

Nurses' use of computerised decision support systems affects drug monitoring in nursing homes

ROSE-MARIE JOHANSSON-PAJALA RN, MSc¹, LENA-KARIN GUSTAFSSON RN, PhD², KERSTIN JORSÄTER BLOMGREN RN, PhD², JOHAN FASTBOM MD, PhD³ and LENE MARTIN RN, PhD⁴

¹PhD-Student, ²Senior Lecturer, ⁴Professor, *School of Health, Care and Social Welfare, Mälardalen University, Eskilstuna*, and ³Professor, *Aging Research Center, Karolinska Institutet, and Stockholm University, Stockholm, Sweden*

Correspondence

Rose-Marie Johansson-Pajala
School of Health
Care and Social Welfare
Mälardalen University
PO Box 325
SE-631 05 Eskilstuna
Sweden
E-mail:
*rose-marie.johansson-
pajala@mdh.se*

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Aim To describe variations in nurses' perceptions of using a computerised decision support system (CDSS) in drug monitoring.

Background There is an increasing focus on incorporating informatics into registered nurses' (RNs) clinical practice. Insight into RNs' perceptions of using a CDSS in drug monitoring can provide a basis for further development of safer practices in drug management.

Method A qualitative interview study of 16 RNs. Data were analysed using a phenomenographic approach.

Results The RNs perceived a variety of aspects of using a CDSS in drug monitoring. Aspects of 'time' were evident, as was giving a 'standardisation' to the clinical work. There were perceptions of effects of obtained knowledge and 'evidence' and the division of 'responsibilities' between RNs and physicians of using the CDSS.

Conclusion The RNs perceived a CDSS as supportive in drug monitoring, in terms of promoting standardised routines, team-collaboration and providing possibilities for evidence-based clinical practice.

Implications Implementing a CDSS seems to be one feasible strategy to improve RNs' preconditions for safe drug management. Nurse managers' engagement and support in this process are vital for a successful result.

Keywords: computerised decision support systems, drug management, nurses, patient safety, phenomenography

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Introduction

Nursing homes provide medical treatment and care for frail patients often with extensive drug treatment (Tolson *et al.* 2013). Inappropriate prescribing is common, leading to an increased risk of adverse drug events (ADEs) and emergency care visits, as well as

reduced health-related quality of life (Cahir *et al.* 2014). It has been suggested that the use of computerised decision support systems (CDSS) in drug monitoring contribute to safer drug treatments (Clyne *et al.* 2012). A number of studies have focused on the use of CDSS to improve drug management in elderly, from the physicians' and pharmacists' perspective

(Ulfvarson *et al.* 2010, Lapane *et al.* 2011). Fewer studies have focused on registered nurses' (RN) use of such systems, despite the fact that, in reality, the review of drug treatments is to a large extent performed by RNs (Vogelmeier *et al.* 2011).

RNs' role in patient care has evolved, including their use of informatics. Nursing informatics refers to the integration of nursing science, computer technology and information science, in order to enhance the quality of care (Carrington & Tiase 2013), and is identified as one of the six core competencies constituting the RNs' professional role (Cronenwett *et al.* 2009). There is a growing awareness of the quality effects of incorporating informatics into the workflow of RNs providing care for elderly patients (Bowles *et al.* 2015), but still, there is a lack of research from these settings (Carrington & Tiase 2013). An increasing number of nurse-led studies demonstrate improved outcomes using informatics within e.g. malnutrition and pressure ulcer risks (Fossum *et al.* 2011, Beeckman *et al.* 2013). Medication administration and the use of CDSSs have been identified as emerging themes within nursing informatics (Carrington & Tiase 2013). The use of such systems can be considered to be particularly justified regarding RNs' drug management in nursing home settings. This is because the RNs have the overall responsibility for patients with extensive drug treatments and complex health problems, whereas the physicians have a limited role (Tolson *et al.* 2013). Moreover, RNs depend on other health care professionals to monitor drug treatments and ensure drug safety, often making decisions based on vicarious assessments from the staff (Johansson-Pajala *et al.* 2016). Previous research shows that RNs' use of a CDSS, allowing targeted observations on adverse drug reactions, contributed to the detection and reporting of adverse drug reactions and formed the basis for interdisciplinary medication reviews (Dilles *et al.* 2013).

