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Quality of health websites and their influence on perceived usefulness, trust and intention to use: an analysis from Thailand

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Abstract

People are seeking ways to retrieve information on their health in an innovative way by looking online for information to decide whether or not to visit a doctor. Searching for health information on the Internet is always easy and convenient. However, the evaluation of the quality of health websites is the main issue since the literature on this topic is not as robust as we would like to see. The purpose of this study is to examine health websites' characteristics, which can reveal website quality. In addition, this study also aims to examine the perceived usefulness of health websites based on the information acceptance model. An online survey was conducted to collect data from consumers who used the Internet for information-seeking, with a total of 222 returned responses. The results indicate that health website quality influences the intention to use the health website when users have trust in and perceive the usefulness of the system.

Keywords: Website quality, Health information, Survey

Introduction

The global Internet continues to grow at an exponential rate, bringing with it innovative ways of transacting, communicating, learning, socializing, and transforming just about every aspect of daily life. In addition, the growth of health information on the Internet affects the doctor-patient relationship because of the use of medical information on the Internet (Harvey et al. 2017). It is clear that the Internet could change the information-seeking behavior of users and their attitudes. People are seeking ways to retrieve information on their health by looking online for information that will help them to decide whether or not to visit a doctor. Searching for health information on the Internet is always easy and convenient. Moreover, the Internet can help people to search for not only disease symptoms but also treatments. Lemire et al. (2008) have studied the use of the Internet for seeking treatment options and how patients use social media communities such as blogs, online communities, and e-mail to share illness symptoms and treatments; these activities will tend to increase in the future.

Various studies indicate that the quality of health websites is essential and should not be ignored (Beaunoyer et al. 2017; Eysenbach et al. 2002; Stoyanov et al. 2015).

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The evaluation of the quality of health websites is the main issue since the literature is not as robust as we would like to see (Beaunoyer et al. 2017). Online health information websites show inconsistent quality, and evidence for their usage is scarce (Sligo et al. 2017). In recent years, the medical community has started to question the reliability of using health websites to seek information; they have reported stories of patients suffering because of incorrect information and unreliable sources, or even negative evaluations of the diagnostic results. Thus, it has become apparent to many users that not all information is reliable. Due to the above situation, concepts such as trust and perceived usefulness acquire particular relevance with regard to the intention to use health websites.

In order to fill this gap, this study has validated the quality of health websites' characteristics and tested a model measuring the roles of trust and perceived usefulness on the intention to use the health website. The purpose is to examine health website characteristics, which can indicate website quality. In addition, this study also aims to study the perceived usefulness and intention to use health websites based on the information acceptance model, since studies regarding the relationship between health website quality and health website acceptance are limited. Most of the studies have found a relationship between health website quality and the intention to use such sites. However, this research aims to investigate the same relationship by using structural equation modeling (SEM) with data from 222 users. This could be a major contribution for both health website designers and the users, who are patients. In addition, the results have practical implications for managers and other online operators in the healthcare industry.

Therefore, the objectives of this study are (1) to examine the quality of health websites, (2) to study the influence of the quality of health website dimensions via perceived quality of health information on websites and risk perception, and (3) to study the impact of quality on the intention to use health websites.

The rest of the paper is structured as follows. First, we review the literature on the quality of health websites, perceived information quality and trust. We then present the theoretical framework and formulate the hypotheses of this study. Subsequently, the methodology is presented, followed by the results and discussion. Managerial implications, limitations, and future research directions are also presented in this paper.

Theoretical background

Concept of technology acceptance model

The theory of reasoned action (TRA) is a well-established model that has been used broadly to predict and explain human behavior in various domains (Ajzen and Fishbein 1980). Davis (1985) proposed a technology acceptance model (TAM), which in fact was derived from the TRA. The original TAM consisted of perceived ease of use, perceived usefulness, attitude toward using the health website, and behavioral intention to use the health website. Perceived usefulness and perceived ease of use are the two most important determinants for system use. The attitude toward using technology directly predicts users' intention to use it, which means the TAM model can forecast attitude toward using a technology. However, a study of the TAM mainly focuses on intention to use via perception of the ease and usefulness. According to Holden and Karsh

(2010), the TAM is widely used in the healthcare context because of a wide spectrum of technology usage within medical professions. The TAM is used for measuring attitude toward involved users, such as a study of physician acceptance of electronic health care records (EHCR) along with their reliability and risk factors.

For receiving health information via the Internet, the TAM is inevitably used as a theoretical foundation to explain the intention to use online health information. For example, there was a study of intention to use online health information by a group of people handicapped due to neurological disorders (Liang et al. 2011a, 2011b). The TAM is widely used to measure the attitude of the handicapped in seeking health information, especially with regard to perceived usefulness and perceived convenience of using the Internet.

