Contrasting the Dimensions of Information Quality in their Effects on Healthcare Quality in Hospitals

Linda W. Byrd
Auburn University
byrdlin@auburn.edu

Terry Anthony Byrd
Auburn University
byrdter@auburn.edu

Abstract
This study examines the relationships between the dimensions of information quality and healthcare quality. Past studies have confirmed a positive relationship between these two constructs, however, the relationships among the underlying dimensions of the constructs have not been explored. One of the primary purposes of this study is to show that different dimensions of information quality have different relationships with dimensions of healthcare quality. As the paper indicates, this development has implications for researchers and practitioners interested in these two constructs.

1. Introduction

Information is the lifeblood of modern organizations as the present era has been labeled the “information age.” Consequently, information quality has moved to the forefront of the important issues in organizations. In fact, the operational, tactical, and strategic performances of today’s organizations are tied directly to the quality of their information [11] [22] [25]. Poor information quality can wreak havoc in businesses and organizations and result in customer dissatisfaction, increased costs, reduced levels in the effectiveness of decision-making, and a diminished ability to plan, implement, and execute organizational strategies [15] [25].

In an industry like healthcare, the quality of information used for decision-making can literally mean the difference between life and death. There are over 50,000 deaths per year in healthcare organizations directly attributable to medical errors that come from poor information quality [1]. As can be seen from this statistic, the consequences from poor information quality can be especially acute in the hospital. These consequences can be immediate when information used to make clinical decisions is either erroneous or untimely. Erroneous or untimely information can result in a worsening of a medical condition and, in many cases, the death of a patient. Therefore, it is imperative to understand the impact of information quality on the overall quality of healthcare.

Previous studies have found that information quality affects healthcare quality in healthcare organizations [2] [26]. For example, Tierney [26] notes that for clinicians to make the best decisions about the care of their patients, they need accurate, up-to-date, and timely information. He also explains that throughout the chain of events in a typical clinical encounter from “(1) selecting the most likely diagnosis to (2) selecting the treatment(s) most likely to be effectively to (3) administering the treatment(s) correctly to (4) properly monitoring to (5) modifying the treatments appropriately” (p. 4) that information quality is a critical component in delivering the best care. Bates and Gawande [2] express similar conclusions in their study.

Since healthcare and, clinical decision making in particular, are so information intensive, it is logical to conclude that there is a positive link between information quality and healthcare quality. As pointed out above, this link has been empirically examined and supported. However, in-depth examinations of the nature of the relationship between information quality and healthcare quality are needed to really understand this relationship. Both information quality and healthcare quality are multi-dimensional concepts and, thus, the relationship between them is likely to be much more complex than have been previously articulated. For example, the concept of information quality can be very broad as illustrated by the information quality framework of Zhou, Chuang, and Nakatani [30]. Their framework includes dimensions of data integrity, which itself is made up of accuracy, completeness, and timeliness; data integration, which includes aspects of data integration; information synchronization; information transparency, includes visibility, accessibility, and security; and information dynamics, which follows the movement of information and data within and among organizations. There are other similar frameworks that present the same or overlapping dimensions of information quality as well that have been offered by other researchers [6] [16].

The same is true of healthcare quality. It too is a multidimensional concept that has been characterized as such in several different frameworks [3] [14]. Across these frameworks, there are
dimensions such as competence, responsiveness, collaboration, courtesy, and reliability, among others. Again, it is not the purpose here to present a comprehensive model of all of these frameworks, but to acknowledge that healthcare quality is a multi-dimensional concept in much the same way as information quality.

The implication of attempting to determine the relationship between these two multi-dimensional concepts is that researchers must look deeper and start to explore the relationships among the dimensions to really understand the link between these two concepts. The purpose of this study is to begin the exploration of these relationships of the dimensions of these two important concepts. The study first examines these dimensions and their relationship through a theoretical lens. One of the premises of this theoretical examination is that different dimensions of information quality will affect different dimensions of healthcare quality. The study surveys one of the most knowledgeable sources of these two constructs in hospitals, the chief nursing officers (CNOs). A CNO is a registered nurse (RN) that managed all the nursing resources of a hospital. Virtually all of these CNOs have come up through the ranks and have been practicing RNs at some point in their career.

