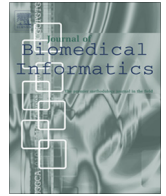




Contents lists available at ScienceDirect

Journal of Biomedical Informatics

journal homepage: www.elsevier.com/locate/yjbini



1

5
6

3 Q1 Mapping patient path in the Pediatric Emergency Department:
4 A workflow model driven approach

7 Q2 Ines Ajmi^b, Hayfa Zgaya^a, Lotfi Gammoudi^{b,*}, Slim Hammadi^b, Alain Martinot^c, Régis Beuscart^a,
8 Jean-Marie Renard^a

9 ^aEA2694 University Lille 2, France
10 ^bLAGIS UMR CNRS 8219, Ecole Centrale de Lille, France
11 Q3 ^cPED of CHRU Lille, France

13
14

ARTICLE INFO

17 Article history:
18 Received 12 June 2014
19 Accepted 9 December 2014
20 Available online xxxxx

21 Keywords:
22 PED
23 Workflow
24 Modeling
25 Peak of activity
26 Crowding indicators
27

A B S T R A C T

The workflow models of the patient journey in a Pediatric Emergency Department (PED) seems to be an effective approach to develop an accurate and complete representation of the PED processes. This model can drive the collection of comprehensive quantitative and qualitative service delivery and patient treatment data as an evidence base for the PED service planning. Our objective in this study is to identify crowded situation indicators and bottlenecks that contribute to over-crowding. The greatest source of delay in patient flow is the waiting time from the health care request, and especially the bed request to exit from the PED for hospital admission. It represented 70% of the time that these patients occupied in the PED waiting rooms. The use of real data to construct the workflow model of the patient path is effective in identifying sources of delay in patient flow, and aspects of the PED activity that could be improved. The development of this model was based on accurate visits made in the PED of the Regional University Hospital Center (CHRU) of Lille (France). This modeling, which has to represent most faithfully possible the reality of the PED of CHRU of Lille, is necessary. It must be detailed enough to produce an analysis allowing to identify the dysfunctions of the PED and also to propose and to estimate prevention indicators of crowded situations. Our survey is integrated into the French National Research Agency (ANR) project, titled: "Hospital: Optimization, Simulation and avoidance of strain" (HOST).¹

© 2014 Elsevier Inc. All rights reserved.

47
48

1. Introduction

In many countries, Emergency Departments are facing problems associated with increased demand in their services [1,14,18–20]. The arrival patient flow to the Emergency Department is stochastic and keeps increasing. This rise has generated a strategic interest in optimizing the technical and human resources while mastering the costs [3]. Especially, Pediatric Emergency Departments (PEDs) have limited resources and/or staff trained, in addition of busy and noisy environment, combined with acuity. This situation creates a set of unique challenges for the patient, family, and care providers [15–17].

This real problem is the main challenge of the HOST² project. The objective is to elaborate an innovative methodological approach for the anticipation of the crowded situation of the complex care production system and more especially of the emergency paths in the PED of the CHRU³ of Lille in France. The tension-reduction strategy, the performance assessment and traceability of the patient course are integrated into the suggested approaches.

The scientific fallouts expected of this project are:

- A prospective vision of the modeling and the monitoring of global PED activity handling system.
- A good tool to anticipate the crowded situations of the PED.
- A scheduling tool for the programmed and not programmed health tasks, taking into account the medical staff skills.

* Corresponding author.

E-mail addresses: ines.ajmi@ec-lille.fr (I. Ajmi), hayfa.zgaya@univ-lille2.fr (H. Zgaya), lotfi.gammoudi@ec-lille.fr (L. Gammoudi), slim.hammadi@ec-lille.fr (S. Hammadi), alain.martinot@chru-lille.fr (A. Martinot), regis.beuscart@univ-lille2.fr (R. Beuscart), jean-marie.renard@univ-lille2.fr (J.-M. Renard).

¹ Hôpital: Optimisation, Simulation et évitement des Tensions (ANR-11-TecSan-010: <http://host.ec-lille.fr/wp-content/themes/twentyeleven/docsANR/R0/HOST-WP0.pdf>).

² "Hospital: Optimization, Simulation and avoidance of strain" Hôpital: Optimisation, Simulation et évitement des Tensions (ANR-11-TecSan-010: <http://host.ec-lille.fr/wp-content/themes/twentyeleven/docsANR/R0/HOST-WP0.pdf>).

³ Regional University Hospital Center (CHRU) of Lille (France).

<http://dx.doi.org/10.1016/j.jbi.2014.12.004>

1532-0464/© 2014 Elsevier Inc. All rights reserved.

- The fallouts for emergency paths actors will consist in establishing the methods and operational tools allowing:
 - o To bring the recommendations for the emergency paths conception and reengineering for health establishments,
 - o To improve the handling efficiency and the quality of the service returned to the patient,
 - o To assure a better internal and external coordination with the other actors of the emergency path when the crowded situations cannot be avoided.