Multidisciplinary teamwork, also identified as a core competence for RNs (Cronenwett *et al.* 2009), is advocated regarding the monitoring of drug treatments, and so is the use of a CDSS in this process (Steinman *et al.* 2011). Additionally, RNs are urged to recognise their roles and responsibilities within the team as regards monitoring, evaluating and challenging poor prescribing and drug administration practices (Dingwall 2007, Nordin Olsson *et al.* 2014). It has even been recommended that they should be at the forefront of structured drug monitoring (Gabe *et al.* 2011). Consequently, the RNs' perspective in relation to the use of a CDSS in drug monitoring needs to be emphasized. To the best of our knowledge, no studies

have focused on RNs' perceptions about using CDSSs and how these affect their clinical practice. Therefore, the aim of the present study was to identify and describe variations in RNs' perceptions of using a CDSS in drug monitoring.

Methods

Design

The study has an explorative qualitative design with a phenomenographic approach. Phenomenography is a method for describing the qualitatively different ways in which people experience, conceptualise, perceive and understand phenomena of the world, in this study being the use of a CDSS. The descriptive variations of experiences have structural and referential aspects. The former relates to the discernment of the whole as well as the parts, and their relationship within the whole, whereas the latter, concerns the meaning and the overall attributes of the phenomena (Marton & Booths 1997). A phenomenographic approach, yielding insights into variation, makes it possible to develop a greater understanding of the phenomena under study, and based on this, improve and enhance current practice (Yates *et al.* 2012).

Setting and process

The study was conducted in four nursing homes, altogether housing approximately 250 residents, situated in an urban district of Sweden. Between three and eleven RNs were working in each nursing home while the physicians were situated in health care centres. The nursing homes had a routine of performing yearly medication reviews, according to Swedish regulations (Swedish National Board of Health and Welfare 2012) and had recently adopted the use of a web-based CDSS as a support in that process. This system retrieves patient-specific information from the available drug lists, electronic medical records and symptom assessments, and then provides quality reports based on indicators compiled from national and local recommendations and guidelines. The quality reports provide information about e.g. inappropriate drugs, potential drug–drug interactions, contra-indications and possible adverse drug events. The medication review process was the same as before the implementation of the CDSS, the only difference being that the information was previously audited by a distant pharmacist, a procedure which now had been replaced by the use of the CDSS.

Participants

The participants were RNs working in nursing homes where the CDSS was used on a regular basis. The initial contact was made by the community head nurse. From a total of 21 RNs, 16 gave their consent to participate, whereas the remaining five declined because of having none or very short experience (Table 1).

Data collection

The interviews were carried out at the RNs' workplace in 2015 and lasted up to 30 min each. They were preceded by two pilot interviews to validate the entry questions in relation to the phenomena in focus. The same entry questions were asked in all interviews, 'What are your perceptions of using a CDSS in drug monitoring', followed by, 'When and how do you perceive a CDSS as supportive or impeding your work?' These were followed by probing questions, to encourage the participants to develop and clarify their answers.

Data analysis

The analysis was made in accordance with a phenomenographic approach guided by Dahlgren and Fallsberg (1991) (Table 2).

