ratio of 47%, 24%, and 29% of the time organizational, human dimension and technological respectively. To attain full benefits of the eHealth artefact, then the technology, innovation, or standard must diffuse and infuse into the healthcare work practices of the health system. Besides studies have explored various pre-existing conditions that influence the success of technology/standards adoption. The identified constructs were used to develop the model in Figure that can be used to assess the potential success of eHealth standards adoption.

Standards adoption success or worthiness can be determined by assessing the standards adoption process and outcomes. The adoption process starts with a proper assessment of the readiness of a health system to adopt standards for eHealth (the pre-adoption phase) followed by actual adoption processes. Comprehensive assessment of standards adoption success can be measured, One, by assessing readiness to adopt standards. Two, the adoption phase where the success of adoption and use of innovation by most, or

 J Health Inform Afr. 2020;7(1):24-37. DOI: 10.12856/JHIA-2020-v7-i1-274

all, of the adopting units (*success of adoption*) is evaluated. Three, the post-adoption phase where the potentially lasting effects/benefits of innovation by the adopting units (*success from adoption*) are measured.

Pre-adoption phase – potential success is possible if a health system is ready to adopt standards for eHealth, i.e., the assessment shows positive antecedents and characteristics of a health system readiness regards the characterizes of the standards, the adopter health system, and the implementation environment. Gesulga [6] argued that readiness assessment as the most important step before implementation and an essential requirement for the success of an eHealth artefact in terms of adoption rate or acceptance. Exploring the readiness of the health system is essential for the successful adoption of eHealth technology [39]. i.e., eHealth artefacts and in this case standards for eHealth. In our previous study, we proposed several metrics for assessing the readiness of a health system to adopt standards for eHealth communication infrastructure [20] that cover the broad dimensions of standards characteristics with six metrics, adopter health system (five metrics), and the standard implementation environment (five metrics).

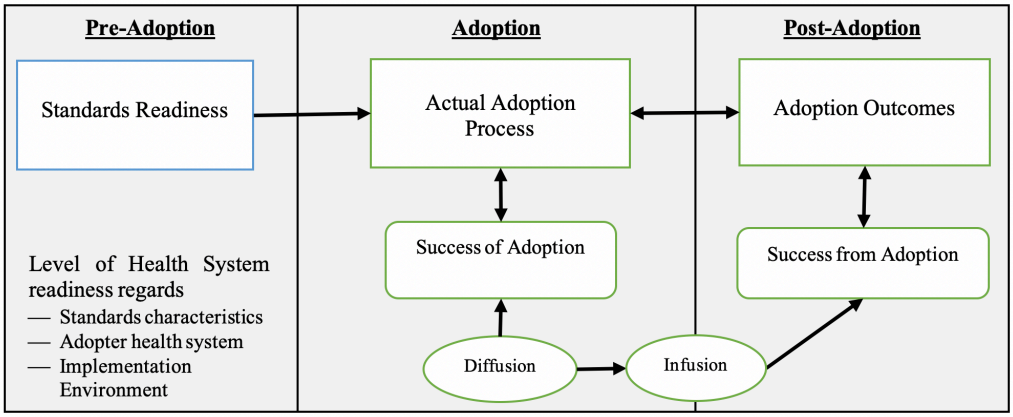

Figure 6: Adaption of Success Model of Innovation Adoption to Success Factor Model for eHealth Standards Adoption

Adoption Phase – is where actual meetings and decisions are taken to select/contextualize particular standards. The adopter organization becomes aware of the standard over time, their possible usefulness, and consider it for adoption (*the diffusion process*) [28]. Rogers [28] identified five characteristics of innovations that influence the decision to adopt or reject it including relative advantage, compatibility, complexity, trialability, and observability. Besides diffusion which [38] termed unprogrammed knowledge transfer, the success of adoption also depends on the infusion. Infusion is deliberate knowledge transfer with three dimensions of the intensity of usage, the scope of usage, and satisfaction with the innovation [35]. To realize the benefits of eHealth standards, the health system as an adopter organization needs to sensitize its relevant stakeholders and involve them in the decision process to select, deploy, and use the standards. This involvement contributes to satisfaction (high or low) to use the innovation/standards by the majority of involved stakeholders [35]. Infusion contributes to both successes of adoption and success from adoption.

Post-adoption Phase – focuses on the outcomes of adopting standards. At this phase success is a measure of the positive outcomes and is influenced by resistance to change, level of reporting on the implementation of standards, and how the implementer organization deals with the "breaks"[32]. Other factors include the presence of other users that can support the use of the standard [21], and the level of management of the implementation [21], [34] among others. These factors span the scope of community and individual user contexts.

4.1 Potential Success Factors of eHealth Standards Adoption

Second, to answer the question of what are the major success factors that influence eHealth standards adoption, the review used constructs of the adoption process, user context, organisational context and

 J Health Inform Afr. 2020;7(1):24-37. DOI: 10.12856/JHIA-2020-v7-i1-274

community of user context (as identified from the technology/standards adoption theories and success of innovation adoption) to identify and categorize potential success factors as summarised in Table. There exist seven factors that relate to the eHealth standards adoption process (Success of Adoption) and six factors that influence eHealth standards adoption outcomes (success from adoption).

