A South African perspective on factors that impact on the adoption and meaningful use of health information technologies

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Abstract

Objective: Various benefits are associated with the adoption and meaningful use of health information technologies (HITs) in the healthcare sector. Despite the associated advantages with the adoption and use of HITs, the South African healthcare sector has been slow to adopt HITs, such as electronic record systems. The purpose of this study was to identify factors that should be addressed to encourage the adoption and meaningful use of HITs in the South African healthcare landscape.

Design: A three-round Delphi study was conducted to identify such factors.

Setting and subjects: The Delphi panel included 21 participants who were considered to be suitably knowledgeable about the acceptance and significant use of HITs in the context of the South African healthcare setting.

Results: A total of 58 factors were uncovered by the participants. Consensus was reached on 42 factors that were considered to have a direct to significant impact on the adoption and meaningful use of HITs in the South African healthcare sector.

Conclusion: The results of this study highlight factors that should be addressed to encourage the adoption and meaningful use of HITs in South Africa's healthcare setting. These results indicate that a wide range of factors need to be addressed and involve a multitude of stakeholders.

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Introduction

Health information technologies (HITs) such as electronic medical records, electronic health records have the potential to transform the healthcare industry. It has been stated that increased use of HITs is the only way for healthcare costs to be controlled in the long term, without decreasing the quality of health care that is delivered to patients.[1-3] The adoption of HITs is also viewed as a way of reducing the widening gap between the demand and supply of healthcare services.[4] HITs employ hardware and software to process, store, retrieve, and share health information, data and knowledge for communication and decision-making in the healthcare sector.[5-7] Even though various technological advances have had a significant impact on the healthcare sector in past decades, the focus has been on financial and administrative applications primarily.[1,8,9] The adoption of HITs is an uncertain and challenging task in the context of any country's healthcare system and calls for a sensitive matching of local needs to available technologies and resources.[10] Much of South Africa's healthcare sector still relies on paper-based information management systems, especially in the context of medical record management.[11,12] One of the strategies which has been proposed by numerous authors to improve the quality of medical records and the exchange of information between various healthcare providers is the use of electronic records, as opposed to paper-based records.[13] The purpose of this study was to identify factors that should be addressed to encourage the adoption and meaningful use of HITs in the South African healthcare setting.

Method

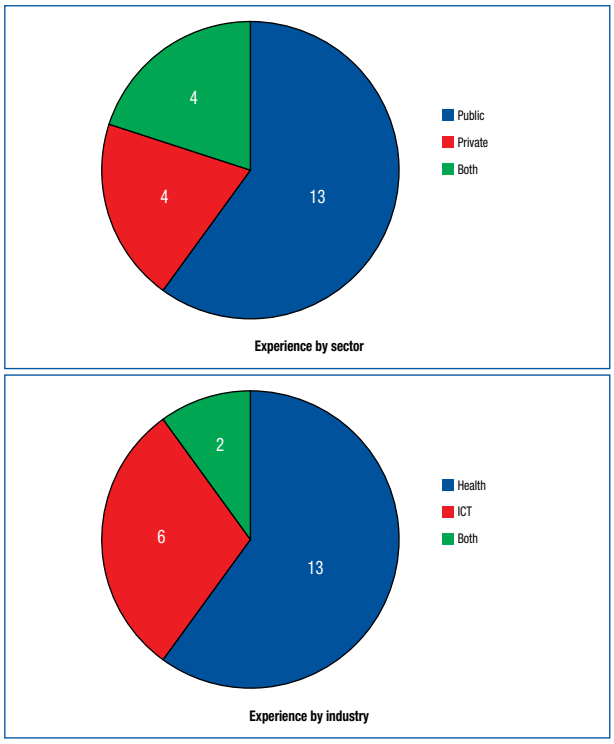
A three-round Delphi study was employed to detect factors that should be addressed to encourage the acceptance and significant use of HITs. The decision to end the study after three rounds was made based on recommendations to contain participant fatigue.[14-20] The researchers also considered three rounds to be sufficient to satisfy the purposes of the Delphi study. The study was completed within a four-month period in 2011. The study was approved

by the ethics committee of the Nelson Mandela Metropolitan University.

