Original Research Article

Structure and process of the patient records computerization project in hospitals of Burundi

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ABSTRACT

Background: The computerization of patient records is an essential catalyst for the hospital performance. In Burundi the first patient records were computerized in 2015. The objective of this study is to evaluate the implementation of this project in order to identify the challenges for its success.

Methods: This is a descriptive cross-sectional study conducted in 11 hospitals. An assessment tool was used to collect data on the availability and organization of resources at the beginning of the project, on the process and on the completeness of patient records. The data collection was been done in February 2020.

Results: The structure and process components were moderately satisfactory with mean scores of 53% and 51% respectively. Governance (21%) for structure component, and maintenance (44%) for process component were the elements with the lowest scores. Concerning the completeness of the records, the main diagnosis at discharge was completed for 68% of the records in the gynecological-obstetrical consultation service; 58% for the pediatric service; 55% for the adult consultation service and 28% for the emergency service. Hospitals that were computerized in 2015 compared to 2017 (OR: 12.5 [10.9 -14.4]) and district hospitals compared to regional and national hospitals (OR: 22.1 [19.3 -25.2]) were more likely to have patient records with diagnosis at discharge.

Conclusions: Continued mobilization of resources, making available the guidelines for managing the electronic patient record and implementing strategies to strengthen the capacity of users will ensure the sustainability of the patient record computerization project.

Keywords: Structure, Process, Patient record computerization, Hospital

INTRODUCTION

The health information system (HIS) is one of the pillars of the health system, providing reliable and timely data to enable appropriate decision-making in the day-to-day management of a health facility. The computerization of the patient record is one of the means of making the information system within a hospital efficient.[1,2]

With the emergence of new information and communication technologies, most Sub-Saharan African countries have implemented computerized patient record projects. Nevertheless, it has been observed that those projects remain limited by multiple factors, the main ones being the cost of equipment, human resource skills, the unilateral adoption of software without consulting professionals, which leads to the social unacceptability of the tool deployed, the absence of the prerequisite's evaluation for the implementation of the project, the absence of strategic planning at the beginning of the project, etc.[3-5]

In Burundi, the government's objective was to strengthen the HIS by using new information and communication technologies. Many actions have been taken to achieve this goal, including the implementation of DHIS 2 (District health information software version 2), which is a routine health data management software. This software, which is only limited to the management of aggregated data, should be completed by other software that allows the management of individual patient information and networking within a hospital. It is in this context that a project to computerize patient records using the OpenClinic GA software was initiated in Burundi hospitals. OpenClinic GA is an OpenSource software for hospital information management. It was developed by a team of doctors and computer scientists from the company MXS SA of Belgium since 2006. It can be redistributed or modified, and marketable versions are also available.[6]

Since the implementation of the computerization project, no evaluation has been made. In order to identify the challenges to be met to ensure the success and the sustainability of the patient record computerization project, it was important to evaluate the six components (resources, indicators, sources, management, information products, and data dissemination and use) of the HIS according to the method of the health metrics network, the results of which are already available.[7,8] On the other hand, it was necessary to evaluate the implementation, hence the interest and objective of the present study. The objective of this study is to evaluate the implementation (structure) and the implementation (process) of the patient record the computerization project in the Burundi hospitals.

METHODS

Study design

This is a descriptive cross-sectional study in 11 hospitals whose patient records were computerized between 2015 and 2017 with the OpenClinic GA software. Beneficiaries of the ENABEL-funded project and belonging to the 3 levels of the health pyramid in Burundi, were included in the study. The data collection was done in the February 2020.

Study instruments

An evaluation grid composed of 64 items was used to evaluate the two components, namely the "structure" and the "process" of the computerization project. The grouping of elements and items in the two components was based on the evaluation model proposed by Donabedian.[9] The "structure" component included 4 sub-components and 21 elements, while "process" component included 4 sub-components and 43 elements that were evaluated (Table 1).

