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Knowledge management systems success in healthcare: Leadership matters

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ABSTRACT

Purpose: To deliver high-quality healthcare doctors need to access, interpret, and share appropriate and localised medical knowledge. Information technology is widely used to facilitate the management of this knowledge in healthcare organisations. The purpose of this study is to develop a knowledge management systems success model for healthcare organisations.
Method: A model was formulated by extending an existing generic knowledge management systems success model by including organisational and system factors relevant to healthcare. It was tested by using data obtained from 263 doctors working within two district health boards in New Zealand.
Results: Of the system factors, knowledge content quality was found to be particularly important for knowledge management systems success. Of the organisational factors, leadership was the most important, and more important than incentives.
Conclusion: Leadership promoted knowledge management systems success primarily by positively affecting knowledge content quality. Leadership also promoted knowledge management use for retrieval, which should lead to the use of that better quality knowledge by the doctors, ultimately resulting in better outcomes for patients.

1. Introduction

Healthcare is a knowledge intensive industry. Medical knowledge is important for clinical decision-making and, ultimately, for delivering better outcomes for patients. The importance of medical knowledge has been highlighted in the ongoing initiatives to promote evidence-based medicine [1–3] and clinical quality improvement [4–6]. Increasingly, healthcare professionals rely on information technology tools to cope with the ever increasing need to manage knowledge [7–11]. Such tools are not limited to specialist knowledge management software but include common tools such as intranets and email [11].

The purpose of the present study is to establish the determinants of success of knowledge management systems in healthcare. To achieve this, we develop a model incorporating system and organisational factors. System factors characterise information technology and its perceptions by the users, and organisational factors describe the organisational context of its use. We do not focus on the use of any particular type of information technology for managing knowledge, such as expert systems or clinical decision support systems. Moreover, we do not limit our consideration to discrete systems explicitly implemented and labelled as "knowledge management systems". Rather, we consider any use of information technology for managing knowledge within an organisation, including commonly available tools such as email, video conferencing, or intranets, as the use of a knowledge management system. This conceptualisation of knowledge management systems is consistent with the Davis's definition of an information system as a social system that uses information technology [12] and has been used in the books by Dalkir [13] and Hislop [14] and in empirical studies [15,16]. It reflects the recent trend (highlighted by Palacios-Marqués [17]) of organisations shifting from relying on proprietary technology developed top-down to encouraging end-users to take a direct role in shaping how information technology is used for knowledge management, using commonly available tools such as social networking software.

The research on health information systems success is well established [18–25]. However, none of the prior studies considered the effects of organisational factors on knowledge management systems success in healthcare organisations.

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To develop the model, we adapt and extend the generic knowledge management systems success model by Wu and Wang [26] by including organisational and system factors relevant to healthcare. (The model by Wu and Wang is based on the well-known DeLone and McLean's conceptual framework [27].) We test our model using empirical data obtained in a cross-sectional survey of doctors working within district health boards serving two mid-size cities in New Zealand.

The paper is structured as follows. First, we review the existing knowledge management systems success models. Then, we introduce the hypotheses, introduce the research methodology, and describe the approach to data collection. Finally, we interpret the results of model testing, discuss their implications, and draw conclusions.

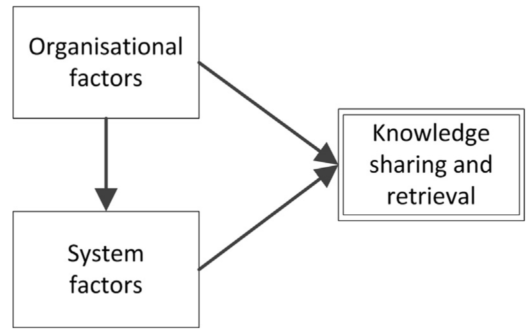

Fig. 1. The overall structure of the proposed knowledge management systems (KMS) success model for healthcare.

2. Literature review

2.1. Health information systems success

There are many studies of factors that influence the success of information systems, as reviewed by Petter et al. [28]. In particular, there are many studies of information systems success at healthcare organisations [18–25].

The well-established DeLone and McLean information systems success model [27,29–31] focuses on system factors. The model suggests that information system attributes, such as system quality and information quality, influence the users' perceptions of the system, which then influence their use of the system. The use of the system results in benefits for the users and for the organisation. The DeLone and McLean information systems success model has been used to explain operational support health information systems success [25] and as a framework for system evaluation [32,33].

2.2. Knowledge management systems success models

Wu and Wang [26] developed a generic knowledge management systems success model based on the DeLone and McLean [27] information systems success model. Wu and Wang tested their model using data collected from firms in Taiwan. Halawi, McCarthy, and Aronson [34] proposed a model very similar to that of Wu and Wang and tested it with data collected from knowledge-based organisations in the USA.