A database containing the names and e-mail addresses of current and former members of the South African Health Informatics Association (SAHIA), as well as individuals who have attended health informatics-related events in South Africa was obtained from SAHIA to identify Delphi participants who would be suitably knowledgeable about the adoption and meaningful use of HITs in the context of the South African healthcare landscape. SAHIA is an independent organisation that is registered as a Section 21 company. It was formed to promote the professional application of health informatics in South Africa. SAHIA aims to represent South African health informatics nationally and internationally, most notably through its membership of the International Medical Informatics Association.[21] One hundred and ninety-six individuals from this database were e-mailed in April 2011 to invite them to take part in the Delphi study. A further 25 individuals were invited to participate in the Delphi study based on recommendations from other researchers who are active in health informatics, as well as suggestions from individuals who responded to the first round of invitations. Although Delphi studies are usually conducted by mail, the use of e-mail can speed up the communication process and was therefore used as the mode of communication for this Delphi study.[18] Delivery receipts were activated, and out of the total of 221 e-mails that were sent, 37 could not be delivered, assumedly because of invalid e-mail addresses.

The first round questionnaire was sent out with the initial invitation. Twenty-one individuals returned their completed questionnaires and became members of the Delphi panel for this study. This falls well within the range of recommendations for the size of a Delphi panel.[18,19,22-26] All 21 participants who returned their questionnaires during the first round continued to all three rounds of the Delphi study. Such a high retention rate indicates a high level of interest in the problem being addressed.[27]

Participants were asked to provide background details that related to their current job title, department and organisation, whether their experience was mostly in the private or the public sector, and whether it was in the health or information and communication technology (ICT) sector. The job titles of the participants who agreed to take part in this study were managers (clinical, clinical risk, contracts, division, project, senior account and senior operations), heads of departments, chief executive officers, directors and presidents. Other job titles included specialists (EMR and healthcare informatics sales), consultants, researchers and senior facilitators. The organisations for whom these participants worked ranged from public and private healthcare providers, medical aids, ICT companies, research



ICT: information and communication technology

Figure 1: Participant experience per sector and industry

institutions, departments of health, agencies providing ICT services to the government, as well as not-for-profit organisations. Figure 1 indicates participants' experience per sector and per industry. The number of participants (out of 21) is indicated per sector and industry.

During the first round, participants were presented with a single, open-ended question: "Based on your experience and knowledge of the South African healthcare landscape, describe as many aspects or barriers that should be addressed to encourage the adoption and meaningful use of HITs". The open-ended nature of the first round questionnaire allowed participants to state their own ideas, views and opinions on the problem under investigation, without any restrictions.[16,20,28] While some Delphi studies have employed a more structured questionnaire in the first round, the open-ended nature of the first questionnaire has been seen as a criterion with which to judge whether or not the study is well conducted.[19] Allowing participants to make contributions during the first round without a seed list, assists with the development of a set of ideas, views and opinions that are more representative of those of the participants. When making use of structured questionnaires during the first round, there is also the risk that the offered items may be open to researcher bias which could influence the results of the study.[15,16]

The qualitative data received during the first round were analysed and collated to identify unique ideas, views and opinions. The first phase involved analysis of the ideas, views and opinions expressed by participants, and grouping

of similar aspects by coding them using broad key phrases. Where several different responses appeared to relate to the same issue, the researcher grouped them together under a broad key phrase in an attempt to provide one universal description. It has been suggested that infrequently occurring aspects should be omitted to ensure that the resultant master list is manageable, but this goes against the basic principles of the Delphi technique.[15] The researcher included key phrases for all of the unique identified aspects. This resulted in a list of 33 unique aspects. An inductive approach was followed for analysis of the data.[29]

To ensure that the list of 33 phrases fairly represented the ideas, views and opinions expressed by participants, a sample of the first round questionnaires was studied to confirm that researcher bias did not influence the identified key phrases, as well as the grouping of aspects under these phrases. It was found that researcher bias did not influence identified key phrases. Once this process was complete, a second phase of analysis of the first round results commenced.

In the second phase of the analysis, all of the aspects that related to a key phrase were grouped together, and each grouping analysed individually to derive factors that could influence the adoption and meaningful use of HITs. A list of 58 factors was constructed from the initial groupings. This master list of factors was checked again to ensure that there was no researcher bias before the second round questionnaire was developed.

