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EXAMINING THE IMPACT OF INFORMATION TECHNOLOGY ON SUPPLY CHAIN MANAGEMENT: AN ANALYSIS OF HOSPITALS IN JORDAN

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Abstract

The purpose of this study was to determine the impact of Information Technology (IT) to the Jordanian hospitals in terms of patient care and financial aspects management. This study established that various Jordanian hospitals have different levels and standards of IT within their supply chain. The research motivated by lack of latest data and information on IT in performing various functions in hospital supply chain. Under the theoretical framework of the study, these include administrative costs management, tracking bills to patients and payment of staffs and suppliers of materials and equipment, managing quality of change process, disaster management and coordination of activities during operational disruptions on the supply chain and management of reimbursement from the medical insurance schemes. Consequently, the researcher adopted a survey method to collect data for testing various IT impact hypotheses among the public, private, military and university hospitals in Jordan. Using ANOVA approach, the research found higher alpha significance than the standard α =0.05 of level of determination for IT impact in all the five hypotheses related to patience care and financial aspects management where implementation has succeeded. This study made further recommendations on how the Jordanian hospitals can improve the IT impacts in the areas captured in the study for implementation and future research.

Keywords: Information Technology, Supply Chain, Patient Care, Hospitals, IT Disaster Management Model

INTRODUCTION

As other sectors continue to adapt to Information Technology (IT) advances, the medical field is equally finding its industry space (Ali, et al., 2013). Some of the common IT areas where the medical profession is benefiting with other industries include digitized pharmaceutical supply chains (Conesa, 2009); virtual medicine communication, data collaboration and multimedia enhanced diagnostic technologies (Oracle Corp, 2009). The fact that the cost of most of these technologies have been coming down is motivational enough for developing countries like Jordan to adopt IT for specific impacts within the hospital supply chains and compete in e-health (Matar & Alnabhan, 2013).

Due to the wide acknowledgement of IT into hospitals supply chain, most operations have been reengineered and the patience care and financial aspects administration is more efficient and effective (Ali, et al., 2013). Various terms are synonymous to the process of integrating IT into hospital supply chains. These include 'e-health', or electronic health, which has broad meanings from use of technology to administering diagnostic and prescriptive activities (Eysenbach, 2001). However, various IT frameworks applied in hospitals may not be for internal purposes only, rather, for distant operations because the facility needs to coordinate with insurance agencies, government, Ministry of health supplies department, and pharmaceutical supply chains for inventory coordination purposes (Karsh, et al., 2004).

Hospitals in Jordan

An evaluation by the National Cancer Statistics (NCS) (2012) found that various Jordanian hospitals are struggling with basic operations like documentation and data management of the patients' records. Majority of these setbacks arise from the hospitals over reliance on manual records, which later misplace or are difficult interpret by second and third party consultants, specialists and office administrators (Al-Nassar, et al., 2011a). Additionally, the confusion posed by the medical records to the staffs has implications of poor care services and loss of financial accountability in many Jordanian hospitals. Whenever hospital specialists and administrators are unable to follow a patient's history, there is a possibility that the services will be unsatisfactory. This is because document and data operations are inaccessible, have gaps or are incomprehensible for decision-making (Banet & Jeffe, 2011).

By 2013, Jordan has 104 major hospitals excluding the smaller health centers in the countryside. Generally, the Jordanian hospitals are stratified as public, private, military and university (Matar & Alnabhan, 2013). However, Jordan classifies as a developing nation whose capacity to integrate IT fully across all the hospital is an uphill task that will take some time (Al-Nassar, et al., 2011b). Even though the Jordanian government has been trying to integrate IT in

various hospitals under its watch and management, the speed is slow for operational, technical and organizational cultural reasons (Al-Nassar, et al., 2011a).

The latest mega scheme of integrating IT into public hospitals in Jordan is the Hakeem project, which kicked off in October 2009 managed by a nonprofit organization called Electronic Health Solution (EHS, 2012). Among the objectives of the Hakeem medical IT programme are to enhance patients service efficiency, better quality service, improve data collection, mining and retrieval process using electronic platforms (Al-Nassar, et al., 2011a; 2011b).

Additionally, the Hakeem project aims at improving healthcare notification systems since most hospitals are facing challenges in follow up of patients across Jordan especially when they travel from their hospital locations. This is very vital among the chronic ailment patients who need reminders of next tests, payments, insurance and medication prescriptions (Matar & Alnabhan, 2013). Overall, the Hakeem project in Jordanian public hospitals is a noble course whose outcomes are struggling to achieve because it ran into operational challenges and staff resistance in various hospitals (Al-Nassar, et al., 2011a; 2011b). Specifically, a synopsis of the scope and capacity of Hakeem shows some gaps that will trail hospital supply chain as illustrated and justified in the rationale of the study.

Rationale of the Study

The impact of IT on manufacturing operations and performance is well established. However, scant research has been devoted to IT investment among hospitals supply chains and its influences on patient care and financial aspects performance. A recent study by Matar & Alnabhan (2013) indicated that the Hakeem project is not only lagging behind scheduled and performance of its IT objectives, but was equally narrow in addressing the below cited issues in hospital supply chains. Thus, the rationales of this study are five-fold.

First, many hospitals in Jordan have been experiencing escalating costs of administration along the supply chain without maximum reciprocation on the patients care. Before the Hakeem project, some hospitals in Jordan have been reluctant in analyze their supply chain positions because there was no data to project the existing operational efficiencies and cost implications (Al-Nassar, et al., 2011a; 2011b). Consequently, it was rational to study how cost and quality could have taken a hit for the worst performance without the senior management having some IT diagnostic discourses.

Second, due to complex operations and process flow, the policies on billing and payment in hospitals in Jordan are sometimes unaccountable and it is possible for misappropriation of resources to occur, as the Hakeem project is experiencing so far (Al-Nassar, et al., 2011a; 2011b). Tracking patients' bills and payment to suppliers of materials,

pharmaceuticals and other equipments is proving an uphill task to some hospitals in Jordan, hence the rationale for this study.