Data collection and analysis

In each hospital, 3 key informants were identified to answer the questions of this evaluation grid: the director of care, the head of the nursing department and the person in charge of the health information system. For each item, the evaluation was based on scores ranging from zero to three (0=not at all satisfactory; 1=moderately satisfactory; 2=satisfactory and 3=very satisfactory). The selected answer was the result of a consensus of the 3 selected key informants (director of care, head of nursing and health information system manager). If there was a discrepancy between the 3 key informants, all responses were retained to calculate an average score. The average score for each component was calculated, reported to the maximum score of three, and converted into quartiles: 0-25%=not at all satisfactory; 26-50%=moderately satisfactory; 51-75%=satisfactory; and 76-100%=very satisfactory. The judgment criteria were based on the HIS evaluation tool of the health metric network.[7] The first comparison variable was the year in which the computerized patient record began to be used, the second comparison variable was the referral level of the study hospitals. Data entry, processing and analysis were performed with the excel tool. Mean scores were calculated for each component, before calculating them by hospital group.

The assessment of the completeness of the data filled on the patient record was done with the PRISM (Performance of routine information system management) tools, whose section on data completeness was adapted for the present evaluation.**[10]** It focused on a single item "principal diagnosis at discharge". It was carried out in four hospital services chosen in a reasoned way from the services already computerized in all 11 study hospitals, namely the gynecological-obstetrical consultation service, the pediatric service, the adult consultation service, and the emergency service. One fifth (1/5) of the medical records were randomly selected in each hospital service, for the four months (March, June, November, December) also randomly selected from the 12 months of the year 2019. Data entry, processing, and analysis were performed with the excel tool. The percentage of records with the item "main diagnosis at discharge" was calculated by service using EPI INFO 7.2 software, the level of completeness was compared between hospitals according to the reference level and according to the year in which the computerized patient record was introduced, using the Pearson Chi-2 statistical test with a p value of 0.05. Odds ratios were also calculated to determine the probability of finding the item "principal diagnosis at discharge" for a group of hospitals.

Ethical approval

This article is part of a research project entitled Evaluation de l'informatisation du système d'information hospitalier: structure, processus, effets, enjeux et perspectives au Burundi (Evaluation of the computerization of the hospital information system:

structure, process, effects, issues and perspectives in Burundi which has received the approval of the national ethics committee for the protection of human subjects of biomedical and behavioral research.

RESULTS

Structure assessment

Overall, the structure component was moderately satisfactory with a mean score of 53%. Governance (coordination, availability of standards and planning documents) was the lowest scoring component with a score of 21% while availability of materials and equipment was the highest scoring component with a score of 72% (Figure 1).
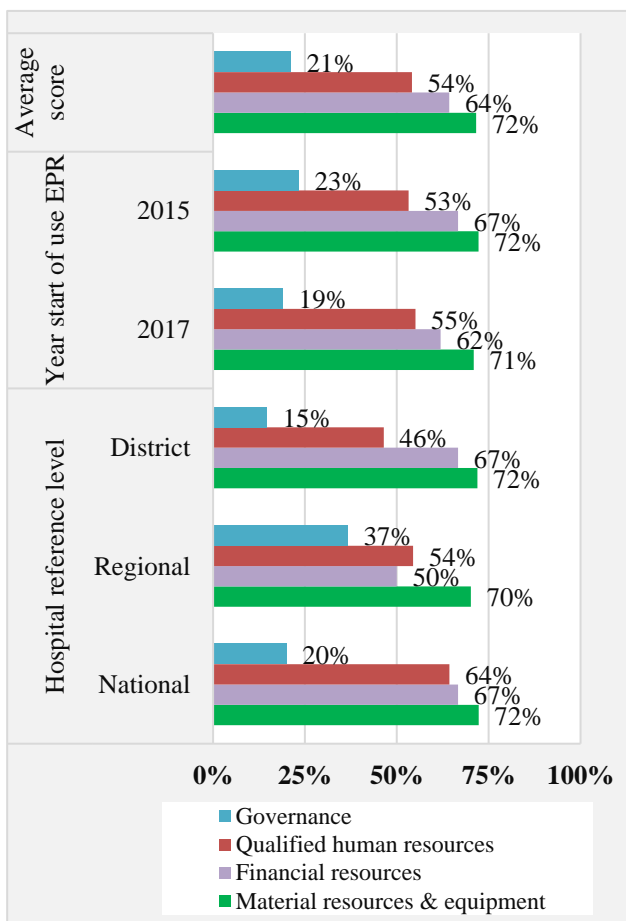

Figure 1: Average score for the structure component for the 11 hospitals.

