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Preliminary Study on Teamwork Communications in the Healthcare Sector: A Perspective of Electronic Clinical Pathways

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Abstract

Background/Objectives: This paper aims to examine the current situation of teamwork communications in Jordan, verify the existing problems, and to provide the electronic Clinical Pathways as a solution. **Methods/Statistical Analysis:** A mixed method approach was adopted to verify if any functions of electronic Clinical Pathways were implemented. At first, the ten physicians were interviewed to check if there is any computerized system to support teamwork communications. Secondly, a survey was conducted across physicians and nurses. Finally, the functions of electronic Clinical Pathways were examined by applying Multivariate method (SPSS v. 19). **Findings:** It was found that both the functions of Clinical Pathways and a support system for teamwork communications were not at all implemented. In other words, the element of teamwork communications is entirely missing in the recent Health Information Systems (HISs). Electronic Clinical Pathways is chosen as the communication tool due to its inherent ability to improve healthcare quality and concurrently reduces the cost of implementation.

Keywords: Electronic Clinical Pathways, Healthcare, Preliminary Study, Teamwork Communication

1. Introduction

Healthcare delivery within a modern patient-centric model follows electronic Clinical Pathways (CP)[1,2]. CP is national clinical guidelines which standardize the quality of the healthcare service provided by the healthcare providers by defining the treatment processes to be followed. Usually, CP involves multi-professionals located at distributed healthcare departments and organizations working as a team. Communications among these multi-professionals use different routes and techniques and take multiple paths. The treatment process is usually dynamic, long, and unpredictable[3]. Moreover, it is common to have patients with multiple conditions following more than one CP for these different conditions. Therefore, the treatment journey for each patient is often unique and can be extremely complex.

Physicians and nurses need to exchange patient data and information to ensure that it is available and easily accessible as appropriate when needed. Since this information does not only need to be exchanged between the different departments and healthcare professionals in a single organization during working hours, but also across off work hours involved in the treatment process. Moreover, treatment of patients for a single disease may involve multiple professionals, and it is often the case that a patient has multiple diseases. It requires care coordination across the different locations according to the clinical guidelines for the diseases. Data and information are extremely sensitive, and mistakes can affect lives. This massive and sensitive data emphasizes the importance of its management and care.

Clinical guidelines are a free-format text documents assist medical decision-making during diagnosis, management and treatment within different areas of healthcare[1], clinical guidelines have more details of the treatment phases which are included in the process definition. For each patient, the process definition is created[2].

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Implementing clinical guidelines aim to provide the same quality of care should be available for all patients. Based on the interview with ten physicians in Jordan university hospitals, the national guidelines implemented are manually; manually procedures always has problems during implementation. It should be computerized to keep and provide quality of care for all patients.

Thus, the professionals use multiple approaches to overcoming the limitations in the support for teamwork communication and care coordination due to the existing legacy of Health Information Systems (HISs)[3]. Furthermore, they still rely on traditional synchronous communication tools, including face-to-face meetings, telephone calls, and video calls as well as asynchronous communication tools, such as e-mails, faxes, and postal mails[4,5]. As each of these approaches has its advantages and disadvantages yet; none is reliable enough to deal with such a sensitive domain. Reliability in this context includes: availability, accessibility and accuracy of the up-to-date medical information as well as the medical history of patient[6]. Consequently, these approaches can't provide a complete and comprehensive information about patients situation, in other words can't provide a full picture for patients.

Thus, there is a need for an information system that can support the healthcare teamwork communication and care coordination. Currently, healthcare professionals work as a team with a disease-centric healthcare delivery model. It is implemented by following the national guidelines manually while planning a patient's treatment journey. Patients information is more crucial to avoid jeopardize them; this information should be computerized based on Clinical Pathways which is implement Clinical guidelines. "If the information is the lifeblood of healthcare, then communication is the heart that pumps it"[7], based on Coiera[7], any system or tool should provide the information and support communication. Synchronous and asynchronous communication can support the communication, but can't provide the accurate and complete information about patients.

