Review Article

Hospital nurses' information retrieval behaviours in relation to evidence based nursing: a literature review

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Abstract

Objective: The purpose of this literature review is to provide an overview of the information retrieval behaviour of clinical nurses, in terms of the use of databases and other information resources and their frequency of use.

Methods: Systematic searches carried out in five databases and handsearching were used to identify the studies from 2010 to 2016, with a populations, exposures and outcomes (PEO) search strategy, focusing on the question: In which databases or other information resources do hospital nurses search for evidence based information, and how often?

Results: Of 5272 titles retrieved based on the search strategy, only nine studies fulfilled the criteria for inclusion. The studies are from the United States, Canada, Taiwan and Nigeria. The results show that hospital nurses' primary choice of source for evidence based information is Google and peers, while bibliographic databases such as PubMed are secondary choices. Data on frequency are only included in four of the studies, and data are heterogenous.

Conclusions: The reasons for choosing Google and peers are primarily lack of time; lack of information; lack of retrieval skills; or lack of training in database searching. Only a few studies are published on clinical nurses' retrieval behaviours, and more studies are needed from Europe and Australia.

Keywords: bibliographic databases; evidence-based practice; information literacy; information retrieval; information seeking behaviour; information sources; nurses; review, literature

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Key Messages

- Hospital nurses use Google and peers more than bibliographic databases for retrieving information on evidence based nursing.
- International differences in the use of PubMed and CINAHL exist.
- Nurses lack skills in information retrieval in bibliographic databases and time dedicated to it.
- Knowing the needs and the information seeking behaviour of the nurses can help the health librarians to make targeted courses and information material.

Background

Clinical nurses have always obtained health care information for the benefit of patient care. Some studies (Dee & Stanley, 2005a; Morris-Docker, Angela, Harrison, Wolstenholme, & Black, 2004; Pravikoff, Tanner, & Pierce, 2005), mainly over 10 years ago, document how and where nurses find this information (Dee & Stanley, 2005b). In these studies, the overall conclusion was that the

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nurses involved preferred human or printed resources over electronic resources such as bibliographic databases, and that the nurses have many barriers towards electronic resources. In the Pravikoff study (Pravikoff et al., 2005) with 760 nurse respondents, the conclusion was that they were more confident in using Google than using bibliographic databases. When only looking at the bibliographic databases, PubMed or MEDLINE and CINAHL were the most commonly used sources for information retrieval. The question is whether the barriers towards searching in bibliographic databases remain a current phenomenon. Physicians' information retrieval behaviour and use of health care information resources conversely are well documented. Davies (Davies & Harrison, 2007) found that primary care physicians usually consult colleagues and paper sources rather than electronic sources when seeking answers to clinical questions, with time constraint being the greatest barrier followed by lack of skills in formulating clinical questions, searching bibliographic databases and interpreting research results. Cullen (Cullen, 2002) investigated primary care physician's extent of using the Internet (mainly Google) and use of bibliographic databases such as MEDLINE for clinical information retrieval. The conclusion was that they needed more training in database searching and in evaluating information. A study from 2010 (Younger, 2010) concludes that there is no significant difference between the reasons why physicians and nurses' search for information. The primary reason for searching the literature and other information sources is to uncover special topics on new or rare patient care issues; filling a knowledge gap; finding information about medicine and side-effects; finding information in relation to their personal professional development; or when writing a scientific manuscript (Dee & Stanley, 2005a; Lialiou, Pavlopoulou, & Mantas, 2016; Liverman, 1997; Tannery, Wessel, Epstein, & Gadd, 2007). Which sources, specifically bibliographic databases, physicians and nurse's use, is an important topic to investigate, as the choice of resource is part of the information seeking behaviour.

Clinical nurses are, besides clinical care of patients, responsible for the enhancement of skill levels of nurses, that is, by attending local introduction and specialised courses in evidence based medicine (EBM) as well as conducting development and quality improvement projects in clinical practice. This is particularly applicable for the Danish nurses trained before 2000 (Bagh, 1999) as the curriculum then did not include problem based learning (PBL), evidence based nursing (EBN) and health informatics.

In Denmark, authorisation as a clinical nurse has since 2000 required a bachelor's degree of 3 year at a University College, alternating between theoretical and clinical education. Before 2000, the nurse education in Denmark was more practice oriented and less academic.

Retrieval of current relevant research literature is a central element in evidence based nursing (EBN) (Cullum, DiCenso, & Ciliska, 1997), which is developed from the concept of EBM (Khan, Kunz, Kleijnen, & Antes, 2003; Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996). The core of clinical decision making in EBN is based on a combination of: (1) clinical expertise, (2) resources, (3) research evidence and (4) patient preferences and values (Guyatt, Ciliska, & DiCenso, 2005). It is a paradigm shift moving from a traditional intuition and personal experience based model towards the evidence based nursing practice (EBNP) (Melnyk & Fineout-Overholt, 2014). As EBNP is a means to ensure that nurses will practice high quality health care and ultimately improve health and safety for the patients. EBN / EBNP is an increasing demand from the public and the professional community worldwide (Stevens, 2013). Essentially scientific evidence includes all types of study designs, depending on the clinical questions asked to generate the most suitable answer (Melnyk & Fineout-Overholt, 2014) and can be obtained by systematic and structured searches – in retrieval systems, bibliographic databases or clinical guidelines. This requires retrieval skills in database searching and information literacy (American Library Association, 2013). EBN / EBNP is becoming a vital part of the nursing practice, nursing science and nursing education (Melnyk & Fineout-Overholt, 2014; Stevens, 2013), and can raise nurses status in the multi-professional teams and the nurse profession in general (Tod, Palfreyman, & Burke, 2004).

Objectives

As health librarians need to target and improve the guidance and training sessions in information retrieval for clinical nurses at hospitals, the aim of this literature review is to summarise the recent existing knowledge on clinical nurses' information retrieval behaviour for EBNP, in terms of health information sources, mainly databases, and the secondary aim is to find the frequency of use, as published in peer reviewed journals.

The objectives for this literature review are:

- Primarily to map clinical nurses' evidence based nursing information sources
- Secondarily to map the frequency of use of the multiple information sources.

Methods

The methods for this literature review are structured according to STARLITE (Booth, 2006), which is a standard for reporting search strategies for the literature searches, with both quantitative and qualitative reviews, and a detailed framework for reporting the literature retrievals and systematic reviews.

