Clinical Decision Support: Evaluating the Development of a Tool for Nurses

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Abstract. VAR Healthcare is a clinical decision support system for nurses that aspires to become even more advanced. By applying The Five Rights model, we have evaluated the status and direction of its development to bring potential lacks or barriers into the fore. The evaluation shows that ensuring APIs that will allow the nurses to combine the assets of VAR Healthcare with information on individual patients from EPRs would bring advanced decision support to nurses. This would adhere to all the principles of the five rights model.

Keywords. Clinical Decision Support, knowledge support, Five Rights model, electronic patient record systems, documentation of nursing, evidence-based procedures, evidence-based guidelines.

1. Introduction

Health care has become extremely complex. There are more complex patient situations, numerous professions involved, complex information flow, and higher turnover of patients. Additionally, treatment and nursing has become extremely advanced, exposing health care personnel to loads of knowledge and an increasing scope of new research that should be made available to and implemented into practice. Thus, there is a need for, and an expectation that digital tools would assist health care personnel in keeping an overview of their patients and providing updated treatment- and care regimes.

The benefits of Electronic Patient Records (EPR) have been increasingly recognized in healthcare. If Clinical Decision Support (CDS) is provided within EPRs based on practice guidelines, care can be provided based on evidence and best practice to achieve better quality and efficiency [1-5]. Yet another promising potential for CDS is the ability to close the gap between clinical practice, research, and education [6]. However, there is a lack of a general CDS that can support nurses across patient conditions, and of systems that are fully integrated with the EPR systems [5,7]. Research on CDS utilization has mostly targeted physicians, with little mention of nurses [8]. The studies of CDS that exists in nursing are mostly tools within the acute care settings and for single clinical conditions, e.g., pressure ulcers haemodynamic instability, respiratory distress, and infection detection [9]. Also, there is a lack of studies that includes CDS development, and a lack of usability studies [7].

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The core of decision support for nurses is evidence-based interventions with connected nursing diagnosis and patient outcomes. Specifically, nurses need support to define and document nursing diagnosis and these should be predefined and anchored in research and provided automatically [8].

Besides standardized, structured data, decision support presupposes a knowledge base that can be combined with the data on individual patients [10,11].

Despite high expectations of quality achievements, it has been difficult to bring decision support systems into routine use in clinical practice. Four characteristics have been identified that significantly contributed to improve clinical practice; the CDS is automatically available in the clinical workflow, the support is provided through the system at the time and place (site) of the decision, provides practical advice / references, and are computer-based [4]. CDS that is an integrated component of the patient record or its order entry system, are significantly more likely to improve clinical practice than standalone systems [3,12].

VAR Healthcare (VAR) started as a public research and development project and is a well-established and still growing CDS system for nurses and is being widely used across the continuum of care and patient conditions in Norway and Denmark the last 20 years. Because the usage is covering primary and secondary care, as well as education in nursing and healthcare this tool closes the gap between clinical practice, research and education. This system consists of evidence-based procedures (interventions) with belonging knowledge summaries (rationales), nursing diagnosis and goals. The content is continuously updated and is integrated to the EPR systems. Furthermore, it is based on various standards and structures, e.g. the ISO, International Organization for Standardization, 9000), and a conceptual model based on four key concepts: well-being, integrity, prevention, and safety (VIPS). VIPS is a structure and keywords for representation of nursing care in patient records. [13,14].

VAR also utilizes reference terminology (International Classification for Nursing Practice - ICNP) to ensure interoperability, an advanced search engine and the possibility to further develop sustainable integrations and information flow across systems [15,16]. A few research projects have involved VAR. However, VAR seems to respond to the gaps in research and development. Therefore, our aim was to evaluate VAR as a decision support tool by using the Five rights model [12] as a framework.

2. Methods

We used a case study approach with a formative evaluation of the VAR tool. The aim was to evaluate and document the development and use of VAR Healthcare and ensure that the tool was evolving in the right and meaningful direction for an advanced clinical decision support tool for nurses.

We used the CDS Five Rights model as a framework. This framework has been widely used for such analysis and is considered a best practice approach for quality improvement and healthcare outcomes, when the interventions in the CDS transfer the right information, to the right person, in the right format, through the right channel at the right time in the workflow [12].

The right information means evidence-based information that provide guidance or advice for relevant, best practice. Examples may be clinical guidelines, procedures or pathway templates.

The right person refers to the person who need the support for best possible process and outcome. This can be health care professionals (physicians, nurses, pharmacist, etc), patients, and/or their next of kin/caretakers.