Third, hospitals have various types of change processes such as adoption of the Hakeem project goals. Some are shift changes, which occur on a daily basis while others are operational and occur periodically (Al-Nassar, et al., 2011a; 2011b). However, the rationale of this study was to investigate how inclusion of IT can create efficiency and effectiveness across the supply chain of hospitals in Jordan. More critical is the need for vertical and horizontal communication of expectations, problems and next steps that must take place in any change cycle (Al-Nassar, et al., 2011a). Hence, it was rational to evaluate how IT can synchronize these change processes and minimize errors in patient care or resistance to new operations.

The fourth rationale of this study is to understand the importance of IT for disaster management or any other interruptions in the hospitals supply chain management. Essentially, many disasters can occur at any hospitals whether on the facilities or operational emergencies as was envisaged by the Hakeem project. However, few studies have investigated how IT can help the management to bring processes back to normalcy and specifications within the shorted time (Al-Nassar, et al., 2011a; 2011b). This rationale of this study is evaluating the role of IT in events such as staff mobilization, inventory and pharmaceutical needs assessment in hospitals in Jordan. Additionally IT will ensure that patient care details are restored immediately with minimal collateral damage.

The final rationale of this study was to analyze how IT in can capture and integrate health insurance reimbursement needs among hospitals in Jordan. It is common for accounting auditors to flag problems of over or under reimbursement because the some hospitals in Jordan have misaligned supply chain operations to the standard insurance policies (Al-Nassar, et al., 2011a; 2011b). Therefore, the rationale of this study was to highlight previous gaps and recommend corrective actions by integration of IT to existing supply chains in respective hospitals.

Aims and Objectives

The aim of this research was to review sampled hospitals in Jordan and investigate their IT status in coordinating and supporting patience care and financial performance. The objectives of the study were:

1. To investigate whether investment in IT can rationalize administrative costs in the hospitals in Jordan.
2. To investigate whether hospitals in Jordan embrace IT for their payment and billing systems

3. To evaluate the role of IT in managing system and operational change process in the hospitals in Jordan
4. To understand the importance of IT in disaster management and disruption relief process among the hospitals in Jordan
5. To elaborate how IT can effect medical insurance reimbursement among the hospitals in Jordan

Research Questions

The central research question is: What are the roles, states, impacts and opportunities of IT in the patience care and financial aspects management among the hospitals in Jordan where investment in the same have accomplished? This question was addressed by the five hypotheses tests as indicated in subsequent sections of this paper.

THEORETICAL FRAMEWORK

In numerous developing countries, there have been paradigm shift by hospitals to improve patients care by leveraging of IT. These efforts cover various hospitals functions at administrative and operational stages of the supply chain. The recognition of role of IT in transforming hospitals further stretches to financial management, inpatient and out-patience cares. Certainly, IT can reduce the hospitals administrative costs especially expenditures on stationeries and office consumables. Additionally IT can improve or sustain quality of care and services to patients in various areas like data management, billing and insurance claims settlement (Bates, et al., 2006).

This research identified five areas where IT has potential of supporting and sustaining hospital supply chain. These are administrative costs management, tracking bills to patients and payment of staffs and suppliers of materials and equipment, managing quality of change process, disaster management and coordination of activities during operational disruptions on the supply chain and management of reimbursement from the medical insurance schemes.

IT in Hospitals Administrative Costs Management

In many hospitals in Jordan, issues of cost overrun are a common occurrence along the patients care supply chain. These occur due to lack of electronic medical records (EMR) where the operational and accounting staffs can reflect on practices and the best way forward to rationalize costs (Garets & Davis, 2006). There are various cost functions like budgets, which are very difficult to monitor in hospital facilities especially when the operatives are unaware or if the systems are unsupportive to such a course (Oracle Corp., 2009).

Generally, administrative cost management can be executed at individual staffs levels and interdepartmentally, whereby IT system have capacities to deploy the best healthcare practices such as automation of procedures and avoidance of wastage of resources minimized (First Consulting Group, 2007). Cost management also entails the general and specialist practitioners are able to assess patients effectively so that the prescriptions and progress can be monitored professionally (Poissant, et al., 2005). Therefore an IT module or framework that monitors operational costs with analytics, aids decision making, guides on affordable referrals, assigned optimum costs for different procedures and tracks inventory costs is favorable (Wang, 2003). Hence, the following hypothesis statement was postulated

H_1: Hospitals investment in IT is important for supply chain cost management

H_0: Hospitals investment in IT is not important for supply chain cost management

IT for Tracking Bills to Patients and Payment of Staffs and Suppliers of Materials and Equipment

Ordinarily, hospitals have numerous bills accruing from doctors' prescriptions, inpatient and outpatients' diagnosis, routine visits and check up, invasive and non-invasive procedures, laboratory examinations and radiology among others. All these procedures require material, equipment and supplies, which the hospitals must purchase periodically. There are IT systems for tracking suppliers' payments, patients' bills and other consultation of service charges at hospitals (Faustine and Austine, 2008).

The importance of these IT modules is to increase efficiency and effectiveness of the billing and payment processes. Otherwise, cases of over or under billing and payments have been rampant in many hospitals leading to patients dissatisfaction with the entire service (Garets & Davis, 2006). This module is particularly useful e-prescriptions where the doctor or consultant requires tracking of bills and information about a patient from a virtual location (Faustine and Austine, 2008). The context of prescription is the same, only administered electronically. After the electronic billing, the consultant can use the same data to pay for drugs from a pharmaceutical store near the patients' location (Lenhart, et al., 2000). Therefore, the following hypothesis statement was postulated:

H_2: Hospital investment in IT is useful for tracking bills to patients and payments to staffs and suppliers of materials and equipment.

H_0: Hospital investment in IT is not useful for tracking bills to patients and payments to staffs and suppliers of materials and equipment.