A comprehensive systematic literature search was carried out according to the populations, exposures and outcomes (PEO) model (Bettany-Saltikov, 2016; Khan et al., 2003) in each of the five selected bibliographic databases. The PEO represents P for clinical nurses at hospitals, E for the nurses' information seeking and O for the databases they are using for the information seeking. Terms matching the PEO are shown in Appendix 1. Five bibliographic databases, PubMed NLM, CINAHL (Ebsco), Cochrane Library, Embase (Ovid) and Library and Information Science Abstracts (LISA) (ProQuest), were chosen according to the Cochrane Handbook (Higgins & Green, 2008) and systematically searched. In the process of examining all the references, articles applicable to this literature review were identified, and Covidence was used as a tool for sorting. Some handsearching and snowballing, based on the references from the systematic searches, were used to complete the searches. The search terms and search histories are available in the Appendices 1 and 2 and were developed in

corporation with colleagues at the Medical Research Library at the University of Southern Denmark and Odense University Hospital.

To collate the recent existing literature, the systematic searches were limited to studies published within the time range from 01 January 2010 to 31 December 2016. The reason for this narrow time limit is the fast development in the databases and the rapid improvement in their potential as consumer-friendly resources, which makes older studies less applicable for this literature review.

The searches were conducted on 25 January 2016. Afterwards handsearching of article references from relevant studies took place to the end of March 2016. Alerts from PubMed and CINAHL were received until the end of November 2016. No further relevant studies were identified from 26 January until the end of November 2016.

The inclusion criteria for this literature review are as follows:

- Nurses employed at hospitals
- Sources (mainly databases): the hospital nurses used when searching
- Languages: Danish, English, German, Norwegian and Swedish
- Publication dates: January 2010 until the end of 2016.
- Study design which exposes where nurses are searching.

We searched for studies investigating the information retrieval behaviours of clinical nurses employed at hospitals in terms of where and by which sources they searched for the evidence based information. The primary focus of resources was databases, and the secondary focus was other resources. While there was no limitation on the study type, the majority of the identified studies were qualitative reviews. As the primary aim of this literature review is to map the resources used by the clinical nurses and the secondary aim to map the frequency, both studies with and without frequency of the use of resources were included.

The criteria for exclusion were as follows:

- Nurses employed other places than hospitals
- Nursing students (bachelor and master degrees)
- Study designs which do not expose where nurses are searching, for example guidelines to searching

Limits in relation to geography, age, race, gender or level of education were not relevant for the searches.

Results

The systematic searches from the five bibliographic databases generated 5272 references, and after a sorting process, it ended with nine studies that met the inclusion criteria for this literature review. The results of 5272 references were found in PubMed (3046), CINAHL (915), Cochrane Library (203), Embase (1071) and LISA (37) and were imported into EndNote version X7. After duplication check in EndNote, the result was 4033 references, and after being imported into Covidence, no further duplicates were detected. After a Title and Abstract screening, 76 references were assessed for full text eligibility. In the full text screening process, 67 studies were excluded, mainly because of wrong exposure or wrong population, that is searches not made by the clinical nurses, but course materials are made to the nurses including databases. A flow chart showing the selection process is available in Appendix 3 and a list of the excluded studies in Appendix 4.

The nurses are the largest workforce group at the hospitals, but only a few reviews are published in the health science literature on how and specifically in which resources the clinical nurses search for information in relation to EBN/EBNP. The majority of the studies found in the current systematic search were concentrated on information retrieval behaviour and choices on information sources for nursing students and not clinical nurses, or the studies included nurses as part of groups of health professionals, and not singled out as a specific group.

In the nine studies included in this literature review, the total sample size of the clinical nurses included in these studies is 6636 respondents. The countries represented in the nine studies are USA (four studies), Canada (two studies), Taiwan (two studies) and Nigeria (one study). Of the two studies from Canada, one (Kumaran & Chipanshi, 2015), included internationally educated nurses.

Table 1 shows an overview of the nine studies, categorised by bibliographic databases or other sources. We listed the studies and made a registration of respondents. If included in the studies, we made registrations on the frequency of the use of bibliographic databases or other sources, and these data are included in the table.

Google or other search engines

Searches made in Google, or similar search engines, are mentioned in eight of the nine studies, (Baro & Ebhomeya, 2013; Chiu et al., 2012; Kumaran & Chipanshi, 2015; Miller, Graves, Jones, & Sievert, 2010; Muallem, 2010; Ross, 2010; Wahoush & Banfield, 2014; Weng et al., 2013) representing a total of 6572 respondents. The studies conclude that the majority of the nurses use Google to search for information, including evidence based and health information. The included studies did not specify the precise use of Google or other web portals. Kumaran (Kumaran & Chipanshi, 2015) concluded that nurses often retrieve information by Googling because of lacking knowledge on how or where to seek information, and a lack of training in bibliographic database searching. The Kumaran study had no data on numbers of respondents or frequency of use. Chiu et al. (2012) found that nurses most frequently use web portals such as Google, and the frequency on the use was reported by 39.4% answering that they always used web portals, and 37% answered that they used it often. The rest answered that they used it seldom (22%), and only a small part (2%) of the respondents never used search engines. In Miller et al. (2010), 69% used Google frequently and 28% used Google occasionally. In Muallem (2010), 48.5% of the nurses used Google, but there are no data on the frequency. In Ross (2010), 47% used Google on a frequent basis and 27% used it occasionally. Wahoush & Banfield (2014) (with only a small number of respondents) reported that 83% used the Internet of whom 67% used it on a weekly basis, and 22% on a occasional basis, and none answered that they never used it.

PubMed/MEDLINE

Among the bibliographic databases, PubMed or MEDLINE is the most frequently used and included in seven of the nine studies (Chiu et al.,

Table 1 Where do clinical nurses retrieve evidence based information?

