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Adopting evidence-based practice in clinical decision making: nurses' perceptions, knowledge, and barriers ▣C

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Objective: Evidence-based practice (EBP) provides nurses with a method to use critically appraised and scientifically proven evidence for delivering quality health care to a specific population. The objective of this study was to explore nurses' awareness of, knowledge of, and attitude toward EBP and factors likely to encourage or create barriers to adoption. In addition, information sources used by nurses and their literature searching skills were also investigated.

Method: A total of 2,100 copies of the questionnaire were distributed to registered nurses in 2 public hospitals in Singapore, and 1,486 completed forms were returned, resulting in a response rate of 70.8%.

Results: More than 64% of the nurses expressed a positive attitude toward EBP. However, they pointed out that due to heavy workload, they cannot keep up to date with new evidence. Regarding self-efficacy of EBP-related abilities, the nurses perceived themselves to possess moderate levels of skills. The nurses also felt that EBP training, time availability, and mentoring by nurses with EBP experience would encourage them to implement EBP. The top three barriers to adopting EBP were lack of time, inability to understand statistical terms, and inadequate understanding of the jargon used in research articles. For literature searching, nurses were using basic search features and less than one-quarter of them were familiar with Boolean and proximity operators.

Conclusion: Although nurses showed a positive attitude toward EBP, certain barriers were hindering their smooth adoption. It is, therefore, desirable that hospital management in Southeast Asia, particularly in Singapore, develop a comprehensive strategy for building EBP competencies through proper training. Moreover, hospital libraries should also play an active role in developing adequate information literacy skills among the nurses.

INTRODUCTION

Medical and health care is one of the most dynamic human disciplines, and large amounts of money are spent annually on high-quality and sophisticated research, resulting in an exponential growth in health care literature. Regularly, new and more effective medicines, medical devices, and procedures are invented. One major objective behind all these efforts is to help doctors, nurses, and medical technicians provide the best possible care and treatment to patients. In addition to using traditional and well-established procedures and practices, health care practitioners are adopting innovative interventions that are based on best practices as well as solid research-based evidence. Evidence-based practice (EBP) is one such technique and is quickly gaining popularity due to its potential to effectively handle clinical issues and provide better patient care.

Historically, care of the patient was influenced by the experiences and opinions of those involved in providing treatment [1]. EBP marks a shift among health care professionals from a traditional emphasis on authoritative opinions to an emphasis on data extracted from prior research and studies [2, 3]. A meta-analysis done by Heater et al. demonstrated that nursing practice based on evidence improves patient

▣C A supplemental appendix and Table 1 are available with the online version of this journal.

Highlights

- Nurses in Singapore, as in other countries, support the idea of evidence-based practice (EBP) but have limited skills in the area of literature searching and understanding evidence, which limits their use of evidence-based practice.
- Only a small number of nurses were able to pick an appropriate search strategy for a given topic, indicating a lack of basic literature searching skills.
- Sufficient literature searching knowledge is essential to retrieve current, relevant, and accurate evidence. However, a majority of nurses do not know how to properly use Boolean and proximity operators, indexing, truncation, or limits.

Implications

- Librarians need to be part of providing ongoing training for clinical nurses in searching the evidence, especially in hospitals promoting EBP or seeking Magnet status.
- Training is needed for clinical nurses to be able to achieve the use of EBP, and librarians can support this goal by teaching the search strategies portion of an EBP skills course.
- This study's instrument could be used by librarians as a needs assessment tool to measure their own clinical nurses' information literacy skills, if justification is needed locally.

care, as compared to traditional practices [4]. Moreover, as nurses are increasingly more involved in clinical decision making, it is becoming important for them to utilize the best evidence to make effective and justifiable decisions [5].