Quality of health websites

The number of people using the Internet for health information is large and growing; more than 70,000 websites provide health information (Sbaffi and Rowley 2017). Estimates of Internet health information-seeking vary widely but are uniformly high, evidencing exponential growth (Cline and Haynes 2001). Reasons for the growth of consumers' online health information-seeking include the development of participative or consumer-oriented health-care models, the growth of health information that makes it hard for any clinician to keep pace, cost-containment efforts that reduce clinicians' time with patients and raise concerns about access to the best care, emphasis on self-care and prevention, an aging population with increased health-care needs, and an increased interest in alternative approaches to healthcare (Grandinetti 2000).

According to Fennell et al. (2017), the quality of a health website is defined as a well-designed website that would lead users to better recall and recognize a favorable attitude toward the site and whose information is more relevant, readable, and effective at improving medical knowledge. A summary of previous studies (Provost et al. 2006; Trivedi et al. 2016) has categorized the characteristics for quality of health websites into five major dimensions: (1) data information, for instance, quality of content, accuracy of content, and being able to fulfill the seekers' needs (Aladwani and Palvia 2002); (2) stability, for instance, quality of systems (Liu et al. 2000), privacy (Yoo and Donthu 2001), and reliability (Wolfinbarger and Gilly 2003); (3) ease of use, for instance, period of response (Loiacono et al. 2002) and website design for easy access; (4) enjoyment, for instance, pleasure and excitement when visiting the website (Liu et al. 2000) and emotional attraction (Loiacono et al. 2002); and (5) quality of services, for instance, customer service (Wolfinbarger and Gilly 2003). The development of health website quality has received the greatest attention, and some suggest that consumers' use of the websites can educate as to the characteristics of a good quality website. Provost et al. (2006) developed and validated the quality of health website dimensions (called "WebMedQual"), which mainly consists of the authorship and exposing data sources. The WebMedQual represents the first step toward a comprehensive and standard quality assessment of health websites. The indicators for WebMedQual include the following.

First, the content evaluation is concerned with how information provided by the health website should be updated, its accuracy, and its appropriateness for website users. Second, the authority of source means the evaluation of the expert's or writer's

detail. For example, who is the website owner? Do they get any benefits from website supporters? Third, the design of the website—whether or not it is user-friendly or attractive in appearance—is another indicator of quality. Fourth, is the information easily accessible and available for non-English speaking users or the visually impaired? Finally, user support is an evaluation of the availability of help and support on the website for technical and health problems, as well as e-commerce. Also, the evaluation of website users' experience is mainly focused on whether the user has ever bought products or health services via that website.

Perceived information quality

Perceived information quality is related to the amount of information, variety of information, richness of content, and navigation (Ilsever et al. 2007). It is a prevalent social concept and a key antecedent of overall user satisfaction (Aggelidis and Chatzoglou 2012), which impacts the perceived value of a health website's quality system (DeLone and McLean 1992). It is essential in the creation of a trust-building relationship (Wong and Hsu 2008) via reliable, relevant, and customized information exchanges. Moreover, information quality presented on the Internet has a significant impact on the user's experience (Chau et al. 2000).

Trust in health websites

Trust has been studied widely across several disciplines, with a variety of definitions offered based on the respective disciplinary perspectives and assumptions. Among these different definitions, a common thread is "willingness to be vulnerable." The current study takes the trusting beliefs approach and defines trust in web-based health information as the extent to which one believes that a specific web-based health information provider has attributes that are beneficial to the consumer. Furthermore, this research focuses on initial trust, referring to trust formation in a relationship in which the consumer does not yet have credible information about, or an effective bond with, the information provider. Although initial trust forms during the first encounter and within a short amount of time, initial trust can still be very influential and make the individual vulnerable. Given this conceptualization of trust in web-based health information, its formation can be understood as a process of persuasion through argumentation, whereby the consumer seeks to alleviate psychological barriers tied to interacting with an unfamiliar object or party. As people often look for relevant health information for their specific situations within a limited amount of time, understanding the factors that influence the formation of initial trust can provide important insights into how people can be directed toward credible health information.

Research hypotheses

Based on the above theoretical background, this study specifies a conceptual model as shown in Fig. 1, indicating the relationships between quality of the health website, trust, perceived usefulness, and intention to use the health website based on the TAM.