2. Theoretical Considerations

2.1 Information Quality

Information quality is a multidimensional concept. Wang and Strong [28] develop an often cited framework of information quality that consist of intrinsic information quality, contextual information quality, representational information quality, and accessibility information quality. They used a two-stage survey and a two-phase sorting procedure to reduce a large number of information quality attributes down into these four dimensions. Intrinsic information quality includes related objective attributes, such as accuracy, reputation, and believability, independent of any specific context. Contextual information, on the other hand, must be considered in light of its context. For example, in an organizational environment such as a hospital emergency room, information can have a very limited life and must be available in a timely fashion. In these cases, information must be relevant, timely, complete, and appropriate in terms of amount so as to add value [28]. The representational information quality dimension includes both the format of the information and the meaning of the information. Some attributes of this dimension include interpretability, ease of understanding, representational consistency, and concise representation. In the study by Wang and Strong [28], this dimension is tied to the output of a computer system. The last dimension in the typology, accessibility information quality, is related to how available and easily reached the information is to find or to discover in a computer system, given its security features.

Examining all of these issues from all of the dimensions in one study would be impossible in the space limitations of a journal article. An initial study investigating information quality in the healthcare industry should examine the attributes that are most frequently associated with information quality. These attributes are most likely those associated with the intrinsic view and the contextual view [9] [28]. The information attributes of these two dimensions most cited are accuracy, completeness, and timeliness. Therefore, the study uses accuracy, completeness, and timeliness specifically to represent information quality.

Accuracy is the degree to which information for decision-making is correct, unambiguous, meaningful, believable, valid, free of errors, and consistent [16] [27]. This is probably the most common feature that we think of when we consider information quality. Completeness is the degree to which the information for decision making allows RNs to act dependably, entirely, and fully in caring for patients or communicating with other healthcare professionals [16] [22] [27]. Timeliness is the degree to which information is opportune, appropriate, and up-to-date at the time the information is needed for decision-making [9] [16].

2.2 Healthcare Quality

Similar to information quality, healthcare quality is a multi-faceted concept as well. Broadly, it has been defined in a number of ways. Nash [21] defines healthcare quality as “the process of intervention, significant measured improvement in the condition of the patient, alleviation of pain or other desired outcomes while providing real value” (p. 205). One other view by Lohr [18] states that healthcare quality is “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge” (p. ).

Donabedian, a seminal leader and founder of the modern field of quality of care, reported that the definition of quality of healthcare should be based on conceptual and operational definitions [7]. He conceptualized and posed seven attributes in a framework to define healthcare quality. He described the attributes of healthcare quality as efficacy, effectiveness, efficiency, equity, acceptability, optimality, and legitimacy [8]. Other researchers have
followed the lead of Donabedian and constructed similar frameworks [3] [14]. Most of these studies have an almost identical set of attributes for healthcare quality, especially after merging a few similar attributes. For example, Bowers et al. [3] and Jun et al. [14] had these (very similar) attributes of healthcare quality: competence, responsiveness, understanding or empathy, professionalism, collaboration, and safety. Other researchers with attributes that mapped into these dimensions very well include Zineldin [31] and Ware and Snyder [29]. Therefore, these attributes were used to provide a multidimensional construct for healthcare quality in this paper.

In this study, competence is the degree to which RNs are knowledgeable, dependable, and reliable in delivering healthcare services to patients [23]. Responsiveness is the degree to which they provide prompt service and respond quickly to the needs of the patients [23] [29]. Understanding is the degree to which RNs can empathize, know, and identify with the needs of the patients [23]. Professionalism is the degree to which the RNs can easily find needed equipment and devices, promptly organize their work environment, and present a professional image to patients [23]. Collaboration is the degree to which RNs are able to communicate with other healthcare workers and work in a cohesive team to deliver proper healthcare [31]. Safety is the degree to which RNs provide an accident and error free environment in providing healthcare to patients [3] [14].