CHALLENGES AND BARRIERS TO ADOPTING EVIDENCE-BASED PRACTICE (EBP)

A number of studies investigating nurses' perceptions show that nurses generally view EBP positively and consider it important to better patient care [6]. Nevertheless, it is a fact that the pace of accepting and implementing EBP is rather slow [7]. Several previous studies have tried to investigate possible barriers to adopting EBP. One barrier that some studies revealed was the enormous amount of health care literature, published in a variety of sources, which makes it almost impossible for individual medical professionals to keep up to date. It is estimated that around 8,000 articles relevant to family practice are published monthly, and a family medicine practitioner would need to dedicate approximately 20 hours a day to stay abreast of new evidence [8].

Several authors have identified other barriers to the acceptance, adoption, and implementation of EBP. Funk et al. designed a questionnaire called ''BARRIERS'' to investigate nurses' views regarding problems in using research findings [9, 10]. The top two barriers cited were ''not having enough authority to change patient care procedures'' and ''having insufficient time on the job to implement new ideas.'' Griffiths et al. also reported that lack of time, lack of resources, and difficulty in understanding statistical analysis were the top barriers to adopting EBP by community nurses [11]. O'Connor and Pettigrew investigated the perceived barriers to implementing EBP for therapists working in southern Ireland [12]. The most significant barrier they reported was the lack of time to search for, understand, and interpret research findings. Other barriers to adopting EBP include inadequate access to information technology (IT) [13], limited IT skills, and lack of information searching skills [14]. Due to its wider adoption in today's medical fields, the barriers to implementing EBP have received more and more attention in recent studies. Through a comparison of participants' experiences with EBP across three distinct health professions, Asadoorian et al. demonstrated that both individual factors and workplace structure act together as enhancer and barrier to EBP [15]. Mclnerney and Suleman discovered a significant number of barriers encountered by academic health care practitioners in implementing EBP in a South African institution, which include lack of knowledge pertaining to EBP, lack of access to research findings, insufficient evidence, and insufficient time [16]. Through a review of the mainstream literature, Solomons and Spross found that barriers and facilitators to EBP adoption occur at both individual and institutional level, and the most common barriers were lack of time and lack of autonomy to change practice [17].

Implementation of EBP places additional demands on nurses to apply credible evidence to individual client situations through searching related evidence, using clinical judgments, and considering client values and system resources [18]. To effectively apply the EBP process, in addition to the basic skills required to undertake nursing work, a nurse must have the ability to: (1) identify knowledge gaps, (2) formulate relevant questions, (3) conduct an efficient literature search, (4) apply rules of evidence to determine the validity of studies, (5) apply the literature findings appropriately to the patient's problem, and (6) appropriately involve the patient in the clinical decision making [19]. Previous literature also highlights the challenges for new nurses because EBP involves reconciling client values with evidence and clinical judgment, which may be particularly difficult for them due to their limited experience [20].

The literature review suggests that although nurses possess a positive attitude toward EBP and consider it fundamental to their practice, several institutional and personal barriers obstruct its smooth implementation. However, the majority of these studies were done in North American, European, and other developed Western countries. No comprehensive study on this topic could be found for Southeast Asia, an area of the world with a different work culture and environment. This study was conducted in a developed Asian country, Singapore, which provides an interesting context, having both characteristics associated with the developed Western world but also exhibiting Asian values and work culture. The purpose of this study was to investigate perceptions of registered nurses, working in public hospitals in Singapore, toward adopting EBP in their practice. The areas covered by this study included the understanding, beliefs, and attitudes of nurses toward EBP; barriers preventing them from adopting EBP; their training needs; information sources they prefer; and finally, their literature searching skills. The findings of this study will be useful for hospital and nursing management in Singapore, as well as in some other Southeast Asian countries, to develop an appropriate strategy to promote EBP among their nurses and overcoming associated barriers. As EBP is an information-intensive activity, findings of this study will also be useful for medical libraries in developing comprehensive training programs to improve the literature searching and utilization skills of nurses and other medical professionals.

METHOD

A survey questionnaire was used to collect data for this study. The questionnaire (Appendix, online only) was developed by a team comprising information studies faculty of the Nanyang Technological University and nursing representatives from the National University Hospital. Survey instruments used by some previous EBP studies were consulted; however, it was noted that only a few of these studies have also explored the literature searching skills of nurses.