The right format refers to how the support is given i.e. data displays, documentation tools, care plans, registry reports.

The right channels might be a clinical information system like the electronic health record system, or more general channels like Internet, mobile technology systems, smart home devices and patient portals.

The right time refers to the timing of the support or guidance in the clinical workflow or –process.

The analysis used 1. the described steps in VAR Healthcare's development and its components, 2. the gaps in CDSSs described in literature [6-8], 3. in depth information of the tool in terms of a synthesis of findings from a previous case study covering a) literature review of studies and publications with VAR, b) e-mail inquiries to the VAR team c) interviews with super users of the VAR tool [17]. The findings of these three main elements were mapped to the Five Rights principles/components.

Two researchers conducted the evaluation independently and met for comparison and discussions until consensus was reached.

3. Results

The right information. The core in VAR Healthcare are procedures for nurses that are anchored in research and best evidence/practice, and furthermore that is used across settings in healthcare. The knowledge base in VAR is rooted in science, personal and collective experience, as well as professional traditions.

Also, systematic and structured use of nursing theories and models are part of the foundation. This is line with the findings in literature of CDS in nursing, where authors suggest use of theories to improve the realizations of CDS in nursing practice [6]. VAR has been used across health care settings and education through 20 years, hence the practical knowledge and experience-based knowledge has developed cumulatively based on input from experts across settings, regions, and countries. The previous case study uncovered the users wishes for more procedures to be developed and this is put into system in a continuous process of development and maintenance in VAR.

The right person. VAR Healthcare is developed for nurses, by nurses. Increasing and strengthen nurses' competences is an important assumption to strengthen patient safety, continuity of care and positive patient outcomes. Not only providing the right content to the right person but providing the pedagogical perspective and research findings have the aim of supporting nurses to provide and understand the rational for their actions. This aims at increased reflection over practice and professionality.

The right format. VAR provides evidence and knowledge in a practical manner and language, and illustrations are in concordance with the text also through the up-dates. Technology has been utilised to provide various levels of information based on the user's need, e.g., a nursing student or a nurse who needs more in-depth information can open a full vision of the main steps of the procedure, while experienced nurses might only need the main steps of the procedure or just a glance of a detailed animation or illustration. A grading system of changes and knowledge tests that guides the nurse to find the right answer, ensures lifelong learning and help nurses keep up to date as an integrative part of their work. Technologically the tool has a responsive design and adjusts to the various

devices, has been found easy to use and user-friendly. Information from the case study report uncovered that the knowledge summaries was less used.

The right channels. VAR is web-based and has a responsive design, meaning that VAR can be accessed from different devices, like the computer, smartphones and tablets, on Android and IOs devices. The access is over IP, so the nurses does not have to log in, but they can register as personal users for access from their private devises too. Perhaps most important is that it can be reached through integrations in EPRs. Literature shows that CDS as an integrated component of the patient record or its order entry system, were significantly likely to improve clinical practice than standalone systems [3,12].

The right time. Integrations with EPR systems also enables nurses to have decision support in their clinical workflow, at the time they need it. The advanced search engine allows for quick and easy access to actual procedures in a busy daily life, included support to find (remember) what interventions to perform in various patient situations (problem and risk diagnosis). The use of ICNP in VAR will be of importance for building further support, including serving nurses information at the right time, as certain information about the individual patient might trigger certain procedures, nursing diagnoses or goals (expected outcomes) and can be served to the nurses automatically. This will enable nurses to act on real-time information, instead of acting retrospectively.

4. Concluding Discussion

The evaluation uncovered that VAR qualifies well based on the Five Rights. A general knowledge system, using standard terminology that ensures interoperability, to be used across continuum of care and across countries/languages, has not been described in the literature. Also, the system is in continuous development. The findings from the case study used in the evaluation shows that the nurses are satisfied with the tool and the services provided. However, one part of the content was found to be less used: the knowledge summaries declaring the rationale for the procedures. This information is important to strengthen in clinical practice to make nurses realise and become aware of why they are promoting actions, be confident in providing best practice to patients, and improve collaboration within and across health professions. It should be considered whether a re-ux design is needed to support the nurses better in using this part of the tool.

