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Knowledge Structures and Problem Representations: How Do Novice and Expert Home Care Nurses Compare?

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ABSTRACT

There is a growing need for home care nurses expert in quickly developing an accurate conceptualization of complex patient situations. An understanding of the cognitive processes underlying this expert skill would provide a foundation for optimal training and practice experiences for the development of expert home care nurses. However, few studies have investigated problem solving within complex situations faced by home care nurses. The purposes of this study were to compare novice and expert home care nurses' underlying knowledge structures and determine their influence on pattern recognition and ability to draw inferences from complex patient data. Specific aims of the study were to: 1) compare novice and expert home care nurses' knowledge structures and problem representations, and 2) determine if underlying knowledge structures predict pattern recognition. This descriptive exploratory study used a written question answering task to measure domain knowledge structures, and a think-aloud question answering task to measure pattern recognition and inferences for a written patient scenario in five novices and five experts in home care nursing. Findings reveal both similarities and differences in experts' and novices' underlying knowledge structures and representations. Knowledge structures were more predictive of pattern recognition for experts than for novices. Implications include mentoring periods for inexperienced home care nurses, employee assessment, utility for nursing education, and future research.

Keywords: Knowledge Structures, Problem Representation, Pattern Recognition, Inference, Home Care Nursing, Problems

Introduction

Home care nursing practice is particularly challenging because home care nurses routinely face problem situations in which a patient has a broad range of multiple interacting medical, functional, and behavioral problems affecting current and future health status. Beyond assisting patients to achieve goals related to restoration, rehabilitation, and palliative care, the home care nurse strives to promote patient or caregiver competence and judgment in the independent management of health care needs at home.[1]

The resulting problem solving situation is complex for several reasons. There is often limited availability of information about the total situation, with only a portion of the variables (e.g., physical signs) lending themselves to direct observation. This requires the nurse to infer additional information about the patient's underlying condition and situation. Also, complex patient situations frequently have a high degree of connectivity of variables. That is, changes in one problem can affect the status of other co-existing problems. Additional difficulties can arise when some of the goals and interventions for concurrent problems are contradictory. Recent changes in the home care industry, such as increasing patient acuity and the introduction of a prospective payment system, complicate the situation. There is a dramatic and growing need for home care nurses expert in quickly developing an accurate conceptualization of complex patient situations so that comprehensive, effective care can be delivered. An understanding of the cognitive processes underlying this expert skill would provide a foundation for planning optimal training and practice experiences for the development of expert home care nurses and serve as the basis for assessments aimed at identifying levels of expertise.

Although some recent studies have begun to investigate problem solving within the complex situations that home care nurses face,[2-4] little remains known about the similarities and differences between novice and expert home care nurses' underlying structure of domain knowledge, or their recognition of patterns and generation of inferences when representing multidimensional patient situations. Of particular concern are questions of how organization of the underlying knowledge base relates to problem representation for problems involving multiple interacting problem entities in home care nursing.

The purposes of this study were to compare novice and expert home care nurses' underlying knowledge structures and determine their influence on pattern recognition and ability to draw inferences from patient data. Specific aims were to: 1) compare novice and expert home care nurses on underlying knowledge structures and problem representation; and 2) determine if underlying knowledge structures predict pattern recognition by novice and expert home care nurses.

Conceptual Basis and Literature Review

Theoretical foundations of domain specific problem solving were established from studies conducted in knowledge-rich, non-nursing domains using novice-expert comparisons.[5-13] From these studies, characteristics of experts' problem representation and underlying knowledge structure were identified.

