



Original Research

Evaluation of clinical practice guideline-derived clinical decision support systems using a novel quality model

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ABSTRACT

Over the last decade, clinical practice guidelines (CPGs) have become an important asset for daily life in healthcare organizations. Efficient management and digitization of CPGs help achieve organizational objectives and improve patient care and healthcare quality by reducing variability. However, digitizing CPGs is a difficult, complex task because they are usually expressed as text, and this often leads to the development of partial software solutions. At present, different research proposals and CPG-derived CDSS (clinical decision support system) do exist for managing CPG digitalization lifecycles (from modeling to deployment and execution), but they do not all provide full lifecycle support, making it more difficult to choose solutions or proposals that fully meet the needs of a healthcare organization. This paper proposes a method based on quality models to uniformly compare and evaluate technological tools, providing a rigorous method that uses qualitative and quantitative analysis of technological aspects. In addition, this paper also presents how this method has been instantiated to evaluate and compare CPG-derived CDSS by highlighting each phase of the CPG digitization lifecycle. Finally, discussion and analysis of currently available tools are presented, identifying gaps and limitations.

1. Introduction

Today, any organization requires innovative, flexible solutions to digitize and automate their processes [2] in conjunction with new technologies [3] for increasing their competitiveness and productivity [4,5]. In healthcare environments, digitization has greater disruptive potential because it affects aspects like patient care, spiraling costs, quality and rewarding value [6]. However, before the technological boom of the last decades, patient care was usually based on the manual application of clinical practice guidelines¹ (CPG); i.e., it was usually based on paper-based medical reporting without automatic support (such as computerized systems for clinical decision support).

Today, many authors have studied the benefits of establishing well-defined CPG digitization processes² to both healthcare professionals and patients [7–9]. CPGs help reduce variability in clinical practice and improve the quality of clinicians' performance and decision-making.

CPGs pool existing knowledge to facilitate the use of effective, reliable interventions based on empirical evidence and clinical experience [10], but the CPG digitization processes make this effort more efficient and reliable by using computerized clinical decision support systems.

Over the last decade, many scientific initiatives and technological proposals have been published to facilitate the automation and digitization of clinical guidelines. These technological initiatives are referred to as CPG-derived CDSS (clinical decision support system) in this paper. Most of them, however, have been limited in their functional scope, or their practical application has focused on treating specific pathologies in controlled environments. After an initial rise of formalisms and languages [11], it is necessary to assume and address the fact that the actual applications of CPG-derived CDSS are limited. This situation has been analyzed by several authors from different perspectives and the reasons for this are heterogeneous [12,13], but the reasons are usually

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¹ The definition of CPG (clinical practice guidelines) assumed in this paper is the one offered by Steinberg et al. [1], who define CPG as «statements that include healthcare processes, clinical rules and recommendations intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options».

² The concept of CPG digitization process is understood in this paper as the process of translating the content of CPG content to digital form for machine-interpretable understanding.