Author Year Country	Baro 2012 Nigeria	Chiu 2012 Taiwan	Hunt 2013 The United States	Kumaran 2015 Canada	Miller 2010 The United States	Muallem 2010 The United States	Ross 2010 The United States	Wahoush 2014 Canada	Weng 2012 Taiwan	Numbers of studies including electronic or other sources.
Sample size in number of clinical nurses	190	1573	64	17	178	262	128	18	4206	
Study methods	Q	Q	L	Q + I	O	Q	Q	C + I	Q	
Electronic or other sources included in the studies										
CINAHL	− 0	+ Accessed by 36.2%	− 0	− 0	− 0	+ na	+ na	+ na	+ na	5
Cochrane	− 0	+ Accessed By 29.6%	− 0	− 0	− 0	− 0	− 0	− 0	+ na	2
Google or other search engines	+ n = 123.	+ Always use 39.4% Often use 36.6% Seldom use 21.7% Never use 2.3%	− 0	+ Na	+ Frequently use 69% Occasionally use 28% Not known 4%	+ Use 48.50%	+ Frequently use 47% Sometimes use 27%	+ At least weekly use 67% Occasionally use 22% Never use 0%	+ na	8
MD Consult	− 0	+ Accessed By 27.9%	− 0	− 0	− 0	− 0	− 0	+ 0	+ na	2
Medical databases	+ n = 95	− 0	− 0	+ Na	− 0	− 0	− 0	− 0	− 0	2
Micromedex	− 0	− 0	+ na	− 0	− 0	− 0	− 0	− 0	+ na	2
PubMed/MEDLINE	− 0	+ Accessed By 43.4%	+ na	− 0	+ Frequently use 12% Occasionally use 28% Not known	+ na	+ Used By 46%	+ na	+ na	7

(continued)

Table 1. (continued)

ProQuest	+ Accessed By 31.9%	– 0	– 0	– 48%	– 0	– 0	– 0	+ na	2
UpToDate	+ Accessed By 31.3%	+ na	– 0	– 0	+ na	– 0	– 0	+ na	4
Local databases	+ Na	+ 0	+ Na	+ Frequently use 42% Occasionally use 45% Not known 14%	+ na	+ 0	+ na	+ na	6
Other sources	+ Asking colleagues *n = 169.* Asking librarians *n = 70*	– 0	+ Na	– 0	+ Asking peers 53.30%	+ Asking peers frequently 60% And sometimes 24%	+ Asking nurse colleagues at least weekly 100%	+ na	6

2012; Hunt, Cimino, & Koziol, 2013; Miller et al., 2010; Muallem, 2010; Ross, 2010; Wahoush & Banfield, 2014; Weng et al., 2013) representing 6429 respondents. Three of the studies reported percentages on the use of PubMed or MEDLINE. Chiu et al. (2012) reported a use of 43.4% of the nurses, while no frequency was reported. In Ross (2010), 46% reported using Medline, and of these, 25% reported that they were successful in their ability in searching MEDLINE. In Miller et al., (2010), only 12% reported using PubMed frequently.

CINAHL

CINAHL is a bibliographic database containing nursing and allied health journals, and was included in five of the nine studies (Chiu et al., 2012; Muallem, 2010; Ross, 2010; Wahoush & Banfield, 2014; Weng et al., 2013) representing 6187 respondents. In the Chiu study from Taiwan (Chiu et al., 2012), 36.2% of the respondents retrieved information in CINAHL, while in the Ross study from the United States (Ross, 2010), no exact numbers were reported, but 11% answered that they were partly successful when searching in CINAHL. The remaining studies are not reporting the number of nurses using CINAHL. Two of the studies have a category named 'Medical databases', which could be MEDLINE or PubMed, CINAHL or other (Baro & Ebhomeya, 2013; Kumaran & Chipanshi, 2015), but it is not specified and thus not included in the analysis.

Other databases or local databases

Four of the studies have included various other databases: Cochrane, MD Consult, Micromedex, ProQuest and UpToDate (Chiu et al., 2012; Hunt et al., 2013; Muallem, 2010; Weng et al., 2013). Only one study (Chiu et al., 2012) reports statistics on these databases, and the authors found that 29.6% of the respondents used Cochrane; 27.9% used MD Consult; 31.9% used ProQuest and 31.3% used UpToDate. These databases were mentioned on the same level in the study although ProQuest is a platform which hosts several databases. Six studies included local databases, for example Chinese ICPL and CEPS or the local intranet, but as these are not specified, and it is a local phenomenon, they are not included in the analysis (Chiu et al., 2012; Kumaran & Chipanshi, 2015; Miller et al., 2010; Muallem, 2010; Wahoush & Banfield, 2014; Weng et al., 2013).

Peers or information specialists

The last category is not an electronic resource or database, but still a very frequently used source in the included studies. It concerns obtaining information from colleagues, peers or librarians. This is included in six of nine of the studies (Baro & Ebhomeya, 2013; Kumaran & Chipanshi, 2015; Muallem, 2010; Ross, 2010; Wahoush & Banfield, 2014; Weng et al., 2013) representing 4821 respondents. Looking at the results of four of the studies (Baro & Ebhomeya, 2013; Muallem, 2010; Ross, 2010; Wahoush & Banfield, 2014), the percentage or number of respondents using Google and peers, respectively, is almost equal. More than half of the nurses are using peers as a source of information. In Baro & Ebhomeya, (2013), it was 169 respondents of a total of 190 who asked colleagues for evidence based information. In Muallem (2010), 53.3% were asking peers for evidence based information, and in comparison, 48.5% had answered they used the Internet. In Ross (2010), 60% used peers frequently, and 24% had answered they used peers sometimes, and in comparison, 47% had answered that they used the Internet frequently. In Wahoush & Banfield (2014), 100% asked nurse colleagues at least weekly, compared to the 67% who used the Internet at least weekly. Other sources included asking librarians or information specialists, and this was reported in only one of the studies (Baro & Ebhomeya, 2013) in which 70 of the 190 respondents answered that they used librarians to obtain information, while there was no report on the frequency.

Comparison on physicians versus nurses

In the nine included studies, two of them (Chiu et al., 2012; Weng et al., 2013) make a comparison between nurse and physician preference, in regard to choice of databases. Chiu

et al., (2012) found that 38% of the 544 participating physicians used online database, compared to the 1573 participating nurses where only 14% used online databases. Ninety-five percent of the physicians used MEDLINE, compared to 43% of the nurses, and CINAHL was used by 33% of the physicians and 36% of the nurses. These data are not included in Table 1.

Discussion

The aims of this literature review were to identify and describe studies published in the past five years regarding (1) in which databases or other resources nurses retrieve evidence based health information and (2) the frequency of this use. To answer this, a systematic search was conducted. Nine studies met the inclusion criteria for the systematic search and the time limitation from 2010 to 2016.