As reported by Gagnon et al [17] various studies, perceived usefulness is reportedly the most frequent adoption factor. This includes ease of use, design, compatibility, and cost among others. Skills and training factors cover know-how, familiarity with the breadth of system functionalities, and other user contextual factors like age, gender experience, and willingness to use the system. Stakeholder participation is another core factor in the success of any innovation and standard. Lack of participation may mean their interest are not factored in, or little understanding of the usefulness and failure to accept (buy-in) use of the standard. Ease of use or amount of resistance to change or industry experience in using standards for technology or an innovation [21], [24], [34] is a factor considered relevant to the success of eHealth standards adoption. Additional factors that pertain to the success of standards adoption are technical aspects like ease to understand or complexity of the standard, compatibility, required material resources required to aid the adoption process [21], [34]. It may be necessary to understand the complexity, compatibility before adopting. This can be achieved during the standard pre-adoption assessment.

Table 2: Success Factors for Potential eHealth Standards Adoption

The dimension of success factors		Success factors
• **Adoption Process** • **User context**	Success of Adoption	• Perceived usefulness [1], [2], [21], [22], [26] • National policy [2] • Amount of training before and during transitions [2], [21], [24], [26], [32] • Amount of buy-in (or contribution) from stakeholders [1], [2], [7], [21], [22], [24], [32] • Amount of resistance to change or industry experience in using standards for eHealth, technology or an innovation [21], [22], [24], [26], [32], [34] • Technical aspects such as complexity, compatibility, needed material resources, etc [21], [34] • Features and characteristics [30]
• **Organizational context** • **Community context**	Success from Adoption	• A clear strategy and organizational process [7], [37] • Level of reporting on the outcomes achieved during and after the implementation of standards [24], [32] • Level of effectiveness in dealing with the “breaks” [24], [32] • Leadership and management of the implementation [7], [21], [32] • Resource factors (human resources, financial, infrastructural and technical resources) [1], [2], [21], [26], [34], [37], [37] • Network externalities and external environment, i.e., presence of other users [2], [21]

Regards the success of adoption, six major factors that may influence the success of technology adoption as identified from the literature were considered relevant to explain the success of standards adoption. They are largely managerial and exist both at organizational and community levels. These include strategies and organizational processes to direct implementation and compliance to standards, reporting of achieved outcomes, how to deal with any breaks, enforcement/management of the standards implementation plan, a network of the user organizations that can support use, and policies on resources required to support pre-adoption, adoption, and post-adoption activities of the standard. Also, there are organizationally engineered facilitating conditions like infrastructural resources, technical financial and human among others that support eHealth standards’ adoption and use by participating stakeholders.

Authors have differently identified or referred to the success factors for the adoption of technology/standards for eHealth. The graph in Figure shows several references to factors that influence the successful adoption of eHealth technology/artefacts in the reviewed literature.

The graph shows that amount of stakeholder buy-in and supportive resource factors have been identified as the highest influencers of successful adoption in several studies. Second, is resistance to the use of the

 J Health Inform Afr. 2020;7(1):24-37. DOI: 10.12856/JHIA-2020-v7-i1-274

new technology. Third, is perceived usefulness and required training on the use of the new technology/standard. Forth, is leadership and management. Fifth, are network externalities, level of effectiveness dealing with breaks, level of reporting, clarity of implementation strategy and organizational process, and technical aspects. Sixth, are feature and characteristics of the technology /standard, and national policy regard adoption of the eHealth technology/standard.