Kulkarni, Ravindran, and Freeze [35] extended the Wu and Wang [26] model by adding organisational factors: leadership, incentives, co-worker (perceived use of the system by co-workers), and supervisor (perceived use of the system by the respondent's supervisor). The model was tested with data collected in a survey of mid-level managers in the United States, and it was found that both organisational and information system factors affected knowledge use.

In the context of healthcare, Hwang et al. [36], adapted the DeLone and McLean information systems success model [27] to study knowledge management systems success (thus, the model included only system factors). They validated their model with data obtained in a survey of the users of a specialised knowledge management application for classifying diseases at a hospital in Taiwan.

2.3. Defining and measuring success

Halawi et al. [34] and Hwang et al. [36] included improvements in organisational productivity and efficiency as outcome variables in their models. In contrast, Wu and Wang [26] and Kulkarni et al. [35] limited their models to explaining knowledge management systems use and knowledge use. Even though improvements in productivity and efficiency are more directly related to organisational success than system use, the respondents' judgements of the magnitudes of such improvements may be considerably less accurate than their reports of observable behaviour [37].

Knowledge management systems use involves both knowledge sharing and knowledge retrieval, which are distinct behaviours. For example, Garud and Kumaraswamy [38] reported a longitudinal case study in which an increase in knowledge sharing resulted in a decrease in knowledge retrieval. The importance of distinguishing between the two behaviours has been emphasized in prior research [39]. Nonetheless, prior studies, such as those by Wu and Wang [26] and Kulkarni et al. [35], did not distinguish knowledge management systems use for sharing from use for retrieval.

3. Research model and hypotheses

The overall structure of the research model of the present study is given in Fig. 1, and the details are introduced in this section and presented in Fig. 2. The model extends the generic knowledge management systems success model by Wu and Wang's by adding organisational factors relevant to the healthcare context. It is hypothesised that organisational context (the influence of the leaders and organisational culture and norms) affects doctors' behaviour with respect to the use of the system both directly and indirectly via the system factors (system characteristics and doctor's perceptions of the systems).

The constructs included in the research model are listed and briefly defined in Table 1. In the following sections we introduce the individual hypotheses; first for the information systems factors and then for the organisational factors.

3.1. System factors

This section presents the hypotheses relating to the characteristics of the knowledge management systems (Knowledge Content Quality, KMS Quality), the perceptions of the users (Perceived Usefulness of KMS, User Satisfaction, and Perceived Security) and their use of the systems (KMS Use for Sharing, KMS Use for Retrieval). This part of the model is based on Wu and Wang's [26] adaptation of the DeLone and McLean model.

Knowledge management systems that provide access to higher quality knowledge are more likely to be perceived as useful and satisfactory [26,36]. High quality of knowledge content is particularly critical in healthcare because it affects doctors' decisions that may have serious implications for their patients' well-being [40].

H1: Higher knowledge content quality leads to higher perceived usefulness of knowledge management systems.

H2: Higher knowledge content quality leads to higher user satisfaction.

Knowledge management systems that are more reliable and responsive are more likely to be perceived as useful and satisfactory [26,35,36]. Doctors, who work under time and performance