Problem Representation. Domain specific problem solving is the process through which an individual determines solution procedures based on previous knowledge and experience in a specific content area. Prior to determining a solution, an individual develops a *representation*, or internal model, that consists of elements within the problem, the relationships among them, and inferences drawn from the knowledge base of the solver.[5,6] Much of an expert's problem solving power lies in the ability to quickly establish correspondence between externally presented events and internal models of these events through pattern recognition and inferred relations that define the situation.[7,8]

Research comparing novices and experts on problem solving performance in physics,[9] chess,[10] and medicine[11] shows that experts are able to focus on meaningful patterns in the information, avoiding attention to the irrelevant details of problems in their domain. In addition, experts are able to use available problem data to infer added information for problem solving. Experts demonstrated superior ability to identify relevant cues or important features of the problem at hand when compared to novices.[12] However, other studies have found that novices' problem solving difficulties generally did not stem from failure to identify relevant cues, but from limited ability to abstract the relevant elements in the problem data.[11,13] While both novices and experts were able to pick out relevant problem features, novices were less likely to generate inferences and relations not explicitly stated in the problem.

A limited number of studies on problem representation in nursing specifically examine pattern recognition and inference. Benner's work on skill acquisition in nursing is congruent with findings from other disciplines regarding experts' superior skill in recognizing patterns in patient condition, including very subtle changes, compared to novices.[14] In a study of wound care decisions, experts focused more on problem-specific (meaningful) data than novices.[15] In a study of decision making in third-space fluid shift problems, more experienced nurses used more cues, selectively clustered these cues, and made more accurate inferences than nurses with less experience.[16] However, no differences were found between nursing students and experienced staff nurses in the number of inferences generated in a simulated diagnostic reasoning task.[17]

Knowledge Structure. An interconnected, organized knowledge base appears to underlie experts' ability to accurately detect relevant patterns in problem data and to infer additional relations and constraints from the situation.[6,18] The organization and interconnections among declarative facts within the learner's knowledge network is referred to as structural knowledge.[19-21] Knowledge of how concepts within a domain are interrelated is believed to contribute to the automaticity and speed of accurate problem solving seen with expert performance. The shift from storing knowledge as isolated facts and loosely bundled units of information to highly integrated knowledge structures is a key factor that characterizes the transition from novice to expert.[22] Novices' underlying knowledge is less complete, less interconnected, and contains more erroneous information than that of experts. In addition, experts appear to know more about the appropriate application of their knowledge, with declarative knowledge tightly bound to conditions for its use.[18,23,24]

Broderick and Ammentorp examined knowledge structures of nursing students and licensed nurses by comparing how subjects sorted data elements related to a patient scenario into categories.[25] The researchers found no differences between the knowledge structures of the two groups. Lauri and Salantera found that the degree of abstraction of knowledge structure was positively related to creative decision making in nursing.[26] However, the researchers did not compare novice and expert nurses.

Previous studies have been successful in identifying some aspects of knowledge structures and problem representation that differentiate novices and experts. However, the majority of these studies have concentrated on problems that are dissimilar to those encountered in home care nursing. Much of what is known about expert problem representation and knowledge structures is found in research using single dimensional problems (e.g., solving a physics problem for which there is one correct answer, identifying a single medical diagnosis, making wound care decisions) rather than using complex multidimensional problems such as those typically faced by home care nurses (e.g., multiple medical and functional problems interacting within a single patient).

Methods

This descriptive exploratory study used a two group, novice/expert comparison design. The study was approved by the University of Oklahoma Institutional Review Board and confidentiality of participants was maintained.

Sample and Setting. A total of ten nurses participated in the study: five novices and five experts in home care nursing. Novices were randomly chosen from an Oklahoma State Board of Nursing list of recent graduates from baccalaureate programs for registered nurses (RN) who had graduated within the month prior to data collection and successfully tested for licensure. Length of experience as an RN ranged from 2 weeks to 1 month. None was previously licensed as an RN or Practical Nurse, or had prior work experience in home health care in any capacity (e.g., home health aide). Four were female, and one was male. Experts were identified through networking with the author's industry contacts and members of the Oklahoma Home Care Association.