Our work represents the first step of the national project (HOST) realization and discusses the emergency handling system. Modeling patients' paths at PED is faced with a high amount of complexity. This complexity stems from the inherent dynamics of the processes and the distributed organization structure of hospitals, as they are divided into several autonomous wards and ancillary units. For treatment, patients visit different units according to their illness. However, the pathway of the patients through the Pediatric Emergency Department (PED) is confronted with uncertainties. Because it is in the nature of diagnostics to gain additional information about the patients' diseases, the necessary medical treatments are often not completely determined at the beginning of the treatment process. Further, the duration of the examinations and treatments are stochastic, due to the individuality of the patients. Additional problems for the patient-modeling in PED arise from complications and emergencies. The immediate need of treatment for emergency patients causes disturbances in the schedule. Complications, which may occur during a treatment, result in waiting times and changed pathways for other patients. This results in variable pathways and stochastic processing times.

The PED staff perceived a number of problems in the management of the PED processes which generate peaks of activity. That is why we have to look for ways to model and then to optimize the PED processes within an environment of increasing demand. To achieve this goal, it is imperative that the associated activities are accurately identified and fully understood.

Modeling of the PED process to investigate problems such as long waiting times and delays in admissions have been extensively reported. PEDs have investigated and adopted a variety of process modeling approaches from business and industry sectors as well as academic disciplines, in an effort to improve efficiency and increase productivity [21–23,4].

The objective of this paper is to provide a complete picture of the PED delivery processes and detailed data on all aspects of the patient journey in order to identify bottlenecks that potentially contribute to overcrowding. For that, we study and analyze the patients' paths in the PED of CHRU of Lille in France, focusing on the identification of the service dysfunctions.

In the present paper, modeling has been used to create an accurate picture of the patient journey within the PED and to clearly depict activities of particular concern to the PED staff. The workflow methodology has shown its efficiency improving the performance of complex business processes and especially health processes [4]. These latter are of significant importance to the early design phase of a software development project since they provide a procedural view on the business. A fundamental problem in this context is the selection of an appropriate notation for defining business process models. Several flowchart-like languages are currently used in practice, including languages like Event-driven Process Chains (EPCs) [38], or diagrams offered by the Unified Modeling Language (UML), most notably Activity Diagrams [27]. Recently, standardization efforts between the Object Management Group (OMG) and the Business Process Management Initiative (BPMI) have led to the definition of the Business Process Model and Notation (BPMN) (OMG, 2011).

The BPMN is a common standardized graphical language which allows the design of a workflow model [24]. It offers the following advantage: including the events, sub-processes, activities, gateways, data and conversations in the same model representing the considered processes. These are critical to our study because we have to model the patient journey as many detailed interconnected processes and sub-processes.

In this paper, we explain how we capture the data necessary to build BPMN models to represent the patient journey through the PED. We then describe how analysis of these models enabled subsequent models (sub-processes) to be constructed to provide more detailed views of the patient journey and sources of delays to be identified.

Therefore, the main contribution of this paper is the introduction of a novel model workflow, approach based on the optimization of the patient path in the Pediatric Emergency Department.

A state of the art workflow system in the field of health will be presented in the second section. In Section 3, we describe the methods of workflow system in the PED. Experiment results are presented in Section 4. After describing the results of the model workflow in Section 6, we present in Section 5 a discussion concerning patient path in the PED. Many limitations are presented in Section 7. This article is closed with conclusions and an outlook to further work.

2. State of the art

2.1. Emergency Department Management

The care of patients occurs in different modes related to the type of needed care: planned treatment, care requiring (or not requiring) a hospital (ambulatory) care and unscheduled care in an emergency (or non-emergency). The emergency medical assistance is an extremely important and sensitive issue. Solutions must be developed not only in French but also in Europe where the same problems exist [25,26]. Thus, all European emergency medical assistance services met on 14 and 15 March 2005 in Paris to discuss their issues and how to improve their activities. More than 350 participants from 30 European countries participated in this discussion. The complexity of the concerned problems illustrated by the diversity [12] of the solutions (specialized call centers, dedicated emergency units, mobile crisis teams...) without any satisfactory results. The United Kingdom, to cope with these difficulties, has established protocols for management of the emergency, which now allow the National Health Service⁴ (NHS) display care delay less than 4 h in a system previously heavily criticized for the length of its waiting time [13]. These protocols are accompanied by a reconfiguration of the activities, a redistribution of tasks between professional groups and the development of tools for communication and exchange. Furthermore, analysis of the system of health care services in Quebec and the transformation of the Montreal Network show that the organization of services has not been able to adequately adapt to the rapid changes and budgetary constraints imposed on networks supported (Centre National Emergency Coordination (CCNU) (2002), Emergency Management Guide). The Quebec, such as France [28], including the creation of a guide to management and organization of the emergency order to flatten the process and to standardize key stages: triage, patient observation time, demand consultation modality integration of personal processes, utilization management beds, liaising with teams. Thus, the discussed issues cover the scientific, technical, social, informational and human. Thus, a multidisciplinary approach is needed

⁴ <http://www.droit-medical.com/perspectives/9-variations/418-national-health-service-nhs>.

Download English Version:

<https://daneshyari.com/en/article/6928254>

Download Persian Version:

<https://daneshyari.com/article/6928254>

[Daneshyari.com](https://daneshyari.com)