2. Current Communication and Coordination Methods

There is a set of approaches used in healthcare domain to tackle teamwork communication and coordination:

1. Synchronous and asynchronous communication: synchronous communication involves face-to-face meetings, telephone calls, and video conferencing. Whereas, asynchronous communication consists of emails, and voice mails. However, these types lack the few most important things such as, patient's information and are less efficient and also interruptible in ways that can cause errors. Moreover, these types of communication have no protocol which is used to exchange information[5,7].
2. Multidisciplinary team: in this type of communication, a meeting is held with the multidisciplinary team to discuss the treatment process of a particular disease. However, this approach provides a partial solution, since it only supports coordination in multidisciplinary teamwork meetings but not for the overall treatment process[2,8].
3. Operation management tools: the tools such as Lean and Six Sigma[9] improve quality, but some of the patient's information remain missing, which is necessary to be exchanged among the medical staff.

The disadvantages of all these types are presented as follows:

1. All the above approaches cannot support the concept of a patient-centred approach.
2. These approaches are unable to provide any communication protocols to standardize and facilitate the communication among medical staff.
3. There is an issue of delayed communication due to a lack of information being communicated.
4. Lack of interventions and information inconsistency.

There are many types of communication protocols, the most common and used, such as briefing (Surgical check list) it's used to emphasis that the teamwork work together as a cohesive team, debriefing, which used by physicians after the patient discharge, they document the care method, advantages and disadvantages, and SBAR (Situation, Background, Assessment, and Recommendations), have ability to standardized and exchange the information in a suitable way specially during hand off time[10]. Consequently the current approaches of communication and coordination can't provide the information in structured method compare to communication protocols.

Based on the above discussion, electronic Clinical Pathways provide a solution to fill the gaps in the discussed approaches.

3. Electronic Clinical Pathways

European Pathway Association (E-P-A, www.E-P-A.org) defines a clinical pathway as: "A complex intervention for the mutual decision making and organization of predictable care for a well-defined group of patients during a distinct period." Electronic Clinical Pathways are an integrated medical treatment protocols, nursing care plans, and other healthcare activities[11,12]. Moreover, it also supports an implementation of evidence-based care and harmonized medical treatments. The foremost objectives of electronic Clinical Pathways are to enhance the features of healthcare, lessen the expenditure and improve teamwork communication[13]. So, one of the methods to enhance the feature is to restructure the entire practice of health care, which will be adopted in electronic Clinical Pathways to utilize resources.

The main characteristics of the CP comprise of the following:

1. Key elements of care based on evidence and an unambiguous declaration of the objectives, best practices, and patients' prospects along with their features;
2. The facilitation of the communication among the team members, patients, and families;
3. The coordination of the care process by coordinating the roles and sequencing the activities of the multidisciplinary care team, patients, and the relatives;
4. The documentation, monitoring, and evaluation of variances and outcomes; and

Based on the definition and characteristics of electronic Clinical Pathways, it can support teamwork communication besides its features in supporting care plan[13,14]. Hence, the standardization of these requirements for electronic Clinical Pathways is essential for its successful implementation and as a process for its objectives. CP consists of the three main processes[15], Based on the definition and characteristics of Clinical Pathways, Clinical Pathways can support teamwork communication beside its own characteristics in supporting care plan[13,14], so standardized these requirements for Clinical Pathways are essential to success its implementation and as a process for its objectives. Clinical Pathways have three main processes, Table 1 explain Clinical Pathways Processes:

Table 1. Clinical Pathways Processes

Process	Sub-process	References
Medical Processes: this process present the medical aspect of Clinical Pathways in term of structure of medical process. Structuring the medical process streamline and facilitate the interaction between medical staff and this process.	Timeline: this function explains present the start and end point for all stages of patients from admission to discharge.	19, 22-25
	Category of care: this function explains and present diagnosis and treatment processes.	
	Outcome criteria: This function explains and presents criteria for each Clinical Pathways.	
	Variance record: This function explains and presents reasons for variance and deviations from the program of care outlined in the Clinical Pathways.	
Administrative Processes: These processes present the leadership, teamwork communication, care coordination, how the management will control the activities of the medical staff?	Resource utilization	
	Leadership	
	Teamwork communication	
	Care Coordination	
Teamwork communication and Decision Making Process: to activate and facilitate decision making process, there is a need to consider the following factors to support the structure of Clinical Pathways, Tasks, Team, Context, Knowledge, and Technology.	Knowledge	
	Teamwork	
	Task	
	Technology	
	Context	

In order to effectively support teamwork communication in healthcare, and to concurrently solve the issues related to i) synchronous communication, including face-to-face meetings, telephone calls, and video calls, and ii) asynchronous communication tools, including e-mails, faxes, and postal mails, electronic Clinical Pathways is required. Each of these approaches has its advantages and disadvantages, yet none is reliable enough to deal with such a sensitive domain[2,16]. Such a system would be responsible for supporting patients care process and teamwork communication.

Electronic Clinical Pathway's processes and characteristics can help and improve teamwork communication[13,17]. Electronic Clinical Pathways provide the medical information based on the timeline, and also deliver comprehensive information about the patients' situation based on electronic Clinical Pathways functions[18]. Consequently, electronic Clinical Pathways play a fundamental role in promoting teamwork communication in healthcare domain. Based on the study of[18], there is a total of 17 functions which are distributed in 6 categories. Hence, this research paper depends on this study to examine the functions of electronic Clinical Pathways and their benefits, if developed and used in the current medical system.

4. Methodology

The researcher designed a questionnaire to check if the electronic Clinical Pathways have been implemented in the healthcare domain in our case or not, or some of electronic Clinical Pathways functions[18-1918-1918-1917-1816-1715-16]. Such gathering of information about these functions has provided indicators and clear vision to the researcher about the current teamwork communications. Hence, the investigation of electronic Clinical Pathways functions provided a set of functions which could be embedded in the Health Information Systems to support the medical staff activities, as electronic Clinical Pathways is a standalone system as a sub-system of Health Information Systems[20].

The questionnaire was designed based on the electronic Clinical Pathways functions as mentioned in the literature[18]. The questionnaire consists of the seven sections

i) General information.
ii) Electronic Clinical Pathways: there is a computer application for electronic Clinical Pathways
iii) Staff activities and performance control: it must be one of the functions of electronic Clinical Pathways.
iv) Inpatients' outcome: this is also the function of electronic Clinical Pathways.
v) Handling variances: this is the most significant content of electronic Clinical Pathways.
vi) Time management: this is also one of the functions of electronic Clinical Pathways.
vii) Utilization of resources efficiently: This characteristic of electronic Clinical Pathways was also included.

87 questionnaires were collect from one university hospital in Jordan, the aim of this questionnaire to check if the Clinical Pathways implemented or not, by question physicians and nurses about these CP functions, here we ask about functions because there are two types of CP implementations, first CP, implemented with functions separately away from HIS, and the second, implement a set of its functions embedded in HIS[18].

After the researcher had finished collecting data based on a survey, the face-to-face interviews were conducted with the ten doctors in the three departments in King Abdu Allah hospital. All the questions in these interviews were kept open-ended to check and evaluate if there exists any computerized system support teamwork communication.

5. Analysis and Results

Investigation of the relationship between electronic Clinical Pathways and its functions was done by using "Multivariate" with SPSS software version [19.0][12,15]. The survey was submitted and distributed face-to-face to the 100 people in medical staff including physicians and nurses. The preliminary findings of the survey aim to identify the situation of healthcare quality based on electronic Clinical Pathways functions. Out of 100 questionnaires, 87 were given back. Based on these feedbacks the researcher identified the problems of quality healthcare services from teamwork communication based on electronic Clinical Pathways functions.