A study of online information-seeking behavior found that the process of deciding on the merits of a website is dependent on the perceived quality of the information. As a result, users need to seek quality information via the use of good health websites in

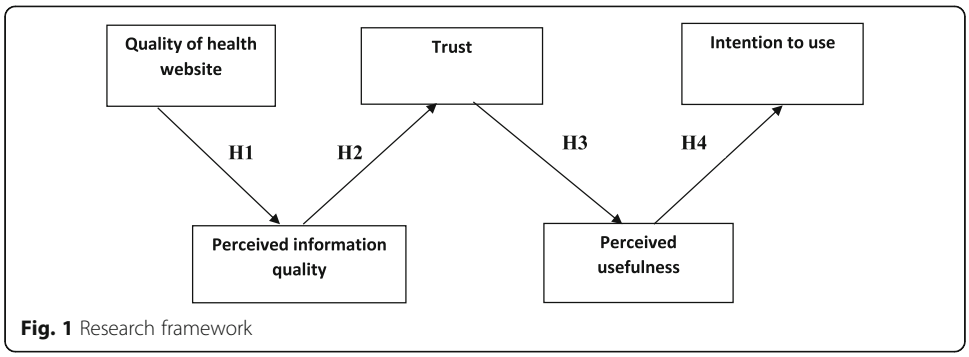

Fig. 1 Research framework

order to make the right decision. High-quality websites have an effect on accuracy perception, and information usefulness within the websites, referring to a change in the users' attitude. Thus, this mechanism puts firm emphasis on changing attitudes regarding trust in health websites through data processing by the use of a peripheral route. The presence of key structural site features and message quality on health websites may lead to more positive attitudes about the broader health topics to which the website is dedicated (Rains and Karmikel 2009). The previous findings assure us that the quality of a health website has a positive effect on perceived information quality regarding health (Adams 2010; Alsaiari et al. 2017; Rains and Karmikel 2009). Therefore, in order to study health websites with quality criteria, the following hypotheses are formulated:

Hypothesis 1

Characteristics of the quality of a health website will have a positive influence on perceived information quality on the health website.

Higher levels of perceived information quality should be directly associated with higher levels of initial trust. Past research identifies information quality as an important trust-building mechanism in online interactions (Siau and Shen 2003) and a direct determinant of trusting beliefs in exchange relationships (Hsu et al. 2018). Information that is perceived to be current, accurate, relevant, useful, and complete reflects an information provider that is competent, truthful, and credible, engendering trust in that provider (Moreri et al. 2018). In the online health-consultation setting, where information is the primary resource exchanged between parties, perceived information quality should play a central role in determining the trustworthiness of the information provider. Consequently, we hypothesize that:

Hypothesis 2

Perceived information quality will have a positive influence on trust in a health website.

One of the most frequently cited reasons for users not using the Internet for their activities is the lack of trust (Lee and Turban 2001). Researchers found that people rely on their general disposition to trust when in a novel situation (Li et al. 2008). Trust is the significant factor that leads to the use of online stores, and it has a direct relation to online shopping behavior (Gefen et al. 2003; Pavlou 2003). From previous research, trust is also the most significant factor for online transactions because trust is part of

the belief and expectation of website users that they will definitely get useful content from those websites (Kim et al. 2009). Regarding health websites, there is research in the medical profession about trust and technology acceptance. The roles of the doctor and nurse are replaced by help buttons and search features, thus removing the basis of doctor–patient trust (Lohse and Spiller 1998). Thus, trust in online health treatment has a positive effect on perceived usefulness. Hallegatte and Nantel (2006) confirmed that the non-technologically related construct of trust of a website affects the intention to visit a commercial website again. Consequently, it is hypothesized that trust in the online health environment positively affects perceived usefulness.

Hypothesis 3

Trust in health websites will have a positive influence on perceived usefulness in seeking health information.

The model assumes a direct relationship between perceived usefulness and intention to use health websites. The basis of such a relationship is the notion that people act on their intentions to use a health website if they perceive it to be useful. This direct relationship with intention has been confirmed by several studies (e.g., Zhang et al. 2008). The study conducted by Kim et al. (2007), for instance, supports the postulation that, in addition to the indirect relationship through attitude, a direct relationship exists between perceived usefulness and members' intention to participate in firm-hosted online travel communities. Meta-analysis research has also confirmed that perceived usefulness has an effect on the prediction of using behavior (Schepers and Wetzels 2007). In the health context, perceived usefulness is used in online information-seeking research in order to forecast Internet use behavior with regard to seeking illness symptoms (Hendrikx et al. 2013). Consequently, there are direct connections between perceived usefulness and the intention to use health information websites for seeking health information. Perceived usefulness of health websites has a positive effect on the intention to use health websites. In view of this, the following hypothesis is proposed.

Hypothesis 4

Perceived usefulness of health websites will have a positive influence on intention to use health websites for seeking health information.

Research methods and data analysis

Sample and data collection

A survey conducted for research purposes has three distinct characteristics. First, the purpose of the survey is to produce quantitative descriptions of some aspects of the studied population. Second, survey research concerns with relationships between variables. Third, survey research is a quantitative method and considered a cross-sectional study method consists of simultaneous assessment of different constructs. A representative random sample of adults from Thailand was contacted through an online survey using e-mail. Their ages fell between 18 and 49 because those under the age of 18 or above 49 were deemed to have little experience with using health information websites, and thus not likely to provide reliable responses. This relates to the study by Kim and Chang (2007), which found that over 80% of those in their 20s and 65% of those in

their 30s use the Internet to access health information, while those in their 50s and above use other media than the Internet to search for health information.