The 58 factors that derived from analysis of the first round responses formed the basis for the structured second round questionnaire. Participants were invited to rate the importance of each factor in order to identify those that required the most urgent attention to encourage the acceptance and significant use of HITs in South Africa. According to the rating scale depicted in Table I, participants could rate a factor as "very important", "important", "slightly important" or "unimportant". The same rating scale was also used for scoring purposes during the third round of the study.

Table I: Rating scale provided to participants for the Delphi second and third round questionnaires

Very important (A most relevant factor)	• Is a first-order priority. • Has a direct bearing on the adoption and meaningful use of HITs. • Must be resolved or dealt with.
Important (Relevant to the issue)	• Is a second-order priority. • Has a significant impact on the adoption and meaningful use of HITs, but not before other factors have been addressed. • Does not have to be fully resolved or dealt with.
Slightly important (Insignificantly relevant)	• Is a third-order priority. • Has little importance on the adoption and meaningful use of HITs. • Is not a determining factor or major issue.
Unimportant (No priority)	• Has no relevance. • Has no measureable effect on the adoption and meaningful use of HITs. • Should be dropped as an aspect or barrier for consideration.

The results from the second round were used to compile the third round questionnaire. Each participant received a personalised questionnaire that indicated his or her response to each factor's level of importance during the previous round, as well as a summary of the panel's response. This allowed the individual to see how his or her responses lay in relation to those of the total panel. After comparing and reflecting on their personal ratings and those of the panel, participants were allowed to change their level of performance rating if so desired.

Various methods were used to determine whether consensus was reached on the rating of an aspect during the second and subsequent rounds. One of the methods used was the median and interquartile range (IQR) to summarise the point of consensus and the amount of spread in the distribution. The median indicates the point of consensus and the IQR was employed to assess the extent of agreement between participants. A lower value indicated a higher degree of consensus. De Loe[22] uses an example to illustrate how these statistics are unsatisfactory in determining the panel's response. In Table II, the IQR works well for examples 1-3, but the median score is not an accurate indication of the ratings provided by participants for all three of these examples. While the median perfectly describes the panel's rating in example 1, it is less adequate in example 2, and completely inadequate in example 3. Example 4 is a case of almost complete ambiguity, while here is moderate and weak support towards a specific rating in examples 5 and 6. Despite these rating distributions, the IQR was the same for all three examples. Hsu and Sandford[30] also note that the median can be misleading in instances where there is polarisation or clustering around two or more ratings.[30]

To overcome the problems illustrated in Table II, De Loe[22] proposed a system that classifies each set of ratings according to the degree of consensus reached, as well as the level of support for a particular rating. The polarity

Table II: Examples of the rating distributions[22]

Example number	Rating				Median	IQR%
	1	2	3	4		
1	20	0	0	0	1.0	1
2	10	0	10	0	2.0	2
3	10	0	0	10	2.5	3
4	5	4	6	4	3.0	2
5	10	3	4	5	2.0	2
6	8	8	6	1	2.0	2

IQR: interquartile range

of responses is also calculated to determine whether the group is polarised, for example, half supporting and half opposing a specific rating.

The polarity indicates whether the participants' responses are polarised and is expressed as being strong if the polarity is equal to or greater than 1.5, weak if it is equal to or greater than 1.2, but less than 1.5 or none if it is less than 1.2.

Consensus was expressed on the degree to which participants agreed on the rating of an item.

In order for the consensus degree to be high, medium, low or none, the following requirements had to be met:

- *High:* 70% of ratings in one rating category, or 80% in two contiguous rating categories.
- *Medium:* 60% of ratings in one rating category, or 70% in two contiguous rating categories.
- *Low:* 50% of ratings in one rating category, or 60% in two contiguous rating categories.
- *None:* Less than 60% of ratings in two contiguous rating categories.

The level of support for a specific rating could be indicated by an individual rating category, or by two contiguous rating categories, for example: "very important", "very important to important", "important", "important to slightly important".

The level of support for a specific rating can be ambiguous in the following situations:[22]

- If the degree of consensus is low, and the ratings are divided equally between two categories: for example, rating distributions of 50% (very important), 0% (important), 0% (slightly important) and 50% (unimportant).
- If the ratings are distributed in a certain pattern: for example, 25% (very important), 45% (important), 25% (slightly important) and 5% (unimportant). In such a case, the degree of consensus would be "medium", but the level of importance could be either "very important to important" or "important to slightly important".

