Addressing the Challenge of Clinical Pathways: Moving beyond Rules and Decision-trees

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Abstract

Clinical Pathways (CPs) are increasingly being perceived and used as a tool to improve quality of care, reduce unwarranted variation, and control costs. As their use increases, many challenges and potential barriers to pathway adoption are becoming apparent. The limitations of the current simple rule-based technologies, used to implement CPs often prevent the user from realising full potential of clinical pathways, and contribute to user pushback. Flexible, dynamic and unobtrusive implementation of CPs using cognitive decision-science and artificial intelligence based technologies can help to overcome many of these challenges.

Introduction

Clinical pathways, also called Integrated Care pathways, are defined as structured multidisciplinary care plan(s), used to channel the translation of guidelines into local procedures, with detailed description of time frames and/or criteria based progression, and aimed at standardisation of care for a specific clinical problem or situation[1]. CPs are typically developed by Providers or third-party pathway vendors, using clinical practice guidelines (CPGs) as a starting point. Though there are published standards[2] for developing CPGs, there is a lack of formal published standards for CPs[3], resulting in substantial variations in their developmental and implementation processes.

CPs are known to improve the quality of care by reducing unwarranted variation and resulting in substantial cost savings[4,5]. The recent worldwide shift in the healthcare payment model from "volume based" payments to "value based" payments has induced providers and payers to adapt CPs to standardise the care delivery and to contain costs[6]. Until now CPs have typically focused on high cost areas such as cancer chemotherapy. However, recent expansion of pathways in areas such as chronic disease management suggest that their impact will be even broader in future[6].

Physician Push-back: a Key Barrier to Pathway Expansion

A number of challenges in the implementation of CPs have been identified. In a recent review of CPs in the US healthcare setting, 85% of the respondents reported physician resistance as the most important barrier to the adoption of CPs[3].

The key reasons identified for user push-back are:

- CPs are often perceived as too restrictive and inflexible by the physicians, curtailing their choices;
- CPs often fail to differentiate unwarranted variation from good variation and make allowance for the latter;
- CPs often focus on a narrow part of care-continuum, such as chemotherapy regimen selection, leaving the rest of the care spectrum unsupported;
- The way CPs are implemented often lacks transparency and the user has no way of judging the basis of recommended and/or excluded options;
- The abundance of different payer-specific CPs creates an administrative burden for the user;
- Physicians often perceive the standardisation aspects of CPs as a threat to practicing personalised (precision) medicine

Moving Beyond Simple Rule-based Technologies

We believe that many of the perceived drawbacks of CPs are due to implementation, and are the direct consequence of limitations of the technology that is used for rendering CPs. The technology strongly influences the way CPs are conceptualised, designed and implemented.

Most CP solutions are built around IF, THEN rules, BPMN type process modelling technologies or similar decision-tree based technologies. This has helped in certain clinical situations where the rules are relatively simple, the scope of the pathway is limited and the decision options are prescriptive in nature. A few examples would be: NHS pathway tool for symptom-based triage and disposition[7], Computer-based physician order entry implementation of pathways[8] and emergency department triage pathways[9]. However, most clinical decisions are multidimensional and often require Multi Criteria Decision Analysis (MCDA) for reasoning about conflicting goals and pieces of information.

Deontics' clinical decision-support and pathway technology goes well beyond simple rules and decision-trees, making Deontics pathways flexible, multi-dimensional and situation adaptive. The advantages of the Deontics approach lies in its AI and cognitive-science underpinnings[10]. The Deontics pathway-model differentiates cognitive decision-making processes (What and Why) from work-flow processes (How). At the heart of the Deontics technology is the PRO*forma* model for the representation of clinical knowledge, and clinical decision-making processes. At a theoretical level we developed a new logical model for reasoning under uncertainty (logic of argumentation)[10], a theory of decision-making[11] that was more intuitive and versatile than classical quantitative theories (symbolic decision theory) and Artificial Inelegance based "agent" architecture[12] that could support complex workflows and adaptively respond to changing clinical circumstances. These came together in a declarative language for modelling and programming clinical tasks called PRO*forma* and a suite of application development software.