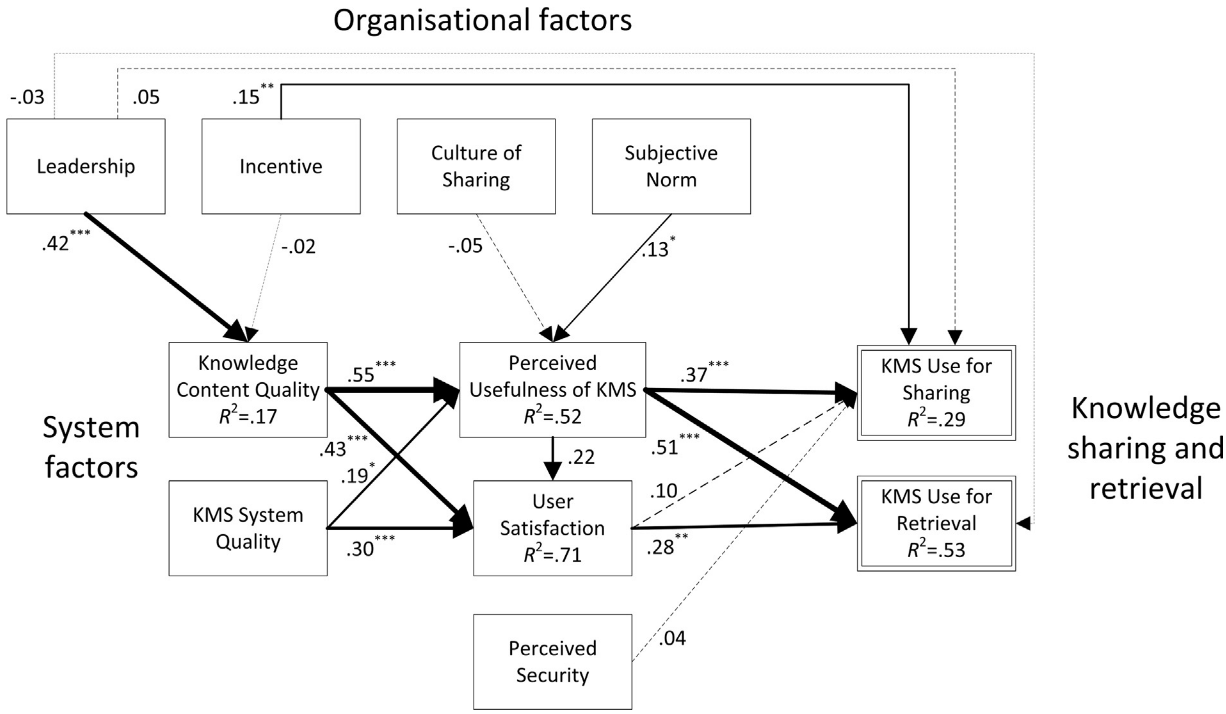

Fig. 2. The details of the model and the results of hypotheses testing (arrows representing the hypotheses are labelled with path coefficients values; stronger relationships are depicted with thicker arrows; non-significant relationships are depicted with dashed lines; $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$).

Table 1
Model constructs.

Construct	Definition	Measurement items based on
Knowledge management systems use for sharing	Doctor's use of knowledge management systems to share knowledge.	[26,71,72,73,74,75]
Knowledge management systems use for retrieval	Doctor's use of knowledge management systems to retrieve knowledge.	[72,76,77,73,74]
Knowledge content quality	Doctor's perception that knowledge provided via knowledge management systems has attributes, such as relevance, timeliness, and completeness, needed to meet the knowledge requirements of the doctor's job.	[26,27]
Knowledge management systems quality	Doctor's perception that knowledge management systems possess the desirable operational characteristics, such as reliability and high response time.	[26,35]
Perceived usefulness of knowledge management systems	Doctor's perception that knowledge management systems contribute to the doctor's job performance and quality of work life.	[26,35]
User satisfaction	Doctor's overall satisfaction with knowledge management systems contribution to meeting the doctor's knowledge needs.	[26,35]
Perceived security	Doctor's perception that sharing knowledge via knowledge management systems will not result in undesirable consequences, such as inappropriate use or loss of intellectual property.	[78,79,80]
Leadership	Doctor's perception that the management at the doctor's organization considers knowledge management as important and actively promotes it.	[81,35,82]
Incentive	Doctor's perception that knowledge sharing will result in tangible benefits, such as salary increases or job security.	[83,35]
Culture of sharing	Doctor's perception that the doctor's organization fosters an environment conducive to collaboration between colleagues.	[84,85]
Subjective norm	Doctor's perception that the colleagues the doctor respects expect the doctor to share knowledge.	[86]

pressures, do not have time or attentional resources to deal with information technology related problems.

H3: Higher knowledge management systems quality leads to higher perceived usefulness of knowledge management systems.

H4: Higher knowledge management systems quality leads to higher user satisfaction.

Busy doctors would use a system only if they believe that it is useful and that doing so would enhance their job performance [40]. Prior studies have confirmed the effect of perceived usefulness on system use [26,36,41,42].

H5: Higher perceived usefulness leads to higher knowledge management systems use for sharing.

H6: Higher perceived usefulness leads to higher knowledge management systems use for retrieval.

Further, empirical studies of knowledge management systems success confirmed the effect of perceived usefulness on user satisfaction [26,35,36].

H7: Higher perceived usefulness leads to a higher user satisfaction.

Prior studies have confirmed the effect of user satisfaction on information system use [43,44]. In particular, the effect has been confirmed for knowledge management systems use [26,35].

H8: Higher user satisfaction leads to higher knowledge management systems use for sharing.

H9: Higher user satisfaction leads to higher knowledge management systems use for retrieval.

Knowledge relating to individual patients and to organisational events and incidents is likely to be highly sensitive, and doctors are unlikely to use knowledge management systems to share such knowledge unless they perceive the systems as secure [45]. However, the effects of perceived security have never been studied empirically for knowledge management systems. To address this research gap, the following hypothesis is proposed.

H10: Better perceived security leads to higher knowledge management systems use for sharing.