All experts were female and had a minimum of a baccalaureate degree in nursing. Two expert participants had a master's degree in nursing and a third expert was certified in home care nursing through the American Nurses Credentialing Center. Length of experience as an RN ranged from 6 to 24 years. Home care experience ranged from 5 to 13 years. Supervisors or peers rated each expert as having superior knowledge and skill in home health nursing practice.

Participants were contacted by telephone, given a brief explanation of the study, and scheduled for an appointment to meet individually for data collection. At the meeting, an explanation of the study was again provided and signed written consent obtained.

Variables and Measurement. Knowledge structure is the interrelationships among domain related concepts within an individual's knowledge base. For the purposes of this study, variables related to interrelationships and concepts were operationalized in the following way. Six concepts defining the domain of home care nursing (congestive heart failure [CHF], depression, impaired mobility, poor medication management, falls, and poor nutrition/hydration) and two types of relationships or links among concepts ("characteristic of" and "leads to") were used in measures of both knowledge structure and problem representation. The six concepts were chosen by the researcher from a review of home care nursing literature due to their relevance for home care nursing, ability to be represented as a problem or potential problem to be addressed by the nurse, and the high degree of interrelationship among them.

The “characteristic of” and “leads to” relationships among concepts were chosen because interpretations of data characteristic of the patient’s condition and inferences of underlying causal dynamics were found to be particularly relevant in studies of problem conceptualization in health care.[6,11] A “characteristic of” link is one that indicates one concept is a feature, attribute, or characteristic of another concept. A “leads to” link is one that indicates a causal relationship between concepts. It should be noted that individuals usually do not store ideal representations of causal mechanisms, but rather only fragments of the true cause-oriented mechanisms.[27] Therefore, the “leads to” relationship does not indicate a strict causal relationship in the sense that one set of events or states constitutes a necessary and sufficient cause of another event or state. The “leads to” link is used in a more general sense to indicate that one concept leads to, causes, or results in another concept.

Procedures. The researcher remained present throughout all data collection procedures. First, data measuring participants’ underlying domain specific knowledge structures were collected using a written question answering task similar to that used by Graesser and Clark[27] in their studies of knowledge structures and discourse processing. Participants were presented with each of the six home care concepts printed at the top of a page and asked to write their answers to two questions related to each of those concepts: (1) What characteristics might patients exhibit that would indicate they have a problem with [concept]? (2) What are the causes of [concept]? There was no time limit for completion.

After completion of the above, problem representation data were collected using a think-aloud question answering task similar to that used by Patel, Evans, and Kaufman[28] in their study of medical diagnosis and reasoning. Problem representation is the ability to analyze data in a problem situation and work out a conceptualization of the problem. Of interest to the present study was participants' ability to recognize patterns in the data and to make inferences during representation when presented with a patient scenario containing multiple interacting problems or potential problems. The six study concepts formed the basis of a realistic patient scenario that included facts characteristic of the concepts and which implied a causal relationship among them, as well as irrelevant data. History of congestive heart failure was explicitly stated in the data; all other problem concepts and the relationships among them were not explicitly stated but could be inferred from the given information. Although facts were given in the scenario that are characteristic of current problems with depression, impaired mobility, poor medication management, and poor nutrition/hydration status, no facts were given that indicated a problem with falls had occurred yet. That is, there were no facts to imply that the patient had actually incurred a fall, but the situation was such that without appropriate intervention a fall was likely to happen.

Participants were allowed three minutes to read the case scenario and were not allowed to refer back to the printed problem during the exercise. Inability to refer back to the scenario forced increased reliance on underlying knowledge structures during the formation of a problem representation and enhanced expert and novice differences in the representation process.

After reading the scenario, participants wrote on a blank piece of paper what problems should be addressed by the home care nurse. After completing the list, participants answered aloud two questions for each problem identified: (1) How do you know the patient has a problem with [listed problem]? (2) What do you think is causing the problem with [listed problem]? When answering the questions, participants stated aloud everything they were thinking. Participants' verbal responses (protocols) were tape recorded for later analysis. The identified problems (pattern recognition) and verbal protocols (inference) constituted participants' representation of the problem.