Therefore, questionnaires used in previous studies on information needs and information-seeking behavior of nurses and other health care professionals were also examined. The draft questionnaire was reviewed for content validity by a team of experts, comprising information studies lecturers, nursing managers, nurse researchers, and registered nurses. The questionnaire was then pilot-tested on twenty nurses, representing different wards and departments in three public hospitals in Singapore. Based on their feedback, some minor changes were made to the language and format of the questions.

The content validity and internal consistency of each subsection of the questionnaire was assessed using Cronbach alpha coefficients (α). Coefficient values from 0.7 to 0.9 indicate good reliability and are excellent if above 0.9 [21]. The Cronbach alpha of different sections of the questionnaire was between 0.681 to 0.954 (Table 1, online only), indicating that data collected through this questionnaire were reliable.

Ethics approval for the study was obtained from the Domain Specific Review Board, appointed by the National Healthcare Group, Singapore. A waiver of informed consent was granted as the participants were aware that by completing the questionnaire they were giving their informed consent.

The questionnaire was divided into three sections. The first section collected demographic information about the participants, such as their professional education, job title, length of nursing experience, specialty, and training in EBP. The second section sought information about their attitudes toward and knowledge of EBP, including motivators and barriers to adopting EBP. The third section of the questionnaire solicited responses related to information sources used by nurses for patient care and clinical decision making. It also collected information about search features they used for literature searching as well as their knowledge of Boolean and proximity operators. To assess the nurses' database searching skills, a hypothetical topic was given to them along with five possible search statements. They were expected to pick the most appropriate search statement for the given topic.

All full-time and part-time registered nurses from 2 metropolitan hospitals in Singapore, who were on duty roster during the 2-week data collection period in the second quarter of 2009, were invited to participate in this survey. Nurses who were on annual, medical, or maternity leave during this period were excluded from the study. Copies of the self-administered survey questionnaire were supplied to nursing managers of all wards and medical departments in the participating hospitals. The nursing managers were personally briefed about the purpose and procedure of the study and were asked to distribute copies of the questionnaire to all nurses working in their respective units. The participating nurses were requested to drop their completed questionnaires into a sealed survey collection box, placed either in their nursing managers' offices or at the nurses' counters. To be convenient for nurses and to improve the response rate, 1 survey collection box was placed in each ward or unit. These boxes were collected at the end of data collection period. A total of 2,100 copies of the questionnaire were distributed in the 2 hospitals, and 1,486 completed questionnaires were returned, yielding an overall response rate of 70.8%. The Statistical Package for Social Sciences (SPSS) was used for data analysis.

RESULTS

Demographic information

It was found that 41.0% of the nurses held a certificate or diploma in nursing, while another 14.8% possessed a post-basic or advanced diploma in nursing. The percentage of nurses with a bachelor's or master's degree in nursing was 41.4% and 2.3%, respectively. A majority (47.2%) of the nurses were working in inpatient wards, 21% in intensive care wards (ICUs), and 7.1% in outpatient units. The percentage of nurses working in operating theaters and emergency departments was 12.1% and 2.5%, respectively. Some 51.1% of the nurses had up to 5 years' experience of working as registered nurses. The percentage of nurses with 6–10 years' of nursing experience was 21.9%, while another 27.0% of them reported having more than 10 years' experience.

The nurses were also asked if they had attended any training related to EBP. An overwhelming majority (82.7%) of the nurses revealed that they had not participated in any specific training on the implementation of EBP in patient care.

Beliefs and attitudes toward EBP

A set of 5 statements were used to investigate the overall beliefs and attitudes of nurses toward integrating EBP into their patient care. It was found that 64.3% of the nurses either "disagreed" or "strongly disagreed" with the statement that they preferred using traditional methods than new patient care approaches (Table 2). Another 52.8% of the nurses disagreed with the statement that they do not like people questioning their clinical practices that are based on established methods. It appeared that the nurses were open to adopt new health care approaches and not overly dedicated to traditional techniques.