Our approach allows a clinical pathway to be designed as a cognitive decision-making process for the specific disease, where clinicians and patients makes a series of decisions, using various strands of information, including patient parameters, evidence of efficacy, cost-based policies, co-morbidities and personal preferences.

The cognitive task-network platform [13] models CPs as multi-disciplinary plans with explicit clinical objectives, allowing goal-based, dynamic and flexible execution of plans unlike typical decision trees. Each plan may contain sub-plans, multiple data capture points and decisions with options, transparently linked to CPGs, local protocols, compendiums, payer policies, primary evidence articles and clinical trials.

The argumentation-based decision-support model (Fig 1) used by the Deontics decision engine evaluates pros and cons for every decision option, reflecting the way that clinicians and patients naturally think about diagnostic and therapeutic decisions. Deontics technology can implement CPs that are capable of reasoning with multiple conflicting strands of information such as evidence quality, treatment efficacy, toxicity profile, costs or affordability, co-morbidities and patient preferences.

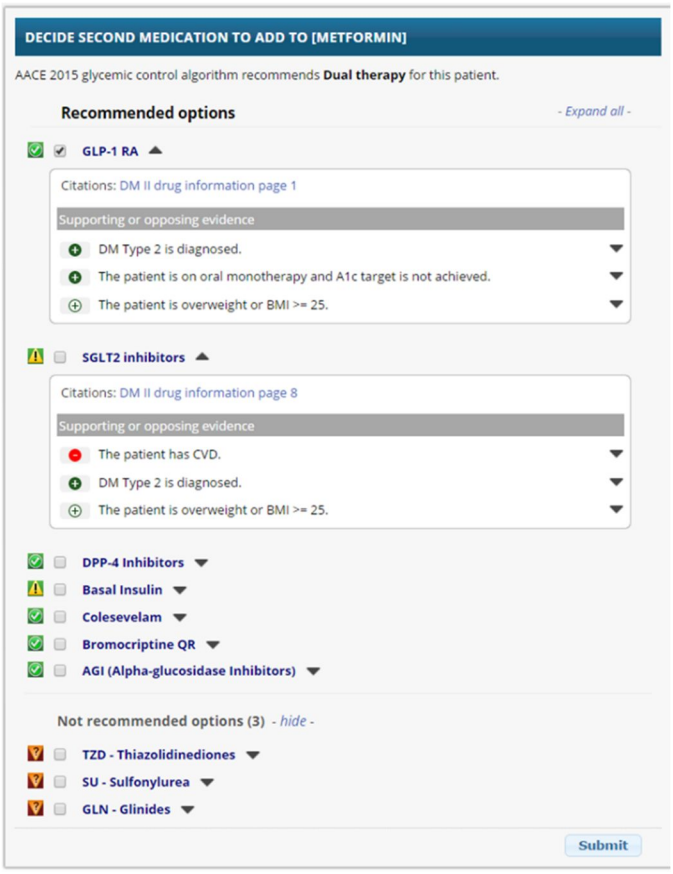

Figure 1: Screen capture from Deontics Type 2 Diabetes Mellitus Pathway

The above example is taken from Deontics diabetes pathway. The pathway suggests recommended and not-recommended treatment options as per the evidence. The options are ranked and for each option, a medical justification/reasoning is provided in the form of patient specific arguments, either for (Pros – the green dot symbols) and/or against (Cons – red dot symbols) the option.

Flexible pathways based on a cognitive model of decision-making and planning, provide evidence-based yet personalised decision-support, at the point of care, that can be highly attractive to clinicians and patients alike. The results of our prototype breast cancer pathway for multi-disciplinary team demonstrated that such technologies can enhance the decision-making in a way that is acceptable to and valued by the specialist clinical team [14].

Conclusion

Clinical pathways have the potential to significantly transform healthcare by striking a better balance of standardisation and personalisation, and at the same time controlling costs by reducing overuse, underuse and misuse of resources. However, using a rigid approach and restrictive technologies to model and implement the CP, has often been found to be unacceptable to the end user. The use of appropriate technology can improve the acceptability of clinical pathways and help to deliver the substantial potential benefits of CPs in everyday practice.

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