Therefore for this study, we are relating the attributes of information quality- accuracy, completeness, and timeliness- to the attributes of healthcare quality – competence, responsiveness, understanding, professionalism, collaboration, and safety. One of the primary purposes of this study is to illustrate that different aspect of information quality will affect the attributes of healthcare quality in different ways. In some cases, an information quality attribute will not affect some of the attributes of healthcare quality, but will affect others. It is important to begin to understand how these attributes of these two very central hospital capabilities relate to each other in a more detailed way. This knowledge can be a boon for researchers as they look deeper into these relationships among critical capabilities. Additionally, practitioners can more selectively invest their limited financial resources into the quality areas that give them the best overall impact based on their strategies and goals.

2.3 Accuracy and the Quality of Healthcare

The information quality attribute that has received the most attention in the literature is accuracy [27]. Sometimes accuracy is difficult to really grasp but we can think about “inaccuracy” of information as a condition where information is different from the real world state that it is suppose to represent [27]. Now, it is important to try to conjecture which healthcare quality attributes that the accuracy attribute might affect or, at least, affect most. There is very little guidance here from the literature as studies usually lump all the information quality variables into one construct when relating them to downstream performance variables [22]. So, therefore, logic reasoning must be the primary way that hypotheses for this study are developed.

Accuracy would seem to be the one attribute of information quality that would have significant and positive effects on all of the healthcare attributes. A couple of these attributes, competence and safety, would seem to certainly benefit from accurate information. Competence has to do with being knowledgeable, dependable, and reliable. Certainly, accurate information is needed to obtain a high level here. Without accurate information, RNs would be acting on information that did not reflect the real world situation. This does not denote being knowledgeable or dependable and would likely result in distrust on the part of the patients and others. Likewise, accurate information would likely have a big effect on safety. Safety is related to have an error-free environment and, therefore, accurate information in that environment must be a given. These arguments results in the following:

H1a: The accuracy attribute of information quality is significantly and positively related to the competence attribute of healthcare quality.

H1b: The accuracy attribute of information quality is significantly and positively related to the safety attribute of healthcare quality.

Collaboration is related to how well RNs work with others in the healthcare team to deliver the best care to patients. Although the relationship here might not be as clear cut as the ones above, it would seem that accuracy would be important in collaboration. One of the most important conditions for effective collaboration is trust [4]. Trust is the willingness to be vulnerable to the actions of others without monitoring or control of those individuals [20]. Potential collaborators will likely be unwilling to give anyone else trust unless they believe that the person is competent and have the knowledge and information to carry out his part of the collaborative task without their
presence or involvement. That competence and knowledge is much more likely with accurate information as noted above. Therefore,

H1c: The accuracy of information is significantly and positively related to the collaboration attribute of healthcare quality.

The relationship between accuracy of information and professionalism is somewhat difficult to theorize. However, one study might hold some insight into the relationship, at least as far as perceptions are concerned. Prasad and Prasad [24] found that the computerization of the workspace in a health maintenance organization (HMO) increased the perceptions of professionalism. RNs and other medical personnel thought that the computers gave the environment a more of a look of “professionalism” with less papers, pens, and pencils to clutter the environment. The computerization of the work also seemed to represent expertise to the workers of the HMO. Before computers they felt that information was difficult to get to and they felt less professional because of it. Finally, they saw the computerization of the environment as moving their organization forward and they had been ashamed of not being “real professionals” before. Although this study is not specifically about the computerization of the work environment, one could easily imagine that the specter of accurate information from whatever source could have similar effect. Additionally, it has been shown that increased computerization does indeed increase the accuracy of information [22]. While in fact, it may not have been the computerization of the environment that increased the perceptions of professionalism in the HMO in the cited study, but perhaps the increase access to accurate information. This argument leads to the following hypothesis:

H1d: The accuracy attribute of information quality is positively and significantly related to the professionalism attribute of healthcare quality.