After sending the questionnaire through an online survey in 2016, the survey was processed until responses reached the sample size allocated by each stratum. Overall, final figures came to a total of 149 responses from the first batch of questionnaires and 73 additional responses from the second one. Thus, this study achieved a total of 222 returned responses. As suggested by Hoelter (1983), a sample size larger than 200 provides sufficient statistical power for SEM analysis. Likewise, the "10 times rule" also suggests that sample size should be at least equal to 10 times the maximum number of structural paths pointing at a latent variable anywhere in the partial least squares structural equation modeling (PLS-SEM) path model (Barclay et al. 1995). The demographic characteristics of the respondents included in this research are shown in Table 1.

A non-response bias test was conducted, comparing early and late respondents (Armstrong and Overton 1977; Churchill Jr. 1979) on the key variables and demographic variables. Late respondents were those who returned the survey after receiving a reminder letter (Claycomb et al. 2005). The results did not indicate any non-response bias in our sample. To reduce the common method variance (CMV) problem, this study took steps to test for CMV statistically. In the questionnaire design, this study separated the variables into sections to reduce the chance of CMV. This study also conducted Harman's one-factor test as one of the statistical remedies by calculating the chi-square difference between the single latent factor and hypothesized construct model. The results suggest significant differences between the two models, indicating no issue with the CMV problem.

Table 1 Respondent characteristics

Respondent profile	Number	Percentage
Ages		
19 years old or below	21	10
20–24 years old	30	14
25–29 years old	44	20
30–34 years old	41	18
35–39 years old	29	13
40–44 years old	47	21
45 years old or above	10	4
Gender		
Male	91	41
Female	131	59
Education level		
Post-graduate	63	28
Graduate	101	46
Other qualifications	58	26
Length of time on using health website		
< 1 year	42	19
1–5 years	84	38
> 5 years	96	43

Research instrument

The measurement items for functional elements and technical features of the quality of health websites were measured as second-order constructs (reflective first-order, formative second-order) composed of five first-order constructs through rigorous review using definitions and characteristics from the previous literature. Thus, first-order constructs are theoretically distinct and contribute a unique component to the second-order construct. The dimensions that constitute the quality of a health website are adapted measures of (1) content of site, (2) authority of source, (3) design, (4) accessibility and availability of information, (5) quality of links to other sources, and (6) user support (Mun et al. 2006). Furthermore, the original elements were further refined and benchmarked with main healthcare websites selected based on Kijsanayotin et al. (2010) to ensure the content and face validity.

The measurement scales for perceived usefulness, trust, and perceived quality are adopted from Yun and Park (2010), Hendrikx et al. (2013), and Mohseni et al. (2018). Finally, the outcome variable, which is the intention to use the health website, was assessed using a three-item scale, drawn from the relevant literature (Mohseni et al. 2018). All measures of key constructs were adapted from the existing literature. Items were translated and formulated, measuring the constructs in the conceptual model. In some cases, the wording had to be modified slightly to suit the current research context. The researcher also independently back-translated the wording between English and Thai to ensure a high translation quality. To validate the measurement items, six expert judges who have more than 10 years of relevant experience and are knowledgeable about accessing the Internet for health information were invited to conduct the Q-Sort method, which requires experts in the area to sort the scales into groups, each of which corresponds to an agreement-upon construct (Moore and Benbasat 1991). The Q-Sort results suggested acceptable content validity because the scale achieved a placement score greater than 70% (Moore and Benbasat 1991). In addition, measurement items were reworded and modified as a result of the in-depth interviews during the use of the Q-sort method and to suit industry requirements. All measures used a 5-point Likert-type scale anchored on 1 = very strongly disagree and 5 = very strongly agree, for all measurement items.

Data analysis

This study used statistical software to process the descriptive statistics and reliability analysis of the data to assess the demographic profile of the sample and the internal consistency of the constructs. This data analysis followed the guidelines from Anderson and Gerbing (1988) to assess the properties of measurement scales for convergent validity and discriminant validity, including composite reliability, by conducting confirmatory factor analysis (CFA), followed by SEM to test the path of causal relationships of the constructs using SmartPLS software. Partial least square-based SEM (PLS-SEM) was used because this method can model latent constructs under conditions of non-normality, using small to medium sample sizes (Hair et al. 2006). In addition, the PLS-SEM technique has become increasingly popular in management research in the last decade (Ali and Kim 2015).

