Application of process metrics to compare children's asthma diagnostic pathways in 30 EE/EEA countries

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Abstract

The paper presents the results of the application of the business process approach to analyse and compare healthcare pathways performed in 30 EU/EEA countries focusing on children's asthma care. The adoption of process metrics allows the identification of different levels of fragmentation across countries resulting from the interactions among primary and secondary healthcare professionals as well as from parents' involvement in the process.

Keywords:

Business process modelling, Bronchial Asthma, Child health

Introduction

Asthma is the most common chronic disease among children [1], representing one of the top 20 conditions for global ranking of disability-adjusted life years (DALY) [2]. Although different international widespread guidelines [3] provide criteria to diagnose, manage and monitor asthma in children and young adults, this disease is still one of the most difficult disease to diagnose and control [4]. A correct, timely and early diagnosis of asthma is necessary to improve its control. This requires to speed up the provision of diagnostic tests, such as spirometry, to confirm asthma diagnosis and its severity, as symptoms alone are not enough to assess the presence and the severity of this respiratory disease [5]. In some countries this is achieved performing spirometry in the primary care setting. Moreover, communication procedures have a crucial role to improve the continuity of care in the management of patients with asthma [6].

This study is part of the MOCHA (Models of Child Health Appraised) project[1] that aims to compare and appraise existing national models of primary care for children. Within this project the objective of this paper is to analyse the efficiency of the diagnostic pathway carried out in 30 EU/EEA countries focusing on the communication among professionals and parents as well as on the performance of the spirometry test.

Methods

The communication procedures between primary and secondary care as well as the provision of the spirometry test in each MOCHA country are captured analysing the answers provided by local experts in child health services, i.e. Country Agents (CAs), in an ad hoc questionnaire. In particular the analysis is focused on the following questions, as reported by 22 CAs: 1) is the spirometry usually performed by a primary care (PC) provider?; 2) how does the secondary care (SC) specialist provide the results of the spirometry test to the primary care provider?; 3) which are the usual procedures to refer the child to secondary care?. Moreover, the CAs were asked to report the availability of the medical record in PC setting and whether the record is shared among other professionals. The result of this analysis has been represented using the UML diagrams that facilitate the comparison between the different business processes performed in the MOCHA countries in the delivery of child care [7]. In particular, the *UML use case diagram* has been developed to provide an overall picture of the activities performed as well as of the actors involved in each activity of the care process. This diagram represents the starting point to group countries that have similar procedures, used similar services, and are based on similar caregivers for the provision of care. Responses reported in each use case can help to cluster countries that have a similar behaviour to complete the process. A set of *UML activity diagrams* have been then developed to summarize the behaviour of each group of countries describing activities performed and messages exchanged by the different actors as well as triggering conditions taking also into account their location and timeline. The process flows adopted in each group of country is analysed to detect differences and similarities among countries in the performance of the different parts of the diagnostic pathway. This analysis requires the identification, quantification and application of business process metrics [8]. Considering the purpose of this paper and giving the high-level description captured from the questionnaire, in this paper we focused on the straightforwardness versus the fragmentation of the care process considering two main aspects: 1) the number of interactions among actors (i.e. professionals, child and parents); 2) the points of the process in which time (waiting for appointments, referral, etc.) has a role in getting the diagnosis and monitoring child health status. Finally, to carry out a performance analysis the activity diagrams were mapped using the NETIMIS process simulation tool. This tool supports the representation of possible bottle necks in a clinical pathway, describing the patients' journey through a series of nodes (e.g. activities) that can be associated with a time and/or a cost for their execution [9].

Results

For space reasons the UML diagrams are not reported in this paper. Starting from the UML use case diagram, countries have been classified and clustered as reported in Table 1. From the cluster analysis three countries have been selected and analyses to capture the level of complexity of the process in terms of its straightforwardness: 1) Spain; 2) Italy and 3) Lithuania. Each activity diagram was subsequently mapped in the NETIMIS simulation tool to represent the differences in the execution of the process, where the probability of the alternatives of the diagnostic pathways decision points is report-

[1] MOCHA website available at http://www.childhealthservicemodels.eu/

ed in the relevant branches. Figure 1 reports the NETIMIS representation of the activity diagram of Italy.