Good arguments for the positive and significant relationship between accurate information and responsiveness and accurate information and understanding are difficult to make. There are certainly times that healthcare workers received accurate information but it is not received in time for the healthcare professional to be responsive to the patient and help with the illness or injury. Responsiveness implies a sense of giving prompt service so that the immediate needs of the patient are met. Sometimes, trying to get the most accurate information can actually work against responsiveness as it may take time to get the best information on the situation.

Understanding or empathy would not necessarily need accurate information either. RNs and other healthcare professionals can certainly empathize and identify with the needs of a patient without having accurate information on the patients. Many times it may be obvious that a patient is having some health problems or a serious injury but the underlying illness or damage is unknown. In such cases, healthcare personnel can certainly be understanding and demonstrate a caring attitude to the patient.

2.4 Completeness and Timeliness of Information

The two attributes, completeness and timeliness, will be considered together because it seems that they may present contrasting effects on the attributes of healthcare quality. Completeness is concerned with obtaining all of the relevant information that can help RNs fully care for patients and work with other healthcare professionals. One view from the literature is that all pertinent information is recorded and made available for the healthcare of patients [27]. Completeness is closely akin to thoroughness. The term implies that all relevant avenues for useful information have been considered, investigated, and, ultimately, the best information choices have been made to render the best quality of care. When really examining this attribute, it is reasonable to assume that it takes time to consider, investigate, and gather the most thorough information to use for work task such as medical care.

On the other hand, timely information seems to be on the other end of the spectrum. Here the information needed for decision-making is opportune and fresh. Wand and Wang [27] states that the timeliness of information is based on “three things: how fast the information is changed or updated after a real-world change; the rate of change of the real-world system; and the time the information is actually used” (p. 93). As we know, in many healthcare situations, all three of these things can be critical to the health and, indeed, the survival of the patient. In many of these situations, complete information is not available or, maybe, even necessary. Certain up-to-date key information may be all that is needed at the time to stabilize the patient and to save his life. Later, more elaborate measures based on more complete information come into play to start the patient on the path to recovery.

As can be seen from these brief descriptions, completeness and timeliness are different views of information quality. With completeness, much more
data are involved with the decision maker actually sifting through what are available to make the decision on what information to use in completing the work task or making decisions. However, with the timeliness of information, there is more a focus on opportune, appropriate, and up-to-date information. That is, only a narrow piece of information that is appropriate is made available at the time of decision-making. So, the question now is which of these somewhat contrasting views of information quality matches up best with which attributes of healthcare quality.

One fairly obvious relationship in considering the possibilities is the one between the timeliness attribute of information quality and the responsiveness attribute of healthcare quality. Responsiveness certainly has a time-based aspect to it. It is the ability to provide prompt service and respond quickly to patient needs. It is easy to see that timely information would help in such a situation. Focused and appropriate information would very likely support the need to provide respond rapidly and make quick and rapid decisions on patient care. In most such situations where there is need to respond rapidly, complete information would slow down the decision making and, could even be, dysfunctional. Therefore, based on the argument above, the next hypothesis is:

**H2a: The timeliness attribute of information quality is positively and significantly related to the responsiveness attribute of healthcare quality.**