Figure 1 shows the percentage of nurses and physicians in the questionnaire. The reason for distributing a survey to only physicians and nurses is that these two staff persons are the most who communicate and deal with patients and HIS. In this case, a good picture from medical staff about the current healthcare quality was required for the research.

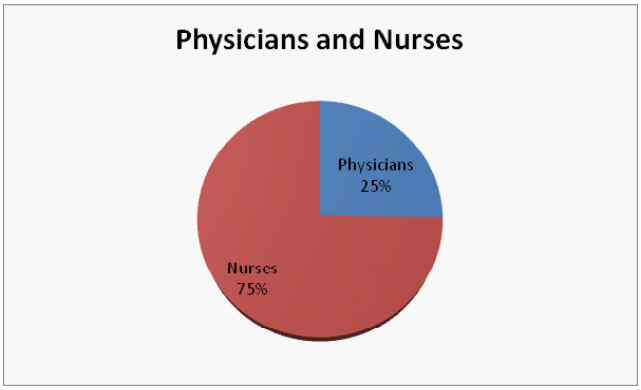

Figure 1. Percentage of nurses and physicians in the survey.

The multivariate test shows that there is no significant variability between the dependent variable (Clinical Pathways) and independent variables (Clinical Pathways functions). In other words, it was found in the case study in King Abdul Allah Hospital in Jordan that none of the functions of Clinical Pathways were implemented; therefore the implementation of electronic Clinical Pathways could not be traced.

Table 2 presents the results of questionnaires, these results shows no significant between Dependent variable (Clinical Pathways) and independent variables (Clinical Pathways functions). Physicians and nurse were interviewed to investigate how teamwork communication among them

Table 2. Results of questionnaire

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.992	50.823[a]	10.000	4.000	.001
	Wilks' Lambda	.008	50.823[a]	10.000	4.000	.001
	Hotelling's Trace	127.058	50.823[a]	10.000	4.000	.001
	Roy's Largest Root	**127.058**	**50.823a**	**10.000**	**4.000**	**.001**
Q11	Pillai's Trace	2.667	1.401	40.000	28.000	.177
	Wilks' Lambda	.001	1.961	40.000	17.023	.068
	Hotelling's Trace	32.600	2.038	40.000	10.000	.114
	Roy's Largest Root	**24.221**	**16.955b**	**10.000**	**7.000**	**.001**
Q12	Pillai's Trace	2.914	1.878	40.000	28.000	.042
	Wilks' Lambda	.001	2.318	40.000	17.023	.032
	Hotelling's Trace	36.739	2.296	40.000	10.000	.080
	Roy's Largest Root	**26.270**	**18.389b**	**10.000**	**7.000**	**.000**
Q13	Pillai's Trace	2.845	1.725	40.000	28.000	.067
	Wilks' Lambda	.005	1.334	40.000	17.023	.265
	Hotelling's Trace	13.232	.827	40.000	10.000	.685
	Roy's Largest Root	**6.834**	**4.784b**	**10.000**	**7.000**	**.025**
Q14	Pillai's Trace	2.747	1.536	40.000	28.000	.119
	Wilks' Lambda	.002	1.724	40.000	17.023	.113
	Hotelling's Trace	23.649	1.478	40.000	10.000	.261
	Roy's Largest Root	**14.646**	**10.252b**	**10.000**	**7.000**	**.003**
Q15	Pillai's Trace	2.280	.928	40.000	28.000	.593
	Wilks' Lambda	.009	1.061	40.000	17.023	.465
	Hotelling's Trace	15.666	.979	40.000	10.000	.557
	Roy's Largest Root	**11.011**	**7.707b**	**10.000**	**7.000**	**.006**

(*Contined*)