The approach proposed by De Loe,[22] and described above, was adopted to analyse the second and third round results of the Delphi study.

Table III: Summarised results of the Delphi study

Factor		Responses (% rounded)				Polarity	Level of importance	Degree of consensus
		Very important	Important	Slightly important	Unimportant			
1	Staff is overburdened due to staff shortages and a heavy patient load which results in no capacity to support technology implementation and use.	57	43	0	0	N 0.24	VI-I 100%	High
2	Lack of ownership and accountability makes it difficult to sustain technological implementation.	38	62	0	0	N 0.32	VI-I 100%	High
3	Decision-makers and management do not provide adequate direction, leadership and support in terms of the adoption of technology.	71	24	5	0	N 0.32	VI-I 95%	High
4	Implementing technology solutions requires considerable changes in an organisation. There is often no comprehensive change management strategy which results in the organisation not being properly prepared for the level of required change.	67	29	5	0	N 0.33	VI-I 95%	High
5	There is no awareness or a deeper understanding of the value that technology could have in supporting the organisation and healthcare delivery.	62	33	5	0	N 0.34	VI-I 95%	High
6	Users are not properly trained and motivated to ensure buy-in. This results in resistance and lack of commitment.	52	43	5	0	N 0.34	VI-I 95%	High
7	There is poor mapping of system capabilities to business processes and workflow in the complex healthcare environment.	43	52	5	0	N 0.33	VI-I 95%	High
8	There is no appropriate training to ensure meaningful use of the system once it is implemented.	33	62	5	0	N 0.30	VI-I 95%	High
9	Users have unrealistic expectations and expect sophisticated technological solutions to immediately solve all of their problems. These expectations are often not met at the onset of implementation of the technology solution which creates resistance to future implementations.	19	76	5	0	N 0.22	VI-I 95%	High
10	Guidelines, policies and procedures to guide sustainable implementation of ever-changing technological solutions in the healthcare environment are not available.	62	29	10	0	N 0.44	VI-I 90%	High

11	Slow, unreliable, unavailable systems result in users losing confidence in the technology solution and not using it.	33	57	5	5	N 0.54	VI-I 90%	High
12	Health information that is captured using technology solutions is considered to be unreliable because there are no quality control mechanisms.	29	62	5	5	N 0.50	VI-I 90%	High
13	Citizens are not engaged in and aware of the benefits that technology can offer in terms of healthcare delivery.	29	62	5	5	N 0.50	VI-I 90%	High
14	High staff turnover results in lack of capacity and consistency in efforts to implement technology.	29	62	10	0	N 0.34	VI-I 90%	High
15	Lack of user involvement at all stages also results in no buy-in.	29	62	10	0	N 0.34	VI-I 90%	High
16	Decision-makers are not trained to understand the available technology solutions and how they will meet requirements for future expansion.	76	10	14	0	N 0.52	VI-I 86%	High
17	There is no capacity and an absence of necessary structures to implement, execute, support and monitor existing policies and regulations in terms of the implementation of the technology.	67	19	14	0	N 0.54	VI-I 86%	High
18	There is poor insight into and a lack of understanding of the role that technology solutions can play in improving healthcare delivery.	52	33	14	0	N 0.52	VI-I 86%	High
19	There is no mediated accountability through audit trails.	48	38	10	5	N 0.68	VI-I 86%	High
20	There is poor planning in terms of budgeting for the implementation of technology.	48	38	10	5	N 0.68	VI-I 86%	High
21	The absence of a standardised technological solution hampers integration and interoperability between systems.	48	38	14	0	N 0.51	VI-I 86%	High
22	There are conflicting expectations. Dependence on various stakeholders hampers the implementation of technology.	43	43	5	10	N 0.82	VI-I 86%	High
23	The absence of an adequate career path in health informatics results in disinterest and reduced incentive to make the effort to learn about available technology.	43	43	14	0	N 0.49	VI-I 86%	High
24	Organisations that are interested in implementing technology often decide not to do so because there are no clear guidelines on what to consider when doing so, and how to prepare the environment for it.	38	48	14	0	N 0.47	VI-I 86%	High
25	The user interface of data-capturing forms offered by technology solutions is not conducive to ease of use and accurate data capturing.	33	52	14	0	N 0.44	VI-I 86%	High
26	There is no implementation, enforcement and monitoring of compliance with relevant healthcare technology standards.	29	57	14	0	N 0.41	VI-I 86%	High
27	An absence of adequate service level agreements results in unacceptable response times to queries and requests for support.	29	57	14	0	N 0.41	VI-I 86%	High
28	The provision of basic health care is top priority, which leaves little capacity to spend time, effort and funds on implementing and using new technology, instead of current systems.	29	57	5	10	N 0.71	VI-I 86%	High
29	An absence of on-site technical support results in unacceptable response times when support is needed.	24	62	10	5	N 0.52	VI-I 86%	High
30	There are insufficient information and communication technology resources on site.	62	19	19	0	N 0.63	VI-I 81%	High
31	Threre is an absence of computer literacy skills among healthcare staff.	43	38	19	0	N 0.56	VI-I 81%	High
32	There is inadequate connectivity and communication infrastructure in South Africa.	62	14	24	0	N 0.71	VI-I 76%	Medium
33	There is no national framework and guidelines to direct implementation of technological systems and to address problems with current systems.	62	14	24	0	N 0.71	VI-I 76%	Medium
34	Some organisations in rural areas are inaccessible in terms of service delivery (especially information technology).	48	29	10	14	N 1.13	VI-I 76%	Medium
35	There is a lack of common unique identifiers with which to track patients.	48	29	19	5	N 0.82	VI-I 76%	Medium