Data Analysis. Participants' written responses to questions testing knowledge structures were analyzed according to (1) number of statements in response to questions; (2) correct and incorrect "characteristic of" statements; (3) correct and incorrect causal statements; and (4) interconnectivity among the six study concepts. Interconnectivity was a measure of the number and percentage of connections between two primary concepts. A connection was considered to exist if a characteristic or cause listed for one of the concepts was: (1) also listed as a characteristic or cause of another of the six concepts (e.g., lack of knowledge listed as a cause of both poor medication management and poor nutrition), or (2) was another of the six concepts (e.g., impaired mobility listed as a cause of depression). Classifications and scoring rules were adapted from those used by Graesser and Clark.[27]

Analysis was conducted by two registered nurses who were knowledgeable and experienced in home care nursing. Each rater was trained in the classification procedures and interrater agreement was 98%. Both raters had to agree in order for a statement to be categorized; disagreements were determined by the researcher. Means, standard deviations, and proportions for both groups were compared.

Participants' written list of problems and verbal protocols in the representation task were segmented, transcribed, and analyzed in a manner similar to that used by Patel, Evans, and Kaufman.[28] Data were translated into conceptual graphs that modeled participants' problem representations, consisting of nodes interrelated by a network of directed relational links. A node is an idea or concept listed as a problem to be addressed by the participants or stated as a characteristic or cause during the think aloud exercise. Nodes were either facts given in the patient scenario or inferences derived from the scenario. Relational links represented the relationships between nodes and were directional. Links were classified as "characteristic of" if one node was a feature, attribute, or characteristic of the second node, or as "leads to" if one node was noted to lead to, cause, or result in the second node.

Conceptual graphs were used to examine similarities and differences in the two groups' representation, pattern recognition, inference, and cohesion. Cohesion of the problem representation, or the degree of interconnection perceived among the scenario patient's problems and associated data and inferences, was determined by calculating: (1) the mean number of relational links per problem node (problem density), and (2) number of causal associations directly linking individual problems, reflecting the degree to which participants viewed each problem as interacting with and affecting each other. In addition, participants' pattern recognition and inference generation were qualitatively analyzed as to content, scenario information used in the identification of problems, errors, and recognition of potential problems.

Participants' responses to the written question answering task (knowledge structure measure) were used in a simple prediction model to determine whether underlying knowledge structures could be used to predict specific problems identified from the patient scenario (problem representation measure). In this model, similar to that developed by Gordon and Gill,[29] it was assumed that when data in the case scenario mapped onto information that a participant had associated with one of the study's six concepts in the knowledge structure task, that concept would be included during problem representation as a problem to be addressed. Conversely, if a participant did not identify associations with one of the six study concepts similar to those in the case scenario, it was predicted that the participant would not identify a problem associated with that concept during the problem representation task. Predictions were visually compared to participants' actual problem representations to test for accuracy of the model. Possible outcomes are described in Table 1.

Table 1. Possible Prediction Model Outcomes

	Actual Representation	
Predicted Representation	Inclusion	exclusion
inclusion	+ +	+ -
exclusion	- +	- -

The + + (predicted inclusion of concept, actual inclusion of concept) and - - (predicted exclusion of concept, actual exclusion of concept) outcomes represent accuracy of the prediction model (hits). Hits indicate accuracy in predications. The + - (predicted inclusion of concept, actual exclusion of concept) and - + (predicted exclusion of concept, actual inclusion of concept) outcomes represent errors in the prediction model (misses). Misses indicate inaccuracy or errors in predications.

Finally, the relationship between interconnections among underlying knowledge structures and associations in problem representations for novices and experts was examined using Spearman's rank-order correlations.

