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Electronic nudge tool technology used in the critical care and peri-anaesthetic setting: a scoping review protocol

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ABSTRACT

Introduction Electronic clinical decision support (eCDS) tools are used to assist clinical decision making. Using computer-generated algorithms with evidence-based rule sets, they alert clinicians to events that require attention. eCDS tools generating alerts using nudge principles present clinicians with evidence-based clinical treatment options to guide clinician behaviour without restricting freedom of choice. Although eCDS tools have shown beneficial outcomes, challenges exist with regard to their acceptability most likely related to implementation. Furthermore, the pace of progress in this field has allowed little time to effectively evaluate the experience of the intended user. This scoping review aims to examine the development and implementation strategies, and the impact on the end user of eCDS tools that generate alerts using nudge principles, specifically in the critical care and peri-anaesthetic setting.

Methods and analysis This review will follow the Arksey and O'Malley framework. A search will be conducted of literature published in the last 15 years in MEDLINE, EMBASE, CINAHL, CENTRAL, Web of Science and SAGE databases. Citation screening and data extraction will be performed by two independent reviewers. Extracted data will include context, e-nudge tool type and design features, development, implementation strategies and associated impact on end users.

Ethics and dissemination This scoping review will synthesise published literature therefore ethical approval is not required. Review findings will be published in topic relevant peer-reviewed journals and associated conferences.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This review will provide a comprehensive overview of the development and implementation strategies required to embed the electronic clinical decision support technology in clinical practice.
⇒ The search strategy includes reviewing six electronic databases with peer-reviewed literature, relevant article bibliographies and a range of grey literature sources.
⇒ Only articles published in English will be reviewed which may introduce bias and limit generalisability.

BACKGROUND AND RATIONALE

Evidence-based practice amalgamates best research evidence with appropriate clinician experience.[1 2] Traditionally, efforts to improve clinician awareness and adherence to evidence-based practice has relied on implementation of up-to-date training that has varied in effectiveness.[3–6] Promoting evidence-based practice relies on the clinician's ability to digest, retain and recall large volumes of information in time-critical and often pressurised environments. Integrating behavioural change techniques with nudge methodologies to augment clinician behaviour by presenting evidence-based treatment recommendations has shown promise in recent years.[7–11] Many of us are familiar with receiving recommendations for products when online shopping; this concept is known as 'nudging'. Simply put, nudging refers to the use of tools to provide information in an environment that subtly guides one to make a decision beneficial to them, without forcing an outcome.[12] Electronic or digital nudge (e-nudge) tools use a combination of (i) information technology (IT) design functionality; (ii) information received and disseminated and (iii) interactive elements, to guide user behaviour without restricting freedom of choice.[12] The goal of e-nudge tools in healthcare is to augment clinician behaviour, improve healthcare delivery and improve patient outcomes.[13]

Early models of electronic clinical decision support (eCDS) technologies have used computer-generated algorithms, with evidence-based rule sets, to merely screen data to identify events or patients that needed to be brought to the attention of their clinician.[14] eCDS systems may generate an alert in a variety of formats, for example, a pop-up message on screen, pager device and/or text message to a designated mobile device or email. More recent evolution of

eCDS tools has led to the integration of nudge principles progressing to the point of presenting clinicians with one or more evidence-based options for clinical treatment or diagnostic modalities in tandem with an alert.[15] This offers clinicians a sense of final decision-making autonomy, while steering them towards the most appropriate behaviours or actions. Integrating nudge principles into evidence-based eCDS models in this way aims to standardise detection while optimising treatment plans and resource allocation to the right patient, in the right format, at the right time.[16] Existing eCDS tools generating alerts using nudge principles have demonstrated improved adherence to evidence-based practice guidelines, rationalised resource distribution and enhanced multidisciplinary communication.[16–21]