Another relationship that might seem logical is between the completeness attribute of information quality and safety attribute of healthcare quality. It is relatively easy to see that when safety is a primary concern any information used in decisions about a healthcare situation should be as complete as possible. One of the primary goals is reduce the number of medical errors that some estimate may cause over 50,000 unnecessary deaths a year [1]. Additionally, one can extrapolate that with this many deaths from medical errors, the toll from pain and suffering from medical errors is magnitudes higher. More complete information that can throw light on several aspects of the problem at hand should reduce the large number of medical errors and increase safety. At the same time, it is difficult to see how the timeliness attribute might be related to the safety issue. It was hypothesized that timeliness is important when targeted information and speed are needed. In true emergencies, safety is rarely the overriding issue, although this is not to say it is totally ignored. But in such cases, the overriding concern is to stabilize the patient and keep him alive. Typically, safety is not stressed here. From this discussion, it would seem that only completeness would affect safety. Thus, the following is offered:

**H2b: The completeness attribute of information quality is positively and significantly related to the safety attribute of healthcare quality.**

The completeness attribute could also be logically linked to collaboration. In the above discussion on collaboration, it was stressed that one of the most important elements to successful collaboration was trust among the collaborators. This is the trust that everyone is knowledgeable enough and has enough integrity to carry out their part of the work task. A recent study shows that as the information shared is increased and is more complete, collaborative performance also increases [12]. The results of this study support the following hypothesis:

**H2c: The completeness attribute of information quality is positively and significantly related to the collaboration attribute of healthcare quality.**

Competence would be an attribute that would benefit from all the different attributes of information quality. We have already argued that accurate information affects competence. Likewise, it would seem that both completeness and timeliness would affect competence of the RNs. Registered nurses in hospitals can experience both emergency situations where timely information is most valuable and in long-term care where the completeness of the information for decision-making (on physical activity, on diets, on medicines, on allergies, etc.) is more useful. Having and utilizing available information to handle both types of situations certainly add to the knowledge and dependability of RNs in rendering overall healthcare. Therefore, the following are given:

**H2d: The completeness attribute of information quality is positively and significantly related to the competence attribute of healthcare quality.**

Although the term, professional, has had many different meaning in the literature, some aspects of the term has remained consistent over time [19]. One of the aspects discussed in the literature is that professionalism is associated with the eagerness to learn and to have acquired information and knowledge [19]. However, it is not just the acquiring of information but also to be well-rounded and
knowledgeable about the relevant field of endeavor. It is not only related to having a large amount of information at your disposal but having information organized so that it can be easily accessed and utilized when needed. In light of this view of professionalism, completeness of information seems to be more relevant than timeliness to this attribute of healthcare quality. So, the following hypothesis is presented:

H2c: The completeness attribute of information quality is positively and significantly associated with the professionalism attribute of healthcare quality.

The last attribute of healthcare quality to consider in this section is understanding. Understanding is related to having empathy and being able to identify with the patient. Like the accuracy attribute, it is not very difficult to see that complete information is not needed to have empathy for patients. Therefore, it is unlikely that completeness of information will have a relationship with understanding. However, it is logical to assume that developing empathy and identifying with patients require some information about the patient. That information should be delivered very quickly and can be fairly brief with just the basic information about the patient. The key is that the information given is all about the patient and his needs or concerns. Thus, the following hypothesis results:

H2f: The timeliness attribute of information quality is positively and significantly associated with the understanding attribute of healthcare quality.

In this study, organization size was used as control in the analysis. The size of the organization always seems to affect relationships involving performance variables at that level. Therefore, we include it in this study as well.

3.0 Methodology

This study collected data using a questionnaire from a key informant, the chief nursing officer (CNO) in a sample of single system independent hospitals. The questionnaire had three majors sections, one to collect data on the quality of information, and one to collect data on the quality of healthcare and one to collect data on demographic and practice characteristics. Each section of the questionnaire had instructions for filing out that portion of the survey to help minimize misunderstandings and misinterpretations.

In addition to questions on the two constructs of research interest, quality of information and quality of healthcare, demographic and practice information such as length of tenure at the hospital, years of experiences, highest degree, gender, age range, job level, and name of position. The practice characteristics helped to assess whether the key informant was indeed knowledgeable and able to answer the questionnaire with accuracy. Some of these were used as controls in the analysis.