3.2. Organisational factors

Higher subjective norm, the perception that important others expect one to share knowledge, is likely to result in knowledge management systems being perceived as useful. For example, Mun et al. [46] found that subjective norm had an indirect effect, through perceived usefulness, on doctors' intention to accept personal digital assistants in a survey of physicians at hospitals in the USA.

Healthcare professionals tend to work collaboratively [47]. Culture of sharing, an overall organisational environment conducive to collaboration and sharing, is likely to have an effect similar to subjective norm because the two concepts are similar.

H11: Higher subjective norm in favour of the use of knowledge management systems leads to higher perceived usefulness of knowledge management systems.

H12: A culture of sharing leads to higher perceived usefulness of knowledge management systems.

Leadership, the perception that management considers an information system as important and actively promotes it, influences the behaviour and the perceptions of organisational members. Sabherwal et al. [48] from their *meta*-analysis study concluded that top management commitment affects system use. Kulkarni et al. [35], in their study of knowledge management systems success at business organisations, found that leadership had an effect on knowledge use and knowledge content quality. In an experience report describing the implementation of a knowledge management system at a cardiology department of a hospital, Koumpouros et al. [49] suggested that support from leaders and their involvement are needed to motivate doctors to use knowledge management systems and to contribute high quality knowledge.

H13: Leadership results in higher knowledge content quality.

H14: Leadership results in knowledge management systems use for sharing.

H15: Leadership results in knowledge management systems use for retrieval.

A number of studies found incentives, the expectation of tangible benefits, to positively affect knowledge sharing [49–52]. Kulkarni et al. [35] found that incentives positively affected both knowledge use and knowledge content quality.

H16: Incentives result in higher knowledge content quality.

H17: Incentives result in knowledge management systems use for sharing.

4. Methods

4.1. Survey instrument

The data were collected in a cross-sectional survey. In the survey instrument, we reused measures available in the literature, rewording items to fit the healthcare context as necessary. For three of the constructs in the model, knowledge management systems use for sharing, knowledge management systems use for retrieval, and culture of sharing measures were not available. Therefore, the items were formulated based on the understanding of the domain gained from the literature. The literature sources on which the measurement items were based are listed in Table 1.

A content validity survey involving experts from the healthcare sector and from the knowledge management systems research community was conducted to validate the measures, focusing on their appropriateness for the healthcare context. The details of the content validity study have been reported elsewhere [53].

The survey questionnaire started by presenting our conceptualisation of knowledge management systems (KMS), followed by the survey items. The items used to measure the constructs of the research model are listed in the appendix. These items were measured on a Likert scale from 1 *strongly disagree* to 7 *strongly agree*.

4.2. Setting and sample

In New Zealand, publicly funded healthcare is delivered primarily through a framework of 20 district health boards. These district health boards plan, manage, provide, and fund health services in their districts, including primary care, hospital services, public health services, aged care services, and services targeting Māori and Pacific populations [54]. The target participants in the present study were doctors practising in Hamilton and Wellington (two mid-size cities in New Zealand). Contact details were obtained from the publically available New Zealand Medical Council database.

To ensure the well-being of the respondents and to comply with the university regulations, we followed the research ethics approval and notification procedures prescribed by our university. The respondents gave informed consent by choosing to fill in the questionnaire.

4.3. Data collection and bias testing

A paper-based mail survey was used. The initial mail-out was followed by two reminders, two weeks and four weeks after the initial mail-out. Out of the 1,164 questionnaires distributed via mail to individual doctors, 117 were returned undelivered. A total of 293 responses were received after the two follow-ups. The response rate increased after each follow-up. Out of the 293 questionnaires received, 30 were returned blank, leaving 263 usable questionnaires involving 100 respondents from Hamilton and 163 from Wellington. This yielded a response rate of 23 percent. Mean replacement was used to deal with missing data (which was minimal), and all of the 263 cases were retained for analysis.

To check for non-response bias, the respondents were divided into two groups, early and late respondents, with 120 and 143 members, respectively. Late respondents were those who returned the questionnaire after a reminder was sent, and early respondents were those who returned the questionnaire before any reminders were sent (an approach suggested by Korkeila et al. [55]). A Mann-Whitney *U* test was used to compare the two groups by age, gender, years in the current organisation, work experience, and computer experience. No statistically significant differences were discovered between early and late respondents.

To verify that the survey sample represented the population of doctors in New Zealand, respondents' gender and age were compared with the population values obtained from a report by the Medical Council of New Zealand [56]. For gender, a chi-square goodness-of-fit test indicated that there was no statistically significant difference between the respondents and the population. Similarly, for age the results of a *t*-test indicated that the respondents did not differ from the population of doctors in New Zealand.

Table 2
Respondent characteristics.