Results

Measurement model

In order to evaluate measurement models, first-order reflective latent variables were subjected to reliability, convergent validity, and discriminant validity testing. The results shown in Table 2 indicate that the measures are robust in terms of their internal consistency reliabilities as indexed by their composite reliabilities (CR). The CR of different measures of the model are in the model range from 0.791 to 0.922, which are above the recommended value of 0.70, suggesting acceptable construct reliability (Nunnally 1978). Convergent validity was assessed by examining whether the average variance extracted (AVE) for each measure exceeds the lower limit of 0.50, consistent with the recommendation of Fornell and Larcker (1981) to ensure the convergent validity. As shown in Table 1, the lowest AVE value was 0.515, which exceeds the threshold.

Convergent validity was also tested by extracting the factor loading and cross loading of all indicator items to their underlying latent construct. According to the analysis, all the items loaded on the underlying construct, and more highly on their respective constructs, than on any other constructs. A common rule to indicate convergent validity is that all items should load greater than 0.70 on their own construct (Yoo and Alavi 2001). Furthermore, each factor loading on its respective construct was highly significant ($p < 0.01$). The loadings from the analysis confirm the convergent validity of measures for the latent constructs.

Discriminant validity was established through the method of examining whether each construct's AVE square root was greater than its highest correlation with any other construct (Fornell-Larcker criterion). The bolded elements in the diagonals representing the square roots of the AVEs are greater in all cases than the off-diagonal elements in their corresponding rows and columns (see Table 3). The result supports the discriminant validity of the scales. Moreover, a comparison of the loadings across the columns also indicates that each indicator's loadings on its own constructs are higher than all cross-loadings with other constructs. Thus, the results indicate discriminant validity between all constructs based on the cross-loading criterion.

Table 4 also shows that weights of first-order constructs on designated second-order constructs indicate that the quality of the health website is a second-order construct factor with six dimensions. All dimensions weighted on the underlying second-order construct from the lower bound of 0.735 and t value of 11.099 to an upper bound of 0.925 and t value of 45.358. Again, these results indicate first-order constructs with the quality of the health website as the designated second-order construct.

Structural model

In order to test the research hypotheses specified in the previous section, PLS-SEM was used to test the structural model and hypotheses in this study because this technique is considered to be a more suitable method for prediction-oriented studies, while covariance-based SEM is better suited to testing which models best fit the data (Anderson and Gerbing 1988). Unlike covariance-based SEM, PLS-SEM does not generate overall goodness of fit indices, so the R-square (R^2) can be used to evaluate the explanatory power of the model (Wasko and Faraj 2005).

Table 2 Reliability assessment of the measurement model

Item	Standardized factor loading	*t* value	Composite reliability (CR) and AVE
Content of site (CO) (Mun et al. 2013; Provost et al. 2006)			CR = 0.881 AVE = 0.515
CO1: Is the clinical content reviewed by medically trained experts pertinent to the content?	0.76	14.98**	
CO2: Is the content comprehensive (right amount, right scope) within the given area and for the intended audience?	0.74	11.91**	
CO3: Does the site state its purpose or mission?	0.72	9.81**	
CO4: Is the home page free of spelling errors?	0.72	8.51**	
CO5: Is the information presented in a balanced and neutral format?	0.77	12.50**	
Authority of source (AU) (Mun et al. 2013; Provost et al. 2006)			CR = 0.864 AVE = 0.615
AU1: Did medically trained and qualified professionals develop the health information provided by the site?	0.83	15.82**	
AU2: Is the author identified?	0.85	17.10**	
AU3: Are the credentials of those responsible for preparing and/or reviewing the site's content mentioned?	0.78	8.55**	
AU4: Is the occupation, experience, training and/or education of the author(s) clearly stated?	0.72	9.13**	
Design (DE) (Mun et al. 2013; Provost et al. 2006)			CR = 0.922 AVE = 0.570
DE1: Is the site easy to navigate?	0.75	9.98**	
DE2: Do the images/graphics facilitate the use of the site?	0.79	14.01**	
DE3: Is the page layout organized and logical?	0.82	16.74**	
DE4: Is the text (font and layout) easy to read?	0.76	9.98**	
Accessibility and availability of information (AC) (Mun et al. 2013; Provost et al. 2006)			CR = 0.792 AVE = 0.562
AC1: Does the site provide a choice of more than one language?	0.64	7.34**	
AC2: Is the site free?	0.84	12.32**	
AC3: Does the site provide accommodations to users with disabilities?	0.77	11.58**	
Quality of links to other sources (QS) (Mun et al. 2013; Provost et al. 2006)			CR = 0.856 AVE = 0.666
QS1: Does the site clearly indicate the date the content was posted?	0.76	10.96**	
QS2: Does the site clearly state that links have been reviewed?	0.85	22.61**	
QS3: Does the site present a policy statement or criteria for selecting links?	0.83	14.64**	
User support (US) (Mun et al. 2013; Provost et al. 2006)			CR = 0.852 AVE = 0.657
US1: Can site users contact the webmaster or technical support specialist via e-mail?	0.80	11.16**	
US2: Is there a statement inviting comments, corrections of inaccurate information or suggestions for improvement?	0.84	19.94**	
US3: Does the site state expected response times for feedback?	0.80	12.43**	
Perceived information quality (PQ)			CR = 0.891 AVE = 0.577
PQ1: 3. The information content maintained by the website is pretty much what I need.	0.75	11.05**	