Critically ill patients are generally the most heterogeneous populations in hospitals with high rates of acute and chronic multimorbidity.[22] Therefore, critical care clinicians, and indeed anaesthetists, use numerous evidence-based guidelines in time-critical and, often, pressurised environments. These require accurate retention, recall and application of diverse theoretical knowledge leading to cognitive overload.[23 24] eCDS technology using nudge principles can capture validated guidelines in electronic form to prompt and advise clinicians, thereby reducing cognitive overload and assisting clinicians in their clinical decisions. In the critical care and the peri-anaesthetic settings, sophisticated technology with established capability for automated recording of multiple data sources makes these environments ideal for exploiting digitisation and introduction of eCDS tools generating alerts using nudge principles.[22–24]

Although eCDS technology incorporating nudge techniques have shown beneficial outcomes in antibiotic stewardship, prescribing practices and sepsis, such tools have not been without their problems.[20 25–27] They are inconsistently applied by clinicians[28] and challenges exist with regard to their acceptability.[27] The pace of progress in this field has allowed little time to effectively evaluate the experience of the intended user.[29] To design eCDS technology generating alerts using nudge principles for successful implementation, developers need to focus on engaging with key stakeholders to understand how innovative technology dynamically interacts with the pre-existing healthcare culture.[13 30] Addressing the challenges during the preparative or prototype phase will ultimately aid overall acceptance of such sophisticated tools.[31] This scoping review, therefore, aims to identify literature related to the critical care or peri-anaesthetic area that specifically addresses the development and implementation of eCDS technology with alerts using nudge principles and any associated impact on end users.

METHODS

This scoping review will be guided by the five distinct steps of the Arksey and O'Malley framework,[32] the Joanna Briggs Institute[2] and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews checklist.[33] We aim to begin the review in April 2022 and complete it by July 2022. Adjustments may be required to the planned protocol as the review develops. Should this occur, we will report any deviations in the final review with a rationale for the changes.

Step 1: defining the research question

A key component to successful practice change, regardless of the change model followed, is preparation. This scoping review aims to explore the literature focusing on the critical care and peri-anaesthetic setting to identify (i) What type and for what purpose have e-nudge tools been developed? (ii) How have e-nudge tools been developed and by whom? (iii) What implementation strategies or frameworks, if any, have been used? (iv) What evaluation methods, if any, have been used to measure the success of these implementation strategies on end users?

A review of this kind has the potential to shed light on the area of e-nudge tool technology use in the critical and peri-anaesthetic care setting, and provide valuable information on the strengths and weaknesses of implementation strategies.[32]

Step 2: identifying relevant articles/studies

Through a consultation process within the research team a search strategy has been developed supported by key inclusion criteria. Key inclusion criteria (table 1) were

Table 1 Population, concept and context criteria

Population	eCDS tool generating alerts using nudge principles from human data
	Patient and care providers
	Any age from preterm to adulthood
	Any sex/ethnic origin
Concept	Development, implementation and evaluation of associated impact on end users eCDS technology generating alerts using nudge principles
Context	Articles will not be limited by geographic location
	All critical care and peri-anaesthetic inpatient care settings will be examined*

*May extend to acute care inpatient setting if literature yield is insufficient.
eCDS, electronic clinical decision support.

Table 2 Search strategy*

Tool identification terms (OR)	Process terms (OR)
Clinical decision support	Implementation science or implementation
Decision support systems	Development
Computer-assisted diagnosis	Validation
Computer-assisted decision making	Setting terms (OR)
Decision support techniques	Critical care or intensive care or ICU
Artificial intelligence	Paediatric intensive care units or PICU
Cognitive aid	Neonatal intensive care units or NICU
CDSS	Peri-operative or anaesthesia or peri-anaesthesia
Nudge	Limits
Choice behaviour or decision making or choice architecture or health behaviour	English language <15 years

*Tool identification terms will be combined with process terms and setting terms then limited to the last 15 years and the English language.

categorised using the simplified population, concept, context[34] mnemonic offered by the Joanna Briggs Institute in the updated guidance for scoping reviews.[35]

Inclusion

We will include studies conducted in the neonatal, paediatric or adult critical care and peri-anaesthetic settings. Should the search yield few studies, we will extend the search to acute care in hospitals. Studies will be considered that address development, implementation and end user evaluation with preterm (neonatal) to adult participants of any age, sex, ethnicity or geographic location.