Demographic attribute	Value	Count	Percentage
Gender	Male	110	41.8
	Female	152	57.8
	Not reported	1	0.4
Age	18–30	35	13.3
	31–40	72	27.4
	41–50	75	28.5
	51–60	58	22.1
	>60	23	8.7
Years of work experience	≤5	33	12.5
	6–10	34	12.9
	11–15	40	15.2
	16–20	48	18.3
	21–25	33	12.5
	>25	75	28.5

5. Results

5.1. Respondent characteristics

Table 2 presents the respondent characteristics. The respondents had a mean age of 45 years, a mean of 8.3 years working within their district health boards, a mean computer experience of 17.3 years, and a mean work experience in the medical profession of 19.9 years.

5.2. Model evaluation

Structural equation modelling utilising the partial least squares (PLS) technique was used to test the model. SmartPLS software was used [57]. The model fit was judged based on the amount of variance explained and on the values of path coefficients. Further, following Kline [58] and Chin [59], the values of path coefficients were interpreted as indicating the effect sizes.

Most of the items loaded on the constructs they were intended to measure above 0.7, and stronger than on other constructs of the model, thus meeting the criteria for indicator reliability introduced by Fornell and Larcker [60] and Chin [61]. The items that did not meet these criteria were removed. The ranges of factor loadings for the items that were retained in the model are given in Table 3, and the items removed are indicated in the Appendix A.

The values of average variance extracted and of composite reliability, listed in Table 3, suggest the convergent validity of the measurement model. For all constructs, average variance extracted and composite reliability were above the thresholds of 0.5 and 0.8, respectively, thus meeting the criteria introduced by Fornell and Larcker [60]. Further, the Cronbach's alpha values were above 0.7. Correlations between constructs were smaller than the corresponding square roots of average variance extracted (see Table 4), suggesting discriminant validity [60].

After evaluating the values of path coefficients, their statistical significance was assessed by using a bootstrapping procedure with 500 resamples. Path coefficients along with the corresponding p values are presented in Fig. 2. Further, indirect effects on knowledge management systems use for retrieval and knowledge management systems use for sharing are summarised in Table 5. The model explained 29 percent of the variance in knowledge management systems use for sharing and 53 percent of the variance in knowledge management systems use for retrieval, suggesting an acceptable explanatory power [61].

The most important findings are depicted in Fig. 3, which focuses on the relationships that were found to be both statistically significant and strong. As seen in Fig. 3, leadership improves knowledge content quality, which improves the perceptions of the knowledge management systems by the users, ultimately promoting knowledge management systems' use.

Table 3
Psychometric properties of measures.

Construct	Average variance extracted	Composite reliability	Cronbach's alpha	Range of item loadings
Knowledge management systems use for sharing	0.709	0.936	0.918	0.763–0.891
Knowledge management systems use for retrieval	0.760	0.926	0.893	0.777–0.915
Knowledge content quality	0.690	0.917	0.886	0.702–0.903
Knowledge management systems quality	0.673	0.925	0.902	0.738–0.889
Perceived usefulness of knowledge management systems	0.764	0.951	0.937	0.760–0.926
User satisfaction	0.707	0.923	0.896	0.801–0.893
Perceived security	0.662	0.886	0.844	0.708–0.886
Leadership	0.731	0.956	0.947	0.798–0.892
Incentive	0.764	0.928	0.896	0.885–0.931
Culture of sharing	0.824	0.959	0.947	0.873–0.935
Subjective norm	0.819	0.947	0.926	0.848–0.932

Table 4
Correlations between constructs.

	Construct	1	2	3	4	5	6	7	8	9	10	11
1	Knowledge management systems use for sharing	**0.842**										
2	Knowledge management systems use for retrieval	0.540	**0.872**									
3	Knowledge management systems content quality	0.447	0.673	**0.830**								
4	Knowledge management systems system quality	0.415	0.473	0.664	**0.821**							
5	Perceived usefulness of knowledge management systems	0.498	0.699	0.697	0.568	**0.874**						
6	User satisfaction	0.421	0.627	0.787	0.715	0.691	**0.841**					
7	Perceived security	0.281	0.231	0.368	0.463	0.370	0.330	**0.813**				
8	Leadership	0.337	0.307	0.415	0.539	0.409	0.439	0.592	**0.855**			
9	Incentive	0.271	0.181	0.181	0.281	0.172	0.227	0.291	0.466	**0.874**		
10	Culture of sharing	0.199	0.144	0.262	0.403	0.209	0.239	0.497	0.657	0.335	**0.908**	
11	Subjective norm	0.323	0.247	0.306	0.302	0.333	0.224	0.451	0.293	0.158	0.323	**0.905**

Note. The values on the diagonal, given in bold, are square roots of AVE for the corresponding constructs.

Table 5
Indirect effects on knowledge management systems use for retrieval and knowledge management systems use for sharing.

