Connecting Health and Humans
K. Saranto et al. (Eds.)
IOS Press, 2009

doi:10.3233/978-1-60750-024-7-506

Experience and Nurses Use of Computerised Decision Support Systems

Dawn DOWDING[ab], Rebecca RANDELL[c], Natasha MITCHELL[b], Rebecca FOSTER[d], Carl THOMPSON[b], Valerie LATTIMER[d] and Nicky CULLUM[b]

[a]*Hull York Medical School, York, UK*
[b]*Department of Health Sciences, University of York, York, UK*
[c]*Centre for HCI Design, School of Informatics, City University, London, UK*
[d]*School of Health Sciences, University of Southampton, Southampton, UK*

Abstract. Computerised clinical decision support systems (CDSS) are increasingly being used by nurses to support their clinical practice. One of the factors which may affect how nurses use technology such as CDSS may be their clinical experience. This paper uses data from a wider study examining how nurses use CDSS to examine the role of experience in nurses' use of CDSS. Data was drawn from two sources; a secondary analysis of interviews from a study examining nurses' use of CDSS in telephone triage and the analysis of observations and interviews of nurses using CDSS in two case sites. Two themes arose from the analysis of the data; the integration of knowledge from CDSS and how experience affects CDSS use. The implications of these results are discussed in relation to our knowledge of the characteristics of the development of expertise in nursing.

Keywords: Clinical decision support systems, computer-assisted decision making, nursing

1. Introduction

Computerised clinical decision support systems (CDSS) are a specific type of information technology, designed to "provide clinicians with patient-specific assessments or recommendations to aid clinical decision making" [1]. They work by matching the patient's characteristics to a computerised knowledge base, which provides the clinician with guidance using algorithms [2]. CDSS are therefore a sophisticated knowledge resource that clinicians, including nurses, can use to help with their clinical decision making in practice. Despite a lack of evidence from randomised controlled trials on the potential efficacy of CDSS use in nursing [3], there has been an increase in the use of CDSS to support nurses in extended roles such as prescribing or the management of chronic conditions [3]. As many nurses who are carrying out such extended roles are generally experienced specialists it is unclear exactly how the use of CDSS may assist them with their practice. A recent analysis of the role of expertise in the implementation of Information Technology in nursing suggests that CDSS may not further enhance the practice of nurses who are already proficient or expert in their field [4]. Nurses use of CDSS may also alter over time, as they become more experienced either in their extended role, or with the CDSS they use. Research examining how nurses working for NHS Direct (the telephone triage system used across England and Wales in the UK) has highlighted how nurses use their knowledge of the CDSS to 'manipulate' the algorithms they access to provide them with a recommendation they felt was appropriate [5]. This interaction between the expertise and experience of the nurse, and the way in which they use CDSS to inform their decision making has been relatively under-explored, and forms the basis of this paper.

2. Objectives

This paper draws on data collected as part of a project funded by the policy research programme in England, UK, to explore the role of experience on how nurses use CDSS for triage and anticoagulation management.

3. Materials and Methods

The data for this paper is drawn from two sources, a secondary analysis of an existing data set, and data collected as part of a case site analysis of nurses' use of CDSS technology in practice [6].

The data set used for the secondary analysis consisted of qualitative interview data collected by researchers at the University of Southampton UK between 2002 and 2004 as part of the National Exemplar Programme for Integrated Out-Of-Hours Care [7]. The model of care evaluated during this study involved patients' calls to the out of hours service being automatically routed to nurses working for NHS Direct who used CDSS to decide what level of care they may require (e.g. attendance at an accident and emergency department or to visit their general practitioner). A total of 53 interviews were included in this analysis.

Four case sites were purposively selected based on their differing use of CDSS. Data collected included non-participant observation of nurses using CDSS during patient consultations and in-depth interviews with nurses. The data from two case sites which used CDSS that provided specific recommendations to nurses, is included in this analysis; case site 1 where nurses managed anticoagulation therapy in a primary care setting, and case site 3 where nurses used CDSS to assist with the assessment of patients attending an NHS Walk-in centre. Full details of the case site study methods and further results have been reported elsewhere [6]. A total of 80 observations of nurse-patient consultations and 11 interviews with nurses are included in this analysis.

Data from the secondary analysis was analysed using framework analysis [8]. Data from the case site study was analysed using thematic content analysis, with themes derived inductively from the observation and interview data.