Q16	Pillai's Trace	2.555	1.238	40.000	28.000	.280
	Wilks' Lambda	.006	1.224	40.000	17.023	.335
	Hotelling's Trace	18.059	1.129	40.000	10.000	.446
	Roy's Largest Root	**14.109**	**9.876b**	**10.000**	**7.000**	**.003**
Q17	Pillai's Trace	2.423	1.076	40.000	28.000	.426
	Wilks' Lambda	.003	1.634	40.000	17.023	.138
	Hotelling's Trace	36.801	2.300	40.000	10.000	.080
	Roy's Largest Root	**31.532**	**22.073b**	**10.000**	**7.000**	**.000**
Q18	Pillai's Trace	2.182	.840	40.000	28.000	.698
	Wilks' Lambda	.009	1.061	40.000	17.023	.466
	Hotelling's Trace	21.824	1.364	40.000	10.000	.311
	Roy's Largest Root	**19.200**	**13.440b**	**10.000**	**7.000**	**.001**
Q19	Pillai's Trace	2.717	1.482	40.000	28.000	.139
	Wilks' Lambda	.004	1.357	40.000	17.023	.252
	Hotelling's Trace	16.552	1.034	40.000	10.000	.514
	Roy's Largest Root	**11.042**	**7.730b**	**10.000**	**7.000**	**.006**
Q20	Pillai's Trace	2.839	1.711	40.000	28.000	.070
	Wilks' Lambda	.003	1.639	40.000	17.023	.136
	Hotelling's Trace	19.015	1.188	40.000	10.000	.407
	Roy's Largest Root	**8.848**	**6.193b**	**10.000**	**7.000**	**.012**
Q21	Pillai's Trace	2.424	1.077	40.000	28.000	.425
	Wilks' Lambda	.005	1.281	40.000	17.023	.297
	Hotelling's Trace	21.268	1.329	40.000	10.000	.328
	Roy's Largest Root	**16.755**	**11.729b**	**10.000**	**7.000**	**.002**
Q22	Pillai's Trace	2.739	1.521	40.000	28.000	.124
	Wilks' Lambda	.002	1.694	40.000	17.023	.121
	Hotelling's Trace	30.986	1.937	40.000	10.000	.132
	Roy's Largest Root	**26.143**	**18.300b**	**10.000**	**7.000**	**.000**
Q23	Pillai's Trace	2.644	1.364	40.000	28.000	.196
	Wilks' Lambda	.002	1.642	40.000	17.023	.135
	Hotelling's Trace	24.100	1.506	40.000	10.000	.250
	Roy's Largest Root	**16.545**	**11.582b**	**10.000**	**7.000**	**.002**
V24	Pillai's Trace	2.854	1.744	40.000	28.000	.063
	Wilks' Lambda	.001	2.247	40.000	17.023	.037
	Hotelling's Trace	50.899	3.181	40.000	10.000	.027
	Roy's Largest Root	**44.645**	**31.251b**	**10.000**	**7.000**	**.000**

(*Contined*)

Q25	Pillai's Trace	2.653	1.379	40.000	28.000	.188
	Wilks' Lambda	.006	1.203	40.000	17.023	.350
	Hotelling's Trace	13.353	.835	40.000	10.000	.679
	Roy's Largest Root	**7.876**	**5.514b**	**10.000**	**7.000**	**.017**
Q26	Pillai's Trace	2.467	1.127	40.000	28.000	.375
	Wilks' Lambda	.007	1.178	40.000	17.023	.368
	Hotelling's Trace	16.509	1.032	40.000	10.000	.516
	Roy's Largest Root	**11.958**	**8.371b**	**10.000**	**7.000**	**.005**
Q27	Pillai's Trace	2.491	1.156	40.000	28.000	.348
	Wilks' Lambda	.005	1.296	40.000	17.023	.288
	Hotelling's Trace	22.486	1.405	40.000	10.000	.292
	Roy's Largest Root	**18.628**	**13.040b**	**10.000**	**7.000**	**.001**
Q28	Pillai's Trace	2.782	1.599	40.000	28.000	.098
	Wilks' Lambda	.001	2.218	40.000	17.023	.039
	Hotelling's Trace	44.254	2.766	40.000	10.000	.044
	Roy's Largest Root	**36.790**	**25.753b**	**10.000**	**7.000**	**.000**

a. Exact statistic
b. The statistic is an upper bound on F that yields a lower bound on the significance level.
c. Design: Intercept + Q11 + Q12 + Q13 + Q14 + Q15 + Q16 + Q17 + Q18 + Q19 + Q20 + Q21 + Q22 + Q23 + V24 + Q25 + Q26 + Q27 + Q28