Similarly, 52.1% of the nurses also disagreed that most of the research articles that they had come across were not relevant to their daily nursing practices. However, more nurses agreed than disagreed that, due to heavy workload, they cannot keep up to date with all new evidence. On the whole, it appeared that a clear majority of the nurses had a positive attitude toward new nursing techniques, provided they were given adequate time off from work to learn and adopt such techniques, including EBP.

Self-efficacy of EBP skills

A 5-point semantic differential scale was used for collecting nurses' perceptions of their skills for

Table 2
Nurses' beliefs and attitudes toward evidence-based practice (EBP)

Statement	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. I prefer using more traditional methods instead of changing to new approaches.	9.9%	54.4%	27.8%	5.4%	0.5%
2. I don't like people questioning my clinical practices, which are based on established methods.	5.7%	47.1%	31.7%	12.7%	0.9%
3. Most research articles are not relevant to my daily practice.	6.0%	46.1%	34.9%	10.5%	0.5%
4. I believe evidence-based practice (EBP) has only limited utility.	3.2%	35.1%	40.6%	18.0%	0.7%
5. My workload is too high to keep up to date with all new evidence.	2.3%	23.7%	33.0%	32.4%	7.3%

performing different EBP activities: a response of "poor" received a score of 1 and a response of "excellent" received a score of 5. A set of 9 statements was used for capturing information about their abilities related to implementing EBP. The first statement asked about their ability to identify potential clinical issues or problems where they can implement EBP. The mean score for this statement was 3.25, which indicated that the nurses felt that they possessed slightly above average ability to identify clinical problems (Table 3). However, the mean score for the next statement, dealing with their ability to translate a clinical problem into a well-formulated clinical question, was comparatively lower, at 3.01. It appeared the nurses had relatively less confidence in their ability to adequately express their information needs and translate these needs into a well-crafted clinical question. For almost all the remaining statements, the mean scores occurred in a very narrow range of 2.96–3.17, which indicated that the participating nurses perceived themselves to possess moderate levels of skills to undertake different EBP activities.

A statistical test was performed to investigate possible relationships between the ability to undertake EBP activities and other related variables A weak relationship was found between the ability of the nurses to implement EBP and their length of experience ($F(4,2)=2.98$, $P=0.05$). This means nurses with longer nursing experience were likely to be more confident in implementing EBP activities. It was interesting to note that for all individual EBP activities, the mean scores of nurses who had a bachelor's or master's degree in nursing was higher than those who had either a certificate or diploma or post-basic or advanced diploma. In addition, the relationship between the overall self-efficacy of nurses and their highest professional qualifications was found to be highly significant at the 0.05 level ($F(4,3)=24.60$, $P=0.00$), indicating that nurses who had higher professional qualifications were likely to have better self-perceived abilities to undertake different EBP-related activities. Similarly, a highly significant relationship was found between the overall self-perceived ability of nurses to undertake different EBP activities and their participation in EBP training courses ($F(4,1)=13.32$, $P=0.00$). Those nurses who attended EBP-related training were likely to feel more competent in their abilities to implement EBP. Moreover, a significant interactive effect was also found between the ability to undertake EBP activities and the 3 variables discussed above ($F=3.40$, $P=0.01$).

Supporting factors in adopting EBP

Nurses were asked to indicate the importance of different factors that were likely to help them in adopting EBP, the most important of which was the provision of adequate training in this area (mean score=3.90), closely followed by the availability of protected time to learn and implement EBP (mean score=3.88). Another factor that they thought could help in adoption was mentoring by nurses who had adequate experience with implementing EBP (mean score=3.86). In addition, nurses also expected support from their nursing management and access to a system for comprehensive literature searching (mean scores=3.79) in implementing EBP.