Results

Four descriptive referential aspects with a total of 13 structural aspects constituted RNs' various perceptions of using a CDSS in drug monitoring (Table 3). Aspects of 'time' in relation to using a CDSS were evident, as was giving a 'standardisation' to the clinical work. There were perceptions of effects of obtained knowledge and 'evidence'. Finally, all aspects could be viewed in relation to the division of 'responsibilities' between RNs and physicians regarding using the

Table 1
Demographic and clinical characteristics of the participants ($n = 16$)

Characteristics	<i>n</i>	Median
Women/men	14/2	
Age	31–64	51
Years in the profession	3–42	13.5
Years in the present nursing home	0–13	3.25
Years of experience in using the CDSS	0.5–3.5	1
Responsible for number of patients		
Daytime	7–34	
Evening/weekend	96–124	

CDSS, computerised decision support system.

Table 2
The seven steps in the process of analysis

Steps of analysis	Process of analysis
Familiarisation	The interviews were carefully read to get acquainted with the details
Condensation	Significant statements were selected, that represented the entire dialogue concerning the phenomena
Comparison	The selected statements were compared, to identify variations or agreements
Grouping	Answers which appeared to be similar were compiled
Articulation	Structural aspects were obtained by describing the essence of the similarity within each group of answers
Labelling	Referential aspects were formed by constructing suitable linguistic expressions for the various aspects
Contrasting	The obtained aspects were compared regarding similarities and difference

Table 3
The aspects of RNs use of CDSS in drug monitoring

Referential aspects	Structural aspects
Time	Focus on variations in aspects of time: Yet another time-consuming computer system It takes time but it's worth it Time-saving administrative procedures resulting in a quicker response and action
Standardisation	Focus on variations in aspects of standardisation of procedure: Affecting the RNs' own clinical practice Calling for the involvement of others Giving prerequisites for overall control
Evidence	Focus on variations in aspects of evidence: Individual pharmacological training for RNs Becoming alerted to the patients' conditions Being prepared to face the physician Promoting overall evidence-based practice
Responsibility	Focus on variations in aspects of responsibility: A tool for RNs Shared responsibility between RNs and physicians The physician should take the ultimate responsibility

RN, registered nurse; CDSS, computerised decision support system.

CDSS, and ultimately the responsibility for the patients' drug treatments.

Time

Aspects of time were frequent in RNs' perceptions and were based on the fact that it was the RNs who used and administered the CDSS. The RNs'

perceptions ranged from that the system was time-consuming to that it was time-saving.

Yet another time-consuming computer system

Some RNs spoke of the CDSS as yet another computer system which increased the time they had to spend on administrative tasks. They claimed that they had become more like administrative personnel than nurses participating in bedside care. Subsequently, the CDSS was perceived as depriving them of valuable time that could have been spent, caring for their patients.

‘It always takes time to sit by the computer, it actually takes time away from the patients ...’
(#1)

It takes time but it's worth it

Although some RNs expressed that it took some time to use the CDSS, they could see advantages, both in relation to previous routines and for the patients. The required time was also related to the degree of knowledge and capability of using the system, as some RNs experienced it a bit complicated.

‘From the beginning I thought, oh help one more thing we must do...we have so many registers to fill in...but that was only in the beginning, I can see the advantage with it’
(#10)

Time-saving administrative procedures resulting in quicker response and action

A common perception was that the use of the CDSS in medication reviews had saved time. The new procedure limited the time required by not having to send documents to distant pharmacists and wait for their reply. Instead, the RNs received an immediate response which they presented to the physician, and necessary actions could be taken. Through this faster procedure, RNs perceived that they were able to finish the job and also see that their patients received help more quickly with drug adjustments.

‘Great that we do not have to send a lot of paper back and forth and back and forth, and that we get a quick result and a quick response’
(#13)

Although time was saved, some RNs expressed that the quality of the responses differed from previous medication reviews, in that the CDSS presented a quality report and no specific recommendations

for actions, something that the pharmacist could provide.

Standardisation

This referential aspect focused on standardised procedures for medication reviews. The use of the CDSS ensured that a certain structure was followed where requested data were obtained and entered into the system. This was a standardised and documented process which affected the RNs' own clinical practice, and in the next step also the involvement of other health care professionals and family members. From a wider perspective, this standardisation also gave prerequisites for overall control.

