Multiple Approaches to the Diagnosis of Attention Deficit Hyperactivity Disorder

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ABSTRACT

Studies indicate that about 3-7% of school-age children have attention deficit hyperactivity disorder (ADHD). If these disorders are not diagnosed and treated early, its consequences can harshly impair the adult life of the individual. In this context, early diagnosis is critical. Clinical reasoning is a key contributor to the quality of health care. Clinical decisions at the policy level are made within a stochastic domain; decisions for individuals are usually more qualitative. In both cases, poor reasoning can result in an undesirable outcome. Clinical decisions are most typically communicated in a document through free text. Text has significant limitations (particularly ambiguity and poor structuring) whether used for analysis, or to explain the decision-making process. In safety engineering, similar problems are faced in conveying safety arguments to support certification. As a result, approaches have been developed to conveying arguments in ways which improve communication and which are more amenable to analysis. The Goal Structuring Notation (GSN) – a graphical argumentation notation for safety – was developed for those reasons. It has evolved to be one of the most widely used techniques for representing safety arguments. The use of text-mining techniques is another approach in the process of achieving or suggesting a diagnosis to the physician. This paper investigates the relative feasibility of these two approaches and discuss their complementation. Based on a case example, the benefits and problems of adopting GSN and ontology approach in clinical decision-making for ADHD are discussed and illustrated.

Keywords: Argumentation, Attention Deficit Hyperactivity Disorder (ADHD), Clinical Decision-Making, Goal Structuring Notation, Text Mining

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1. INTRODUCTION

Studies have shown that about 3-7% of school-age children have attention deficit hyperactivity disorder (ADHD) (Biederman, et al., 2004; Westby & Watson, 2003). Difficulties with attention, impulsiveness, or hyperactivity (or all three) characterize children diagnosed as having ADHD (DSM-IV-TR, 2002; Barkley, 2006). These deficiencies arise relatively early during childhood (Barkley & Biederman, 1997), are persistent overtime in most diagnosed cases (Barkley, 2006), and often result in impairment in multiple domains of major life activities (Barkley, 1997). If ADHD disorders are not attended to and treated early, its consequences may severely impair the adult life of the individual. Early diagnosis of ADHD is therefore crucial to mitigate its effects.

Making a diagnosis is a decision-making activity. Decision-making is an integral and crucial element in health care. All over the globe, clinicians make millions of decisions relating to individual patients everyday. Further, healthcare managers and policymakers make thousands of decisions about groups of patients, or populations (Gray, 2001). For an individual patient, the clinician has to diagnose what is wrong and recommend the appropriate treatment, while the patient has to decide whether or not to seek medical care, and whether to accept the recommended treatment. For a group of patients or populations, health policymakers and insurers have to decide, for example, based on the results of trials and past knowledge, what to promote, what to discourage, and what to pay for.

Many of these clinical decisions are, of course, direct and immediately important to patients, and also convey special messages to those who govern and manage healthcare services. Together, these decisions help to determine the quality of health care, and its financial cost. Increasingly, decision makers at all levels are under the pressure to practice medicine cost effectively, as resources are not infinite and changes in policies and clinical practice are the major factors driving the unrelenting increase in healthcare costs (Eddy, 2001).

Research into clinical decision-making, which has been studied for decades, has continued to expand rapidly (Lusted, 1968; Sackett et al., 1997; Wulff & Gotzsche, 2000). Clinical decision-making has interdisciplinary aspects, drawing from both the natural sciences and the humanities (Wulff & Gotzsche, 2000). From the perspective of software engineering, for example, research into clinical decision-making includes use of quantitative theoretical techniques and tools for modeling decisions, use of various scientific methodologies to explore how decisions are actually made, and applied research approaches to uncover how the process of clinical decision-making may be improved. Any clinical decision, whether diagnostic, therapeutic or about policy, is implicitly an argument that the decision is the best choice for the patient, or community, in a given circumstance.

Similarity with decision-making in safety engineering can be found as practiced in many industries (e.g., defense, aerospace, nuclear and railways). Here, the responsibility for ensuring system safety is primarily on the developers and operators. In several industries, it is becoming common to construct and present well-reasoned arguments that systems are acceptably safe. These arguments (together with supporting evidence) are typically referred to as “safety cases”. In practice, safety engineers have found that evidence, in and of itself, is never sufficient. Evidence is essential grounding for a given high-level claim, but it requires an act of judgment to make the connection between evidence and the overall safety claim; specifically, the bridge between the evidence and claim is usually referred to as an argument. The Goal Structuring Notation (GSN) has become one of most widely adopted means for presenting the arguments in safety cases (Kelly & Weaver, 2004; Kelly, 1998, Kelly, 2004).

In order to detect the possibility of a child having ADHD, another approach is applying a proper ontology to extract information from a diagnosis text (Mol, 2002). This text can be part of a set of unstructured (harder to extract information) or structured documents. It is a complex process because it requires the study
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