Exclusion

We will exclude studies of eCDS nudge technology implemented in the outpatient or community setting. We will exclude eCDS tools whose sole purpose was to screen and alert without the addition of recommending favourable treatment outcomes to the end user.

Search strategy

We will follow the three-step process recommended by the Joanna Briggs Institute.[35] Step 1 recommends a preliminary search using one online database. For this, we will use MEDLINE. The proposed search strategy is shown in online supplemental material 1. Step 2 uses an index of keywords and index terms derived from the results of the initial search. Possible terms are shown in table 2. The list of keywords and index terms will be used to perform a second round of searches using the following databases: EMBASE, CINAHL, CENTRAL, Web of Science and SAGE. These databases have been chosen as they cover the vast majority of publications in this area. Following on from database searches an examination of grey literature will be carried out.[36] In step 3, we will review the reference lists of all studies identified in steps 1 and 2 to identify any relevant missed studies. The final list of studies will be stored in a reference management package with duplicates removed. Searches will be restricted to the English language.

Step 3: study selection

Study selection will be conducted in two phases. First, study citations will be stored in a reference management system (Endnote). LMc will screen titles and abstracts for eligibility using the inclusion/exclusion criteria. The citations will be classified as 'included', 'excluded' and 'uncertain'. A second reviewer will check the citations in these citation categories. Any uncertainties will be discussed, and agreement reached between both reviewers. Should conflict arise, a third reviewer may be consulted to reach agreement. Given that the purpose of a scoping review is to present the available evidence in a chosen topic area rather than seeking the best available evidence, quality of evidence presented will not be assessed as part of this review process.

Step 4: charting the data

The process of charting the data refers to the extraction of data from the included studies. By extracting data consistently using a data extraction form (online supplemental material 2), we aim to extract relevant information corresponding to the aims of the scoping review questions. Two reviewers will pilot the data extraction form on a minimum of two studies to ensure reliability. All reviewers will be involved in the data extraction process. Pairs of reviewers will independently extract data from all included studies. Any conflicts or discrepancies in data extraction will be agreed by consultation with a third reviewer. The data extracted will include specific details about the context, focus of the eCDS technology, type of alert, style of nudge principles employed, style of paper (developmental, implementation or evaluation of eCDS tool), how the tool was developed (eg, clinician led or IT developer led) and tested, the implementation strategies and support resources used to introduce the tool in practice and the evaluation strategies used to assess success for end users.

Step 5: collating, summarising and reporting the results

We will analyse quantitative data using appropriate descriptive statistics and present the results in tabular form. We will analyse qualitative data using content analysis[37] and will summarise and present data in narrative form. All summaries will describe how the results relate to the review aim and questions. As is the norm for scoping reviews, the resulting narrative will not evaluate the strength of the evidence in a quantitative form.[33 38] Instead, it will focus on available literature discussing the

development and implementation strategies of eCDS tools with alerts using nudge principles to highlight any frameworks reported in the literature and their associated effectiveness in practice.

Patient and public involvement

Patients and/or public were not involved in the design of this scoping review protocol. However, intensive care unit (ICU) survivors and relatives of ICU patients have had significant input in the wider design of the multipart ATTITUDE study. The ATTITUDE study is a pre-intervention and post-intervention quality improvement project using non-participant observations and key informant interviews to design and implement a nudge tool technology to expedite invasive mechanical ventilation weaning in intensive care (ORECNI Research Ethics Committee Ref. 21/NI/0044).

Ethics and dissemination

This scoping review will collect and synthesise data in published literature therefore ethical approval is not required. We anticipate this review will highlight areas where there are gaps in the information that may be explored in future studies. The results will also provide essential information to critical care professionals, information technology experts and behavioural change scientists interested in designing and/or implementing eCDS technology with alerts using nudge principles for clinical practice, particularly in the field of critical care and peranaesthetic care. Review findings will be published in a peer-reviewed journal and presented at relevant healthcare and computational science conferences.

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Contributors LM, MS and BB conceptualised the project and drafted all aspects of the project methodology and manuscript. LL, MD, CG, RH and FK developed aspects of the background and search strategy, in addition to reviewing and commented on all aspects of the manuscript.

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Competing interests None declared.

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