Regarding the governance sub-component, the results showed that none of the hospitals had the standards and procedures manuals (guidelines) for managing the electronic patient record (0%). For the reorganization of services before the start of computerization, the score obtained was 55%. With regard to the availability of human resources, the score obtained for the availability of qualified human resources with skills in health information science and computer science was 51%,

while the capacity building of personnel at the beginning of the project obtained a score of 58%. For financial resources, the contribution of the project's beneficiary hospitals in terms of staff recruitment scored 91%, while the existence of strategies for mobilizing funds scored 27%. Regarding material resources and equipment, the availability of the server and data security scored 74% and the availability of computers (desktop/laptop/tablet) scored 65% (Table 2).

Process evaluation

The process component was satisfactory with a score of 51%. Maintenance had the lowest average score of 44%, while the management of the computerized patient record obtained the highest average score of 66% (Figure 2).
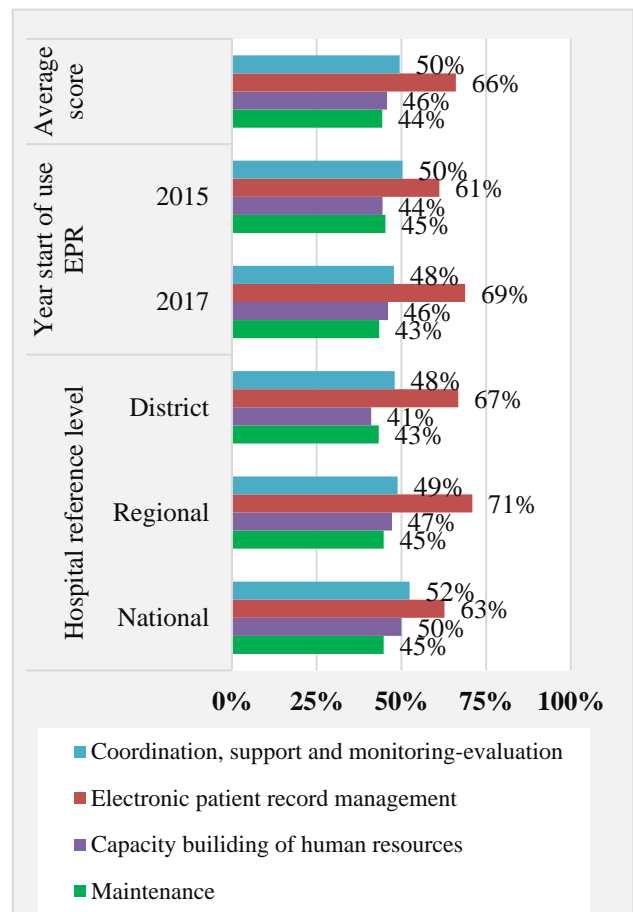
Figure 2: Average score for the process component for the 11 hospitals.

For the coordination, support, monitoring and evaluation sub-component, supervision of hospital offices by the health districts or provinces and/or the central level scored 18%, while support from partners scored 100%. With regard to the management of the electronic patient record (EPR), the use of documents on the standards and procedures for managing the EPR scored 37%. In terms of human resource capacity building, capacity building in network and computer maintenance scored 12% and capacity building in software use scored 100%.

Arrangements and activities to maintain servers, local area networks, OpenClinic GA software, and computer equipment scored 37%, 49%, 40%, and 51%, respectively (Table 3).

Evaluation of the level of completion of the computerized patient record

Of the 11 hospitals, the gynaecology-obstetrics service had 68% of the records bearing the diagnosis at discharge, whereas the emergency service had only 28% (Table 4).

The results of the comparison of the level of patient record completion by year of the project's start showed that hospitals that were computerized in 2015 were more likely to have the patient records with the diagnosis at discharge than hospitals computerized in 2017 for all four services. The large difference was observed for the emergency service (OR: 12.5 [10.9 -14.4]; p<10-4). Regarding the referral level of the study hospitals, the 1st referral level hospitals (district) were more likely to have the patient records with the diagnosis at discharge than the 2nd and 3rd level hospitals (regional and national level). The large difference was observed for the emergency services (22.1 [19.3 -25.2]; p<10-4) (Table 5).