36	Users do not make meaningful use of the system once it is implemented because they do not have confidence in the information provided by the system, and are unwilling to make decisions based on this information.	38	38	19	5	N 0.75	VI-I 76%	Medium
37	Available technological solutions do not meet the clinical needs of the healthcare sector.	29	48	19	5	N 0.67	VI-I 76%	Medium
38	There is no government-backed drive to implement the technology solutions.	38	33	24	5	N 0.81	VI-I 71%	Medium
39	There is an absence of funding to spend on technology solutions.	24	48	19	10	N 0.79	VI-I 71%	Medium
40	Potential benefits offered by wireless technologies and mobile devices are not exploited to their full potential.	38	29	33	0	N 0.71	VI-I 67%	Low
41	There is insufficient evidence of a meaningful return on investment with the implementation of technology.	24	43	19	14	N 0.94	VI-I 67%	Low
42	Available technological solutions do not meet the administrative needs of the healthcare sector.	29	33	24	14	N 1.04	VI-I 62%	Low
43	There are concerns that relate to the theft of hardware.	5	57	33	5	N 0.43	I-SI 90%	High
44	There is a perception that the use of technology will have a negative impact on the doctor-patient relationship.	0	38	52	10	N 0.39	I-SI 90%	High
45	Cost-cutting mechanisms, such as aggressive time scales for implementation, are detrimental to the long-term success of the implementation of technology.	14	62	24	0	N 0.37	I-SI 86%	High
46	The physical layout on site restricts easy interaction between the technological system and the workflow.	10	52	33	5	N 0.51	I-SI 86%	High
47	The cost of hardware, software, maintenance and support is prohibitive.	5	38	48	10	N 0.52	I-SI 86%	High
48	There is resistance to moving away from current paper-based systems and the present way of doing things.	19	52	29	0	N 0.47	I-SI 81%	High
49	There is a lack of reliable electricity supply.	19	43	38	0	N 0.54	I-SI 81%	High
50	Concerns relating to the confidentiality, security and privacy of patient data are not adequately addressed.	19	43	38	0	N 0.54	I-SI 81%	High
51	There is no space for information and communication technology resources on site.	14	38	43	5	N 0.62	I-SI 81%	High
52	Poor after-sales support results in inadequate maintenance, customisation and enhancement of systems once they have been implemented.	14	38	43	5	N 0.62	I-SI 81%	High
53	To ensure the desired effect on quality of care, it is necessary to assess the proposed implementation properly and to consider cost-effectiveness.	24	43	33	0	N 0.56	I-SI 76%	Medium
54	There are no open-source solutions.	0	10	57	33	N 0.37	SI-U 90%	High
55	Potential advantages that are offered by cloud computing are not exploited to their full potential.	29	5	43	24	W 1.28	SI-U 67%	Low
56	Fear and the absence of computer literacy skills results in resistance to the adoption of technology.	19	62	19	0	N 0.38	A VI-I or I-SI 81%	Medium
57	Project implementation takes too long to complete, or is not completed at all.	19	62	19	0	N 0.38	A VI-I or I-SI 81%	Medium
58	It is necessary to introduce incentives to use the technology to motivate staff and increase staff retention.	14	43	14	29	N 1.10	-	None

