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Computer-based clinical decision support for general practitioners.

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A general practitioner makes many decisions within every consultation. A computer-based clinical decision support system (CDSS) is software designed to support this decision-making. It matches individual patient characteristics to a computerised clinical knowledge base and then provides patient-specific assessments or recommendations to the clinician to support a decision that can relate to diagnosis, investigation, prognosis or treatment (1). CDSSs offers the potential to translate the most up to date and robust evidence into practice. An example would include a GP being prompted to use a clinical prediction rule for pharyngitis (such as the Centor score) through a CDSS integrated into the electronic health record, after typing the word 'sore throat', with suggested management options then being delivered to the GP (2).

Evidence suggests that CDSS interventions improve physician behaviour and doctor performance, but few have been shown to deliver consistent improvements in patient outcomes, safety and cost of care. A 2013 systematic review of 166 randomised controlled trials in both secondary and primary care found CDSS improved the process of medical care in over half of included studies. However only 15-31% of studies that evaluated the impact on patient health outcomes showed a positive effect and these were typically surrogate outcomes (3). Similar findings were also seen in two systematic reviews that examined the effects of CDSS in the management of type 2 diabetes mellitus (T2DM) in general practice- between them looking at twenty eight trials (4, 5). They highlighted a variety of interventions and outcomes with short follow up periods. They concluded that CDSSs used by healthcare providers to manage T2DM in primary care are effective in improving the process of care but there was only a marginal effect on surrogate outcomes, such as HBA1c, blood pressure and lipid levels. Only two of the twenty eight trials reported a cost-effectiveness analysis.

CDSS has also been used to target prescribing in general practice with systems varying from basic drug-allergy checking and dosing guidance to more complex CDSS applications integrated within the electronic health record making individualised recommendations regarding interactions and monitoring (6). McGinn et al. randomised GPs to provide standard care or to use a clinical prediction rule for pharyngitis or pneumonia, through a CDSS (2). They showed that this CDSS intervention for the management of respiratory tract infections led to less antibiotic prescribing and less use of streptococcal antigen testing, through the insertion of the clinical prediction rules, with an absolute risk reduction in antibiotic prescribing of 9%. Similarly, the identification of potentially inappropriate

prescribing in older adults has been shown to be enhanced through CDSS, yet the effect on patient outcomes such as adverse drug events is again uncertain (7).

The features which help successful application of decision support have been well described (3). They include point of care use, at the time and location of decision making and features that require clinicians to justify their decision before they can over-ride electronic advice. As their title implies, CDSS should be designed to support the decision making process. Poorly designed interventions can frustrate physicians and alert fatigue can set in if recommendations are too numerous. It is known that primary care professionals have to perceive CDSS guidance as being useful for their clinical practice and that CDSS should not be implemented in isolation; CDSS is most effective when combined with training and education of the health professionals who use them (8). There are situations where CDSS is particularly effective, such as in detecting hazards and promoting best practices; and areas where CDSS is less effective, particularly in areas where subtle judgment is required or where the necessary data is incomplete or imprecise (9).

Experts have highlighted the need for more effective methods of decision support that improve patient outcomes and are cost effective (4, 5). To date, CDSS interventions have been designed to target patients with specific conditions but they may be more effective if used to specifically target patients with poor-control of their chronic illness or patients with a specific problem such as potentially inappropriate prescribing. These targeted approaches could be a focus of future research. Challenges also relate to the increasing need to manage patients with multimorbidity (10). How disease-specific CDSS interventions help such patients remains uncertain. Greenhalgh et al. have argued that we need to return to 'real evidence based medicine' that asks; "what is the best course of action for this patient, in these circumstances, at this point in their illness or condition?" (11). Perhaps the biggest challenge for future CDSS interventions is to translate robust evidence into clinical practice whilst preserving personalised, shared decision making with patients.

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