Table 1: Sub-component and items of structure and processus components.

Components		No. of items	No. of elements
Structure	Governance	5	5
	Qualified human resources	2	3
	Financial resources	3	7
	Material resources and equipment	3	6
Sub total		13	21
Processus	Coordination, support and monitoring-evaluation	4	10
	Electronic patient record management	3	9
	Capacity builiding of human resources	3	8
	Maintenance	4	16
Sub-total		14	43
Total		27	64

Table 2: Average score obtained for the "structure" component (n=11).

Components/Sub-component		Year starts of use EMR		Hospital reference level			Average score (%)	Appreciation
		2015 (%)	2017 (%)	District (%)	Regional (%)	National (%)		
Governance	Availability of the standards and procedures (guidelines)	0	0	0	0	0	0	
	Availability of the computerization project action plan	0	10	0	17	8	6	
	Monitoring and evaluation mechanism for the computerization project	0	10	0	17	8	6	
	Coordination framework of the steering committee	42	33	33	50	33	36	
	Reorganization of services before the start of the project	75	43	40	100	50	55	
Average score of the sub-component		23	19	15	37	20	21	Not at all Satisfactory
Qualified human resources	Skills in health information science, ICT	51	51	44	48	62	51	
	Capacity building of staff at the beginning of the project	56	59	49	61	67	58	
Average score of the sub-component		53	55	46	54	64	54	Satisfactory
Financial resources	Existence of fundraising strategies	0	43	20	0	50	27	
	Recruitment of human resources to support the computerization process	100	86	80	100	100	91	
	Commitment of hospital funds during implementation	100	57	100	50	50	73	

Continued.

Components/Sub-component		Year starts of use EMR		Hospital reference level			Average score (%)	Appreciation
		2015 (%)	2017 (%)	District (%)	Regional (%)	National (%)		
Average score of the sub-component		67	62	67	50	67	64	
Material resources and equipment	Server management and data security	81	70	73	69	78	74	Satisfactory
	Availability of support materials (registers, various supplies)	92	77	70	100	88	82	
	Computer availability (desktop/laptop/tablet)	60	67	68	67	59	65	
	Availability of basic communication equipment	58	79	80	50	72	72	
Average score for the sub-component		72	71	72	70	72	72	Satisfactory
Average score of the component structure		54	52	50	53	56	53	Satisfactory

Table 3: Average score obtained for the "process" component (n=11).

Components/Sub-component		Year starts of use EMR		Hospital reference level			Average score (%)	Appreciation
		2015 (%)	2017 (%)	District (%)	Regional (%)	National (%)		
Coordination, support and monitoring-evaluation	Holding of meetings	29	19	20	33	21	24	
	Supervision and monitoring of hospital services	56	56	56	56	56	56	
	Supervision and support from the hierarchical level	17	17	17	7	33	18	
	Support from partners	100	100	100	100	100	100	
Average score of the sub-component		50	48	48	49	52	50	Moderately satisfactory
Electronic patient record management	Availability of user manuals	25	43	40	50	25	37	
	Management of user roles	100	100	100	100	100	100	
	Software performance	59	64	60	63	63	62	
Average score of the sub-component		61	69	67	71	63	66	Satisfactory
Capacity building of human resources	Capacity building in conceptualization	17	29	13	33	33	25	
	Maintenance capacity building	17	10	10	8	17	12	
	Capacity building in the use of the software	100	100	100	100	100	100	
Average score of the sub-component		44	46	41	47	50	46	Moderately satisfactory
Maintenance	Servers	38	37	33	38	42	37	
	Local area network	50	49	48	50	50	49	
	Software	44	37	40	42	38	40	
	Computer-park	50	51	52	50	50	51	
Average score of the sub-component		45	43	43	45	45	44	Moderately satisfactory
Average score of the component proessus		50	52	50	53	52	51	Satisfactory

Table 4: Proportion of EPR with diagnosis at discharge.

Hospital department	No. of records audited	Record with diagnosis at discharge, n (%)
Gynaecology-obstetrics: consultation	1954	1 333 (68)
Pediatrics	3370	1 943 (58)
Adult consultation	5524	3 065 (55)
Emergencies	4065	1 140 (28)
Total	14912	7 480 (50)

Table 5: Comparison of proportions of medical records with diagnosis at discharge between departments and by hospital group.