Results

A summary of the differences between novice and expert knowledge structures and problem representation is provided in Table 2.

Knowledge Structures. Experts listed a greater number of both characteristic statements (M = 62.8, SD = 18.52) and causal statements (M = 49.6, SD = 17.35) than did novices (M = 36.2, SD = 9.24 and M=29.0, SD = 5.06, respectively), although experts and novices listed the same proportion of characteristic statements (56%) to causal statements (44%). There were only slight differences in the accuracy of statements between the two groups. Of the 314 total characteristic statements listed by experts, 95% were correct, while 93% of the novices' 181 total characteristic statements were correct. Experts listed a total of 248 causal statements with a 96% accuracy rate, while novices listed a total of 145 causal statements, with a 97% accuracy rate. Experts' statements were more interconnected than those of novices. Of the 562 total statements made by experts, 170 (30%) were connected to each other. For novices, 75 (23%) of the 326 total statements were connected to each other.

Experts and novices made several qualitatively similar types of statements. Both noted factors that could be verified only through laboratory testing, such as "anemia," "decreased serum albumin," and "digoxin level high." Also, both groups stated many and varied outward signs or objective observations that might be characteristic of patients with problems related to the concepts, for example "edema," "unsteady gait," and "poor skin turgor."

Experts' and novices' statements also exhibited qualitative differences. Experts listed a greater number and variety of statements that related to social and environmental characteristics and causes than did the novices, for example "lack of social support," "low income," and "multiple environmental hazards." Experts also noted a greater number and variety of symptoms or subjective information about patients that would be known or verified only through history taking, questioning, or interviewing patients or their caregivers, such as "confusion from too many meds," and "decreased appetite."

Problem Representation. Visual inspection of all experts' representations showed data and inferences that were so interrelated as to present a singular web of problems. Three of the novices' representations, however, consisted of two to four concurrent yet unrelated groups of problems that appeared as separate islands within the total representation. In contrast, representations of the experts were highly interrelated. Average problem density for experts' graphs was 6.30 compared to 4.44 for novices. Experts noted a mean of 5.6 causal associations directly linking individual problems, while novices noted a mean of 1.4. Experts were able to offer extensive explanations of the problems, while novices' graphs were less extensive and generally contained less satisfactory explanations. For example, all experts were able to state possible causes of each of the problems identified, yet two of the novices were unable to speculate any possible cause for one of the problems they identified.

Pattern recognition was reflected in the problems identified from data in the scenario. Novices identified a range of three to seven problems to be addressed (M = 4.8) while experts identified from four to seven (M = 5.6). All of the experts noted the potential for exacerbation of CHF as a problem to be addressed, while none of the novices did even though the scenario specifically stated a history of CHF and included evidence of noncompliance with medications. However, only two of the experts noted a potential for falls while all of the novices did. The only other potential problem cited was by one expert who noted the potential for skin breakdown. Experts made a total of 111 inferences from scenario data (M = 22.2), while novices made 79 (M = 15.8). There were 13 total inferential errors made by novices (11%), and 85% of those were related to causal inferences. Only one inferential error (characteristic) was made by the experts.

Table 2. Differences Between Novice and Expert Knowledge Structures and Problem Representations

		Experts	Novices
Knowledge Structures	Total written characteristic statements	314 (mean = 62.8)	181 (mean = 36.2)
	Accuracy of characteristic statements	95%	93%
	Total written causal statements	248 (mean = 49.6)	145 (mean = 29.0)
	Accuracy of causal statements	96%	97%
	Connected statements	30%	23%
Problem Representation	Mean problem density	6.30	4.44
	Mean causal associations	5.6	1.4
	Mean problems identified	5.6 (range = 4-7)	4.8 (range = 3-7)
	Total inferences	111 (mean = 22.2)	79 (mean = 15.8)
	Total inferential errors	1	13