Factor	Knowledge management systems use for retrieval		Knowledge management systems use for sharing	
Knowledge content quality	0.44***	(.000)	0.26***	(.000)
Knowledge management systems quality	0.19***	(.000)	0.10**	(.009)
Leadership	0.16*	(.014)	0.16	(.085)
Incentive	−0.01	(.784)	0.15*	(.020)
Subjective norm	0.07*	(.011)	0.05*	(.025)
Culture of sharing	−0.03	(.359)	−0.02	(.355)

Note. β values are followed by *p* values in parentheses.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

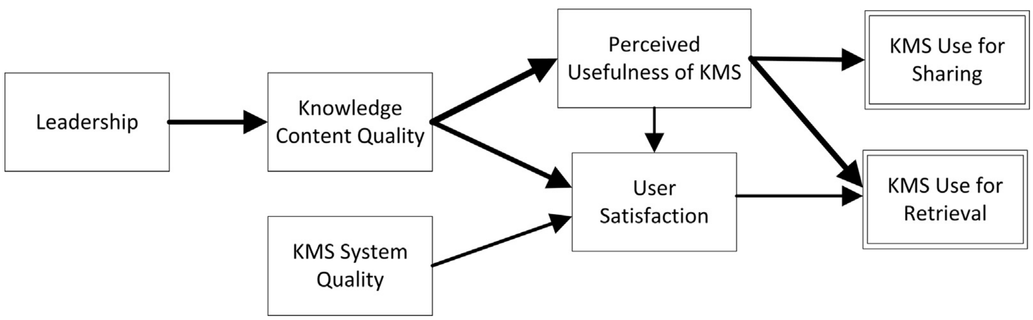

Fig. 3. The relationships found to be both statistically significant and strong (with path coefficients of 0.20 or greater).

6. Discussion

This section discusses the results and their implications for practice.

6.1. System factors

Perceived usefulness was a strong predictor of knowledge management systems use for sharing and for retrieval. User satisfaction also affected knowledge management systems use for retrieval, but the effect of user satisfaction on knowledge management systems use for sharing was not confirmed. The results suggest that it does not matter so much whether knowledge management systems meet doctors' expectations, as long as the doctors perceive them to be useful.

Knowledge content quality was the strongest predictor of both perceived usefulness of knowledge management systems and user satisfaction. Further, knowledge content quality indirectly affected both knowledge management systems use for sharing and knowledge management systems use for retrieval via perceived usefulness and user satisfaction.

Similarly, knowledge management systems quality affected both perceived usefulness and user satisfaction, although for both of them it was a weaker predictor than knowledge content quality. The effect of knowledge management systems quality on perceived usefulness of knowledge management systems was considerably weaker than on user satisfaction. This result suggests that low-quality knowledge management systems (for example, difficult to use or unreliable) might make doctors feel less satisfied, but the doctors may still perceive them as useful for as long as the quality of the knowledge they provide is high.

Knowledge management systems quality indirectly affected both knowledge management systems use for sharing and for retrieval, via perceived usefulness and via user satisfaction. However, both of the effects were weak, weaker than the corresponding effects of knowledge content quality.

The findings, therefore, suggest that system use is most strongly influenced by the perception that the system is useful, which is most strongly influenced by the quality of the knowledge provided by the system.

Perceived security was not found to have a statistically significant effect on knowledge management systems use for sharing. This finding can be explained by suggesting that IT security is well managed in healthcare. Research on security in healthcare information systems [62–64] suggests that various security measures are given priority in the implementation of information systems in healthcare organisations. If security is overall at a high level, it is likely that even the respondents who rated the security relatively low still felt secure enough. The results suggest that in healthcare further improving the perceptions of knowledge management systems as secure is unlikely to promote knowledge sharing.

6.2. Organisational factors

Leadership affected knowledge content quality with a relatively strong effect size, but it was not found to affect directly knowledge management systems use for sharing or knowledge management systems use for retrieval. However, leadership did affect knowledge management systems use for retrieval indirectly, via knowledge content quality, perceived usefulness of knowledge management systems, and user satisfaction. Further, even though the total effect of leadership on knowledge management systems use for sharing was not statistically significant in the present study, the *p* value was rather low ($p = 0.085$), suggesting that it is possible that the effect would have been discovered if the sample size was larger. The implications for practice are that leadership involvement results in better quality knowledge being made available via knowledge management systems and in that better quality knowledge being accessed.