Polarity scale: S: strong, W: weak, N: none

Support scale: V: Very important, VI-I: Very important to important, I: Important, I-SI: Important to slightly important, SI: Slightly important, SI-U: Slightly important to unimportant, U: Unimportant, A: Ambiguous

In the following section, the final results of the Delphi study will be discussed.

Results

Table III summarises the final results of the Delphi study. The factors were sorted according to the level of importance and degree of consensus.

Despite this, consensus was obtained with regard to 42 factors rated as being "very important to important" in encouraging the adoption and meaningful use of HITs (factors 1-42 in Table III). The implication of the rating scale used by participants to score each factor during the second and third rounds of the Delphi study was that addressing these factors would have a direct to significant impact on the adoption and meaningful use of HITs in the South African healthcare setting. Since these factors were derived from the contributions made by participants themselves during the first round, it is not surprising that the majority of the factors were scored as "very important to important".

Eleven factors were rated as being "important to slightly important" (factors 43-53 in Table III). Only two were rated as being "slightly important to unimportant" (factors 54-55 in Table III). There were also two where the level of importance was "ambiguous" (factors 56-57 in Table III), as well as one where the degree of consensus was "none" (factor 58 in Table III). The degree of consensus was "medium" for both of the factors where the level of importance was "ambiguous", but the level of importance was either "very important to important" or "important to slightly important".

According to the method of analysis used, consensus was "ambiguous" with regard to factors 56-57 and "none" for factor 58. When the percentage ratings for each of the individual levels of importance were analysed, it was possible to see the importance that was attributed by the majority of participants to specific factors. It is clear that 62% of the participants thought that it was "important" that fear and an absence of computer literacy skills among healthcare workers should be addressed to lessen resistance to the adoption of technology (factor 56).

Sixty-two per cent of participants also thought that it was "important" to address project implementation that takes too long to complete, or which is not completed at all (factor 57).

There was only one factor where the degree of consensus was "none" (Factor 58). When the participants' ratings for each of the levels of importance were considered, no clear level was scored significantly higher than the others, although 43% of the participants thought that it was necessary to introduce incentives to motivate staff to use technology.

During the third round of the Delphi study, participants were asked to provide motivations if their rating of a factor did not correspond with that of the majority of the Delphi panel. It is possible to spot interesting trends by looking at these motivations that were provided by the participants who did not agree with this 43%. Participants who rated this factor as "very important" were of the opinion that incentives would be the only way through which to ensure the meaningful use of HITs, while those who scored the factor as "slightly important" believed that a thorough change management process would ensure that incentives were not necessary. Twenty-nine per cen of participants who deemed this factor to be "unimportant" thought that HITs should be accepted as "tools of the trade" in today's healthcare landscape, and that staff should not receive incentives for simply doing what is expected of them.

These results will be discussed in the following section.

Discussion

The purpose of the Delphi study was to identify factors for consideration in encouraging the adoption and meaningful use of HITs in the South African healthcare setting. The Delphi study participants were considered to be suitably knowledgeable about the South African context and the domain under investigation. Consensus was reached that addressing 42 of the factors was "very important to important" in order to encourage the adoption and meaningful use of HITs. The implication of the rating scale used by participants to score each factor during the second and third rounds of the Delphi study was that addressing these factors would have a direct or significant impact on the adoption and meaningful use of HITs in the South African healthcare sector. These factors are summarised and discussed in Table IV.