Table 2 Reliability assessment of the measurement model *(Continued)*

Item	Standardized factor loading	*t* value	Composite reliability (CR) and AVE
PQ2: The information exchange maintains data at an appropriate level.	0.77	12.91**	
PQ3: The information content is up to date enough.	0.74	11.51**	
PQ4: The information content provided by this exchange is completely error-free.	0.82	16.74**	
PQ5: The information content has no missing data items.	0.75	9.42**	
Trust (TR) (Mohseni et al. 2018)			CR =0.800 AVE = 0.572
TR1: I feel my privacy is protected on this website.	0.72	6.74**	
TR2: I find this online website trustworthy.	0.82	16.85**	
TR3: I trust this online website.	0.74	9.79**	
Perceived usefulness (PU) (Mohseni et al. 2018)			CR = 0.791 AVE = 0.559
PER1: I find the instructions are easy to follow.	0.76	13.24**	
PER2: I find this website is easy to navigate.	0.79	14.88**	
PER3: I find this website is easy to learn how to use.	0.68	7.45**	
Intention to use (IT) (Mohseni et al. 2018)			CR = 0.802 AVE = 0.575
IT1: I plan to use this website again in the future.	0.75	9.94**	
IT2: I will recommend that other people use this website.	0.72	7.25**	
IT3: My intentions are to continue using this website more than any alternative ones.	0.80	15.65**	

**t value > 2.58 ($p < 0.01$)

Following the measurement model, the structural model was also tested. The corrected R^2 values refer to the explanatory power of the predictor variables on each construct. The structural model explains 67.8% of the variance in perceived information quality ($R^2 = 0.678$), 54.8% of that in trust ($R^2 = 0.548$), 61.1% of that in perceived usefulness ($R^2 = 0.611$), and 62% of that in intention to use the health website ($R^2 = 0.62$). R^2 values between 0.50 and 0.75 indicate that the model has a moderately strong

Table 3 Results of the test of discriminant validity and correlation (square root of AVEs in the diagonal)

	CO	AU	DE	AC	QS	US	PQ	TR	PU	IT
Content of site (CO)	*0.740*									
Authority of source (AU)	0.721	*0.784*								
Design (DE)	0.690	0.641	*0.765*							
Accessibility and availability of information (AC)	0.621	0.545	0.698	*0.750*						
Quality of links to other sources (QS)	0.609	0.596	0.610	0.587	*0.811*					
User support (US)	0.597	0.616	0.739	0.650	0.409	*0.816*				
Perceived information quality (PQ)	0.344	0.442	0.468	0.460	0.708	0.537	*0.711*			
Trust (TR)	0.439	0.408	0.519	0.495	0.373	0.606	0.427	*0.756*		
Perceived usefulness (PU)	0.013	0.051	0.004	0.016	0.214	0.353	0.139	0.524	*0.744*	
Intention to use (IT)	0.349	0.442	0.495	0.216	0.321	0.102	0.249	0.139	0.347	*0.804*

Italicized values (diagonal elements) are the square root of the average variance extracted (AVE). They show the variance shared between a construct and its measures. Off-diagonal elements are correlations between latent constructs. All correlations are significant at $p < 0.01$ level

Table 4 Weights of the first-order constructs on the designated second-order construct

Second-order construct	First-order constructs	Weight	*t* value
WebMedQual	CO	0.889	26.880**
	AU	0.797	15.967**
	DE	0.925	45.358**
	AC	0.787	12.349**
	QS	0.735	11.099**
	US	0.831	18.282**

CO content of site, *AU* authority of source, *DE* design, *AC* accessibility and availability of information, *QS* quality of links to other sources, *US* user support
***t* value > 2.58 ($p < 0.01$)

explanatory capability (Hair et al. 2006). In addition to examining the R^2, the predictive sample reuse technique (Q^2) can serve as a criterion for predictive relevance (Chin et al. 2008). As suggested by Chin et al. (2008), a Q^2 greater than 0 means that the model has predictive relevance. Results of Q^2 demonstrates that perceived information quality ($Q^2 = 0.21$), trust ($Q^2 = 0.14$), perceived usefulness ($Q^2 = 0.32$), and intention to use the health website ($Q^2 = 0.45$) all have satisfactory predictive relevance (Henseler et al. 2009).