Although there is an overall global increase in the use of electronic devices, such as computers, mobile devices and smartphones, and much information is available from the Internet or in databases, our literature review indicates that the nurses' use of bibliographic databases is significantly low. Nurses still prefer searching information on resources such as Google, as well as consulting and asking peers, rather than searching bibliographic databases. It seems that Google and peers are the nurses' primary sources of evidence based information, realising that the studies included in this review are from 2010 to 2015 and that results after 2015 might vary.

A study by Clarke et al. (2013) found that nurses and physicians use colleagues as the preferred information source and that the Internet has an escalating usage. This study was not included in the original search according to our choice of exposure.

A similar finding is reported in a study from Iran in 2015 (Farokhzadian, Khajouei, & Ahmadian 2015). One hundred and ninety-five nurses with an academic degree and working at hospitals were the respondents, and the result showed that human information sources, mainly from other nurses or physicians, were the most used resources. The use of electronic information resources was reported with general Internet search engines such as Google as the most used source, and bibliographic databases as the least used sources. It is reported that the nurses' skills in using search features and advanced search strategies were poor. This study was not included in the original search according to our choice of outcomes.

CINAHL is an index of nursing and research journals covering nursing and other health care professions, which is expected to be the top prioritised database among nurses. The rest of the databases also showed a higher score by the physicians compared with the nurses, and even Google was used more frequently, so presumably the physicians are, in general, using more information resources than the nurses. Weng et al. (2013) found that physicians accessed Internet based resources, including MEDLINE and CINAHL, more often than other professional groups. While nurses seemed more prone to consult peers, they were less likely to access databases. Both nurses and physicians used Google as an information resource.

We are aware of the immense use of Google, and Googling for quick answers is a universal thing, but we wanted to investigate the use of Google, as a source on evidence based information, when conducting comprehensive searches. Despite the advantages of using high quality information from medical bibliographic databases, it seems that the nurses still prefer to be informed by peers, or rely on what they have learned during their nursing educations and their personal experience (Chiu et al., 2012; Kumaran & Chipanshi, 2015; Muallem, 2010; Pravikoff et al., 2005; Ross, 2010; Wahoush & Banfield, 2014; Weng et al., 2013). The nurses in Denmark had, before the year 2000, a more practice oriented and insignificantly evidence based education, which could have an effect on the nursing students' information literacy and their approach to research literature. Furthermore, this could have an effect on their information literacy level after graduation and in the hospital employment. A systematic review from 2006 (Milner, Estabrooks, & Myrick, 2006) found a positive correlation between the searching for research literature, reading research reviews and the educational level. Although there were no

findings which indicate whether they understood what they had read or whether they actually used the information in practice, this could indicate why the nurses prefer sources as Google or peers.

Some of the reasons why physicians have chosen Google, rather than using bibliographic databases such as PubMed and CINAHL, seem to be a quick gateway into more relevant information, but with pitfalls such as Google may include incorrect information and searching may be inefficient and not systematic (Chiu et al., 2012). The results of the included studies indicate that nurses most frequently use peers or Google, and the least indicated information sources are medical or other databases. Consulting peers, colleagues and information specialists is a commonly used strategy for information seeking in six of nine studies included in this literature review, where more than 50% of respondents report such use, but unfortunately, the percentage use of information specialists cannot be singled out. Only the Baro study (Baro & Ebhomeya, 2013) reported that 70 of the 190 respondents asked librarians. Three of the studies (Baro & Ebhomeya, 2013; Miller et al., 2010; Muallem, 2010; Ross, 2010) indicate that the reasons for the nurses' choices are primarily barriers concerning lack of time to retrieve information, and other barriers such as lack of awareness of medical bibliographic databases; lack of training in databases; and inadequate computer skills and lack of information competencies. Chiu et al., (2012) has in addition to this added language barriers as a challenge, as most of the databases have English as a search language, and non-native English speaking nurses are often not proficient in reading and writing in English.

Apart from the lack of information retrieval skills and the lack of time available to spend on searching for evidence based information, there seems to be an overlying obstacle as well; in Denmark, for example, there is no national, policy level demand for the implementation of EBM or EBN. Adherence to national clinical guidelines and other sources of evidence based information is optional for the hospitals, but it is considered good clinical practice to do so. As a consequence, efforts of implementation of EBP, in nursing particularly, are largely dependent on the implementation capacity of clinical nursing experts at the hospitals whose implementation strategies rarely have a central, administrative origin (Oikarainen, 2016). Hospital policies, visions and strategies may encourage evidence based practice and the use of evidence based information; however, these types of guiding documents serve a more intentional purpose rather than outlining implementation procedures and demands. With treatment, care, prevention and palliation being the core tasks for the clinical staff at hospitals, evidence based practice and evidence based information could be considered a necessary but not mandatory vehicle to meet the goal, but not the goal itself. In other words, the very tangible needs of the patients in any busy hospital ward simply overshadow the need and motivation for accomplishing skills in evidence based information retrieval. There is no time for extra tasks, such as information seeking, in the clinical workflow for the busy hospital nurses, and there is a lack of highly educated nurses to improve nursing research and implementing EBN or EBNP (Oikarainen, 2016). In addition to this, Thompson, Estabrooks, Scott-Findlay, Moore, & Wallin, (2007) found that organisational training is the most important factor, when the aim was to enhance nurses' use of research findings in their practice. In the hospital organisations, another barrier can be organisational disagreements between nurses and the hospital administration on the importance of implementing EBNP in the nursing practice and, as a derivation of this, a general negative attitude towards EBNP among the nurses (Koivunen, Valimaki, & Hatonen, 2010). When nursing leaders and nursing colleagues do not demand evidence based information, the motivation to maintain and develop searching competence will be absent. Furthermore, availability and accessibility of published resources in evidence based information is suggested as another barrier for evidence based practice and information retrieval (Tanner, Pierce, & Pravikoff, 2004; Wahoush & Banfield, 2014).