The 33 broad key phrases used during the first-phase analysis of the Delphi first round results to group the ideas, views and opinions expressed by participants were employed a second time to group relevant factors with a view of meeting the main objective of this research project. The 42 individual factors on which consensus was reached that addressing them was "very important to important", were grouped according to the broad key phrases from which they were derived from during the first round of the Delphi study. This resulted in the identification of 26 broad categories. Of the 33 identified broad categories during the first round of the Delphi study, seven of these contained no factors rated as "very important to important" in terms of the need to be addressed. In summarising these results, the quantitative data that resulted from the third-phase analysis and some of the motivations provided by participants as to why they disagreed with the majority of other participants, were considered in order to categorise the factors.

Table IV: Discussion of final results

Category	Factors[1*]	Discussion
Guidelines, policies, and procedures	10, 17, 24	Participants considered factors that needed addressing to be the absence of clear guidelines on what to consider when selecting a technological solution, especially taking into account the dynamic nature of health information technologies. There was inadequate or no information on how to prepare the environment for sustainable implementation of health information technologies. A lack of capacity and the necessary structures to implement, execute, support and monitor existing policies and regulations in terms of technology implementation also rated as a factor that hampered the adoption and meaningful use of health information technologies.
User support	6, 14, 15	The absence of user involvement in all stages of the adoption of health information technologies results in no commitment. Other factors that ensure resistance include insufficient training on how to use the adopted health information technologies and no motivation for their use. These factors can be contributed to high staff turnover. This causes absence of capacity and consistency of effort needed to implement the technology.
Management and/ or decision-maker support	2, 3	All 21 participants indicated that a lack of ownership and accountability made it difficult to sustain the implementation of technology. One hundred per cent of participants rated factor 2 as "very important to important". This also relates to factor 3 which indicates that decision-makers and management do not provide adequate direction, leadership and support in terms of adoption of the technology.
Quality control and accountability	12, 19	Captured health data, using health information technologies, is considered to be unreliable because there are no quality control mechanisms for and accountability of the information.
Data capturing	25	Despite user involvement in the development of many software systems in the healthcare environment and an improvement in user-interface, it seems that the user-interface of data-capturing forms is still not as conducive to ease of use and accurate data capturing as it should be.
Staff capacity	1	A staff shortage that leads to overburdened staff and a heavy patient load emerged as a factor that has a direct impact on the adoption and meaningful use of health information technologies. All participants indicated that staff shortages results in a diminished capacity to support health information technology implementation and meaningful use thereof.
Education, training and awareness	5, 8, 16, 18, 31	Participants believed that the absence of computer literacy skills among healthcare staff and decision-makers not trained to understand the offered technology solutions, as well as strategies to meet future expansion requirements, were important factors that needed addressing. This could be attributed to a lack of appropriate training once the system was implemented. This factor was also rated by participants as having a direct impact on the meaningful use of health information technologies. Three participants who scored the absence of computer literacy skills as only "slightly important" mentioned that having no computer literacy skills could be addressed relatively easily and quickly with appropriate training, and that healthcare staff members were generally more computer literate than they were a few years ago, especially with the increased penetration of mobile technology. Other factors which needed to be addressed related to awareness, poor insight and an inability to understand the value that health information technologies could have in supporting the organisation and healthcare delivery.
Infrastructure	30, 32	Insufficient information and communication technology on-site resources were deemed to be factors that needed addressing. There was consensus among participants that the absence of adequate connectivity and communication infrastructure in South Africa hampers the adoption and meaningful use of health information technologies.
Unrealistic expectations	9	Participants thought that users had unrealistic expectations and believed that sophisticated technological solutions would immediately solve all of their problems. When these expectations were not met at the onset of implementation of the solution, resistance to future establishment of technologies resulted. This relates to poor insight and lack of understanding of the value that health information technologies can have in supporting the organisation and healthcare delivery. A better comprehension of the value offered by health information technologies, as well as the limitations of the solution, could aid in the management of unrealistic expectations.
Meaningful use	36	Often, users were not confident about the information provided by a health information technology system because of a lack of quality control and accountability. They were unwilling to make decisions based on the information provided by the system. This resulted in the absence of meaningful use thereof.
Standardisation	21, 26	In terms of standardisation, two factors need to be addressed. First, there was a failure of implementation, enforcement and monitoring of compliance with relevant healthcare technology standards. Second, this hampered integration and interoperability between systems. Both of these factors have a negative impact on the adoption and meaningful use of health information technologies.
Cost	20, 39	A factor that was rated as "very important to important" in terms of cost related to inadequate funding for technology solutions. Interestingly, poor planning in terms of budgeting for technology implementation was rated significantly more important than the absence of funding. It seems that the lack of funding might be a result of poor budgeting practices. Based on comments made by two participants, it seems that this is less of a factor in the private healthcare sector and that health information technology adoption is not a high priority in an overburdened public healthcare sector. This results in the allocation of less funds for health information technology implementation. Another factor that related to cost was added to the questionnaire during the first round. It pertained to the cost of hardware, software, maintenance and support. This factor was finally rated as "important to slightly important", indicating that it is not the actual cost of health information technology implementation that is prohibitive, but rather the absence of funding.