Leadership has been empirically shown to promote quality in clinical settings (see, for example, the results of the large-scale study by Weiner, Shortell, and Alexander [65] and the review by West et al. [66]). The transformational leadership theory by Bass

[67] posits that effective leaders lead by articulating an attractive vision, encouraging the organisations' members to act independently and to look beyond self-interest, and by appealing to their ideals, thus relying on qualities that align with medical professionalism. Transformational leadership promotes discretionary effort; therefore, it may result in quality improvements that are difficult or impossible for the leaders to monitor. The core of medical professionalism is to seek better health outcomes for patients. Because health outcomes depend on the availability of high quality knowledge, transformational leadership that promotes high-quality contributions to knowledge management systems is likely to be particularly effective.

In contrast to the findings for leadership, incentive affected knowledge management systems use for sharing but was not found to affect knowledge content quality. This suggests that direct incentives are likely to increase the quantity, but not necessarily the quality of the contributions; whereas leadership promotes intrinsic motivation to contribute better knowledge, and not to contribute knowledge of questionable value. This interpretation is consistent with the longitudinal case study conducted at a large information technology company by Garud and Kumaraswamy [38], who observed over time how knowledge management based on direct incentives resulted in a large number of low-quality contributions and how a change to an approach emphasizing intrinsic motivation resulted in a smaller number of better quality contributions. The findings of the present study suggest that similar dynamics may be applicable in healthcare. Further examples of incentives in knowledge management practice resulting in uncertain or negative outcomes are reviewed by Chua [68].

Culture of sharing was not found to have a statistically significant effect on perceived usefulness of knowledge management systems. One possible explanation is that culture of sharing does not affect the perceptions directly, but via the influence of important colleagues and thus, via subjective norm, which was found to have effect. Subjective norm affected perceived usefulness directly and affected both knowledge management systems use for sharing and knowledge management systems use for retrieval indirectly, via perceived usefulness, although the effect sizes were rather small.

7. Limitations and suggestions for further research

The results of the present study are based on a survey of doctors in New Zealand, and care should be exercised when generalising the results to other populations and other healthcare roles, such as nurses or allied health professionals. Further, the study has limitations stemming from the use of a cross-sectional survey based on self-reports. It is desirable to confirm the results of the present study by using longitudinal research designs and by measuring actual knowledge management systems use. These limitations could be addressed in future work.

It has been suggested [69,70] that in the long term, leadership is effective in promoting changes in behaviour only if the initial transformational leadership efforts are routinized via changes in the incentives structure or in the organisational culture, so that the desired behaviour is maintained and reinforced with no ongoing leadership involvement. Conducting a longitudinal study of how the effects of leadership to promote knowledge management systems success are routinized in healthcare settings is a topic for further research.

8. Conclusions

Knowledge content quality was found to be a strong predictor of knowledge management systems success. Knowledge content quality is highly important in healthcare because low quality knowledge may lead to poor clinical decisions and even endanger lives. Knowledge management systems quality, conceptualised as reliability and ease of use, was also found to be important, but it did not influence use as strongly as the quality of the content.

Leadership was found to be the most important organisational factor, more important than incentives. Leadership strongly affected knowledge content quality. Leadership also promoted knowledge management systems use for retrieval, and thus the use of that better quality knowledge.

The overall findings suggest that leadership is a key element in promoting the success of knowledge management systems in healthcare organisations.

Author contribution

All authors contributed to the conceptualisation and design of the study. NA conducted the survey and managed the acquisition of data. NA and AT performed the data analysis. All authors contributed to the interpretation of the results. NA drafted the article and all co-authors were involved in the revision of the article and approval of the final version of the manuscript.

Conflict of interest

The authors declare that there are no conflicts of interest.

Summary points

What was already known before on the topic

- Healthcare is knowledge intensive, and information technology is widely used to facilitate knowledge management at healthcare organisations.
- The existing body of knowledge management systems success research lacks a knowledge management system success model taking into account both organisational and system factors and taking into account the specifics of the healthcare context.

What this study added to our knowledge

- A knowledge management systems success model for healthcare was formulated by extending an existing generic knowledge management systems success model by incorporating the relevant organisational and system factors, with knowledge management systems use for sharing and for retrieval used as outcome variables.
- The model was validated against empirical data.
- Organisational and system factors important for the successful use of information technology to facilitate knowledge management in healthcare have been identified.

Appendix A. : Item wordings

KMS use for sharing	
KMS_Sh1	I use KMS to communicate knowledge with colleagues.
KMS_Sh2	I use KMS to contribute ideas and/or feedback.
KMS_Sh3	I use KMS to participate in discussion groups.
KMS_Sh4	I use KMS to discuss and/or exchange ideas/views/experiences with colleagues.
KMS_Sh5	I use KMS to collaborate with colleagues (e.g. to be part of work flow process).
KMS_Sh6	I use KMS to distribute knowledge (e.g. news, memos, reports, presentation, organisation policies).