4. Results

There were two main themes that arose from the analysis; nurses' integration of knowledge from the CDSS and the effect of nurses' experience on how the CDSS was used.

4.1. Nurses integration of knowledge from the CDSS

Although not referred to explicitly by the majority of nurses interviewed in both data sets, from the case site observation data it appeared that nurses had 'integrated' knowledge contained within the CDSS they were using, which they then utilized to inform their decisions in practice. This was most apparent in case site 1 (anticoagulation management) where the nurses were observed to frequently give the patient a new dosage for their anticoagulation therapy *before* the CDSS had provided them with the recommendation. The nurses referred to the CDSS as 'confirming' the decision that they had already made in these instances:

"It's nice to see the same thing come up on the computer." (CS1 Nurse6 Int)

In case site 3 nurses reported having an in-depth knowledge of the algorithms contained within the CDSS, which meant they either did not use the algorithms, or manipulated them to provide them with the guidance they thought appropriate:

"and they'll (the experienced nurses) know that's the most suitable algorithm, because they've worked them for ages, so they know most of the algorithms anyway …. and they hardly need to read them even, 'cause they are very familiar with them." (CS3 Nurse2 Int)
"I end up almost engineering the answers, because you think 'oh I can't put that because it's going to say" (CS3 Nurse5 Int)

4.2. The effect of experience on CDSS use

The experience of nurses *before* they started working in the environment using CDSS was seen to be an important issue that managers from the secondary analysis highlighted as a factor in how they expected the nurses to use the CDSS.

"That's the reason why they employ nurses who are senior nurses in their fields …. at the end of that a disposition will be reached on the basis of the questions and the answers, now that decision can be over-ridden by the nurse advisor if she feels that other information which she would have documented which isn't actually asked as a specific question may then have a, you know an impact on what needs to be done for this particular caller so that decision is left with the nurse advisor" *(Clinical Team Leader) [NH08 W10]*

It was therefore expected that nurses would use their previous experiences to inform decisions about patient care, rather than following the advice of the CDSS without question. However, in practice nurses' experience *with the CDSS* appeared to affect exactly how they used it. In both the secondary analysis and the case sites nurses reported being more inclined to follow the advice given to them by the CDSS when they first started and had little experience in their role or with the software:

"when you first start something, if you've got an algorithm and you follow it, then it will always err on the side of caution so will the individual who is using it." (Director of Primary and Community Services) [EX29 W09]
"I think it does help when you're new, confirms things, guides you, so yeah, I think its good when you're new to the job." (CS3 Nurse3 Int)
"when you start doing the job, you do tend to rely on that more for guidance, you know, but as you get more experienced, that lessens." (CS1 Nurse1 Int)

As nurses became more experienced they were less likely to follow the guidance contained within the CDSS and be more confident in using their own professional judgment to override the recommendations, if they thought it was appropriate. In case site 1 nurses discussed in detail how they used information not contained in the CDSS to inform their clinical judgments:

"I over-ride a lot of algorithms, I really do over-ride a lot of algorithms." (Nurse) [EX02 W15]
"But we have to use our clinical judgment because there could be some different reason than what it says on the computer, the software. I mean it may be a change in their INR because of medications, foodstuffs, or they've missed doses. Do if there's a sudden drop, or just a little drop, and they've been on a steady flow ….. we'll just use our clinical judgment." (CS1 Nurse4 Int).

However, experienced nurses still used the CDSS for certain situations, and valued the information that it could provide. Many of the nurses interviewed highlighted that they would use the CDSS for unfamiliar patient cases, or as a way of ensuring that they had remembered to ask all the questions they needed to of a patient. They valued the CDSS as a 'safety net' for their practice:

" if I come across something that I haven't seen so much of in the flesh as it were, that's when I'll look at it." (CS3 Nurse5 Int)
"I think it enhances. It does underline. I think it helps you think out of the box. It does help you think more laterally because you think 'yes I've got to remember all these different aspects." (CS3 Nurse2 Int)
"But its nice to have it there, as well. I mean, even just as a prompt, an example being that if you have a very high INR, then you have to miss the Warfarin dose for one day, two days, three days whatever. It will prompt you, you know, when you put in a high reading it will prompt you." (CS1 Nurse1 Int).