Return on investment	41	There was "low" consensus as to whether there was sufficient evidence for meaningful return on investment following technology implementation. One participant, who did not agree with this statement, indicated that he considered health information technology adoption to be so important that there should not be a strong focus on return on investment. Two other participants said that studies have shown the value of return on investment of health information technologies, but that this information is not made readily available to the decision-makers.
Change management	4	The adoption of health information technologies into the healthcare environment requires significant change in the organisation. A comprehensive change management strategy is often not in place. This results in the organisation being unprepared for the level of required change. There was strong consensus that change management should be addressed. Sixty-seven per cent of participants rated appropriate change management as having a direct impact on the adoption and meaningful use of health information technologies.
Business processes and workflow	7	The majority of participants believed that there was a poor mapping of system capabilities to business processes and workflow in the complex healthcare environment.
After-sales and technical support	27, 29	No on-site technical support resulted in unacceptable response times when support was needed, which hampered meaningful use of health information technologies implementation. This may be attributed to inadequate service level agreements.
System availability and reliability	11	Systems which are slow, unreliable or unavailable resulted in loss of confidence and engagement by users in health information technology implementation. These factors may be attributed to inadequate after-sales and technical support, as discussed above.
Government	33, 38	The absence of a government-backed drive to implement health information technologies, and a national framework and guidelines to drive implementation thereof, were indicated as factors that needed to be addressed. Two participants, who rated factors 33 and 38 as only "slightly important", commented that this was not applicable to the private healthcare sector, but rather to the public healthcare sector, where the implementation of health information technologies would have to be backed by government.
Patient identifier	35	A common unique identifier to track patients is lacking.
Clinical and administrative needs	37, 42	There was "medium" consensus that available technological solutions do not meet the clinical needs of the healthcare sector, and "low" consensus that available solutions do not meet their administrative needs. Four participants who disagreed with factor 37, and five who disagreed with factor 42, commented that very good solutions are available to meet the clinical and administrative needs of the healthcare sector, but that these solutions are expensive.
Mobile health and wireless technologies	40	There was only "low" consensus that the potential benefits offered by wireless technologies and mobile devices are not exploited to their full potential. The benefits of these technologies should be investigated to make health information technologies more accessible.
Citizen focused	13	Citizens are not engaged and aware of the benefits that technology can offer in terms of healthcare delivery and there is not enough demand for the adoption of health information technologies to lower costs and improve the quality of care that is received.
Career path	23	There is little incentive for healthcare staff to make an effort to learn about health information technologies because currently, there is no career path for health informaticians in South Africa.
Priority	28	A factor that has a direct impact on the adoption and meaningful use of health information technologies in the South African healthcare sector, and which has been alluded to in the discussion about several of the factors, relates to the priorities of the South African healthcare sector. In the overburdened public sector, the provision of basic health care is a top priority, which leaves little capacity to spend time, effort, human resources and funds on implementing and using new technologies, instead of current systems.
Involved stakeholders	22	Many stakeholders may be affected by the adoption and use of health information technologies, and conflicting expectations and dependence on the approval of these stakeholders often hampers implementation thereof.
Accessibility	34	Many healthcare facilities are located in rural areas in the public sector and it may be difficult to deliver information and communication technology services to these inaccessible areas.

*: Refer to Table III for an in-depth description of the factors

Conclusion

The results of this Delphi study have contributed to a clearer understanding of the factors that should be addressed to encourage the adoption and meaningful use of HITs in the South African healthcare landscape. The acceptance of HITs into the complex healthcare environment is a challenging task in which various stakeholders are implicated. The results of this study have raised awareness of the factors that need be taken into consideration when planning the implementation of HITs.

Declaration

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