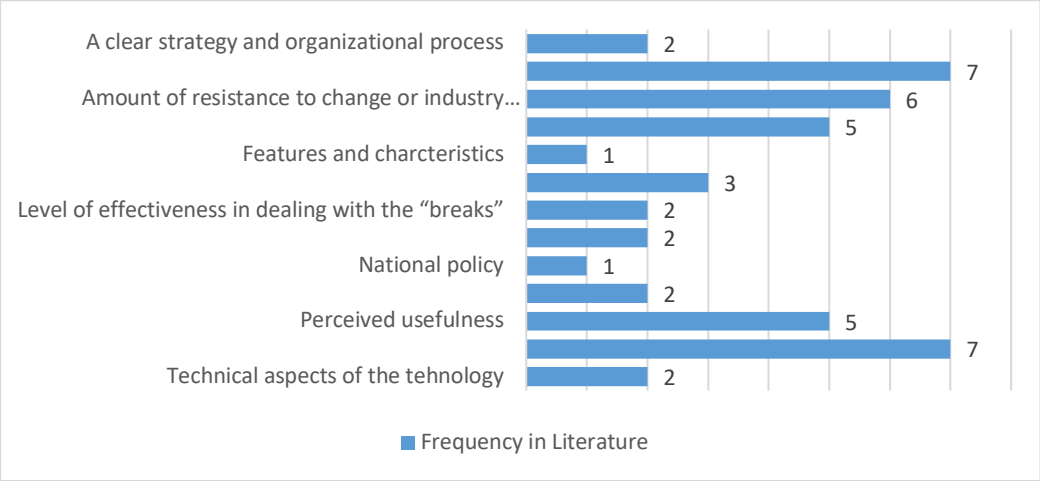

Figure 7: Frequency of Success factors of Adoption of eHealth Technologies

5 Discussion

Successful adoption and use of any technology or standard depend on success at each phase of adoption or implementation [37]. Unlike Rajiv and McLean [24] who suggest that the adoption success should start either at the adoption process level or the adoption outcome level, we argue that the overall standards adoption success should integrate readiness assessment with both levels of adoption process and adoption outcome as illustrated in Figure , creating a model for assessing the potential success of eHealth standards adoption. The model has the pre-adoption, actual adoption, and post-adoption phases. A comprehensive measure of success cannot be done in isolation of any of these phases. While pre-adoption concerns itself with standards readiness, the actual adoption process focuses on the decision process, that is, possible delays in buy-in and or resistance to change by decision-makers, to fail the adoption process. The amount of training before and during transitions, that is, standard user support, can improve the use of the standard. Adoption outcome assesses the level of reporting on the outcome measured during and after implementation (communication on the technology adoption progress) and level of effectiveness in dealing with the "breaks" can both improve adopter understanding of the standard and its impact, hence support the monitoring and review process. Similarly, overall, standards adoption success is dependent on the accomplishments of the pre-adoption phase. A health system with established antecedents and characteristics (readiness to adopt standards for eHealth) for standard adoption and follows the due process of adoption is more likely to succeed in adoption.

On one hand, the success of adoption arises from the standards adoption process. Adopters are motivated by their view of the perceived usefulness of the standards [21] that relate to the performance expectancy of UTAUT [26]. Interest can be initiated via training on the need and usefulness of standards. Training can ensure that the adopter organization, user community, and the individual users are convinced of the benefits of the standard, build confidence in the use of a standard, or gain control and are efficient (that is, optimism in use of standard). This increases the possibility of successful adoption of eHealth standards. Training health workers and stakeholders in Uganda's health system will enable them to appreciate the benefit of adopting/adhering to standards for eHealth. Training and orientation in using the standard or industry experience in using related standards can reduce the amount of resistance to the adoption of the standard for eHealth, their technology, or innovation. Furthermore, increased buy-in implies an increased number of

 J Health Inform Afr. 2020;7(1):24-37. DOI: 10.12856/JHIA-2020-v7-i1-274

stakeholders, wide implementation, and a broad base of collaborating partners using the standards; this becomes a possible enabler of successful adoption of the standards.

The dimension of success from adoption is a consequence of the adoption process [24]. As much as positive results cannot be expected from the failed adoption process, success from adoption follows after the success of adoption by measuring the level of reporting during implementation and level of effectiveness when dealing with breaks. The standards adoption process can be considered successful by Uganda's Ministry of Health only when adoption outcome (post-adoption behaviours) include compliance with the use of the standards.

As shown, many dimensions and factors influence the success of standards adoption. The dimensions of success factors are overlapped as was depicted in Figure 5, and therefore some of the factors overlap the dimensions of successful adoption of standards. For example, the resource factors can be an organizational policy issue on one hand and the other hand stakeholder training is required to sensitize them of the need, purpose, and benefits of adopting standards, or even user training on the use of the standards. The identified factor has been differently emphasized by the authors. The graph in Figure revealed that studies have emphasized 6/13 factors above all others signifying they are high influencers of successful adoption of eHealth artefacts. Besides, the six factors relate to artefact acceptance due to perceived usefulness, training stakeholder involvement and availability of resource factors like finances, infrastructure leading to reduced resistance to the new introduction of an eHealth artefact, standard. These factors span the breadth of organizational, human and technological dimensions of the technology adoption theories. In this manner, the study of successful adoption of eHealth standards conforms to principles of technology adoption theories.

6 Conclusion

Motivated by the realization that to date, other studies have not explored the concept of successful adoption of eHealth standards, this study reviewed the literature on the success of technology/innovation adoption and applied it to standards adoption. Conceptualization of eHealth standards adoption was informed by four technology adoption theories, i.e. Diffusion of Innovation Theory (DOI), Unified Theory of Acceptance and Use of Technology (UTAUT), Internet Standards Adoption (ISA), and Success Model of Innovation Adoption. We argued that since standards adoption and implementation is an iterative process, then to attain success all phases of the standards adoption and implementation process must be involved. Thus the inclusion of pre-adoption, adoption, and post-adoption phases in the conceptual model. Furthermore, the study identified four major dimensions of success factors of standards adoption to include, including the adoption process, the user, organizational, and community contexts. Finally, the study identified thirteen factors that influence the success of eHealth standards adoption. However, these factors may not in the current form be useful to assess potential success and therefore need to be evaluated/validated. Future research should focus on validating the potential success factors to determine their impact on the adoption of standards for eHealth in Uganda's health system.

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