The authors have not yet made surveys on the difference between physicians and nurses, according to information retrieval, and it is not of these authors' knowledge, if choices on information sources are a local, a national or a

worldwide phenomenon. In Denmark, there are some differences between physicians and nurses' introduction to and training in information retrieval during the bachelor or master degree, which could explain the difference. Also it is known that nursing colleagues and especially the ward sisters or evidence based practitioner mentors in the clinical practice do not demand basic nurses to search for evidence based nursing information as a part of their daily work (Arguelles, 2011). In that way, newly graduated nurses consequently lose their recently acquired competences concerning information retrieval. Only when clinical nurses participate in projects or conduct postgraduate courses or acquire a university degree, there is a demand on information retrieval and thereby, at first, an extrinsic motivation to improve information searching skills. As a supportive function, a closer collaboration between nurses and health librarians is proposed by Tod, Beverly, Leonard, Gilsenan, & Palfreyman (2007), that is with health librarians offering assistance in the literature retrieval in the wards at a regular basis when nurses propose clinical questions; attending journal clubs; audit meetings; participate in medical projects; or conducting supplementary education. The role of the librarian or information specialist has not been elaborated in this review as the main goal was to expose the information retrieval behaviour of clinical nurses and thereby exclude initiatives from information specialists or librarians. But there is no doubt that that the librarians have a huge impact on the quality of literature searches, when nurses are supervised by librarians (Dee & Stanley, 2005b).

Limitations to this literature review are that a limited number of studies on the subject were found, and the included studies are from different parts of the world in terms of culture and economic positions, and in terms of access to databases. No studies were found from Europe or Australia. This could be a source of bias in the results. The nine studies identified for inclusion were heterogeneous, and this made it difficult to do an overall comparison between studies.

In our search strategy, we have chosen the outcome in our PEO model to be mainly database names. Our main focus was databases, which hospital nurses were using for searching, but this could be seen as a limitation, as studies mentioning databases in more general terms, and named in the full text but not in the abstract or databases not searched for, may have been excluded in the results.

The search strategy for this review did not include adjacency searching, and we have not been aware of spelling words in British or American English, which also is a limitation to our search, as some relevant studies could be excluded.

We chose a specific population of nurses, namely nurses at hospitals and thereby we did not include nurses in, for example primary health care. We did that because of our special interest in hospital nurses, as a main part of our employment. Secondarily, we regarded hospital nurses as a homogeneous and comparable population. Some studies could be excluded by this narrow population choice and thus seem to be a limitation.

The nine included studies did not specify the level of education for the respondents among hospital nurses. The content of nurses' educations and nursing degrees can vary significantly worldwide, from University College educations to regular bachelors and master degrees from high level universities.

The nine included studies show where clinical nurses mainly search for evidence based information, but the studies are heterogenous, in terms of sample sizes. It varies from the smallest sample size of 17 respondents (Kumaran & Chipanshi, 2015) to the largest number of 4206 respondents (Weng et al., 2013). Another point of difference is the study designs, as they vary from questionnaires to online surveys, to observations on log files or to a combination of all of these. In the questionnaires (used in seven of nine of the studies), the questions are close-ended, which will limit the possible answers from the respondents mainly on choices of information sources. In the study using log files (Hunt et al., 2013), it was possible to track the nurses' choices of information sources. But a limitation to this tracking of resources was that only health resources were reported, and all searches in Google or other non-professional websites or other resources were left out. A final difference is that the studies has variant ways of presenting data, which varies from numbers

of persons included in the studies to percentages of respondents, and this is clarified in Table 1.

This literature review had a secondary aim to find the frequency of use of databases or other electronic resources. Only four of the studies included frequency of use (Chiu et al., 2012; Miller et al., 2010; Ross, 2010; Wahoush & Banfield, 2014). The presentation on frequency was heterogenous, for example in Chiu et al. (2012) Google was not mentioned specifically, the category was web portals, and the choices on frequency varied in the studies, which meant it was difficult to compare the frequency in the selected studies.

Conclusions

The purpose of this literature review was to provide an overview of the information retrieval behaviour of clinical nurses, in terms of the use of databases and other information resources, and secondary their frequency of use. We found that Google and peers are still the most frequently used sources and that bibliographic databases such as PubMed or MEDLINE and CINAHL are used to a limited extent.

The reasons for not using bibliographic databases are primarily lack of skills on information searching, lack of time and low degree of motivation for implementing evidence based practice in general. This literature review highlights the actual need and importance of proactive initiatives by information specialists providing assistance in the wards teaching nurse mentors how to search for evidence based information.

We recommend that information retrieval is introduced as an educational module during postgraduate courses on local levels and included in the daily clinical reflection among nurses and requested and initiated by the local nursing leaders. In addition, we recommend health librarians offer seminars, workshops or other kinds of training sessions, which could develop the search skills, and assistance to the hospital nurses in making systematic searches. Information on EBN/EBNP should be offered in a differentiated approach depending on the actual needs and levels of information literacy among the respondents and

in the clinical setting. There should be a variation of theoretical lessons and especially hands on training with actual clinical cases and clinical search questions as starting points and including guidance on how to set up alerts from systematic searches, primarily in CINAHL and PubMed and MEDLINE.

Further research on this topic is recommended, and particularly studies from Europe and Australia are needed. The authors of this literature review are consequently planning a research project to investigate how to make targeted course materials, workshops or other actions for nurses in order to improve retrieval literacy.

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Conflict of interest

The authors declare no conflict of interests.

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Appendix 1 Search terms

P- Population	E- Exposure	O- Outcome
Nurse	Information seeking behavior	Database
Nurses	Information seeking	Databases
nursing	information-seeking	"data base"
	Search strategies	"data bases"
	Search strategy	full-text database
	literature search	full-text databases
	literature searches	full text database
	literature searching	full text databases
	searching	bibliographic database
	Information retrieval	bibliographic databases
	literature retrieval	Medline
	data retrieval	Medlars
	retrieval of information	Pubmed
		Cinahl
		Embase
		ERIC
		web of science
		science direct
		scisearch
		scopus
		clinicalkey
		Cochrane library
		Cochrane Central
		Embase
		Psycinfo
		google scholar
		amed