The questionnaire for the primary constructs of study was developed with the standard process for measurement instrument [17]. Preliminary factors for the two constructs of interest in the study, information quality and healthcare quality, were determined after through literature reviews for the two. Initial items for the factors were taken from past research studies in association with the literature reviews [3] [14] [22] [24] [28].

Two pretest procedures were done to begin validation of the questionnaire. First, two registered nurses involved in hospital information systems and four academicians well-informed about IT reviewed the factors for legitimacy and their items for understandability, clarity, and consistency in the terminology used in healthcare settings. After several iterations, the questions were judged to be unambiguous and comprehensible by the six experts. The terminology used in the questions was deemed to be the same as that used in the healthcare industry.

Next, the revised questionnaire was administered to faculty members of a School of Nursing at a major university in the southeastern United States. They were asked to complete the survey and to review both its appearance and its content. The instrument was also administered to five members of a nursing sorority that includes some nursing supervisors and managers. They also were asked to fill out the questionnaire and to comment on its appearance and content. The comments were reviewed, and the instrument was revised based on feedback from the nursing professors and the members of the nursing sorority. After being evaluated by two sets of experts in healthcare and IT and being revised from the comments from each set as stated, the questionnaire was now deemed ready for pilot testing.

The pilot test used members of a nursing sorority who worked as full time RNs. Two hundred questionnaires were distributed and fifty-seven (29%) were returned for analysis. Principal component analysis was used to determine the factors. The three factors for the information quality construct and the six factors for the healthcare quality construct were confirmed through the analysis. The items for each
factor of the questionnaire is given in the Appendix at the end of the article.

3.1 Data Collection

The revised instrument was used to collect data from the CNO in each hospital. The data collection process used the key informant method. The key informant method targets one individual who is knowledgeable about the area of interest as the source of data collection. A questionnaire was sent to each CNO in 1000 single system hospitals. A cover letter accompanied the questionnaire. The cover letter introduced the researcher and the parameters of the study itself. It also contained a statement assuring the informants that all responses will be kept in the strictest confidence and that no individual responses, names of participants, or names of associated hospitals would be shared with anyone other than the researcher of the study and that all published information would only be in de-identified summary form. The mail packet also contained a self-addressed and prepaid return envelope to mail back the questionnaire.

In addition to returning the paper questionnaire in the prepaid envelope, the informant had the option of completing the survey online rather than on paper. The Web-based questionnaire was hosted on a university Web site. It was developed by a technical expert that was employed by the university as part of their information technology staff. The site was thoroughly tested by the expert and the researcher by entering sample data for each question and examining the output. The Web-based questionnaire was created to be convenient and user-friendly, and it relayed the same information and collected the same data as the paper-based questionnaire.

One hundred and forty-eight respondents used the paper-based questionnaire, and 66 used the online questionnaire, for a total of 214 respondents. Therefore, the response rate for the survey was 21.4%, based on the actual set of survey responses used in the analyses. After the first three weeks, 92 questionnaires were completed. After the initial email, 62 more were completed and returned over the next two weeks. Finally, after a second email to the CNOs, 60 more completed questionnaires were returned. One packet was returned from the paper mailing. Thirty emails were returned from the first email request and 10 emails were returned on the second email request. Most of the hospitals with responding CNOs were nonprofit healthcare organizations. Of the 214 hospitals, only seven were “for profit” organizations, leaving 207 nonprofit hospitals in the sample.

The general characteristics of the survey respondents were as follows. The job titles varied but stayed within the scope and definition of a CNO. For example, some of the job titles were CNO, Vice President of Nursing Services, Director of Nursing and Patient Care Services, Chief Clinical Officer, Vice President of Patient Care Services, and Chief Nursing Executive. There were 193 female respondents, 16 male respondents, and five respondents who did not give their gender. There were 205 Caucasian respondents, 4 Hispanic/Spanish respondents, 3 African-American respondents, and 1 Asian-American respondent. One respondent did not give her race. All but one of the respondents noted that they were RNs.