IT for Managing Quality of Change Process

During routine shift changes and periodic hospital operational change process, it is critical to ensure there is no loss in medical data control. Additionally, the change process must be able to support recommendations for better service with guidance of available medical records and data. Therefore, the change process must be administrative friendly and each responsible staff must be identifiable from their previous to following role in the hospital supply chain. There are IT modules supporting such functions and can be further used for conducting meetings to address any difficulties in the hospital supply chain. The choice of technology should be robust enough to initiate, manage and appraise the entire change process in the hospital (Garets & Davis, 2006). Hence, the following hypothesis statement was postulated:

H_3: Hospitals investment in IT is essential for quality management of all change processes whenever they occur in the supply chain.

H_0: Hospitals investment in IT is non-essential for quality management of all change processes whenever they occur in the supply chain.

IT for Hospital Disaster Management and Coordination of Activities during Operational Disruptions on the Supply Chain

It is important for hospitals to create a knowledge base in the hospital where data can be stores and retrieved during disaster or disruption of normal operational activities (Faustine & Austine, 2008). These data can be in an IT repository, which has robust networking and cloud systems as illustrated in the figure below (Calton, 2013). . Moreover, the hospital data repository should be along ailment types so that different practitioners can have common professional and practical access according to their verifiable and authenticated details (Lenhart, et al., 2000). The importance of having such data along ailment types is to standardize practice such as dosage and patience care (Faustine & Austine, 2008).

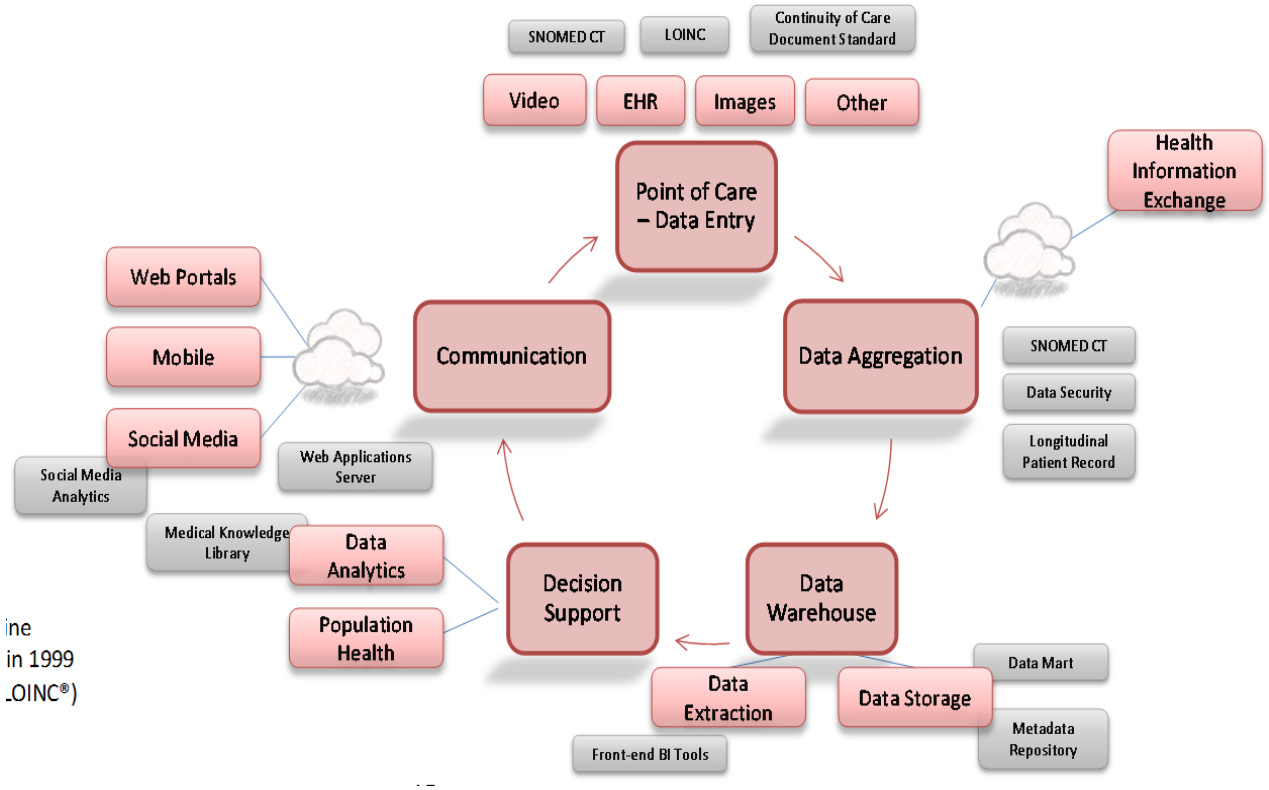
As illustrated in the figure below, the IT disaster management module must have data flow from data entry point, data consolidation and aggregation, data mining, professional decision support and aids, communication among stakeholders and back to data entry point. All along this data management cycle, various support activities increase the efficiency and reliability of the data in case of disaster or emergency disruptions. Therefore, the responsible IT manager or administrator should ensure synchrony of all these functions to support general practitioners, nurses, laboratory personnel, doctors and other hospital staffs (Calton, 2013).

Therefore, the following hypothesis statement was postulated:

H_4: Hospitals investment in IT is important for their supply chain disaster management and coordination during operational disruptions.

H_0: Hospitals investment in IT is not important for their supply chain disaster management and coordination during operational disruptions.

Figure1: IT Disaster Management Model



Source: (Calton, 2013, p. 15)

IT for Management of Reimbursement from the Medical Insurance Schemes

There are IT modules for tracking and supporting medical insurance claims and reimbursement (Faustine and Austine, 2008). Such modules aid in data mining and retrieval of insurance data while transmitting claims simultaneously to the respective companies or agencies (Lenhart, et al., 2000). The IT module aggregates all accounts receivable from the patients and separates what is indemnified by the insurance policy while billing the patients for cash settlement of the balance. Whenever the hospitals is not paid in time, the IT module is programmed to resend claims with the same bill details (Faustine and Austine, 2008; Lenhart, et al., 2000). Therefore, the following hypothesis statement was posed:

H_5: Hospital investment in IT is critical for supply chain reimbursement from the medical insurance fraternity.