Appendix 2 Search strategies

Cinahl 25.1.16

915 references, imported into EndNote

ID	Term(s)	Options	Results
S17	(S7 OR S8 OR S9 OR S10 OR S11 OR S12) AND (S13 AND S14 AND S15)	Limiters - Published Date: 20100101-20161231; Language: Danish, English, German, Norwegian, Swedish	915
S16	(S7 OR S8 OR S9 OR S10 OR S11 OR S12) AND (S13 AND S14 AND S15)	Search modes -Boolean/Phrase	3,199
S15	S7 OR S8 OR S9 OR S10 OR S11 OR S12	Search modes -Boolean/Phrase	90,465
S14	S5 OR S6	Search modes -Boolean/Phrase	617,033
S13	S1 OR S2 OR S3 OR S4	Search modes -Boolean/Phrase	28,523
S12	Database OR Databases OR "data base" OR "data bases" OR full-text databases OR full-text databases OR full text database OR full text database OR bibliographic database OR bibliographic databases OR Medline OR medlars OR Pubmed OR Cinahl OR Embase OR ERIC OR web of science OR science direct OR scisearch OR scopus OR clinicalkey OR Cochrane library OR Cochrane Central OR Embase OR psycinfo OR google scholar OR amed	Search modes -Boolean/Phrase	90,465
S11	(MH "AMED Database")	Search modes -Boolean/Phrase	101
S10	(MH "Cochrane Library") OR (MH "Full-Text Databases, Health")	Search modes -Boolean/Phrase	12,270
S9	(MH "CINAHL Database") OR (MH "Embase") OR (MH "ERIC Database") OR (MH "Psycinfo")	Search modes -Boolean/Phrase	21,430
S8	(MH "Medline") OR (MH "PubMed") OR (MH "Medlars")	Search modes -Boolean/Phrase	30,678
S7	(MH "Databases")	Search modes -Boolean/Phrase	7,967
S6	nurse* OR nursing	Search modes -Boolean/Phrase	617,033
S5	(MH "Nurses")	Search modes -Boolean/Phrase	43,659
S4	Information seeking behavior OR Information seeking OR information-seeking OR Search strategies OR Search strategy OR literature search OR literature searches OR literature searching OR searching OR Information retrieval OR literature retrieval OR data retrieval OR retrieval of information	Search modes -Boolean/Phrase	28,523
S3	(MH "Information Retrieval")	Search modes -Boolean/Phrase	6,303
S2	(MH "Literature Searching")	Search modes -Boolean/Phrase	832
S1	(MH "Information Seeking Behavior")	Search modes -Boolean/Phrase	2,254

Pubmed 25.1.16

3046 references imported into EndNote

Appendix 2. (continued)

Query	Items found
Search (Information seeking behavior OR Information seeking OR information-seeking OR Search strategies OR Search strategy OR literature search OR literature searches OR literature searching OR searching OR Information retrieval OR literature retrieval OR data retrieval OR retrieval of information) AND (Nurse OR nurses OR nursing)) AND (Database OR Databases OR "data base" OR "data bases" OR full-text databases OR full-text databases OR full text database OR full text database OR bibliographic database OR bibliographic databases OR Medline OR medlars OR Pubmed OR Cinahl OR Embase OR ERIC OR web of science OR science direct OR scisearch OR scopus OR clinicalkey OR Cochrane library OR Cochrane Central OR Embase OR psycinfo OR google scholar OR amed) AND ("last 5 years"[PDat] AND (Danish[lang] OR English[lang] OR German[lang] OR Norwegian[lang] OR Swedish[lang])	3046

Embase 25.1.16
1071 references imported into EndNote

ID	Term(s)	Results
1	exp information seeking/	1474
2	exp information seeking/ or exp information retrieval/	26070
3	(Information seeking behavior or Information seeking or information-seeking or Search strategies or Search strategy or literature search or literature searches or literature searching or searching or Information retrieval or literature retrieval or data retrieval or retrieval of information).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]	102078
4	1 or 2 or 3	102078
5	exp data base/	275302
6	exp full text database/	134
7	exp bibliographic database/ or cinahl/ or cochrane library/ or embase/ or medline/ or psycinfo/ or sciencedirect/ or scisearch/ or scopus/ or "web of science"/	60940
8	(Database or Databases or data base or data bases or full-text databases or full-text databases or full text database or full text database or bibliographic database or bibliographic databases or Medline or medlars or Pubmed or Cinahl or Embase or ERIC or web of science or science direct or scisearch or scopus or clinicalkey or Cochrane library or Cochrane Central or Embase or psycinfo or google scholar or amed).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]	480956
9	5 or 6 or 7 or 8	486068
10	exp nurse/	97794
11	exp nursing/	185002
12	(nurse or nurses or nursing).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]	390798
13	10 or 11 or 12	391879
14	4 and 9 and 13	1910
15	limit 14 to ((danish or english or german or norwegian or swedish) and yr="2010 -Current")	1071

LISA 25.1.16
37 references imported into EndNote

Cochrane 25.1.16
203 references import into EndNote

No limitattion on languages. Word variations are not searched

Appendix 3 Literature search. Flow chart from Covidence
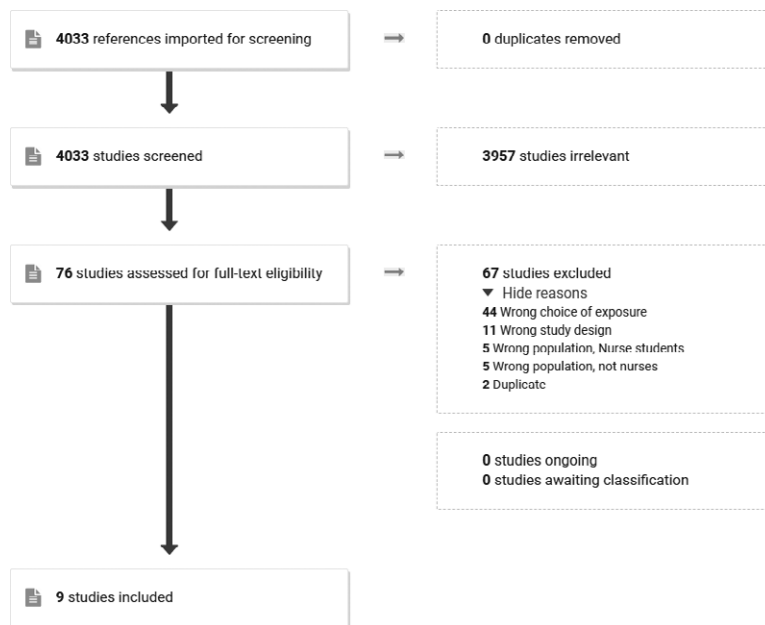
Appendix 4 List of excluded studies after full text screening

Specialized nursing practice for chronic disease management in the primary care setting: An evidence-based analysis. (2013). Ontario Health Technology Assessment Series, 13(10).