Table 1–Cluster of countries considering the referral (columns) and communication procedures (rows) and the availability of spirometry in PC (= available; # = partially available). The presence of a shared EHR is reported in brackets (E)*

		PC refers to SC		
		Direct	***Both***	***Parents***
SC communicates to PC	***Direct***	Austria Croatia * Finland (E) * Spain (E) *	Cyprus Germany # Ireland *	France # Iceland * Netherlands #
	Both	Portugal (E)#	Estonia (E)* Italy # Norway (E) *	Malta Greece *
	Parents		Belgium # Latvia #	Poland * Bulgaria Lithuania Romania *

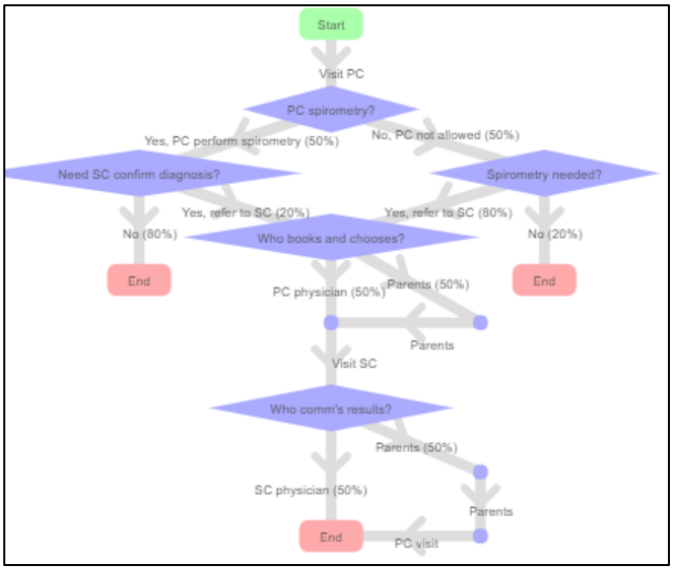

Figure 1–NETIMIS process diagram

Models have been run considering 100 children that start the process by accessing the PC physician. The results of the simulation are presented in Figure 2 showing the number of: visits; interaction transactions and waiting times of each scenario.

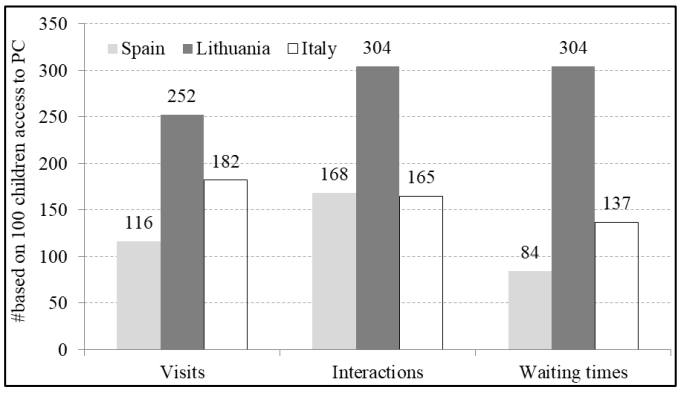

Figure 2–Simulation results reporting the number of visits, interactions and waiting times occurred in each scenario

Discussion and Conclusions

Our approach supports the analysis of the different diagnostic pathways that represent a mix of organisational solutions adopted at local level to address childcare needs [10]. In the present example of asthma, the analysis considered number of encounters, interaction transactions, presence and use of EHR and waiting times across countries. It contributes to outlining the efficiency of organizational models of asthma diagnosis for children on the basis of process metrics highlighting bottlenecks and - through cross-country comparison - possible solutions to improve the process. The need of an early and appropriate diagnosis speaks in favour of spirometry done at PC encounters, especially in cases of exacerbations, when the major focus is posed on the organisational efficacy. Under the business metrics' perspective this resulted in the reduction of the number of visits and interaction between PC and SC physicians and consequently waiting times. In the countries where this is not allowed, the presence of shared EHR and/or close collaboration between primary and secondary care can support both accurate and timely diagnosis (decrease of number of interactions) as well as provide relief of parents' burden in childcare with asthma. The mapping in the NETIMIS simulation tool provides further insights in the analysis of the organisational process, as time and costs of resources can be evaluated. The association of these indicators with children health outcomes could contribute to evaluate the efficacy in the adopted diagnostic process outlining optimal pathways of childcare.

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