H_0: Hospital investment in IT is not critical for supply chain reimbursement from the medical insurance fraternity management.

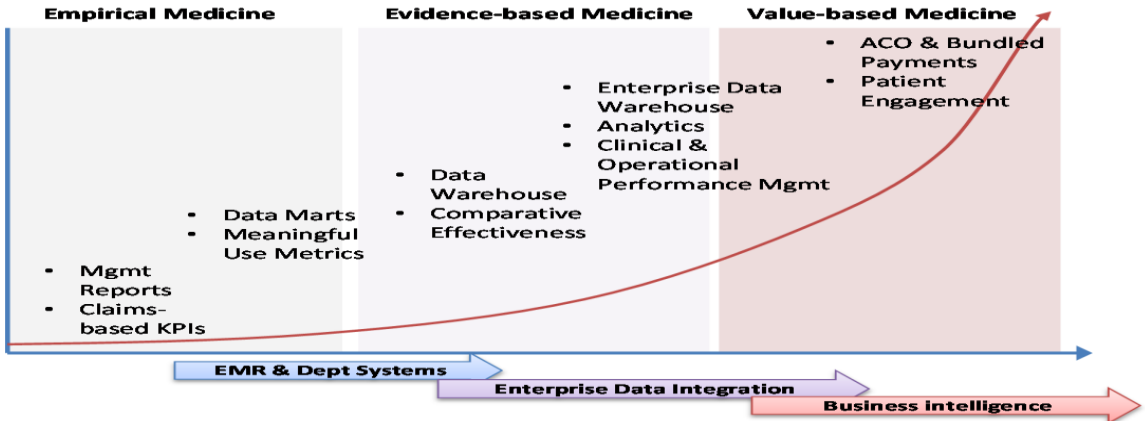
Conceptual Framework and Modeling

The proposed conceptual framework of IT for hospitals in Jordan is divided into three scalable phases. In the first phase, the empirical medicine practice should be supported with IT framework that captures all financial and operational management reports and facilitates claims and reimbursement schemes from all the departments, patients and other stakeholders. Additionally, the person responsible for decision-making must understand the data metrics and formats. The IT systems should be developed or procured with liaison and participation of the regular and emergency departments of hospitals in Jordan (Oracle Corp., 2009).

The second phase of proposed IT framework should address the hospitals evidence based medicine practices and care of patients. Thus, each hospital in Jordan should have a data warehousing IT system where the patients' current and historic information is mined and retrievable accordingly. Furthermore, the hospitals need such a system in case of emergency or disruptions in operations. Such data warehouse would further be useful for hospital specialists and administers to determine if their practices have comparative effectiveness when collaborated across the public, private, military and university hospitals. During hospital routine and periodic change processes, the enterprise data warehouse will inform decision makers appropriately from the versatile analytics. Success in this phase will lead to hospital supply chain data integration (Oracle Corp., 2009).

The final phase of the proposed concept of IT framework is founded on value-based medicine. Therefore, all hospitals need an overall IT framework that streams the accounting, billing and payment in live bundles while the patients care is optimized. Additionally, the IT system should be interactive and engaging to the patients who are the primary stakeholders. Success in this phase will lead to hospital supply chain business intelligence (Oracle, Corp., 2009). The following figure illustrates the concept discussed above:

Figure 2: Proposed IT Conceptual Framework and Model for Hospitals in Jordan



Source: Oracle Corp, 2009, Cited from Calton, 2013, p.14

RESEARCH METHODOLOGY

Population, Sample and Sampling Procedures

The aim of the study was to evaluate the impact if IT integration on supply chains of hospitals in Jordan in terms of care quality and financial aspects management. This study targeted Jordanian hospital managers and/ or IT administrative heads in the private, public, military and university facilities. The respondents were selected first by stratified samples according to the type of hospital management; and second at random within the strata group or purposive samples groups. The researcher target 15-public and 15-private hospitals and 5-military and 5-university hospitals from each strata of hospital with expected participants 40 to participate in the survey. The researcher expected feedback from 50% to 75% of the successful respondent, which according to Kaplowitz, et al., (2004), is sufficient for online surveys data dependability.

Data Collection Instruments and Strategy

There were two main data collection strategies. First, under content analysis, each of the participating hospitals websites were reviewed to determine their supply chain details, maturity and integration of IT. Therefore, content analysis (Krippendorff, 2003) accomplished for the targeted 40 hospital websites to evaluate the percentage of those with IT integration into their systems. A critical content analysis of the hospitals and literature review indicated the following. There is insufficient knowledge and personnel to implement and manage IT in hospitals (Eysenbach, 2001; Lockyer, et al., 2001).

Some hospitals lack of appropriate IT framework to target specific hospital activities in the supply chain (Bates, et al, 2006). Most hospitals have insufficient funding to procure appropriate IT services (Karsh, et al., 2004; Oracle Corp, 2009). Other hospitals are sluggish in acceptance and motivation towards IT in hospital supply chain (Miller & Sim, 2004). Some hospital lack policy and systems for adopting IT (Al-Saada, et al, 2013) and lack feedback from patients about care along hospital supply chain (Gill, et al., 2001). The outcomes of this finding determine that most of the purposefully sampled hospitals have partial IT integration for the five areas objective in this study.

Second, a closed ended questionnaire (Saunders, et al., 2007), designed by the researcher, as attached in Appendix A, was used in the data collection from the hospitals managers and administrative heads. The objective of using the hospitals managers and or IT administrative heads was to evaluate their institutions adoption of IT and the impact realized to date. The questionnaires were sent to each of the hospitals administrator of IT managers via online to with justification of expediting the study process and rationalize the budgetary allocations. The other justification for mailing the questionnaire is because the hospital are

geographically dispersed and manual collection of data would be time consuming with accompanied costs.