Hypothesis 1 predicts that the quality of a health website will have a significant impact on perceived information quality. The standardized coefficients of quality of the health website and perceived information quality are 0.723, and the t value is 9.309, $p < 0.01$, indicating statistical insignificance. Thus, hypothesis 1 is fully supported. Hypothesis 2 proposes that perceived information quality has a significant relationship with trust. The standardized coefficients of perceived information quality and trust are 0.337, and the t value is 2.136, $p < 0.01$, indicating statistical significance. Thus, hypothesis 2 is fully supported.

For hypothesis 3, the result illustrates that there is a significant positive relationship between trust and perceived usefulness. The standardized coefficients of trust and perceived usefulness are 0.333, and the t value is 2.845, $p < 0.01$, indicating statistical significance. Thus, hypothesis 3 is also fully supported. Finally, hypothesis 4 predicts that the perceived usefulness has a positive influence on intention to use the health website. That is, there is a significant positive relationship between the perceived usefulness and intention to use healthcare websites. The standardized coefficients of perceived usefulness and the intention to use the health website are 0.263, and the t value is 9.264, $p < 0.01$, which is statistically significant. Thus, hypothesis 4 is fully supported.

Table 5 presents the completed results of the structural model and hypotheses testing. All four hypotheses were strongly supported, indicating that the quality of the health website was a good predictor of perceived information quality and then trust for

Table 5 Structural estimates (hypotheses testing)

Hypotheses	Paths	Standard Beta	*t*-statistics
H1	WebMedQual ➔PQ	0.723	9.309**
H2	PQ ➔ TR	0.337	2.136**
H3	TR ➔ PU	0.333	2.845**
H4	PU ➔ IT	0.263	9.264**

Criteria *t* value **2.58 ($p < 0.01$); *WebMedQual* quality of health website, *PQ* perceived information quality, *PU* perceived usefulness, *IT* intention to use

users. Moreover, the findings indicate that trust can predict perceived usefulness and intention to use a health website. In the proposed model for this study, perceived information quality, trust, and perceived usefulness can play predictor roles for the intention to use healthcare websites.

Discussion

Despite the fact that a significant amount of research on the quality of health websites has been conducted in recent years (e.g., Fink and Beck 2015; Lu et al. 2016; Sowter et al. 2016), understanding the consequences through perceived information quality, perceived usefulness, trust, and intention to use the health website is still crucial. This study has tested the relationships through a survey of online users for health websites in Thailand, and evidence has been obtained to support the hypotheses. The results of the PLS-SEM analysis are shown in Fig. 2. The key factors identified are crucial, which can enhance the intention to use websites in a healthcare context.

Based on hypothesis testing, the characteristic of quality of health websites has a positive impact on perceived information quality. This finding supports hypothesis 1, which is consistent with the previous studies (Kim and Niehm 2009; Pearson et al. 2012). The finding indicates that the quality of a website's content, such as up-to-date information, reliable content, information on the article's writers, and user-friendliness are factors that lead to perceived high quality when users evaluate the website. This confirms that the quality of the health website has a positive impact on perceived information quality. Moreover, perceived information quality can motivate users to have trust in order to use a health website as their source of health information. This study also confirms that trust in technology has an important role in perceived usefulness. Finally, perceived usefulness of health information on a website has an impact on the intention to use the health website to seek health information. The findings support the hypothesis in accordance with the previous findings based on the TAM (Davis 1985; Venkatesh and Bala 2008). This direct relationship with intention to use the health website has been confirmed by several studies (e.g., Kim and Chang 2007; Zhang et al. 2018).

In addition, the research indicates that trust in a health information website has a positive impact on the perceived usefulness of the health website. This finding is consistent with the previous studies that confirmed the relationship between trust and perceived usefulness in various contexts (Tung et al. 2008). Increasing trust in using health websites can also lead to their perceived usefulness for seeking health

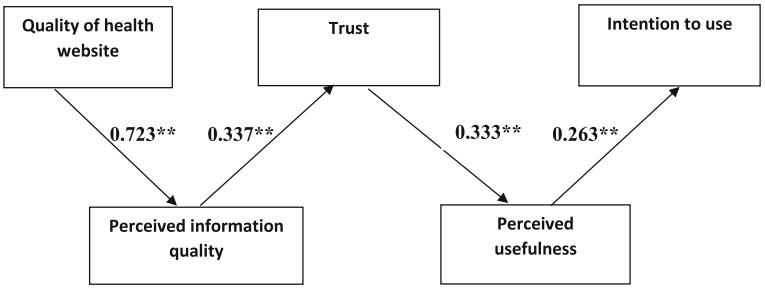

Fig. 2 Results for model of quality of health website and intention to use

information. The results of this study benefit practitioners as they learn that users have a general disposition to trust, especially in a new setting. In the health website context, the roles of doctor and nurse are replaced by search features. Therefore, trust is very important for people when they use health websites or online systems as tools for finding treatments. Moreover, the level of trust in using health websites can improve their perceived usefulness, and the intention to use these websites for seeking health information will increase.