Exclusion reason: Wrong choice of exposure;

Creating Interactive Online Instruction: The McGoogan Library Experience. (2015). Medical Reference Services Quarterly, 34(4), 407-417 411p. https://doi.org/10.1080/02763869.2015.1082373

Exclusion reason: Wrong population, Nurse students;

Rigorous, robust and systematic: Qualitative research and its contribution to burn care. An integrative review. (2015). Burns (03054179), 41 (8), 1619-1626 1618p. https://doi.org/10.1016/j.b urns.2015.04.007

Exclusion reason: Wrong population, not nurses;

Arguelles, C. (2011). Evidence-Based Practice Mentors: Taking Information Literacy to the Units in a Teaching Hospital. Journal of Hospital Librarianship, 11(1), 8-22. https://doi.org/10.1080/15323269.2011.537989

Exclusion reason: Wrong choice of exposure;

Aromataris, E., & Riitano, D. (2014). Constructing a search strategy and searching for evidence. American Journal of Nursing, 114(5), 49-56.

Exclusion reason: Duplicate;

Aromataris, E., & Riitano, D. (2014). Constructing a search strategy and searching for evidence. A guide to the literature search for a systematic review. American Journal of Nursing, 114(5), 49-56. https://doi.org/10.1097/01.naj.0000446779.99522.f6

Exclusion reason: Wrong study design;

Aromataris, E., & Riitano, D. (2014). Constructing a Search Strategy and Searching for Evidence...third in a new series. American Journal of Nursing, 114(5), 49-56 48p. https://doi.org/10.1097/01.naj.0000446779.99522.f6

Exclusion reason: Duplicate;

Barnoy, S., Volfin-Pruss, D., Ehrenfeld, M., & Kushnir, T. (2011). Self-epistemic authority and nurses' reactions to medical information that is retrieved from Internet sites of different credibility. Nursing & Health Sciences, 13(3), 366-370. https://doi.org/10.1111/j.1442-2018.2011.00626.x

Exclusion reason: Wrong choice of exposure;

Campbell, C. J., & McDowell, D. E. (2011). Computer Literacy of Nurses in a Community Hospital: Where Are We Today? Journal of Continuing Education in Nursing, 42(8), 365-370 366p. https://doi.org/10.3928/00220124-20110215-01

Exclusion reason: Wrong choice of exposure;

Cheeseman, S. E. (2012). Information literacy: using computers to connect practice to evidence. Neonatal network : NN, 31(4), 253-258. doi:63185M7H16HL7555 [pii]

Exclusion reason: Wrong study design;

Cheeseman, S. E. (2013). Information literacy: foundation for evidence-based practice. Neonatal Netw, 32(2), 127-131. https://doi.org/10.1891/0730-0832.32.2.127

Exclusion reason: Wrong choice of exposure;

Clarke, M. A., Belden, J. L., Koopman, R. J., Steege, L. M., Moore, J. L., Canfield, S. M., & Kim, M. S. (2013). Information needs and information-seeking behaviour analysis of primary care physicians and nurses: a literature review. Health Information and Libraries Journal, 30(3), 178-190. https://doi.org/10.1111/hir.12036

Exclusion reason: Wrong choice of exposure;

Czaplewski, L. M. (2012). Searching the Literature: A Researcher's Perspective. Journal of Infusion Nursing, 35(1), 20-26 27p.

Exclusion reason: Wrong study design;

De Groote, S. L., Shultz, M., & Blecic, D. D. (2014). Information-seeking behavior and the use of online resources: a snapshot of current health sciences faculty. Journal of the Medical Library Association : JMLA, 102(3), 169-176. https://doi.org/10.3163/1536-5050.102.3.006

Exclusion reason: Wrong population, not nurses;

Deberg, J., Adams, S., & Cullen, L. (2012). Evidence Into Practice: Basic Steps for Planning Your Evidence Search. Journal of PeriAnesthesia Nursing, 27(1), 37-41 35p. https://doi.org/10.1016/j.jopan.2011.11.001

Exclusion reason: Wrong study design;

Du, S., Liu, Z., Liu, S., Yin, H., Xu, G., Zhang, H., & Wang, A. (2013). Web-based distance learning for nurse education: a systematic review. International nursing review, 60(2), 167-177. https://doi.org/10.1111/inr.12015

Exclusion reason: Wrong population, Nurse students;

Gazarian, P. K. (2013). Use of the critical decision method in nursing research: an integrative review. 36(2), 106-117. https://doi.org/10.1097/ans.0b013e3182901f8d

Exclusion reason: Wrong choice of exposure;

Goncalves, L. S., Wolff, L. D., Staggers, N., & Peres, A. M. (2012). Nursing informatics competencies: an analysis of the latest research. Ni 2012 (2012), 2012, 127.

Exclusion reason: Wrong choice of exposure;

Haigh, C. A. (2011). Wikipedia as an evidence source for nursing and healthcare students. 31(2), 135-139. https://doi.org/10.1016/j.nedt.2010.05.004

Exclusion reason: Wrong population, Nurse students;

Hallyburton, A., & John, B. S. (2010). Partnering with your library to strengthen nursing research. The Journal of nursing education, 49(3), 164-167. https://doi.org/10.3928/01484834-20091118-04; 10.3928/01484834-20091118-04

Exclusion reason: Wrong choice of exposure;

Halm, M. A. (2010). 'Inside looking in' or 'inside looking out'? How leaders shape cultures equipped for evidence-based practice. American Journal of Critical Care, 19(4), 375-378 374p. doi:10.4037/ajcc2010627

Exclusion reason: Wrong choice of exposure;

Halm, M. A. (2013). Nursing handoffs: ensuring safe passage for patients. Am J Crit Care, 22(2), 158-162. doi:10.4037/ajcc2013454

Exclusion reason: Wrong population, not nurses;

Hamilton, P., Willis, E., Henderson, J., Harvey, C., Toffoli, L., Abery, E., & Verrall, C. (2014). Mapping social processes at work in nursing knowledge development. 16(3), 395-402. doi:10.1111/nhs.12106

Exclusion reason: Wrong choice of exposure;

Heyd, M., & Spigelmyer, P. C. (2014). Librarian–Nursing Collaboration to Promote Nursing Research in a Small Rural Health Care System. Journal of Hospital Librarianship, 14(3), 322-327. doi:10.1080/15323269.2014.923805

Exclusion reason: Wrong choice of exposure;

Hines, S., Ramsbotham, J., & Coyer, F. (2015). The Effectiveness of Interventions for Improving the Research Literacy of Nurses: A Systematic Review. Worldviews Evid Based Nurs, 12(5), 265-272. doi:10.1111/wvn.12106