This questionnaire had three sections; the demographics; the hospital IT status and the hypotheses statements .The questionnaire also had a likert scale of 5 points from 1=Strongly Disagree to 5=Strongly Agree to collect the views of the hospital managers and IT administrative heads along on the IT impact along the five sub objective questions. Additionally the same respondents were surveyed on the hospitals IT status. .

Reliability and Validity of data collection instrument

The reliability of the study instrument and findings was based on the consistency of outcomes as portrayed across the four strata of hospitals within the Jordanian population (Joppe, 2000). Qualitatively, this implies that the outcomes of content analysis in a public hospital had to be replicable in private, military and university hospitals and repeatable vice versa as demonstration of data stability (Kirk & Miller, 1986) since the concept of IT was introduced in hospital supply chain. Quantitatively, a Cronbach's alpha $\alpha = 0.7$ was adopted as standard to determine the survey data reliability (Golafshani, 2003) and this was achieved across board.

The validity of the data was based on the content and construct factors, and demonstrates "*the degree of accuracy, objectivity, empirical conceptions, truth, evidence, fact, actuality, reason, etc, in a research work*" (Winter, 2000, Online). Thus, for face validity (Golafshani, 2003), the choice of four different types of hospitals, public, private, military and university would validate the questionnaire instrument because each has unique experience. Therefore, questionnaire was modified to ensure each item is clear and applicable in all the hospital strata. For content validity, the researcher adopted *Pearson's Correlation Matrix* (Honaker, 2001) via *Factor Analysis* to determine the relationship among the 5 main hypothesis items across the four types of hospitals in terms of IT impact. Since a high correlation was determined, the data also indicates that convergence validity was achieved (Sekaran & Roger, 2010).

ANALYSIS

Data Analysis of Demographic Factors

From the target of 40 hospitals, there were 29 successful returned questionnaires, which is equivalent to 72.5% return rates under the following breakdown, 13 public, 11 private, 2 military and 3 University hospitals. The SPSS tool (SPSS Inc., 2008) was used for analyzing the survey data. Overall, this survey indicates that most of the hospitals in the four categories / strata have good patients care experience, whereby a mean of 3.5517 indicates 11-15 years of service as

indicated in appendix B. The survey on the number of year that hospitals have been in service indicated that majority of those with 21 years and above are public / government hospitals while most university and military hospitals have been in service between 16 -20 years. Most private hospital clustered around 11-15 years of service as shown in table appendix C.

In terms of hospital management, majority of the respondents were from the public hospitals as indicated by the mean of 1.9655 in table appendix B and at 41.4% as shown in table Appendix D. Additionally, the private hospitals were hospitals were second highest frequency at 37.9%. The military and University hospitals had low frequency because they tend to serve limited groups of people of communities at 6.9% and 13.8% respectively.

On hospital patients' capacity, a mean of 3.1724 in appendix B indicates that all hospitals combined handle average of 500 -750 patients per day. The survey on the approximate number of patients' population per day indicated that the public / government hospitals have highest frequency if care of over 1,001 patients. This implies that the government hospitals are bigger and have more personnel to hand such large numbers of patients. The university and military hospitals have a mode of 1-250 patients per day while the private hospitals mostly attend to 251-500 patients each per day. The frequency categories are illustrated in the table Appendix E.

Hospitals IT status and Evaluation

The second section of the survey targeted an evaluation of the IT system / modules existing in the participating hospitals. Multiple data outcomes were admissible because it is possible for the same hospital to have more than a single IT system or module in operation. Overall, the most common IT system / module is accounting and cost management at 41.6%, while the least present is the insurance schemes management at 9.1% as shown in table appendix F. This implies that most of the insurance claims and reimbursement accomplished manually among the hospitals in Jordan.

The evaluation of hospitals IT infrastructure mean of 2.2069 in table appendix G indicates that majority of the managers and IT administrators are neutral about the impact of IT systems / modules that are already in place in public, private, military and university hospitals. Thus, 51.7% of the managers and IT administrators who took part in the study feel that so far the IT system have neither a positive nor a negative impact as shown in table appendix H. This implies that a lot of room for improvement was highlighted in terms of investment and capacity building for positive impact.

Hypothesis Testing

The third stage of the analysis was hypothesis testing as shown in table 1.

Table 1: ANOVA

				Sum of Squares	df	Mean Square	F	Sig.
H1: Hospitals investment in IT is important for supply chain cost management.	Between Groups		(Combined)	1.009	3	.336	.534	.663
		Linear Term	Unweighted	.839	1	.839	1.331	.259
			Weighted	.936	1	.936	1.486	.234
			Deviation	.073	2	.036	.058	.944
	Within Groups			15.750	25	.630		
	Total			16.759	28			
H2: Hospital investment in IT is useful for tracking bills to patients and payments to staffs and suppliers of materials and equipment	Between Groups		(Combined)	3.971	3	1.324	1.029	.397
		Linear Term	Unweighted	.920	1	.920	.715	.406
			Weighted	.276	1	.276	.215	.647
			Deviation	3.695	2	1.848	1.436	.257
	Within Groups			32.167	25	1.287		
	Total			36.138	28			
H3: Hospitals investment in IT is essential for quality management of all change processes whenever they occur in the supply chain.	Between Groups		(Combined)	.945	3	.315	.230	.875
		Linear Term	Unweighted	.204	1	.204	.149	.703
			Weighted	.072	1	.072	.053	.820
			Deviation	.873	2	.436	.319	.730
	Within Groups			34.227	25	1.369		
	Total			35.172	28			
H4: Hospitals investment in IT is important for their supply chain disaster management and coordination during operational disruptions	Between Groups		(Combined)	1.391	3	.464	.849	.480
		Linear Term	Unweighted	1.038	1	1.038	1.902	.180
			Weighted	.726	1	.726	1.331	.260
			Deviation	.664	2	.332	.609	.552
	Within Groups			13.644	25	.546		
	Total			15.034	28			
H5: Hospital investment in IT is critical for supply chain reimbursement from the medical insurance fraternity	Between Groups		(Combined)	1.436	3	.479	1.247	.314
		Linear Term	Unweighted	1.206	1	1.206	3.141	.089
			Weighted	1.012	1	1.012	2.635	.117
			Deviation	.424	2	.212	.552	.582
	Within Groups			9.598	25	.384		
	Total			11.034	28			

As illustrated further in table 1 above, the highest mean square within the hospital groups was 1.369 by H_3. Consequently, the lowest combined significance alpha between the hospital

groups was found p = 0.314 with H_5: Hospital investment in IT is critical for supply chain reimbursement from the medical insurance fraternity". The highest was p= 0.875 with H_3: Hospitals investment in IT is essential for quality management of all change processes whenever they occur in the supply chain."