Table 3. Electronic Clinical Pathways functions

electronic Clinical Pathways functions (sections of questionnaire)		
Function/section	**Aims and definition**	**Comments**
Clinical Pathways	The aim of this section is to verify the functions of Clinical Pathways based on its dimensions.	The dimensions depicted in: • treatment process • disease management • patients' outcome • communication (knowledge sharing) • variance
Staff activities and performance control	The aim of this function or section is to computerize and document the activities of medical staff	Presenting roles of staff and their performance, and evaluate their performance by computerized system
Inpatients' outcome	This section seeks to present the healthcare quality regarding outcome based on indicators.	Indicators of health care quality are • mortality • morbidity • the length of stay • readmission
Handling variance	The aim of this function is to handle variances; these variances identify the most interventions for patients.	Identified the variances of patients reduce medical errors
Time management	The purpose of this function is to determine the date and time for diagnosis and treatment processes.	Setting date and time for diagnosis and treatment
Utilization of resources efficiency	The aim of this function is to utilise the hospital's resources to minimize the delay of care.	Using computerized system to utilize the resources. Using computerized system to utilize the resources minimize medical errors

Table 4. Factors supporting teamwork communication

Factor	Findings
Teamwork	• Teamwork was not well activated. • No computerized system to support teamwork Communication between the team was synchronous and asynchronous (face-to-face, verbal communication, paper, mobile).
Tasks	• Tasks werestill on paper base • Tasks were managed on a dailybasis, and no proactive system was found. • No system was found which supports the flow of the tasks.
Knowledge	• Teamwork communication depends on the two factors: o Medical records. o Communication with the patient.
Technology	• No computerized system was found to support teamwork communication
Context	• Hospital policy has an effect on teamwork communication and decision-making process. • The hospital depends on international clinical guidelines in the treatment process, but these guidelines were not embedded in HIS (Health Information System).

happened and supported, the interviews based on a set of functions witch based on previous research[21].

6. Discussion

As mentioned earlier, based on the investigation of literature on electronic Clinical Pathways function, there are 17 functions which are distributed in 6 categories[18] and are also based on the ontology of electronic Clinical Pathways[19]. Table 3 presents the aims and functions of electronic Clinical Pathways.

Based on the interviews with physicians, Table 4 tabulates the result of the interviews. The interviews were structured based on the four factors, which support teamwork communication among medical staff or any domain.

7. Conclusions and Future Work

This paper focuses on investigating and studying the current HIS, which has Clinical Pathways as a sub-system or is embedded as functions in HIS. It also investigated if there is any system supporting teamwork communication embedded in the current HIS.

The aims and the future work of this study are directed as following:

i) No electronic Clinical Pathways have been implemented in Jordan until now. Also, none of the function has yet been embedded in the current HIS.
ii) None of the electronic or computerized system support teamwork communication.

Based on this conclusion, there is a problem of teamwork communication in Jordan hospitals, because they still depend on synchronous and asynchronous communication approaches. As mentioned previously, these types have disadvantages, and there is still a need for such system to support teamwork communication to streamline a flow of treatment.

In the future work, there is a need for such system which can support teamwork communication, electronic Clinical Pathways support teamwork communication and fill the gaps and avoid the disadvantages of synchronous and asynchronous communications. In addition, there is also a need for a model to study the influencing factors, which support teamwork communication by using electronic Clinical.

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