TRANSFORMING A HIGH BLOOD PRESSURE CLINICAL GUIDELINE INTO A CDSS
Difficulties in Understanding

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Keywords: Guideline, Hypertension, JNC 7, Electronic health record, Clinical decision support system.

Abstract: Introduction. Due to the increasing use of Electronic Health Records there is a tendency to implement clinical decision support system (CDSS) based on existing clinical guidelines. The Seventh Report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) is well known and widely used worldwide guideline. Transforming published guidelines into CDSS is a process that still needs to be improved. Aim. To describe the difficulties in understanding the guideline, to recommend better suited descriptions for the contents. Methods. Systematic reading of the guideline for the extraction of the main patient variables, processes and evaluation suggested. The issues were evaluated considering the Domain 4 of the Appraisal of Guidelines for Research & Evaluation II Instrument. Results. Several problems were identified considering whether the recommendations are specific and unambiguous, the different options for management of the condition or health issue are clearly presented and key recommendations are easily identifiable. Discussion. Some initiatives have been made, as the Guideline Elements Models and the development of guideline model representations. This attempt to formalise the JNC 7 guideline allowed to discover many ambiguities, concepts related to prior knowledge and issues related to the distribution of the content presentation.

1 INTRODUCTION

It is a consensus that clinical guidelines should be deployed through clinical information systems. Such measure facilitates overcoming two obstacles to guideline adherence, which are the awareness of the document and the availability of its contents for the healthcare professional at the moment of care. Despite this, a major guideline implementation problem is the difficulty to create a comprehensible document, easy to convert it later into a useful framework for EHR or a clinical decision support system (CDSS). Some times the clinical guidelines are logically incomplete and often employ concepts that require background knowledge not contained in the guideline document (Fox et al., 2009). Among other definitions of what is desirable to a guideline, the Appraisal of Guidelines for Research & Evaluation II (AGREE II) Instrument highlights the clarity of presentation, which involves the assessment of specificity, unambiguity, clearly presentation of different options for management and easiness to identify key recommendations (The AGREE Next Steps Consortium 2009).

The Seventh Report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) was published in 2003 and since then has been serving as an important reference to the management of high blood pressure (BP) worldwide. The JNC 7 updated and introduced new concepts to hypertension guidelines. The BP classification (i.e. normal, prehypertension, hypertension) was simpler than previous versions and each category should lead to different approaches to hypertension management. It also brought new epidemiologic data concerning the risk of the BP levels, treatment and control rates and how to apply the guideline concepts to public health and in medical care practices (Chobanian et al.,

Bacelar-Silva G., Chen R. and Cruz-Correia R..
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DOI: 10.5220/0003787804050408
In *Proceedings of the International Conference on Health Informatics* (HEALTHINF-2012), pages 405-408
ISBN: 978-989-8425-88-1

2003). Transforming the JNC 7 to an electronically readable format could bring many benefits to health providers. It could improve the development of electronic health records (EHR) and clinical decision support system (CDSS) being a framework to a more efficient clinical approach to prevent and manage hypertension, a cardiac chronic condition that affected nearly one billion people worldwide in 2000 and is expected to affect 1.56 billion by 2025 (Kearney et al., 2005).

The aim of this work is to assess the clarity of presentation and describe the difficulties in understanding patient evaluation items of JNC 7 clinical guideline and recommend better-suited descriptions for its contents.

2 METHODS

The JNC 7 clinical guideline is available on the Internet in two documents, an express edition and a full report. There is also a quick reference card available to download. We used the full report and the quick reference card to perform the assessment of the guideline.

The aspects considered to assess the guideline were based on the AGREE II Instrument. This instrument was developed by an independent body established in 2004 to address the issue of variability in guideline quality. Its purpose is to provide a generic framework to (1) assess the quality, (2) serve as a methodological strategy for the development of guidelines and (3) inform what information and how information ought to be reported in guidelines. The instrument is composed of 23-item organized into six domains. In order to assess the JNC 7 we used the Domain 4, which is Clarity of Presentation. The items that comprise this selected domain are described as follows:

- The recommendations are specific and unambiguous - A recommendation should provide a concrete and precise description of which option is appropriate in which situation and in what population group, as informed by the body of evidence.
- The different options for management of the condition or health issue are clearly presented - A guideline that targets the management of a disease should consider the different possible options for screening, prevention, diagnosis or treatment of the condition it covers. These possible options should be clearly presented in the guideline.
- Key recommendations are easily identifiable – Users should be able to find the most relevant recommendations easily. These recommendations answer the main question(s) that have been covered by the guideline and can be identified in different ways. For example, they can be summarized in a box, typed in bold, underlined or presented as flow charts or algorithms.

Once we established a framework to consider for analysis, a systematic reading of the guideline was conducted. We focused on the extraction of the main patient variables, processes and its evaluation according to the AGREED II selected items. Several new readings were made when it was necessary to clarify the points considered in disagreement with the Clarity of Presentation evaluation items. To better visualize, we developed a diagram illustrating the thinking processes within the content of the guideline concerning the patient evaluation.

3 RESULTS

First will be presented the results of our evaluation, addressing the three items of the selected AGREE II domain, followed by suggestions on what could have been done to improve the mentioned issues of the guideline.

