Information Retrieval – Swedish Specialist Student Nurses` Strategies for Finding Clinical Evidence

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Abstract: The care that intra-operative nurses perform has to be based on scientific knowledge. It is therefore vitally important that they have access to different databases and the Internet, as well as knowledge of the search procedure to find evidence for best practice. This means that specialist nurses should be proficient in the search procedure, interpretation of data, and implementation of available knowledge.

The aim of this study was therefore to highlight the search strategies of specialist student nurses for finding scientific knowledge with regard to specific clinical issues. An additional aim was to assess their ability to critically evaluate scientific articles.

Methods: The participants, n 16, all students enrolled in a university programme for specialist nursing in anaesthesia care, were required to find support for six questions, by using scientific knowledge databases. The tasks that required support are related to their future profession and were divided into three main areas: pre-, intra-, and post-operative care. Two distinct questions for each main area had to be answered. The data was analysed quantitatively using manifest content analysis as a basis.

Result: This study reveals that the student nurses mostly used the CINAHL and PubMed databases to search for answers related to the areas in focus. The keywords the participants used differed between the individuals and were applied more frequently than MESH terms. In addition, the critical evaluation of articles of scientific value that were found was not optimal. The study demonstrated that most of the participants were unable to complete all the required tasks. With regard to the initial questions, all 16 participants provided answers, while only eight student nurses completed the final questions.

Conclusions: The specialist student nurses in this study used the databases Chinal and PubMed to find scientific knowledge with the help of MESH-terms and keywords. Further research is needed to understand how education of the specialist student nurses should be carried out, in order to optimise their search strategies and critical evaluation of scientific articles.

Keywords: Information retrieval, search strategies, nurses.

INTRODUCTION

In today's intra-operative care, nurses must base their nursing competence on scientific knowledge. The development of knowledge in the field of nursing anaesthesia has increased rapidly during the last decades, both with regard to the development of medical technology and the relational individual care and treatment. Furthermore, patients receiving anaesthesia today are often older people with multiple diseases. All these developments thus require updated individual solutions. Nurse anaesthetists must therefore apply actual knowledge to different aspects of their work. Such knowledge can be readily accessed on available research databases or more general search engines on the Internet, making it easier to find solutions to problems [1].

In health care, the use of computers to manage health care duties and to find knowledge on the Internet has increased substantially since the 1990s [2]. For this reason, computer-based clinical decision-support programmes and best practice guidelines for evidence-based practice (EBP) are being developed to support clinical physicians and nurses in their daily work. In 2009, 73% of the population in the USA, 60% in Australia, and 50% in Europe used the Internet for this purpose [3]. It is also common for patients themselves to seek medical information about their symptoms on the Web [4, 5]. Despite these increases in the use of computers and the Internet, the limited availability of improved access to these facilities in the workplace has been found to be a barrier when it comes to the adoption of new technology [6]. It has been revealed that nurses in the USA do not have the necessary skills to integrate research into clinical practice. They do not understand or value research and receive little or no training in search strategies on scientific knowledge databases [7]. The use of Internet-based searches for knowledge by physicians increases the quality of clinical problem solving [7, 8]. Physicians making complicated diagnoses could also be given valuable support by using general search engines such as Google [9]. However, contradictory results were found in a review from 1995-2009 which indicated that there were no differences

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between the doctors and nurses who used the Internet to search for knowledge and the participants who did not [3]. Nurses predominately rely on tacit knowledge, both when searching for evidence and when evaluating a treatment outcome [1]. In spite of the expressed positive attitudes of nurses regarding scientific nursing knowledge, the use of research results is impaired by different barriers among nurses, for example, insufficient power to change practice, difficulty understanding statistical analyses, and perceived isolation from knowledgeable colleagues with whom to discuss the findings [10]. Another barrier identified with regard to using databases on the Internet is limited experience in using the online library [3]. In Sweden, barriers to research utilisation in nursing have been investigated; they include the lack of clear, realistic goals for nursing work focused on evidence-based care [11], the research-related skills of nurses [12], and the fact that relevant literature has not been gathered in one place [13]. To cover the limited research utilisation in clinical practice, nursing educators improved their teaching with regard to generic skills, in accordance with the Higher Education Ordinance in Sweden [14]. One example is using problem-based learning to integrate theory and practice during clinical education [15].