Table 3
Perceived ability of nurses to undertake different evidence-based activities

	n	Mean score*	Standard deviation
I am able to:			
1. identify clinical issues/problems.	1,464	3.25	0.60
2. translate a clinical issue/problem into a well-formulated clinical question.	1,463	3.01	0.62
3. distinguish between different types of questions (e.g., intervention, prognosis, harm, and cost-effectiveness).	1,463	3.17	0.64
4. conduct online searches (using databases and web search engines).	1,458	3.07	0.79
When reading research article, I am able to:			
5. relate research finding to my clinical practice and point out similarities and differences	1,463	3.15	0.67
6. use a check list to assess research articles.	1,464	2.96	0.74
7. read a research report and have a general notion about its strength and weaknesses	1,460	3.01	0.71
When applying research recommendations, I am able to:			
8. apply an intervention based on the most applicable evidence.	1,464	3.10	0.63
9. evaluate the application of intervention and identify areas of improvement.	1,463	3.10	0.66

* Mean scores calculated from ratings on a 5-point scale, from 1 (poor) to 5 (excellent).

Table 4
Barriers to adopting EBP

Barriers	n	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. Difficulty in finding time at work place to search for and read research articles and reports	1,470	0.6%	12.6%	33.6%	42.3%	10.9%
2. Inability to understand statistical terms used in research articles.	1,472	0.2%	14.9%	36.3%	44.0%	4.6%
3. Inadequate understanding of research terms used in research articles	1,474	0.3%	14.2%	37.0%	46.3%	2.2%
4. Difficulty in judging the quality of research articles and reports	1,474	0.3%	11.7%	40.7%	43.3%	4.0%
5. Insufficient time at work place to implement changes in their current practice	1,466	0.3%	14.0%	39.6%	39.1%	7.0%
6. Insufficient resources (e.g., equipment, materials) to implement EBP	1,455	0.9%	14.6%	41.0%	37.9%	5.6%
7. Inability to properly interpret the results of research studies	1,470	0.3%	17.4%	41.5%	37.7%	3.1%
8. Difficulty in determining the applicability of research findings	1,471	0.3%	16.0%	45.2%	36.3%	2.2%
9. Inability to implement recommendations of research studies into clinical practice	1,470	0.7%	19.1%	44.2%	32.9%	3.1%

Barriers to adopting EBP

Nurses were asked about the barriers that prevented them from implementing EBP. A set of 9 statements were used to capture their responses. It was worth noting that a very high percentage of nurses did not express any opinion for most of these statements, probably because they were either not practicing EBP or had only limited knowledge of this practice. More than 53% of the nurses either ''agreed'' or ''strongly agreed'' with the statement that the major barrier to their adoption of EBP was the lack of time at their workplaces to search and read research articles (Table 4). The next 3 barriers, identified by more than 47% of the nurses, were their inability to understand statistical terms, inadequate understanding of technical jargon used in research articles, and difficulty in judging the quality of research articles and reports. Another 46% of the nurses either ''agreed'' or ''strongly agreed'' that they do not get sufficient time to change their current patient care practices.

The statistical test revealed that the effect of 2 variables, ''highest nursing qualification'' ($F(4,3)=$ 12.14, $P=0.00$) and ''attending EBP training'' ($F(4,1)=$ 9.30, $P=0.00$), were significant at the 0.05 level. Nurses who had a degree or higher qualification and those who had attended EBP training tended to face fewer barriers in adopting EBP. This finding also endorsed the finding reported above, that nurses said that EBP training was the most important factor that was likely to encourage them in implementing EBP.

Desired areas of EBP training

As shown in the above section, appropriate EBP training was perceived to be likely to reduce barriers and resistance to adopting EBP. The nurses were asked to identify EBP activities for which they would like to receive training The two areas considered the most important were ''identifying clinical issues for implementing EBP'' (mean score=3.92) and ''understanding what is EBP'' (mean score=3.91). There was also a high demand for training in the remaining EBP areas: Mean scores for implementing recommendations to practice, understanding research and statistical terms, synthesizing evidence, and conducting critical appraisals and literature searches all fell in a very narrow range of 3.74–3.87, clearly indicating that

nurses felt that they needed training in almost all of the mentioned areas to effectively adopt and implement EBP.