5. Discussion

Nurses' experience and expertise appears to directly affect how they use CDSS to assist with clinical decision making. There are two ways in which experience appears to influence CDSS use; through the integration of the knowledge provided by the CDSS into nurses' own knowledge base, and through nurses' increasing confidence in their own professional judgement, the more experienced they become.
These findings can possibly be explained by reference to the literature on clinical expertise in medicine and nursing. As individuals become more experienced in an area, they develop integrated knowledge structures such as 'schemas', 'prototypes' or 'exemplars' which facilitate effective information processing [9]. Although nurses who begin to work with CDSS may be experienced in their clinical field, such knowledge is 'context specific' and therefore not readily transferrable to a different area of practice. Newer nurses are operating at a less experienced level with the CDSS, and therefore exhibit the characteristics of less experienced individuals, who are more likely to follow rules and guidelines when making decisions in practice (i.e. follow the CDSS guidance) [4].
As these nurses become more experienced, they incorporate knowledge from the CDSS into their own knowledge structures, and use these to inform their decision making. In other words the knowledge base from the CDSS becomes part of the experienced nurses' schema for how to deal with certain types of clinical situation. This leads to them not using the CDSS (because they already know what to do), using the CDSS to confirm what they have already decided (because they can predict what the CDSS will say) or manipulating the CDSS to gain an answer they desire (because they can work through the CDSS knowledge base easily).
As nurses become more experienced, their confidence in their own professional judgement, and their willingness to 'over-ride' the advice given to them by the CDSS also increases. With increasing experience in a particular area, nurses are able to accumulate knowledge from a variety of sources beyond that of the CDSS, which are also incorporated into their schemas, to inform practice. In situations that fall outside this knowledge base (such as when they are faced with an unfamiliar patient problem) they fall back to a reliance on the CDSS.
Although the experienced nurses in the data analysed here highlighted a number of situations where they did not use the CDSS exactly as the system designers perhaps originally intended, they did indicate that they found the CDSS useful. Although experienced nurses were likely not to use CDSS for familiar situations, or often over-rode its recommendations, they did value it as a source of guidance for their clinical practice. They recognised that they could forget to ask questions, or follow important guidance, and valued the CDSS as a 'safety-net' to ensure that this did not happen.

6. Conclusion

With the increase in the use of CDSS in nursing practice, it is important to understand the factors which influence how such systems are used in practice. Nurses' experience in a clinical area, and their experience using a specific CDSS are likely to influence exactly how they use the system in practice to inform the decisions they take.

References

[1] Kawamoto K, Houlihan CA, Balas EA, Lobach DF. Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. British Medical Journal. 2005;330:765-.
[2] Garg AX, Adhikari NKJ, McDonald H, Rosas-Arellano MP, Devereaux PJ, Beyene PJ, et al. Effects of computerized clincial decision support systems on practitioner performance and patient outcomes. Journal of the American Medical Association. 2005;293(10):1223-1238.
[3] Randell R, Mitchell N, Dowding D, Cullum N, Thompson C. Effects of computerized decision support systems on nursing performance and patient outcomes: a systematic review. Journal of Health Services Research and Policy. 2007;12(4):242-249.
[4] Courtney KL, Alexander GL, Demiris G. Information technology from novice to expert: implementation implications. Journal of Nursing Management. 2008;16:692-699.
[5] O'Cathain A, Sampson FC, Munro JF, Thomas KJ, Nicholl J. Nurses' views of using computerized decision support software in NHS Direct. Journal of Advanced Nursing. 2004;45(3):280-286.
[6] Dowding D, Mitchell N, Randell R, Foster R, Lattimer V, Thompson C. Nurses' use of computerised decision support systems: a case site analysis. Journal of Clinical Nursing. 2008;In press.
[7] Lattimer V, Gerard K, George S, Smith H, Lathlean J, Burgess A, et al. The Exemplar Programme for integrated out of hours care: Evaluation report. Southampton: University of Southampton; 2004.
[8] Ritchie J, Spencer L. Qualitative data analysis for applied policy research. In: Bryman A, Burgess R, editors. Analyzing qualitative data. London: Routledge; 1994. p. 173-194.
[9] Norman G. Reseach in clinical reasoning: past history and current trends. Medical Education. 2005;39:418-427

Email address for correspondence dawn.dowding@hyms.ac.uk