Extended efforts have been made to fill the gap between theory, research, and practice in Sweden, by developing guidelines for clinical education. In another Swedish study, it was illustrated that assisting student nurses in integrating the theory of nursing into practice was crucial [16]. To support research utilisation, an organisational learning culture which involves knowledge, skills, feelings, attitudes, and beliefs needs to be developed in the workplace [17]. There are advantages in developing a learning culture at work, an increase in the standard of care, improved patient treatment outcomes, as well as progress in the continuation of professional development [18]. The resources available on the Internet are a dynamic, well-established way of seeking information, but domain knowledge is a prerequisite for achieving good knowledge acquisition. A well-defined question has an impact on the ability to successfully find knowledge from the internet [19]. It has been found that student nurses are limited in their ability to find answers to their clinical nursing questions. However, whether the students lacked the skills to search the relevant databases and literature, or whether there really were no answers to the clinical questions, was not made apparent in the study [20].

The quality of the information found via general search engines does not include any guarantees that reinforce claims relating to the above-mentioned knowledge and skills [6, 21, 22]. Furthermore, the quality of scientific nursing journals also varies [23], which means that nurses require a particular level of domain knowledge and knowledge of critical evaluation, in order to review articles related to nursing and medical databases on the Internet. They also need technical search skills, that is, how to apply the search process and knowledge of the appropriate databases [20].

Very few articles have been found in the literature review that investigate the way nurses search for information and evidence relating to clinical practice, that is, whether a single search word is used or whether MESH terms (Medical

Subject Headings) are employed [3]. Similarly, the number of studies investigating the critical evaluation of retrieved articles is also small. Furthermore, the way students in specialist nursing programmes in Sweden use the available resources on the Internet to find relevant scientific knowledge has not been investigated.

The aim of this study was therefore to highlight the search strategies that specialist student nurses use to find scientific knowledge about specific clinical issues. An additional aim was to assess their ability to critically evaluate scientific articles.

The student nurses were required to answer the following research questions:

–   To what degree are the participants successful in finding scientific knowledge for given clinical issues?

–   To what extent do the participants evaluate?

    –   the scientific merit of articles

    –   the search strategies used?

MATERIALS AND METHODS

A descriptive, cross-sectional design was used for this study. In order to complete the research tasks, a questionnaire with six different questions was developed. The participants, students enrolled in the Specialist Nursing Programme, had to seek answers to these questions in scientific databases available on the Internet. The issues in focus are related to their future profession and were divided into three main areas: pre-, intra-, and post-operative care.

Data Collection

In this small-scale study, the issues relating to pre-surgical care were made clear to the participants and focused on six areas: 1) the nurse anaesthetist's professional role when giving the patients pre-surgical information before the day of surgery, 2) the nurse anaesthetist's field of responsibility when preparing the patient for anaesthesia. The intra-operative issues focused on 3) the kind of operations generally performed on the day of surgery and 4) the nurse anaesthetist's intra-operative responsibility. Issues related to post-operative care were 5) post-operative symptoms, especially pain, and 6) the nurse anaesthetist's post-operative responsibility to prevent and relieve pain. The participants were also asked to indicate the databases, keywords, and MESH terms used, the number of articles found, and to assess the scientific value of the articles. The questions were based on earlier research focusing on nurses' anaesthesia procedures in peri-operative nursing [24].

The participants were trained by the librarian (3 x 45 minutes) in information retrieval a week before data was collected for the study. They also received instruction regarding the different search strategies that can be used to find knowledge in databases and general search engines on the Internet. MESH terms and key words were introduced. MESH terms comprise vocabulary developed by the U.S National Library of Medicine indexing articles for PubMed (http://www.ncbi.nlm.nih.gov/mesh), while keywords are commonly search words or phrases that describe content in an article and are used as search terms in both databases and other search engines. Evidence-based care was also a subject

the students had studied on the course before data collection. Each participant answered the questionnaire individually, without communicating with other participants or teachers. During the data collection, each one had access to a computer and the Internet, the library's available databases were on hand, and they had four hours to complete the questionnaire.