Exclusion reason: Wrong choice of exposure;

Hopp, L. (2014). Developing a robust evidence base for nursing. Nurs Clin North Am, 49(4), 475-484. doi:10.1016/j.cnur.2014.08.003

Exclusion reason: Wrong choice of exposure;

Hough, H. (2012). Evaluating Website Resources. Perioperative Nursing Clinics, 7(2), 189-193. https://doi.org/10.1016/j.cpen.2012.02.007

Exclusion reason: Wrong choice of exposure;

Im, E. O., & Chang, S. J. (2012). A Systematic Integrated Literature Review of Systematic Integrated Literature Reviews in Nursing. 51(11), 632-U110. doi:10.3928/01484834-20120914-02

Exclusion reason: Wrong choice of exposure;

Jaffe, R., & Cowell, J. M. (2014). Approaches for Improving Literature Review Methods. The Journal of school nursing : the official publication of the National Association of School Nurses, 30 (4), 236-239. doi:10.1177/1059840514540427

Exclusion reason: Wrong population, Nurse students;

Jin, Y.-h., Ma, E.-t., Gao, W.-j., Hua, W., & Dou, H.-y. (2014). Reporting and methodological quality of systematic reviews or meta-analyses in nursing field in China. International Journal of Nursing Practice, 20(1), 70-78 79p. doi:10.1111/ijn.12123

Exclusion reason: Wrong choice of exposure;

Kamienski, M., Carman, M. J., Wolf, L. A., Henderson, D., &Manton, A. (2013). Searching the Literature: What Is Known (and Not Known) About Your Topic? JEN: Journal of Emergency Nursing, 39(4), 395-397 393p. doi:10.1016/j.jen.2013.05.003

Exclusion reason: Wrong choice of exposure;

Lialiou, P., & Mantas, J. (2013). Evaluation of health professionals in the use of internet information retrieval systems in health: a literature review. Studies in Health Technology & Informatics, 190, 80-82.

Exclusion reason: Wrong choice of exposure;

Lialiou, P., & Mantas, J. (2014). Online information retrieval systems and health professionals. Stud Health Technol Inform, 202, 146-148.

Exclusion reason: Wrong choice of exposure;

Lialiou, P., & Mantas, J. (2015). Health Professionals' Use of Computer Databases to Utilize Research for Practice: A Pilot Study. Studies in health technology and informatics, 213, 291-293.
Exclusion reason: Wrong choice of exposure;

Liang, J. C., Wu, S. H., & Tsai, C. C. (2011). Nurses' Internet self-efficacy and attitudes toward web-based continuing learning. Nurse Educ Today, 31(8), 768-773. doi:10.1016/j.nedt.2010.11.021

Exclusion reason: Wrong choice of exposure;

Licen, S., & Plazar, N. (2015). Identification of nursing competency assessment tools as possibility of their use in nursing education in Slovenia---a systematic literature review. 35(4), 602-608. doi:10.1016/j.nedt.2014.12.023

Exclusion reason: Wrong choice of exposure;

Majid, S., Foo, S., Luyt, B., Zhang, X., Theng, Y. L., Chang, Y. K., & Mokhtar, I. A. (2011). Adopting evidence-based practice in clinical decision making: Nurses' perceptions, knowledge, and barriers. 99(3), 229-236. doi:10.3163/1536-5050.99.3.010

Exclusion reason: Wrong choice of exposure;

McGrath, J. M., & Brandon, D. (2014). Searching the literature is not for the faint of heart! Advances in Neonatal Care (Lippincott Williams & Wilkins), 14(4), 229-231 223p. doi:10.1097/ANC.0000000000000111

Exclusion reason: Wrong choice of exposure;

McGrath, J. M., Brown, R. E., & Samra, H. A. (2012). Before You Search the Literature: How to Prepare and Get the Most Out of Citation Databases. Newborn & Infant Nursing Reviews, 12 (3), 162-170 169p. doi:10.1053/j.nainr.2012.06.003

Exclusion reason: Wrong study design;

Mitchell, S. A., Fisher, C. A., Hastings, C. E., Silverman, L. B., & Wallen, G. R. (2010). A thematic analysis of theoretical models for translational science in nursing: Mapping the field. Nursing Outlook, 58(6), 287-300 214p. doi:10.1016/j.outlook.2010.07.001

Exclusion reason: Wrong choice of exposure;

Moen, A., &Mæland Knudsen, L. M. (2013). Nursing informatics: decades of contribution to health informatics. 19(2), 86-92. doi:10.4258/hir.2013.19.2.86

Exclusion reason: Wrong choice of exposure;

Morris, E., & Burkett, K. (2011). Mixed methodologies: a new research paradigm or enhanced quantitative paradigm. Online Journal of Cultural Competence in Nursing & Healthcare, 1 (1), 27-36 10p.

Exclusion reason: Wrong choice of exposure;

Murthy, L., Shepperd, S., Clarke, M. J., Garner, S. E., Lavis, J. N., Perrier, L., . . . Straus, S. E. (2012). Interventions to improve the use of systematic reviews in decision-making by health system managers, policy makers and clinicians. The Cochrane database of systematic reviews, 9, CD009401. https://doi.org/10.1002/14651858.cd009401.pub2

Exclusion reason: Wrong population, not nurses;

Newman, K., Doran, D., & Nagle, L. M. (2014). The relation of critical care nurses' information-seeking behaviour with perception of personal control, training, and non-routineness of the task. Dynamics, 25(1), 13-18.

Exclusion reason: Wrong choice of exposure;

Newman, K. M. (2012). The exploration of critical care nurses' use of accumulated knowledge and information-seeking for non-routine tasks. Ph.D., 137 p-137 p 131p.

Exclusion reason: Wrong choice of exposure;

Newman, K. M., & Doran, D. (2012). Critical care nurses' information-seeking behaviour during an unfamiliar patient care task. 23(1), 12-17.

Exclusion reason: Wrong choice of exposure;

Olsan, T. H., Bianchi, C., White, P., Glessner, T., & Mapstone, P. L. (2011). Finding electronic information for health policy advocacy: A guide to improving search results. Journal of the American Academy of Nurse Practitioners, 23(12), 648-658. doi:10.1111/j.1745-7599.2011.00670.x

Exclusion reason: Wrong study design;

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