3.1 The Recommendations are Specific and Unambiguous

- Lacks explanation of what is important to know about the medical history evaluation. Some of this information is cited in a different chapter, which describes particular forms of identifiable hypertension (e.g. Pheochromocytoma suspicion in patients with labile hypertension or with paroxysms of hypertension accompanied by headache, palpitations, pallor, and perspiration). A list of signs and symptoms should be presented with a correlated suspicion.
- Prehypertension is not considered a disease category, but the JNC 7 states that drug therapy should be considered for individuals that also have diabetes or kidney disease and BP levels higher than 130/80 mmHg after a trial of lifestyle modification. Since these individuals are candidates for drug therapy, the guideline lacks explaining whether the physician should perform a more thorough clinical evaluation besides BP measurement. The guideline should indicate the clinical approach to this situation.

- Many vague recommendations linked to implicit references of knowledge not contained in the document (e.g. a thorough examination of the heart and lungs). Although it may seem obvious for physicians, it would be better to have these items clearer explained or referenced to an external content.
- Sometimes the guideline lacks explaining and/or correlating the reasons patient evaluation items are performed (e.g. lipid panel to evaluate cardiovascular risk factor). Correlating patient evaluation items with objectives would ease the comprehension.

3.2 The Different Options for Management of the Condition or Health Issue are Clearly Presented

- The table that is supposed to contain the concomitant disorders that may affect prognosis and guide treatment actually describes the target organ damage and is named "Cardiovascular risk factors". A new separate table should contain target organ damage and another one should contain the concomitant disorders that may affect prognosis and guide treatment.
- Although referred in the Patient Evaluation chapter, a list of the concomitant disorders that may affect prognosis and guide treatment is described only four chapters ahead ("Special Situations in Hypertension Management"). It should be presented in the "Patient Evaluation" chapter.
- Lifestyle evaluation items are not grouped, but lifestyle modifications are grouped as a table in the treatment chapter, including items not included within the evaluation items (e.g. alcohol consumption). The lifestyle evaluation items should be described within medical history.
- The guideline is conducted through two paths, the Objectives-oriented (evidence-based thinking) and the Semiology-oriented (traditional medical thinking) paths. The problem is that these paths are rarely correlated. The establishment of a connection between these two paths (e.g. subdividing the semiology items according to the objectives of patient evaluation) would improve the comprehension of the guideline as a whole, allowing the readers to know what is necessary to do and why it is necessary to be done.
- Electrocardiography is presented as a routine laboratory test, but it is not a laboratory test, it is a diagnostic tool (Meek and Morris, 2002). A new name, such as "Routine diagnostic procedures" would be more appropriated.
- "Other diagnostic procedures" are not clearly grouped. They are cited and start to be described in the "Patient Evaluation" chapter but continue and end in the next chapter ("Identifiable Causes of Hypertension"). They are also referred as "additional diagnostic procedures". They should have been cited before as a single term and completely described in the chapter.

3.3 Key Recommendations are Easily Identifiable

- Recommendations for patient follow-up frequency according to BP measurements are presented in the chapter named "Calibration, Maintenance, and Use of Blood Pressure Devices". It would be better to present the recommended approach after the patient has been classified.
- The Quick Reference Card contains the sections "Diagnostic Workup of Hypertension", "Assess risk factors and comorbidities" and "Reveal identifiable causes of hypertension" in a manner that they seem to be different aspects to evaluate, but actually the last two sections are items of the first one. "Assess risk factors and comorbidities" and "Reveal identifiable causes of hypertension" sections should be presented in a different manner to demonstrate they are within "Diagnostic Workup of Hypertension".

4 DISCUSSION

As already mentioned, the JNC 7 guideline is a very important document, which has been cited over than 10,500 articles worldwide since 2003. But despite the efforts of the medical informatics community, this document, as many others, has several issues that make it difficult to understand and convert it into an EHR or CDSS.

Five years before the release of the JNC 7, Douglas K. Owens (1998) published a paper about the implementation of guidelines into the clinical practice. The guidelines' potential to improve quality of healthcare and the increased benefit of their integration to an EHR and CDSS were reported and are well known today. But he also described the two main reasons why guidelines were rarely used: (1) the lack of computing infrastructure to support computer-based guidelines; and (2) the substantial technical challenges related to the guideline development, which were the medical vocabularies

insufficiently standardized and guideline produced without precise enough recommendations.

The technology advances involving, for example, wider access and use of Internet and mobile devices have been allowing to address the first reason.

But the second reason is not so easy. Some initiatives have been made, as the Guideline Elements Models (GEM) and development of guideline model representations. The GEM is a framework that uses tags and intends to promote translation of natural language within guideline documents into a format that can be electronically processed by describing concepts, their attributes and their relationships. However, GEM has some limitations, such as its little potential to resolve the ambiguities that are easily found in many guidelines (Shiffman et al. 2000). Several different formalisms have been developed by research teams to develop guideline decision models. These models are representations of guideline recommendations as a plan, composed by decisions, actions, subplans and their relationships. In order to facilitate future updates, the model element is associated with the guideline text using the GEM tags (Quaglini and Ciccarese, 2006).

5 CONCLUSIONS

This attempt to formalise the JNC 7 guideline allowed to discover many ambiguities, concepts related to prior knowledge and issues related to the distribution of the content presentation. Since the date the JNC 7 was published many efforts were made in order to put together the paper and machine-readable versions of guidelines. The guideline developers should consider during its developing time to use the medical informatics tools to have, in the end, both versions made. This would also improve the quality and comprehension of the guideline's statements and meet the needs of healthcare stakeholders to build a more affordable and reliable practice. We expect that our suggestions can help improving the future guidelines development.

ACKNOWLEDGEMENTS

This work is funded by FEDER funds (Programa Operacional Factores de Competitividade – COMPETE) and by National funds (FCT – Fundação para a Ciência e a Tecnologia) through project SAHIB - Enhancing multi-institutional health data availability through multi-agent systems [PTDC/EIA-EIA/105352/2008].

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