Participants

The participants, that is, the 16 students enrolled in a one-year Specialist Anaesthesia Nursing Programme, were all registered nurses with at least one year work experience. The study was conducted during the first term of the two-term educational programme. All the participants gave their informed consent. In accordance with the Declaration of Helsinki [25], the students were informed about the purpose of the study and the confidentiality of the results. No ethical permission was sought, as Swedish legislation [26] does not require consent for this kind of research. Furthermore, each questionnaire was coded with a number to ensure confidentiality of the participants' identity. None of the students refrained from participating in the study, the result of which was not included in the course examination.

Data Analysis

The data was analysed using manifest content analysis [27, 28] and the content was subsequently quantified. The first step involved reading all the data to obtain a sense of the whole manifest content. This was followed by the content of the six issues in focus for the study and the additional questions being grouped into categories. A phase involving the condensation of the search words and MESH terms continued to elucidate the content. Inspired by Polit and Beck [27], the students were requested to judge the scientific value of the articles on the basis of the following questions: 1) Was the chosen method appropriate? 2) Was the selection of participants well described? 3) Was the analysis logical? All the data was entered into a computerised database and processed using the Statistical Package for the Social Sciences (SPSS version 18.0).

RESULTS

The sixteen participants responded to a various number of the six issues in focus (presented under method) and their answers were collated both in text and in three tables. Firstly, the response rates are presented in Table **1** and illustrate the number of participants who responded to the individual

questions, and whether they referred to one or more articles. The table also lists the databases that dominate the issues. The response rate to questions 1-6, the number of relevant articles found and the databases used are presented in Table **1**. The keywords and MESH terms used in the search process are indicated in Table **2**, while the critical analysis of the articles found is described in Table **3**. Finally, the number of students who completed the task is included in a summary.

Table **1** reveals that the response rate gradually decreased from the first to the last question; being 8/16 for the last one. Similarly, the number of participants who did not answer the last question gradually increased to 71 of 96 possible answers for the last question. In addition, the number of articles found to support the findings that were requested gradually decreased in a similar way.

The participants made a total of 74 searches and in the study their strategy was to use the CINAHL database for the searches. Consequently, CINAHL was used 56 times, PubMed 16 times, while Medline was employed on two occasions. Table **2** presents a list of the search terms, such as keywords and MESH terms, employed.

As Table **2** indicates, similarities in MESH terms and keywords were used as strategies to find scientific articles. Both MESH terms and keywords were used at the same time. Keywords were sometimes used more frequently than MESH terms, 67/54 respectively. Depending on the question, the search paths varied, but the dominant MESH term was *ambulatory surgery* and even the keyword "ambulatory surgery" was used in four of the six issues in focus.

Table **3** shows that the critical evaluation of the articles found was not completed by all the participants. Several answers were missing. Half of the participants (8/16) answered all the questions. Nevertheless, the critical evaluation showed that a clear majority of participants considered that the articles were appropriate in terms of methodology, sampling, and analysis. The assessments of a few participants were critical of the findings. Only one participant answered "no" to the question of whether the method was appropriately described and three answered "no" to whether the participants were well described. Two participants were critical of the logical analysis.

A summary of the number of participants who completed the whole task allocated reveals that eight of the 16 students succeeded.

Table 1.   Response Rate for Each Question, Number of Articles Found and Databases Used

Question Number	Response Rate, n	One Article Referred to, n	Two Articles Referred to, n	PubMed Database Used, n	CINAHL Database Used, n	MEDLINE Database Used, n
1	16	16	6	3	13	
2	12	8	4	5	8	1
3	14	10	3	6	8	
4	10	8	2		9	1
5	11	10	1	1	10	
6	8	6	1	1	8	