KMS use for retrieval	
KMS_R1	I use KMS to retrieve knowledge for decision making.
KMS_R2	I use KMS to retrieve knowledge to solve my job-related problems.
KMS_R3	I use KMS to retrieve knowledge that can help me improve the quality of my work.
KMS_R4[a]	I use KMS to identify and locate people for knowledge and expertise.
KMS_R5	I use KMS to retrieve knowledge that can help me to be innovative.

Knowledge content quality	
KCQ1[a]	The words and phrases in content provided by KMS are consistent.
KCQ2	The knowledge provided by KMS is up-to-date.
KCQ3	The knowledge provided by KMS is important and helpful for my work.
KCQ4	The knowledge provided by KMS is meaningful, understandable, and practicable.
KCQ5	The knowledge provided by KMS is complete.
KCQ6	The knowledge provided by KMS is relevant to my job.
KCQ7[a]	KMS provide a helpful directory (e.g. expert locator) for my specific work.
KCQ8[a]	The link to the expert directory where I can locate newly hired or newly acquired expertise is always updated.
KCQ9[a]	KMS provide contextual knowledge, so that I can truly understand how knowledge can be applied.

KMS system quality	
SQ1	KMS are easy to use.
SQ2	KMS are user-friendly.
SQ3	KMS are reliable.
SQ4	The response time of KMS is acceptable.
SQ5	There are systems/tools available for me to locate knowledge.
SQ6	The system/tools allow searches using multiple criteria.
SQ7[a]	KMS are accessible from anywhere by the authorised users.
SQ8[a]	KMS are adequately documented (e.g. in user manuals).
SQ9[a]	KMS allow me to contribute knowledge that may be useful to other people in the organisation.

Perceived usefulness of KMS	
PU1[b]	KMS help me acquire new knowledge and innovative ideas.
PU2	KMS help me effectively manage and store knowledge that I need.
PU3	KMS make it easier for me to do my job.
PU4	KMS enhance my performance on the job.
PU5	KMS enhance my effectiveness on the job.
PU6	KMS improve the quality of my work life.
PU7	KMS are useful to me in my job.

User satisfaction	
US1	KMS make it easy for me to acquire the knowledge I need to do my job.
US2	I am satisfied with the knowledge I am able to access from KMS to do my job.
US3	KMS provide knowledge that meets my needs.
US4	KMS in my organisation provide knowledge in a timely manner.
US5	Overall, I am satisfied with KMS in my organisation.

Perceived security	
PS1[a]	I believe that knowledge I share will not be modified by inappropriate parties.
PS2[a]	I believe that knowledge I share will only be accessed by authorized users.
PS3[a]	I believe that knowledge I share will be available to the right people.
PS4	I believe that people in my organisation do not use the KMS to access knowledge they are not authorized to access.
PS5	I believe that people in my organisation use other's knowledge appropriately.
PS6[a]	I believe that KMS have the mechanisms to avoid the loss of critical knowledge.
PS7	I believe that KMS has the mechanism to protect knowledge from being stolen.
PS8	In my opinion, the top management in my organisation is entirely committed to security.

Leadership	
LS1	Our ability to contribute knowledge is respected/recognised by the leadership.
LS2	The role of the leader in this organisation can best be described as supportive.
LS3	There is a general understanding at the top levels of management about how KM is applied to the business.
LS4	Senior management demonstrates commitment and action with respect to KM policy, guidelines, and activities.
LS5	I believe that senior management periodically reviews the effectiveness of KM to the whole company.
LS6	In this organisation, top management feels that the time and resources spent on the development of KM initiatives are wisely invested.
LS7	In this organisation, top management is strongly in favour of the concept of KM.
LS8	Top management has made a long-term commitment to provide funding for KM.

Incentive	
INC1	I will receive financial incentives (e.g. higher bonus, higher salary) in return for my knowledge sharing.
INC2	I will receive increased promotion opportunities in return for my knowledge sharing.
INC3	I will receive increased job security in return for my knowledge sharing.
INC4	Knowledge sharing is built into and monitored within the appraisal system.
INC5[a]	Generally, individuals are visibly rewarded for teamwork.

Culture of sharing	
CS1	Our organisation supports a culture where team-oriented work is valued.
CS2	Our organisation supports a culture where sharing information freely is valued.
CS3	Our organisation supports a culture where being supportive of employees is valued.
CS4	Our organisation supports a culture where working closely with others is valued.
CS5	Our organisation supports a culture where trust is valued.

Subjective norm	
SN1	Most colleagues who are important to me think that I should share knowledge with others.
SN2	Most colleagues who are important to me share their knowledge with others.
SN3	My colleagues whose opinions I value would approve of my behaviour to share knowledge with others.
SN4	My colleagues whose opinions I value share their knowledge with others.

[a] Removed because of low factor loading.
[b] Removed because of cross-loading.

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