With a 95% confidence interval for means, H_3 had the lowest mean total at 3.4483 while H_4 and H_5 tied at the highest mean total at 4.5862 as shown in Appendix I. Next, we used ANOVA to test the respective hypotheses, taking significance p=0.05 as the standard for rejection or acceptance. Across H1 to H_5 the lowest mean square within the hospital groups (public, private, military and university) was p= 0.384 by H_5. While testing the data content validity we found that all but one of the hypotheses meets the alpha significance threshold as indicated in appendix J.

FINDINGS AND DISCUSSIONS

We found the following very strong significance of alpha across the entire test hypothesis. *H1 p*= 0.663, *H2 p*= 0.397, H3 p= 0.875, H4 p=0.480 and *H5 p*=0.314. Therefore, all the hypotheses had alpha p > 0.05 for significance of determination. Therefore, we fail to reject the entire study hypothesis accordingly; however, we reject the entire null hypotheses H_0 for each statement. We conclude that across the strata of hospitals in Jordan supply chains, investment n IT is important for cost management, useful for tracking bills and suppliers payments, essential for management of change processes, important for disaster and disruption management and critical for medical insurance reimbursement.

Overall, IT has had impact in hospital operations in many ways including health education (Lockyer, et al., 2001) and documentation process (Gill, et al., 2001). Other positive impacts include improvement of patients care efficiency and smooth relations with the medical industry stakeholders such as the government Ministry of Health and the pharmaceutical industry (Lockyer, et al., 2001). Additionally IT has improved the timelines by which various hospitals comply with quality standards and implement the same in patients care (Gill, et al., 2001).

The illustration of impact of IT in healthcare facilities as capture by the hypotheses is non-exhaustive (Matar & Alnabhan, 2013). IT has increased the communication frequency between the hospitals and patients as they collaborate in programmes like public or primary health services especially during change management. IT has improved the monitoring of disease breakout including the research and administration of alternative healthcare procedures (Matar & Alnabhan, 2013) and lowered insurance reimbursement costs. Since many hospitals embraced IT, there have been reductions in emergency services cost because some

procedures can be coordinated directly from the hospitals to the patients (Lockyer, et al., 2001) in mitigation of disaster management.

Moreover, the non-emergency activities have improved care with integration of IT in hospitals at lower administrative costs. Some hospital patients have acknowledges that the inclusion of IT into some procedures has reduced the waiting times for inpatients (Matar & Alnabhan, 2013). Various hospitals use IT to create positive impact on the rural patients where outreach faces personnel, financial and logistical challenges. Furthermore, IT enables the public to access some critical health information that would be useful during emergency and disaster management procedures (Gill, et al., 2001).

Certainly, the list of impacts that IT has impression on various hospitals is on the long. However, most of these studies have individual focus on specific benefits in the healthcare system. There are study gaps on how hospitals supply chains perceive impact of IT financially. The magnitude and transformation achieved by the integration of IT into hospitals is currently under review with the challenge being abrupt changes in technology from competitive designers and practitioners (Miller & Sim, 2004).

CONCLUSIONS

Based on the findings of the test hypotheses, the strength or ranking of the alpha of significance indicate the severity of IT problems or the priority that hospitals should follow to resolve the highlighted issues. In that order of ranking, we conclude that IT modules for medical insurance reimbursement coordination are top priority as the significance α (*H5* p= 0.314). Nevertheless, some hospitals in Jordan have mixed understanding of the operations and do not perceive how appropriate reimbursement should administer. The negative impact is that some high value services can get low value reimbursement even when a very qualified physician is around.

We conclude that such as IT systems to ease billing and payments management and analytics will improve decision-making process along the hospitals supply chain. This is because IT systems /modules for bills tracking and payments for staffs and supplies are the next most urgent in need among the hospitals in Jordan with significance α (*H2* p = 0.397). Hospitals in Jordan, often seek ways of billing and collective payments. These payments also need arise with the material and equipment suppliers to the hospitals as well as to their clients.

IT systems / modules for disaster management and backup during operational disruptions are required in hospitals in Jordan as demonstrated with the significance α (H4 p =0.480). Thus, we conclude that in such cases, the hospital clinicians require to communicate with the relevant personnel to maintain inventory levels and be able to predict incidences that can disrupt supply chain in future.

We found that most hospitals recognize the need of cost management IT module or system. However, the survey finding of neutral impact leads to a conclusion that the modules may not be effective and perhaps require replacement of retraining of staffs as demonstrated by the significance α (H1 p = 0.663).

Finally, at significance α (H3 p = 0.875), most hospitals in Jordan indicated importance of IT systems for change process management, because it is the backbone of daily communications. Therefore, we conclude that the process of communicating the change policies and progress is a challenge, yet the senior management seeks to brief the stakeholders, build consensus and inspire individual and team motivation. However, IT has a strong role in quality coordination of all these functions whenever a hospital in Jordan is undergoing changes within their supply chain.