Affecting the RNs' own clinical practice

Within this structural aspect many of the RNs stated that the CDSS provided them with a structure for how to conduct a medication review; a standardisation which was perceived as beneficial as it implied that all RNs would perform the review in the same way. The RNs' clinical practice also became more explicit since their activities were clearly documented.

‘If you imagine that there are many cooks in the broth here, then it's good if we get a standardised way of looking at different things. As individuals we have different approaches ... but you get a standardisation that I think is good’
(#6)

Furthermore the standardisation contributed to gathering all the data in the same place, giving an overall picture of the patient's health condition. This facilitated the RNs' clinical practice since they could follow and compare the patients' health condition and drug treatments over time.

Calling for the involvement of others

Some RNs expressed that the standardised procedure called for involvement with others. The procedure requires that the patients' symptoms are evaluated according to a symptom assessment form, which is a task that the RNs usually cannot manage themselves as they do not know the patients well enough. Subsequently, they need to collaborate with the nursing staff and family members when the patients cannot speak for themselves.

‘The idea is that we should do it [the symptom assessment] in the team, nursing staff, contact

person, nurse, occupational therapist... to get as comprehensive an assessment as possible'

(#5)

Many RNs stated that the process of conducting a medication review requires teamwork. However, there was a wish for increased collaboration, particularly with the physicians.

Giving prerequisites for overall control

Many RNs stated that the standardised process provided possibilities for controlling the drug treatments from a wider perspective. Statistics could be extracted at a group level, such as from different wards. These could then be compared and form the basis for discussions. Some RNs suggested that comparisons could even be made on a community or national level.

'We can withdraw statistics which we can bring to the team meetings... we can see that we have made this many medication reviews and these drugs have been removed'

(#2)

Evidence

The area of evidence ranged from the individual to an overall perspective. The RNs use of the CDSS had an impact on their own pharmacological knowledge. The retrieved information also alerted them to potential risks for the individual patient and further prepared them to discuss these with the physician. Ultimately this was considered to promote the overall evidence-based practice.

Individual pharmacological training for RNs

Many of the RNs expressed that they received further training in the area of pharmacology. They learned more about drug effects and ADEs. The obtained knowledge increased the RNs' pharmacovigilant awareness in the sense that they became more attentive to potential risks with drug treatments for older persons, in general, as well as possible associations between drugs and various symptoms.

'You learn what things the system refers to, interactions or potential risks and you will then get everyday knowledge, like when you get a new patient and see all these drugs and think this we have to look into'

(#6)

Becoming alerted to the patients' conditions

Many RNs perceived the CDSS as an eye-opener. By viewing the quality reports they were alerted to possible connections between the individual patients' condition and their drug treatments. The information could make them think in new ways or confirm their own previous suspicions.

'You might become a little more attentive to certain things... maybe a lamp lights up and you think oh well maybe that is why this patient is falling so much. Yes a little wakeup call sometimes'

(#7)

However, they were aware that it was a computer system, dependent on the data that were entered into it. Consequently, the results were assessed in relation to what would be best for the individual patient.

Being prepared to face the physician

A common perception was that the RNs became prepared for facing the physician. They could get ideas about the problems they should bring up for discussion, and also present suggestions for the actions they thought should be taken. These involved suspicions of possible ADEs, suggestions for drug adjustments or discontinuation of treatments. Additionally, the preparedness gave them evidence which they used to motivate and even persuade the physicians about specific actions which they regarded as necessary.

'I felt that I gained more knowledge and that I might be able to use that when I'm talking to the physician about a drug. This is on the basis that I know how the patient feels and how the patient acts in their daily life'

(#9)

Promoting overall evidence-based practice

The CDSS could be perceived to promote evidence-based practice and thus patient safety overall. The RNs expressed that they continuously tried to reduce the number of drugs, and hence the risks of ADEs. They were supported in these attempts as they assumed that the obtained reports were based on the latest research and current guidelines. This increased their confidence that the patients were receiving appropriate and safe treatment.