4.0 Data Analysis and Results

4.1 Non-Response Bias Check

Non-response analysis was needed to make sure that the hospitals of the responding informants did not differ significantly from the hospitals in the population that did not respond. Early respondents were compared with late respondents on the questionnaire items to make sure that there was no significant difference between the two groups [17].

4.2 Convergent and Discriminant Validity

Convergent validity was used to test if the items reflected the true dimensions of the factors that they are purported to measure. The average variance explained (AVE) “reflects the overall amount of variance in the indicators accounted for by the latent constructs (the factor)” (p. 642) [13]. The higher the AVE, the more likely the items are truly representative of the underlying factor. Recommended value for AVE is typically 0.50 or higher [17]. All of the AVEs were above the .50 cutoff as determined using confirmatory factor analysis (CFA).

Discriminant validity was evaluated using the test from Fornell and Larcker [10]. The test compares the square root of the AVE of a factor and checks if it exceeds every related correlation between that factor and all of the other factors in the study. In every case, the square root of the AVE was higher. This test shows that the factors exhibit excellent discriminant validity.

The reliability using Cronbach’s Alpha show all of the factors exceeded the recommended cutoff of .70. Therefore, reliability of the factors was confirmed.

4.3 Relationship Analyses

The relationship model was analyzed using Partial Least Squares (PLS) regression. PLS allows for
analysis within a smaller sample size than covariance-based structural equation models (SEMS), like AMOS and LISREL [5]. PLS also handles non-normal data better than the covariance-based SEMs; therefore, the underlying data distribution is not as important [5]. The advantage of PLS over regular regression is that it is able to analyze multiple dependent variables and also allow a factor to be an independent and dependent variable in the same analysis [5].

In using PLS, we included all links between the factors in the study. This was to ensure that relationships that were not hypothesized might also be considered and examined. Although we feel that we made the most logical arguments for or against the various relationships, we could certainly have overlooked some valid relationships or been incorrect in our logical arguments.

### 4.4 Relationship Results

The results of the analysis supported almost all of the stated hypotheses at the .05 level of significance. For H1a, the information quality variable, accuracy, was positively related to the healthcare related variable, competence (β=.24). Accuracy was also positively related to healthcare variables, safety (H1b, β=.28), collaboration (H1c, β=.32); and professionalism (H1d, β=.20). As implied in the lack of arguments for other relationships for this information quality variable, accuracy was not significantly related to the healthcare variables, responsiveness and professionalism.

For the information quality variable, timeliness, it was positively related to the healthcare quality variables, responsiveness (H2a, β=.18), competence (H2c, β=.17), and understanding (H2f, β=.20). Again, as implied by the lack of arguments for other relationships, timeliness is not significantly related to the healthcare variables, professionalism, collaboration, and safety.

Last the information variable, completeness, is positively related to the healthcare variables, safety (H2b, β=.23), collaboration (H2c, β=.22), and professionalism (H2e, β=.28). We were surprised that completeness was not significantly related to competence as hypothesized in H2d. Completeness was also not significantly related to healthcare quality variables, understanding and responsiveness as implied by no hypotheses stating such relationships.

The control variable size was also related significantly and negatively to the healthcare quality variables, responsiveness (β=-.24), understanding (β=-.19), professionalism (β=-.15), and safety (β=-.15).

### 5.0 Discussion

Past studies have shown that there is certainly a link between information quality and healthcare quality in healthcare organizations. It only makes sense that with better information quality, that healthcare quality will also improve. However, no study that we have been able to find focused on the relationships between dimensions of information quality and healthcare quality. One of the purposes of this study was to establish one set of dimensions for each of these constructs and examine how the dimensions of the two constructs might be related. As expected different dimensions of information quality were associated with a different subset of dimensions for healthcare quality. For example, timeliness was related to responsiveness, competence, and understanding while completeness was related to safety, collaboration, and professionalism, a completely different subset, in the study.