Prediction of Problem Representation from Knowledge Structure. The prediction model was more accurate in predicting inclusion or exclusion of specific problems in the representation for the experts (79%) than for the novices (59%). Hits were almost exclusively due to the "+ +" type for both groups. There were twice as many misses for novices (12) than for experts

(6). Almost all of the experts' misses were "+ -," one each for four of the experts while the fifth had none. However, misses for the novices were evenly split between "+ -" and "- +" types. Two of the novices had one miss each, while the remaining three novices had from 2 to 5 misses each. Correlation between total interconnectivity of underlying structural knowledge and representation density was r_s = .40 for both novices and experts. A closer look at the correlation between just the causal links in underlying knowledge structure and representations revealed differences between the groups. Findings were r_s = .23 for novices and r_s = .45 for experts.

Discussion

Consistent with research in other fields, expert home care nurses' underlying structural knowledge was more extensive and interconnected than that of novices. However, unlike findings in some domains, novices and experts were very similar in the accuracy of their underlying knowledge so differences were not related to erroneous knowledge elements. While both groups' underlying structures were very similar in some types of knowledge associated with the six study concepts, there were notable differences. Experts appeared much more knowledgeable about social and environmental factors, as well as subjective information that could be elicited to evaluate them. Both of these differences are likely related to the experts' extensive practice in the home care setting, where there is considerable focus on social and environmental factors that impact patients' and caregivers' ability to manage care. Through their extensive practice, experts appeared to have developed broad, highly interconnected knowledge structures related to concepts relevant to home care practice. Basic nursing education programs have traditionally focused students' limited practical experiences on hospitalized patients, where novice nurses have less opportunity to develop structures related to the impact of home environment and social support on self- or caregiver-management.

Findings regarding problem representation were also similar to those from other fields and to those using single dimensional problems. Experts' problem representations were more complete, complex, and cohesive, indicating a highly dynamic conceptualization of the patient situation. The present study's use of multidimensional problems also demonstrates that experts are more likely than novices to view individual sub-problems within a single patient as being highly interrelated with and affecting each other, particularly in a causal manner.

Experts' problem conceptualizations included a greater number of problems with a high degree of interconnectivity. Novices' representations were somewhat more superficial and piecemeal than those of the experts. There were too few potential problems in the scenario to closely examine recognition of potential problems from patterns in the data. However, experts did demonstrate a distinct superiority compared to novices in ability to recognize the potential for exacerbation of CHF as an area that should be addressed. Findings related to identifying other potential problems (e.g., falls) were mixed, and warrant additional study.

In research conducted in other domains, there are conflicting findings regarding novices' ability to attend to relevant cues in the problem data. In some studies, novices experienced difficulty in identifying relevant cues, while in other work novices were very similar to experts in identifying key elements. In the present study, both novices and experts cited the same scenario data to support identification of problems. However, while novices and experts used similar cues in the case scenarios to develop their representations, novices at times used inaccurate reasoning chains, leading to inferential errors from the data.

Experts stated problems as broad concepts (e.g., “poor nutrition” and “depression”), demonstrating ability to view given signs and symptoms as subcomponents of higher level problems. In contrast, novices more often stated problems on a lower level than experts, for example, “need to gain weight.” Many of the problems listed by novices were considered by experts to be symptoms of broader problems. For example, one novice listed “ambulating with use of wall” as a problem, while experts listed it as a sign characteristic of a problem with mobility. What was particularly evident, however, was novices’ greater likelihood of inferring different meanings to some cues or to make no inference at all.

Novices identified many of the same occurring problems as the experts based on detection of patterns in the data. However, at other times novices either did not identify a problem, or viewed it in a less complete manner or at a superficial depth of understanding. It appeared that limitations in novices’ pattern recognition were associated with limits in ability to consistently generate the appropriate inferences and relations not explicitly stated in the problem.