'I'm thinking that it is a way [using the CDSS] to review and modify drug treatments overall -to reduce the use of inappropriate medication, I

think that this in some way must be the overall aim'

(#4)

Responsibility

This referential aspect focused on issues regarding responsibilities to use the CDSS. A variation of perceptions were revealed, ranging from this use being the RNs' responsibility to being primarily the physicians' responsibility.

A tool for RNs

Some RNs perceived that the CDSS was a tool mainly for them. This was because RNs were closer to the patients and thus could see and assess changes in the patients' health condition which could be related to their drug treatments. Some RNs even thought that they should take more responsibility and view the reports in more detail.

'He [the physician] reads the reports from the CDSS... he looks at them and then makes a decision... I'm a little on the side, too much on the side, which I do not like, and it depends on myself'

(#3)

Shared responsibility between RNs and physicians

This aspect included perceptions about shared responsibility. According to the existing routine, it was the RNs who planned the medication reviews and entirely handled the CDSS. Many RNs expressed that the physician should take more responsibility in this process. They requested greater involvement and interaction with them, which could include aspects of dedicated time, interest and suggestions about potential drug adjustments.

'If the physician had more time, and more, if I am to be mean, interest, then you could work more actively with it [the CDSS report]'

(#11)

The physician should take the ultimate responsibility

The RNs claimed that the physicians were ultimately responsible for the patients' drug treatments. Still, they perceived that much responsibility was put on them, and they felt compelled to be well informed and prepared before the medical rounds. Subsequently, they read the reports and prepared questions and suggestions about the current drug treatments, even although they expressed it should primarily be the physicians' responsibility to assess them.

'It is the physicians' responsibility to prescribe and end drug treatments, I insist on that, it is not RNs' responsibility to keep track of adverse drug reactions and which drugs do this and that...of course I am interested but it is not really our responsibility to do this'

(#14)

Discussion

Main findings

The findings show that a CDSS affects RNs' clinical practice. It provides a standardised way of working, which is perceived as beneficial as it implies that all RNs follow the same routines; an aspect of particular importance if there is a lack of staff continuity or high employee turnover, but also regarding possible differences in the professionals' medication competence. The standardisation could thus be considered to promote drug safety and hence patient safety. Additionally, it calls for the involvement of others, encouraging teamwork, an effect previously described by Ulfvarson *et al.* (2010) in relation to the use of a CDSS in medication reviews. Teamwork, based on shared responsibilities, has been identified as a key factor for improving drug monitoring in clinical practice (Steinman *et al.* 2011). However, in the present study, some RNs wished for increased collaboration and responsibility-taking from the physicians. This aspect has been highlighted previously, where RNs expressed uncertainty about the responsibility to monitor drug effects (Dilles *et al.* 2011, Johansson-Pajala *et al.* 2016). In the present study, the CDSS was handled by the RNs, who additionally took on a great responsibility to view the reports and assess whether drug adjustments were required. Although the RNs wished the physicians were more involved, they still perceived the system to be beneficial for their clinical practice. Previous research has described the importance of physicians' engagement in successful implementation of CDSSs, but similarly to the present findings, the RNs proved to be capable of introducing and using the system without their engagement (Randell & Dowding 2010).

The information retrieved from the CDSS was perceived to increase the RNs' general awareness of potential risks. Considering that knowledge about drugs is the most urgent area of education in elder care (Karlstedt *et al.* 2015), the use of such systems can benefit RNs' pharmacological training and

ultimately enhance the quality of care. Previous research has likewise advocated that RNs should be provided with access to informatics and best practice information to support their learning needs and promote evidence-based practice (Doran *et al.* 2012). The information also served as an eye-opener for potential drug-related problems and based on the RNs' knowledge about the patients they were prepared to question the drug treatments. They could also, similar to what Dowding *et al.* (2009) describe, use the information to monitor patients' progress and confirm their own previous assessments.