Also, the Five rights model can be used to strengthen the implementation and use of VAR in practice. To ensure continuous, clinical care of good quality, ensure patient safety and best possible health outcomes, data must be structured and must be of good quality. Clinical Data models (CDM) and reference terminologies/-models are needed to ensure even semantic interoperability. The advanced search engine in VAR serves as a decision support tool and is evolving in the right direction to become an advanced clinical decision support system for nurses across settings and countries. However, attention should be given to "the right time" of the rights in the Five Rights model. To utilize the benefits from structured data, clinical data models and the reference terminology, close collaboration with EPR vendors should be established. There is a need to develop deeper integration, e.g. based on rest-call APIs with the EPR systems, to provide nurses with automatic suggestions based on a combination of information on individual patients from the EPR and evidence-based suggestions from VAR. Such integrations would bring CDS to the next level that could further optimize clinical practice and documentation – the next level of decision support for nurses. Nurses will be able to practice nursing care

of the highest quality, based on evidence, and more efficiently, which in turn contributes to integrated care pathways and patient safety, as well as better use of the resources.

Moreover, the combination of high-quality knowledge base and real time patient data from the EPR, may ensure better quality data for statistics and research.

References

[1] Hyruk LA. Information Systems and Decision Support Systems: What are they and how are they used in nursing? AJN. 2012 112(1):62-65

[2] Wang P, Zhang H, Baohua L, Lin K. Making Patient Risk Visible: Implementation of a Nursing Document Information System to Improve Patient Safety. In Sermeus W. et al. (Editors). IMIA and IOS Press. 2016 Doi: 10.3233/978-1-61499-658-3-8.

[3] Barretto S, Warren J, Goodchild A, Bird L, Heard S, Stumptner M. Linking guidelines to Electronic Health Record design for improved chronic disease management. AMIA Symposium. 2003 66-70.

[4] 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. MBJ. 2005 330: 765

[5] Sim I, Gorman P, Greenes RA, Haynes RB, Kaplan B, Lehmann, H, Tang PC. Clinical Decision Support Systems for the Practice of Evidence-based Medicine. J. Am. Med. Inform. Assoc. 2001 8: 527–534.

[6] Van der Lei J. Closing the loop between clinical practice, research, and education: the potential of electronic patient records. Methods Inf. Med. 2002 41: 51–54

[7] Lopez K, Febretti A, Stifter J, Johnson A, Wilkie D, Keenan G. Toward a More Robust and Efficient Usability Testing Method of Clinical Decision Support for Nurses Derived From Nursing Electronic Health Record Data. International Journal of Nursing Knowledge. 2017 28(4): 211-218

[8] Borum C. Barriers to hospital-based nurse practitioners utilizing clinical decision support systems. CIN Computers Informatics Nursing. 2018 36(4):1

[9] Bennett P, Hardiker NR. The use of computerized clinical decision support systems in emergency care: a substantive review of the literature. J Am Med Inform Assoc. 2017 May 1;24(3):655-668. doi: 10.1093/jamia/ocw151

[10] Beslutningsstøtte: Definisjoner, status og forvaltning av ulike former for IKT-basert klinisk støtte. Rapport fra ekspertgruppe. Versjon 1.0. Oslo: Helsedirektoratet; 2014: https://www.nsf.no/Content/1527347/Beslutningsst%C3%B8tte%20rapport%202014_v1%200%20%282%29.pdf Accessed June 15, 2022

[11] Goossen-Baremans A, Collins S, Park HA. Semanticification in connected health. Stud Health Technol Inform. 2017 232:133-151.

[12] Osheroff JA, Teich JA, Levick D. et al. Improving Outcomes with Clinical Decision Support: An Implementer's Guide. 2nd Edition. Chicago, IL: HIMSS, 2012. American Medical Informatics Association. 2017 24(3): 669-676.

[13] Ehrenberg A, Ehnfors M, Thorell-Ekstrand I. Nursing documentation in patient records: experience of the use of the VIPS model. Journal of Advanced Nursing. 1996 24 (4): 853-867.

[14] Ehnfors M, Ehrenberg A, Thorell-Ekstrand I. Nya VIPS-boken. Välbefinnande, integritet, prevention, säkerhet. 2. utg. Lund: Studentlitteratur; 2013

[15] ISO/TS 13972; 2015 (en). Health informatics – Detailed clinical models, characteristics and processes https://www.iso.org/obp/ui/#iso:std:iso:ts:13972:ed-1:v1:en, Accessed 24.07.22

[16] WHO family of classifications: https://unstats.un.org/unsd/classifications/Family/Detail/1024 Accessed June, 15, 2022

[17] Rotegård AK, Fossum M. Fra oppslagsverk til beslutningsstøtte–VAR Healthcare som case. Digitalisering i sykepleietjenesten–en arbeidshverdag i endring. 2019 p.177-200