Implications for researchers

This study makes several key contributions to theory. First, it identifies the importance of the relationship between the quality of a health website and perceived information quality in achieving trust. This research elaborates and empirically tests the effects of the quality of the health website and perceived information quality. The findings also represent an important step forward in revealing the role of health website quality regarding trust. Second, the results suggest that trust and perceived usefulness are the major determinants of intention to use health websites. Direct experience in using health websites in the past helps establish a good reputation by increasing familiarity and knowledge about the website. Perceived usefulness can contribute to the success or failure of websites.

Lastly, the research community in online healthcare has started questioning the quality of health websites for seeking information. They report stories of patients suffering because of incorrect information and unreliable sources or even negative evaluations of the treatment. This study fills this knowledge gap by validating the quality of health websites, particularly in emerging countries such as Thailand, where Internet use is growing extensively. The results show that online users tend to use content of site, authority of source, design, accessibility and availability of information, quality of links to other sources, and user support as the indicators of quality.

In line with some specific applications of the TAM suggested by Davis (1985), the study suggests that the quality of a health website influences the intention to use it when users have trust and perceive the usefulness of the system. More detail, such as how information is selected to engender greater trust, needs to be provided. In addition, ensuring that websites are easy to use contributes to the level of trust users have in a website. Finally, the retrieval of relevant information could be improved through the implementation of functionality.

Managerial implications

Such findings also underscore the importance of health websites having good characteristics in order to ensure trust and to maximize the benefits accruing from users' perceived usefulness. If a health website can satisfy users, this will also make them trust it, and then improve their intention to use it again; this is consistent with research by Zhang et al. (2018). The effects of trust on intention to use the health website are also positive. Moreover, care should be taken to strengthen users' belief that health website systems are flexible to use, convenient, and effective, thus leading them to have the intention to use the system.

Having grown up with the Internet, users nowadays are heavy online consumers, and not only in the healthcare industry. It is important to understand the characteristics of good websites for health-information seekers. The developers/designers of healthcare websites need to understand the quality of web-based health information in order to facilitate precise health decision-making by the users. The evaluation of the quality of health websites is the main issue since it is not yet robust. This study helps practitioners by introducing the characteristics of well-designed health websites. Moreover, it is important to consider the behavior of users, underlying how people value information or certainty about their health status. According to Vuong et al. (2018), people with different marital and job statuses diverge in their views on healthcare expenditure. This factor is crucial when developers/designers desire to develop health website systems. In addition, practitioners need to distinguish between trust and perceived usefulness; they concomitantly have not understood their relationships with each other or how they influence the intention to use the websites. Therefore, distinguishing between these concepts conceptually will provide important insights into their distinct roles in the health website context.

Limitations and future research directions

1Like any other study, this study is bound by certain limitations that also provide fertile grounds for further research. First, this study employed a convenience sample. Although it was a strong sample in terms of diversity, generalizations of the results must be made with caution. Therefore, future studies can use random sampling of general users. Second, this study did not consider cross-cultural issues; any comparative study from a developed or developing country would make a worthwhile contribution to this body of knowledge. A third limitation of the current study is related to health websites. In this study, the definition of a health website is a little broad; therefore, the results may not be suitable for particular categories. Thus, future studies should examine the validity of the proposed model on a specific online service. In addition, the variables of this study have been measured at a single point in time; future studies should use a longitudinal analysis in order to validate the proposed model.

Lastly, this study focuses on the direct relationships between quality of a website, trust, perceived information quality, and perceived usefulness, on the one hand, and intention to use health websites, on the other hand, but does not specifically address the effect of other potential moderating variables such as time spent online, knowledge of technology, age, gender, or other auxiliary factors that might affect the direct relationships. Examining the impact of the quality of a health website in such a setting would require the inclusion of additional theoretical underpinning.

Concluding remarks

In conclusion, website quality studies are of major interest to researchers and practitioners. This study has offered a robust model of the quality of health websites as a framework to classify health website quality attributes. Moreover, this study has examined how health website quality influences the intention to use the health website when

users have trust and perceive the usefulness of the system. This study also presents the model and the findings, which hold considerable promise in helping practitioners and researchers better understand the relationship between the quality dimensions of health websites and intention to use a health website. This study can lay the groundwork for future studies in investigating the relationship between website quality and behavior of online users in some specific health contexts.

Abbreviations

AVE: Average variance extracted; CMV: Common method variance; CR: Composite reliabilities; EHCR: Electronic health care records; PLS-SEM: Partial least squares structural equation modeling; SEM: Structural equation modeling; TAM: Technology acceptance model; TRA: Theory of reasoned action; WebMedQual: Web medical quality

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Availability of data and materials

Data and material are available at any time.
There are no restrictions on the availability of data and material.

Author's contributions

I have full contributions to this manuscript. The author has read and approved the final manuscript.

Competing interests

The author declares that there are no competing interests.

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