The implication for research is that scholars must look deeper at information quality and healthcare quality in their studies examining one or both of these constructs. The results of their studies will probably differ if the dimensions of these constructs are considered instead of the constructs themselves in their experimental models. As we found in this study, the dimensions are distinct and have different effects and relationships.

The implication for practitioners is that they should take into consideration the various aspects of information quality and focus on the aspects that might be needed for their particular goals. For example, emergency room managers might want to improve timeliness of information to improve healthcare quality because responsiveness might be most important to them. The operating room manager, on the other hand, might be more concerned about the completeness dimension of information quality because his healthcare quality emphasis might be more on safety and collaboration.

The results here might also have implication for healthcare software applications. Healthcare applications should be implemented on the basis of the most important goals for information quality and, therefore, for healthcare quality. For instance, an alert for laboratory results may be used to notify personnel that some tests are needed in a timely way. The results in this study might also help in the development of standards for the key information quality and healthcare quality domains such as data from medications, laboratory and medical conditions.

Evidenced Based Practice (EBP), the practice of using the best current evidence about care, pivotal in healthcare, might make use of the quality measures
developed in this study thus making it easier to collect, measure, and interpret healthcare quality and information quality indicators and the resources used to provide care. This information in a computerized format would provide healthcare providers and managers an invaluable tool to analyze and track quality outcomes, improving the value of IT to healthcare organizations.

At the very least, we hope the results of this study will open dialogue about these very two important constructs in healthcare. Through the open dialogue and more studies with dimensions of information quality and healthcare quality, we might be able to improve the particular areas of these two organizational resources that matters the most to specific organizations or circumstances.

6.0 References


Appendix:

Items for Information Quality:

**Accuracy:**
A1: The information used for clinical decision making has numerous accuracy problems that make it difficult for nurses to care for patients.
A2: The information used for clinical decision making that is provided to nurses is accurate.
A3: The information that is used for clinical decision making is correct and adequate to provide excellent patient care.

**Completeness:**
C1: The information that nurses need for patient care includes all necessary values.
C2: Clinical information for nurses received is sufficiently complete to provide high quality patient care.
C3: The information that nurses received for patient care has sufficient breadth and depth.

**Timeliness:**
T1: The information that nurses received for clinical decision making is not sufficiently timely to provide the high quality healthcare.

T2: The information used for clinical decision making is not sufficiently timely to provide the high quality healthcare.
T3: The information nurses used for clinical decisions is sufficiently up-to-date to offer high quality patient care.

Items for Healthcare Quality

**Competence:**
CH1: Our nursing service is one of the best at providing reliable healthcare.
CH2: Our nurses are known for performing services right the first time.
CH3: The nursing staff is dependable in handling patient needs.
CH4: The nurses at this hospital maintain error-free charts on patients.

**Responsiveness:**
R1: The nurses keep patients informed about when their services will be performed while here in our hospital.
R2: Our nurses provide prompt services to patients.
R3: The nursing staff is known for responding quickly to patients’ requests.

**Understanding:**
U1: Our nurses understand the needs of the patients and their healthcare needs.
U2: The nursing staff knows the patients on a personal level.
U3: Nurses at the hospital can identify with the patients and their healthcare needs.

**Professionalism**
P1: Nurses can easily find the equipment or devices they need for patient care.
P2: The nursing areas in the hospital are not cluttered but are neat and organized.
P3: The nursing station has everything in its proper place.

**Collaboration:**
CO1: The nurses in the hospitals can collaborate with other departments such as pharmacy and laboratory.
CO2: Our nurses communicate with the pharmacists and laboratory personnel.
CO3: The nursing staff communicates with physicians on the status of patients

**Safety:**
S1: Our nursing staff has created a safe environment for patients.
S2: Medical errors from nurses are rare compared to other hospitals of this size.
S3: The nurses at this hospital are vigilant about preventing accidents among patients.