Table 2.   Keywords and MESH Terms Used

Issues Focused on	Questions Searched for	MESH Terms Used (n, Issues Number)	Keywords Used (n, Issues Number)
Pre-operative issue 1	Nursing role	*Ambulatory surgical/procedures* (9) *Anaesthesia and analgesia (2)* *Pre-operative care* (5)	Ambulatory, day surgical (7) Peri-operative care/information (7)
Pre-operative issue 2	Nursing responsibility	*Anaesthesia nurse (3)* *Analgesia* (3) *Ambulatory surgery (2)* *Nurse's role (1)*	Peri-operative care, (6) Ambulatory surgical (4) Nurse anaesthetist (5)
Intra-operative issue 3	Day surgery	*Ambulatory surgery* (8) *Nurse's role* (4) *Day surgery* (2)	Day surgery (5) Ambulatory surgery (7)
Intra-operative issue 4	Intra-operative responsibility	*Intra-operative nurse* (5) *Intra-operative care* (5)	Nurse anaesthetist (4) Intra-operative nurse (8)
Post-operative issue 5	Pain and symptoms	*Pain post-operative (1)* *Symptoms experienced (1)*	Ambulatory surgery (4) Post-operative pain (3)
Post-operative issue 6	Prevention and pain relief	*Nurse's role (1)* *Ambulatory surgery procedure (1)* *Post-operative pain* (1)	Nurse's role (2) Ambulatory surgery (1) Post-operative pain (2) Nurse anaesthetist (2)

Table 3.   Evaluation of the Articles

Question Number	Appropriate Method, Yes/No	No Response, n	Participants well Described, Yes/No	No Response, n	Logical Analysis, Yes/No	No Response, n
1	14/1	1	12/1	3	12	4
2	10/0	6	8/2	6	9/1	6
3	10	6	10	6	10	6
4	9	7	9	7	9	7
5	8	8	9	7	4/1	11
6	6	10	6	10	6	10

DISCUSSION

The results show a progressive decrease in the responses to the questions, which may be due to many reasons. One could be the time factor, as four hours was allocated for answering the questions. This time limit was estimated by the authors and determined as being sufficient. Based on the response rate, it could be discussed whether more time should have been allotted to allow all the participants to complete the task or whether the specialist nursing students' lack of experience in searching for scientific articles was the reason for the low completion rate. It is surprising that the students' newly completed training in searching for scientific articles did not improve the findings to a greater extent.

In this study, there were six well-delineated questions, based on the fact that Portney and Watkins [19] emphasise the importance of limiting issues as a means of guiding participants. This may also have influenced the students in the sense that peri-operative care is a new area for which they may not have the required domain knowledge necessary for finding the appropriate keywords [22]. However, the fact that all the participants had a three-year university nursing education which included training in searching for scientific articles argues against this hypothesis. In addition, all the

participants have worked as nurses, which mean they should be familiar with searching for scientific articles. Nevertheless, previous studies have shown that clinically active nurses reveal a lack of time and experience with regard to searching for scientific knowledge [29]. Instead, nurses prefer to work as they were taught during training. Any corresponding results for Swedish conditions have not been found. However, the results of the study, which reveal weaknesses in the participants' skills in terms of information retrieval, can be interpreted as an indication that the corresponding conditions also apply in Sweden [12, 13]. On the other hand, results indicate that doctors rapidly obtain information by making more extensive use of the Internet [9]. It is possible that there are deficiencies in the education content/structure with regard to giving aspiring nurses the tools to search for knowledge. This could, in turn, indicate a need to intensify training in information retrieval in nursing education. There is a pre-existing perception that specialist students have the skills needed to seek strategies for scientific knowledge. Nevertheless, previous studies show that these skills vary widely and that the age of students could have an impact [30], even if availability and use of the Internet has increased dramatically since 1990 [2]. This study demonstrates that registered nurses participating in

specialist education have not fully internalised this technology. The study shows that most of the participants answered questions with the support of only one article, while only a few referred to a maximum of two articles. The time factor may have played a crucial role regarding the number of articles found to ensure a reliable answer to the question. On the other hand, nurses in their everyday work can hardly be expected to have more time to search for information, which raises a question about the kind of validated evidence on which the care is based.