A statistical test was used to investigate the possible effect of the perceived importance of EBP training and other related variables A significant relationship was found between the perceived importance of EBP training and participation in previous EBP training ($F(4,1)=7.03$, $P=0.01$), years of nursing experience ($F(4,2)=15.46$, $P=0.00$), and highest nursing qualification ($F(4,3)=7.30$, $P=0.00$). This means that those nurses who had previously attended EBP training considered it useful. Similarly, nurses who had more experience and higher nursing qualifications were also likely to appreciate EBP training.

Use of information sources for nursing care

Access to relevant, accurate, and current information is becoming crucial for nurses to keep their knowledge up to date and adopt EBP. It was, therefore, considered desirable to explore how frequently nurses used different information sources to fulfill their information needs. In the questionnaire, these information sources were presented under three broad categories: print, electronic, and human information sources.

A 5-point scale was again used, and, among the printed information sources, medical reference sources (mean score=3.48) were the most frequently used, closely followed by health care pamphlets and information made available by health care companies and hospitals (mean score=3.36). The use frequency of textbooks (mean=3.31) and journals, which included published research articles that can be used as evidence, was quite low (mean=3.23). It was, however, not surprising that newspapers were not frequently used by nurses for getting health care–related information (mean=2.84).

Among the electronic information sources, websites providing information about a specific disease, medicine, or treatment (mean score=3.76) were the most frequently used sources, followed by electronic information sources provided by the respective hospitals, including their hospitals' standard operation procedure (mean score=3.64). However, the reported use of Internet resources, nursing e-books, digital medical and nursing libraries, medical data-

Table 5
Use frequency of different information sources (combined)

Information source	n	Mean score*	Standard deviation
Human information sources	1,443	3.26	0.71
Print information sources	1,447	3.25	0.65
Electronic information sources	1,382	3.03	0.70

* Mean scores calculated from ratings on a 5-point scale, from 1 (poor) to 5 (excellent).

Table 6
Selection of search statements

	Selection	
Search statement	n	(%)
1. Effect of cigarettes on lung cancer	560	(41.1%)
2. Cigarettes AND lung cancer	327	(24.0%)
3. Effect AND cigarettes AND lung cancer	130	(9.5%)
4. (Cigarettes OR smoking OR tobacco) AND ("Lung Cancer" OR "Lung Tumor" OR "Lung Neoplasm")	180	(13.2%)
5. Cigarettes AND smoking AND tobacco AND "Lung Cancer" AND "Lung Tumor" AND "Lung Neoplasm"	165	(12.1%)
Total	1,362	

bases, UpToDate and MD Consult, and EBP-related blogs was quite low (means=3.02, 2.04, 2.87, 2.87, 2.82, and 2.35, respectively).

The most frequently used human sources were nursing supervisors (mean score=3.54), ward or department colleagues (mean score=3.43), and nursing management staff (mean score=3.35). Doctors received a mean score of 3.23, professional friends working elsewhere 3.07, and the nursing research committee or evidence-based nursing group 2.89.

To determine the overall popularity of different types of information sources, the combined mean scores for printed, electronic, and human sources were calculated (Table 5). It was interesting to note that the use of human sources for getting nursing care information was at the top (mean score=3.26). Human information sources were closely followed by print sources (mean score=3.25).

It was worth noting that the use of electronic information sources (mean score=3.03) received the lowest score. The low use of electronic information sources by nurses is a matter of concern because a considerable amount of the latest research information is now only available in electronic format. The low use could be due to limited literature searching skills of nurses, to be discussed in the following section. However, it is a still matter of concern as nurses also rated conducting literature searching as the least important of the areas in which they needed EBP training.

Information searching skills

The nurses were asked to indicate how frequently they used different search features provided by online databases and web search engines. The "quick/basic search" option (mean score=3.38) was used more often than the "advanced search" option (mean score=3.12). Among Boolean operators, the "AND" operator was used most frequently (mean score=2.34) and "NOT" operator was used the least frequently (mean score=2.17). However, the mean scores for all Boolean operators were quite low.