RECOMMENDATIONS

For successful IT to support Jordan hospitals, supply chains, the following recommendations should be reflected and implemented. First, the hospital management must ponder and support the importance of IT in providing analytical data regarding supply chains and cost saving strategies. Essentially, knowledge about the strengths, weaknesses, opportunities and threats of the supply chains of hospitals is vital for justifying the importance of investment in suitable IT (Al-Nassar, et al., 2011a).

Second, it is recommended that the hospitals review the systems and clarify the payment policies. This role best achieves by using IT to support the hospitals supply chains. Thereafter the hospitals management will be able to track, bill and collect payments while improving patients' service quality (Stempniak, 2013).

Third, many hospitals in Jordan are perpetually undergoing change management whether wholesome or at departmental level. Thus, Hospitals investment in suitable IT is recommended as it will also assure minimal resistance to change and maximum commitment by all stakeholders (Al-Nassar, et al., 2011b).

Fourth, many hospitals in Jordan often experience some supply chain disruptions which require rapid mobilization and response (Al-Saada, et al., 2013). It is recommended that hospitals invest in appropriate inventory IT that will address all the above concerns in supply chains (Al-Nassar, et al., 2011a).

Fifth, many Jordan hospitals liaise services of medical insurance whereby some reimbursement systems apply. It is recommended that every hospital in Jordan adopt the most suitable IT framework where all their operations are mapped along the service supply chains so that appropriate reimbursement can administer all the time (Stempniak, 2013).

Finally, as has been pointed out in the body of the study, a major weakness of most of the studies assessing the use of information Technology in business functions particularly the supply chain, is that these studies are based on self-reported rather than actual data used. As has been demonstrated elsewhere, most of the self-reported data is subjective because it is coloured by the self-reference criterion, thus resulting into measurement instruments with questionable levels of reliability and into models with low predictive ability (Legris, Ingham, & Collerette, 2003). Thus, several studies should be conducted to overcome this problem by adopting the experimental research strategy instead.

LIMITATIONS OF THE CURRENT STUDY

Most organizations treat sensitive IT data as confidential, even proprietary, and therefore, this study had to rely on individual self-reported data rather than secondary firm data. Even though the study was framed within the positivistic grounding, the data collected for purposes of validating the proposed model depends on self-reported data given by individuals. This may introduce the self-reference criterion into the study, and infect it with bias. Resource and time constraints were the other major limitations which affected the conduct of this study.

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APPENDICES

Appendix A: Sample Questionnaire

Section A: Demographics

Please select and mark only one most appropriate response.

1. How old is your hospital facility since commencing operations

[A] 1-5 years [B] 6-10 years [D] 11-15 years [E] 16-20 years [F] Over 21 years

2. What category does your hospital fall below?

[A] Private [B] Public [C] Military [D] University [E] Others

3. How many inpatients and outpatients does your hospital handle per day on average?

[A] 1- 250 [B] 251-500 [C] 501- 750 [D] 751-1,000 [E] Over 1,000

Section B: State of Hospital IT Infrastructure

Please select and mark whenever most appropriate response / multiple responses allowed

4. Which of the following IT systems exist in your hospital supply chain?

[A] Accounting and Cost Management [B] Billing and Procurement
[C] Internal and External Communication [D] Operations and Emergency Data Banks
[E] Insurance Schemes Management [E] Others

5. What is your evaluation of the hospital's IT infrastructure?

[A] Negative Impact [B] Neutral [C] Positive Impact

Section C: Hypotheses

Please select and mark only one most appropriate response

Test Hypotheses	Strongly Disagree (1)	Disagree (2)	Neither Disagree nor Agree (3)	Agree (4)	Strongly Agree (5)
H_1: Hospitals investment in IT is important for supply chain cost management.					
H_2: Hospital investment in IT is useful for tracking bills to patients and payments to staffs and suppliers of materials and equipment					
H_3: Hospitals investment in IT is essential for quality management of all change processes whenever they occur in the supply chain.					
H_4: Hospitals investment in IT is important for their supply chain disaster management and coordination during operational disruptions					
H_5: Hospital investment in IT is critical for supply chain reimbursement from the medical insurance fraternity					

Appendix B: Hypothesis Means Description

		Hospital Years in Service	Hospital Management	Approximate patients population per day
N	Valid	29	29	29
	Missing	0	0	0
Mean		3.5517	1.9655	3.1724
Std. Error of Mean		.23586	.18887	.27214
Median		4.0000	2.0000	3.0000
Mode		3.00[a]	2.00	5.00
Std. Deviation		1.27016	1.01710	1.46553
Variance		1.613	1.034	2.148
Skewness		-.630	.948	-.101
Std. Error of Skewness		.434	.434	.434
Kurtosis		-.374	-.026	-1.317
Std. Error of Kurtosis		.845	.845	.845
Range		4.00	3.00	4.00
Minimum		1.00	1.00	1.00
Maximum		5.00	4.00	5.00

a. Multiple modes exist. The smallest value is shown

Appendix C: Hospital Years in Service

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-5 years	3	10.3	10.3	10.3
	6-10 years	2	6.9	6.9	17.2
	11-15 years	8	27.6	27.6	44.8
	16-20 years	8	27.6	27.6	72.4
	Over 21 years	8	27.6	27.6	100.0
	Total	29	100.0	100.0	

Appendix D: Hospital Management

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Private	11	37.9	37.9	37.9
	Public	12	41.4	41.4	79.3
	Military	2	6.9	6.9	86.2
	University	4	13.8	13.8	100.0
	Total	29	100.0	100.0	

Appendix E: Approximate patients population per day

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-250 patients	5	17.2	17.2	17.2
	251-500 patients	5	17.2	17.2	34.5
	501-750 patients	7	24.1	24.1	58.6
	751-1,000 patients	4	13.8	13.8	72.4
	Over 1,001 patients	8	27.6	27.6	100.0
	Total	29	100.0	100.0	

Appendix F: IT Systems / Modules available at hospital

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Accounting and Cost Management	32	41.6	41.6	41.6
	Billing and Procurement	8	10.4	10.4	51.9
	Internal and External Communication	11	14.3	14.3	66.2
	Operational and Emergency Data Banks	11	14.3	14.3	80.5
	Insurance Schemes Management	7	9.1	9.1	89.6
	Others	8	10.4	10.4	100.0