This study provides insight into the phenomena of how RNs perceive the use of a CDSS in drug monitoring. Given that RNs have an important role in ensuring drug safety (Choo *et al.* 2010), and that new strategies have been requested to facilitate their possibilities to do that (Johansson-Pajala *et al.* 2016), the present study shows that a CDSS can be a useful tool in this endeavour. The results may be perceived as giving an overly positive picture of the RNs' comprehension; however, this corresponds to previous findings, showing that RNs have a positive attitude towards informatics (Huryk 2010). There were perceptions that the CDSS was yet another time-consuming computer system, which deprived the RNs of time with the patients. Still, they perceived advantages with respect to time-saving and enhanced patient safety. As previously reported, informatics are meant to be supportive. Hence the primary focus must always be the individual patients' needs (Bowles *et al.* 2015). This appeared to be in line with the present findings, as the RNs perceived that the quality reports should be validated in relation to the individual patient, providing the possibility for the RN to evaluate them with respect to the patients' needs.

Methodological considerations

The strength of a phenomenographic approach is that it provides knowledge about variations in ways people experience phenomena (Marton & Booths 1997). Thus, it cannot be concluded how well these results correspond to the phenomena in reality, as the assumption is that the reality depends on the describer. Still, it can provide a rough picture of the variation of RNs' perceptions of the matter. The credibility of the study is, as Sjöström and Dahlgren (2002) describe, based on a precise description of the research process and that excerpts from the interviews are presented to support the relevance of the results.

The study was performed in settings where the RNs previously had a routine of conducting yearly medication reviews with the support of a pharmacist at a distance. This might have affected the outcome in favour of the CDSS, as the RNs understandably compared the two ways of working, the former being perceived as a more time-consuming process. The outcome would probably have been different if the settings had no previous routines about conducting medication reviews. However, medication reviews have been mandatory in Sweden since 2012, and all settings should perform them yearly on all patients 75 years or older who are prescribed at least five drugs.

Implications for nursing management

This study focuses on RNs' use of informatics, described as one of the RNs' core competencies. The study also touches upon other core competencies such as teamwork, evidence-based practice, quality improvement and safety (Cronenwett *et al.* 2009), implying that this is an important area which should be acknowledged by nurse managers. Informatics can contribute to improving care and outcomes for the elderly (Bowles *et al.* 2015), which may also be considered relevant in relation to drug management. Nurse managers should thus strive to improve RNs' preconditions for safe drug management. The implementation of a CDSS seems to be a feasible way to introduce standardised procedures with a multi-professional approach as well as giving the opportunity for a more evidence-based practice in drug management. Nurse managers can engage in the process, for example by providing sufficient technical support and feedback on the progress, and particularly by encouraging teamwork. This can include that they, in the agreements with the health care centres, place demands on physicians' engagement and responsibility-taking in the drug monitoring process. However, nurse managers should also consider the readiness of the organisation to implement a CDSS, taking account of factors such as RNs' experiences of technology, training needs and of course the applicability of the technology itself.

Conclusions

This study illuminates variations in RNs' perceptions of using a CDSS. The findings show that the RNs perceived the CDSS as supportive in drug monitoring in terms of promoting standardised routines and team collaboration and giving possibilities for evidence-

based clinical practice. However, aspects of responsibilities need to be addressed.

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Contributions

Study design: R.M.J.P., K.J.B., J.F., L.M.; data collection: R.M.J.P.; data analysis: R.M.J.P., L.K.G.; manuscript preparation: R.M.J.P., L.K.G., K.J.B., J.F., L.M.

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Ethical approval

This study was approved by the Regional Ethical Review Board Uppsala (Dno. 2013/488).

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