With respect to common search features, the reported use of "Index browsing" was the highest (mean score=2.89), followed by "Search limits" (mean score=2.62). "Medical Subject Headings (MeSH)," "truncation/wildcards," and "proximity operators" were used comparatively less frequently (mean scores of 2.51, 2.28, and 2.09, respectively). On the whole, it appeared that the use of Boolean operators and other

search features, which can help increase the precision and recall of a search, was quite low. Nurses who had a degree in nursing ($F(4,3)=6.31$, $P=0.00$), nurses who had attended EBP training ($F(4,1)=22.47$, $P=0.00$), and nurses who had up to 5 years' experience ($F=4,2)=10.00$, $P=00$) tended to use advanced search options more frequently.

Familiarity with search operators

When asked if they knew how the use of different Boolean and proximity operators would change their search results, 92.1% of the nurses said that they were not familiar how the use of different proximity operators would change their search output. The percentage of nurses not familiar with Boolean "AND," "OR," and "NOT" was 75.9%, 77.2%, and 85.2%, respectively. Once again compared to nurses with other qualifications, graduate nurses had comparatively better understanding of Boolean and proximity operators.

Assessment of developing search strategy

The previous section presented nurses' self-perceived understanding of different search operators. To assess their actual skills in developing an effective search statement by using Boolean operators, the nurses were given a simple hypothetical topic, "Effect of cigarettes on lung cancer." Use of certain other search features, such as truncations and proximity operators, were avoided to keep these statements simple. Similarly, extensive use of synonyms was also avoided. The nurses were asked to pick the most appropriate statement from a list of 5 possible search statements. The option of using the exact search topic, "Effect of cigarettes on lung cancer" (Table 6), was chosen by 41.1% of the nurses. Most (85.7%) of those who chose this option had indicated earlier that they usually used quick or basic search options for searching for information. Another 24.0% of respondents selected the option to use only 1 keyword, "cigarettes," and a phrase, "lung cancer." Only 13.2% of the nurses picked a comparatively more appropriate statement, using some synonyms of the concepts "cigarette" and "lung cancer" and grouping them in parentheses. A higher percentage of nurses (20.7%) who had previously attended EBP training selected this statement than those who had not attended any such training (11.7%).

DISCUSSION

The majority of the nurses working in public hospitals in Singapore had a positive attitude toward EBP, which was consistent with some previous studies [6, 22]. Nurses who had longer experience in nursing were likely to be more confident in implementing EBP, supporting the finding of Ferguson and Day, who reported that new nurses, due to limited practical knowledge and experience, felt less confident and willing to engage in EBP [11]. Similarly, those nurses who had attended EBP training considered themselves more comfortable in integrating EBP into their practice.

This study also explored the factors that were likely to encourage nurses in adopting EBP. Availability of adequate time appeared to be the most important factor for nurses to learn and implement EBP. As EBP is a multistep process, nurses need sufficient time to identify clinical issues where EBP can be implemented, translate these issues into well-formulated clinical questions, locate the best available evidence through literature searching, conduct a critical appraisal of the retrieved evidence, formulate and apply an intervention, and assess the effectiveness of the applied intervention. Several previous studies also highlighted lack of time as a major barrier to adopting EBP [11, 12, 16, 17]. Hospital management needs to make necessary adjustments in the work schedule of nurses to ensure sufficient time for them to learn and implement EBP.

Two other barriers to adopting EBP that this study identified were inadequate understanding of statistical terms and the technical jargon used in research articles. This finding was consistent with studies conducted by Griffiths et al. [11] and O'Connor and Pettigrew [12]. Unfamiliarity with statistical and research terminology could be a serious barrier for nurses with a certificate or diploma in nursing who might not be sufficiently exposed to such jargon. A well-designed training program is likely to overcome these problems to some extent.

An obvious deficiency of many previous studies on this topic was inadequate coverage given to information-related competencies. As medical and health care literature is growing exponentially, all health care professionals, including nurses, need to possess good searching skills to quickly retrieve current, relevant, and accurate information. Inadequate search skills can result in missing crucial information or retrieving too much information that could cause information overload and anxiety.