The databases most frequently used were (mainly) CINAHL and to some extent PubMed. The dominance of these databases may be due to the training in information retrieval that was given prior to the implementation of the study, which emphasises search strategies in the CINAHL and PubMed databases. However, these databases are also extremely relevant with regard to finding answers to questions and are frequently used by professionals in the health care sector when they search for information. One participant used the Medline database, which can perhaps be explained by that person's past experience in using this database. Since the participants mostly used CINAHL and PubMed, it may guarantee that they have learned to employ secure sources on which to base their practice. However, there are other search strategies, such as Google and Google Scholar, which can provide information. None of the participants used these general sources, which may be due to the fact that they require more knowledge in order to critically evaluate the scientific value.

Large individual variations, as well as similarities, in the use of MESH terms were revealed, which may be explained by the issue in focus and by the participants' ability to search for information. English keywords were clearly dominant. The questions focused on issues related to patients undergoing surgery. *Ambulatory surgery* was the MESH term used most frequently in questions 1-3 and 6. One explanation for the variation in the search words could be that the Swedish term "day surgery" has several international counterparts, such as day surgery, day care surgery, ambulatory surgery, office-based surgery, and outpatient procedure [29]. The results show that, to some extent, the participants had the ability to customise the keywords to match the question and delimit the area of inquiry. Question number 4 focused on the anaesthesia nurses, with regard to their responsibilities, and the MESH term *nurse anaesthetist* dominated, which resulted in only 10/16 participants answering the question. Perhaps the most appropriate MESH term was not used. In the search for support relating to a patient's post-operative pain, keywords such as post-operative pain and nurse's role were used, resulting in 9/16 not answering the question.

When there is insufficient domain-specific knowledge, it can be useful to initially "Google" for information about one diagnosis to provide the foundation for subject-specific search terms that can facilitate further inquiries in specific databases [9]. The study result did not provide any indication that the participants took advantage of this alternative strategy.

EBP is the core of care and medicine and focuses on the Swedish description of the skills of anaesthesia nurses, and the description of skills for registered nurses with a graduate diploma in specialist nursing specifies this anaesthesia care [31]. It is surprising that the participants did not critically evaluate the scientific value of the articles. Gerjets and Hellenthal-Schorr [32] show that the query being investigated must be sufficiently well defined to be answered and the reader must have the necessary knowledge in order to examine the result critically. To assess whether the participants' knowledge enabled them to interpret the scientific value of the articles they found, they were required to evaluate the method used for each article, the sample selection, and whether the analysis was logical. The internal response rate was extremely low and most of the respondents that answered the questions evaluated the articles as scientifically well written. In all, only six assessments of the scientific value of the articles found regarded them as non-optimal. This could be due to the participants not having the necessary competence to methodologically evaluate the scientific relevance, as described by [23] who argued for the improbability of all the articles being optimal in scientific terms. Based on this result, it is obvious that the assessment of the scientific value was not optimal in this study.

Limitations

This study had several limitations. Firstly, the population was small and therefore we cannot make any generalisation of the study. In addition, we did not know the extent to which the participants were experienced in searching for scientific knowledge. The participants had just begun to study a new topic about which they were asked to search for information. Consequently, their knowledge with regard to defining the subject could have been limited. All of these factors may have affected the result. Otherwise, they had all recently participated in a course on data-based search procedures and since they were registered nurses they should also have been accustomed to searching for scientific knowledge. The relevance of the content of the articles in relation to the six questions has not been evaluated in this study.

Implications for Improvements in Education

The results underline the necessity for the education of Swedish specialist student nurses to intensify the training in search strategies and critical evaluation of the results found. A critical approach to routines in clinical practice must be internalised.

CONCLUSION

This study shows that most of the participants did not optimally complete the required task, despite recent training in how to find scientific knowledge and despite the fact that the participants were registered nurses. The CINAHL and PubMed databases were primarily used to search for the issues in question. Furthermore, the keywords differed between individuals and were used more frequently than MESH terms, and the critical evaluation of the scientific value of the articles was not optimal. In conclusion, further research is needed to understand how education of the specialist nursing students should be performed to optimise their search strategies and critical evaluation of scientific articles.

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