In earlier studies of problem solving cognition it was noted that when individuals’ underlying knowledge structures contained incomplete associations, those individuals were less apt to develop complete problem representations.[23] However, the present study's findings are more consistent with (1) the presence of weak, rather than absent, knowledge links, and (2) less understanding of when to apply specific knowledge, as explanations for novices' less complete problem representations. If missing links among concepts within knowledge structures were the primary explanation, a greater number of prediction model hits would be of the "- -" type. That is, underlying associations in structural knowledge would be absent, so no association would be made during problem presentation. However, since there were very few "- -" hits for either group (one for experts, two for novices), this is not likely.

It also seems reasonable to assume that strong links would result in consistent ability to associate concepts during both free recall and problem representation, as seen with the experts, and that weaker links would result in inconsistent ability to associate concepts during free recall and problem representation, as seen with novices. In addition, experts may know more about the appropriate conditions for application of their knowledge, increasing the predictability of its use. In contrast, novices may have less knowledge related to conditions of applicability, therefore decreasing the predictability that their underlying knowledge will be applied in specific problem situations.

The moderate positive relationship between total interconnectivity of structural knowledge and cohesion of problem representation is consistent with research in other fields. Differences between experts and novices in the relationship between causal interconnections in knowledge structures and causally interacting patient problems in the representations were specifically examined because in practice, changes in one patient problem can cause changes in other coexisting problems. As might be expected, there was a stronger relationship for experts than for novices, although, due to small sample size, significance could not be demonstrated. Differences related to knowledge of conditions of applicability and stronger links among knowledge elements could account for this finding as well.

Limitations. The number of participants in this study is small which limits generalizability of the findings. Readers must therefore take this limitation into account when interpreting findings.

The traditional method or criteria for determining expertise levels is to base expertise level on the amount of experience in the domain of interest. This may not be the most differentiating factor possible. Attempts were made to compensate for this by considering subjective evaluations of participants by those familiar with their knowledge and expertise. However, there is still the possibility that all persons included in the study were not truly representative of their expertise level.

The literature reflects some concern that completion of a structural knowledge task may affect subsequent problem representation if the question answering task used to measure structural knowledge uses the same concepts included in the problem representation scenario.[20] Although there was no evidence of question probe intrusiveness in a study using a similar approach,[29] there was no feasible way to check for this effect in the present study. Some researchers[20] suggest inserting additional concepts among those of interest in order to decrease the likelihood of question probe intrusiveness. This was tried during pilot testing of the present study's materials; however, doing so considerably lengthened participation time. Participants reported fatigue after completing the lengthy task which may have affected performance on the problem representation task. While the possibility of intrusiveness remains, the researcher felt it would pose a lesser threat to study validity than participant fatigue.

Implications for practice, education, and research. Generalization of study findings is limited due to small sample size, however several implications warrant examination in future studies. New graduates or nurses with no experience in home care may not be prepared to assume a fully independent role in establishing the initial care plan for home care patients. Lack of experience in home care practice appears related to less knowledge regarding certain aspects of care for patients at home, particularly related to social support and environmental influences. Inexperience also appears related to the development of patient representations that may be superficial and less dynamic, with some errors in reasoning. Until the nurse obtains adequate experience in home care practice, it may be advisable to encourage close preceptor and mentoring activities with coworkers who are expert home care nurses. Also, employee assessment tests that focus on underlying knowledge alone may not be adequate in predicting the ability of nurses with no home care experience to develop comprehensive patient representations.

The assessment of knowledge structures and problem representation may hold some utility for nursing education. This study and others [30] document the influence of extensive practice in a problem solving domain for the development of expert performance. Therefore, it is reasonable to expect that nursing student clinical experiences in community settings may influence their underlying knowledge structures or representations for complex home care nursing patients.

More information is needed regarding the extensiveness and specific types of home care experiences under which knowledge structures expand and/or strengthen and problem representation skill begins to approach expert levels. Studies with representative samples and variety in problem situations are needed to generate more meaningful data.

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