Hospital department	Year starts of use EMR (%)		OR [IC95%]	Hospital reference level (%)		OR [IC95%]
	2015	2017		1st level	2nd and 3rd level	
Pediatrics (n=1954)	65	57	1.4 [1.1-1.7]	79	55	3.0 [2.5 -3.6]
	p=0.0002			p<10^{-4}		
Adult consultation (n=3370)	86	43	8.2 [7.1-9.1]	77	50	3.4 [3.1 -3.8]
	p<10^{-4}			p<10^{-4}		
Emergencies (n=5524)	74	19	12.5 [10.9 -14.4]	78	14	22.1 [19.3 -25.2]
	p<10^{-4}			p<10^{-4}		
Gynaecology-obstetrics: consultation (n=4065)	78	67	5.2 [4.2 -6.4]	78	66	1.9 [1.5 -2.3]
	p<10^{-4}			*p<10^{-4}		

*Significant at $p<0.05$.

DISCUSSION

The average score recorded for the "structure" component was 53% and was at the lower end of the third quartile (Q3). The element of this component that recorded a low average score was governance. During the assessment, it was noted that none of the hospitals had the standards and procedures manuals (guidelines). The literature has shown that managing the diversity of stakeholders in the provision of care and services within a hospital, the completeness and consistency of patient information, the balance of decision-making and good coordination within the institution requires standards and procedures documents. Thus, the absence of such a document creates a significant gap in the process of implementing the project of computerization of the patient record.[11,12] In addition, two of the eleven hospitals had an action plan containing the implementation, monitoring and evaluation activities of the computerization project. However, this plan was not regularly used for monitoring and evaluation of implementation activities. The absence of a coordination framework in the majority of hospitals could also explain the low score recorded for this component (Table 2).

The "process" component was satisfactory with a score of 51% and was also at the lower end of the third quartile (Q3). Human resource capacity building (46%) and maintenance (44%) were the sub-components that had the lowest average score. Indeed, capacity building in maintenance had the lowest average score of 12%. The explanations given by the providers showed that the hospitals use the software designers for maintenance. As

for development and update of patient record, the average score obtained was 25%. The hospitals' IT staff did not have the capacity to add the necessary information to the software, and any changes to the software required external assistance. Although there have been trainings aimed at empowering the IT staff, there is still a need for capacity building. Concerning the maintenance, the strategies adopted by the hospitals to ensure the maintenance, especially of servers, local networks and software, were deficient. The skills of the hospitals' IT staff were limited, and they had to seek external support, which either required a significant budget or did not respond in time (Table 3).

Comparing the two hospital groups by year of EPR introduction, the results showed that those computerized in 2015 scored higher than those computerized in 2017 for the structure component, 54% versus 52%. The deployment of resources would be greater in the pilot phase than in the expanded implementation of the software. In contrast, for the "process" component, hospitals that were computerized in 2017 had a higher score than those computerized in 2015, 52% versus 50%. The experience of the hospitals in the pilot phase undoubtedly contributed to making some improvements during the project extension process.

Assessment of the level of completion of the electronic patient record

Regarding the assessment of the level of completion of the patient records, the low proportion recorded for emergency services (28%) could be explained by the

increased frequentation by patients requiring emergency care, so the providers' concern would be focused on the provision of care rather than on the correct filling in of patient information.[13,14] Normally, computerization of the patient record should improve the completion of the record. However, some studies have identified problems with the completion and completeness of computerized patient records. Factors identified that could explain incomplete completion of the EPR include work overload, lack of technical knowledge, lack of sufficient computer equipment, the impossibility of real-time data entry at the patient's bedside, and certain computer system malfunctions.[12,13,15]

CONCLUSION

The evaluation of the structure and process of the computerization project in Burundi revealed that the availability of standard documents and procedures, coordination, planning and maintenance of equipment and materials are aspects that require the combined efforts of the stakeholders. In addition, the use of the electronic patient record has not made its completion effective. Improving planning, the level of collaboration between actors at different levels of the health system and capacity building strategies for users will help consolidate the achievements and guarantee the success and sustainability of the patient record computerization project in Burundi hospitals.

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