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Accounting and Cost Management	32	41.6	41.6	41.6
	Billing and Procurement	8	10.4	10.4	51.9
	Internal and External Communication	11	14.3	14.3	66.2
	Operational and Emergency Data Banks	11	14.3	14.3	80.5
	Insurance Schemes Management	7	9.1	9.1	89.6
	Others	8	10.4	10.4	100.0
	Total	77	100.0	100.0	

Appendix G: Evaluation of the hospitals IT infrastructure- Statistics

N	Valid	29
	Missing	0
Mean		2.2069
Std. Error of Mean		.12535
Median		2.0000
Mode		2.00
Std. Deviation		.67503
Variance		.456
Skewness		-.271
Std. Error of Skewness		.434
Kurtosis		-.692
Std. Error of Kurtosis		.845
Range		2.00
Minimum		1.00
Maximum		3.00

Appendix H: Evaluation of the hospitals IT infrastructure- Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Negative Impact	4	13.8	13.8	13.8
	Neutral	15	51.7	51.7	65.5
	Positive Impact	10	34.5	34.5	100.0
	Total	29	100.0	100.0	

Appendix I: Hypothesis Means Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
H_1: Hospitals investment in IT is important for supply chain cost management.	Private	11	4.0000	.44721	.13484	3.6996	4.3004	3.00	5.00
	Public	12	4.2500	1.05529	.30464	3.5795	4.9205	2.00	5.00
	Military	2	4.5000	.70711	.50000	-1.8531	10.8531	4.00	5.00
	University	4	4.5000	.57735	.28868	3.5813	5.4187	4.00	5.00
	Total	29	4.2069	.77364	.14366	3.9126	4.5012	2.00	5.00
H_2: Hospital investment in IT is useful for tracking bills to patients and payments to staffs and suppliers of materials and equipment	Private	11	4.0000	1.34164	.40452	3.0987	4.9013	1.00	5.00
	Public	12	4.5833	.51493	.14865	4.2562	4.9105	4.00	5.00
	Military	2	3.5000	.70711	.50000	-2.8531	9.8531	3.00	4.00
	University	4	3.7500	1.89297	.94648	.7379	6.7621	1.00	5.00
	Total	29	4.1724	1.13606	.21096	3.7403	4.6045	1.00	5.00
H_3: Hospitals investment in IT is essential for quality management of all change processes whenever they occur in the supply chain.	Private	11	3.5455	1.36848	.41261	2.6261	4.4648	1.00	5.00
	Public	12	3.2500	1.13818	.32856	2.5268	3.9732	1.00	5.00
	Military	2	3.5000	.70711	.50000	-2.8531	9.8531	3.00	4.00
	University	4	3.7500	.50000	.25000	2.9544	4.5456	3.00	4.00
	Total	29	3.4483	1.12078	.20812	3.0220	3.8746	1.00	5.00
H_4: Hospitals investment in IT is important for their supply chain disaster management and coordination during operational disruptions	Private	11	4.5455	.68755	.20730	4.0836	5.0074	3.00	5.00
	Public	12	4.4167	.90034	.25990	3.8446	4.9887	2.00	5.00
	Military	2	5.0000	.00000	.00000	5.0000	5.0000	5.00	5.00
	University	4	5.0000	.00000	.00000	5.0000	5.0000	5.00	5.00
	Total	29	4.5862	.73277	.13607	4.3075	4.8649	2.00	5.00
H_5: Hospital investment in IT is critical for supply chain reimbursement from the medical insurance fraternity	Private	11	4.7273	.46710	.14084	4.4135	5.0411	4.00	5.00
	Public	12	4.6667	.65134	.18803	4.2528	5.0805	3.00	5.00
	Military	2	4.0000	1.41421	1.00000	-8.7062	16.7062	3.00	5.00
	University	4	4.2500	.50000	.25000	3.4544	5.0456	4.00	5.00
	Total	29	4.5862	.62776	.11657	4.3474	4.8250	3.00	5.00

Appendix J: Correlations

		H1: Hospitals investment in IT is important for supply chain cost management.	H2: Hospital investment in IT is useful for tracking bills to patients and payments to staffs and suppliers of materials and equipment	H3: Hospitals investment in IT is essential for quality management of all change processes whenever they occur in the supply chain.	H4: Hospitals investment in IT is important for their supply chain disaster management and coordination during operational disruptions	H5: Hospital investment in IT is critical for supply chain reimbursement from the medical insurance fraternity
H1: Hospitals investment in IT is important for supply chain cost management.	Pearson Correlation	1	.202	.054	-.096	-.406*
	Sig. (1-tailed)		.147	.390	.311	.014
	N	29	29	29	29	29
H2: Hospital investment in IT is useful for tracking bills to patients and payments to staffs and suppliers of materials and equipment	Pearson Correlation	.202	1	-.259	-.254	.104
	Sig. (1-tailed)	.147		.087	.091	.296
	N	29	29	29	29	29
H3: Hospitals investment in IT is essential for quality management of all change processes whenever they occur in the supply chain.	Pearson Correlation	.054	-.259	1	.277	-.438**
	Sig. (1-tailed)	.390	.087		.073	.009
	N	29	29	29	29	29
H4: Hospitals investment in IT is important for their supply	Pearson Correlation	-.096	-.254	.277	1	.158
	Sig. (1-tailed)	.311	.091	.073		.207

chain disaster management and coordination during operational disruptions	N	29	29	29	29	29
H5: Hospital investment in IT is critical for supply chain reimbursement from the medical insurance fraternity	Pearson Correlation	-.406*	.104	-.438**	.158	1
	Sig. (1-tailed)	.014	.296	.009	.207	
	N	29	29	29	29	29
*. Correlation is significant at the 0.05 level (1-tailed).						
**. Correlation is significant at the 0.01 level (1-tailed).						