The overwhelming majority of the nurses in this study did not know how the use of Boolean and proximity operators could change their search outcomes. The reported use of different search operators was also quite low. Nurses' limited familiarity with Boolean operators was also evident from the very small percentage of nurses who chose an appropriate search statement for a given hypothetical topic. The use frequency of certain other useful search features—such as MeSH terms, truncations and wildcards, search limits, and index browsing—was also quite low. All of these responses are a cause for concern. As clinical issues and related clinical questions are usually very complex, proper understanding and appropriate use of different search features is desirable to retrieve relevant and quality evidence. The low use of online medical databases by these nurses was probably due to lack of adequate search skills and searching experience. These findings were consistent with Young and Ward's study, which identified a lack of information searching skills as a barrier to implementing evidence-based medicine by general practitioners in Australia [14]. A segment on literature searching skills needs to be included in EBP training programs. Even hospitals not actively pursuing integration of EBP in nursing practice need to impart basic searching skills to nurses to help them benefit from the huge volume of medical and health care information.

Study limitations

Data for this study were collected from two public hospitals in Singapore, and, therefore, care should be exercised when generalizing its findings to other types of hospitals. A comprehensive study involving other public, private, and specialized hospitals could yield more conclusive data. Similarly, findings of this study cannot be fully generalized to public hospitals in other Southeast Asian countries due to different standards and available resources. A cross-country study would help compare awareness of, perceptions of, competencies in, and barriers to integrating EBP in nursing practices in these countries.

The instrument used for this study was a self-administered questionnaire, investigating nurses' perceptions of EBP and their literature searching skills, which could be subject to personal bias and the participants' ability to self-assess their skills. A competency test could help determine the actual skills, particularly information literacy skills, of the nurses. Moreover, to avoid a lengthy questionnaire, only a few information-related questions were asked. As EBP is an information-intensive activity, a more comprehensive study investigating information literacy skills of nurses is desirable.

Another limitation of this study was that it used a questionnaire-based, quantitative data collection approach. For more reliable and meaningful findings, a triangulation of research approaches was desirable. Data collected through certain qualitative research techniques, such as interviews and focus group discussions, could further this study.

CONCLUSION

Like many other disciplines, the health care sector is experiencing major changes due to extensive research and development activities. As nurses play a crucial role in the delivery of health care, they need to embrace new and innovative techniques to provide effective and best possible treatment to their patients. Like many previous studies, this study also discovered a positive attitude among nurses toward EBP.

However, at the same time, it was found that several institutional and personal barriers were hindering nurses from adopting EBP. Hospital management can easily overcome some of these barriers through arranging EBP training and providing time off from work for nurses to learn and implement new techniques. Another important finding of this study was that nurses preferred to consult their supervisors and colleagues to obtain needed information. Hospital management can create a conducive environment and provide socializing opportunities for nurses to promote peer-to-peer information and knowledge sharing. Similarly, as EBP is an information-intensive activity, library and information professionals working in hospitals can play a significant role in developing basic information literacy skills, particularly literature searching skills, among nurses and other medical practitioners.

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Adopting evidence-based practice in clinical decision making: nurses' perceptions, knowledge, and barriers

Shaheen Majid, PhD; Schubert Foo, PhD; Brendan Luyt, PhD; Xue Zhang, MSc; Theng Yin Leng, PhD; Chang Yun-Ke, PhD; Intan A. Mokhtar, PhD

Perceptions of nurses of evidence-based practice (EBP) questionnaire

Section I: demographics

1. Highest nursing qualification attained (Please shade only one bubble)
○ Certificate/diploma in nursing
○ Master's degree in nursing
○ Post basic/advanced diploma in nursing
○ Others, please specify _____
○ Bachelor degree in nursing
2. Designation:
○ SN
○ SSN
○ NM/SNM
○ NC/NE/SNC/SNE
3. Number of years as RN:
○ 0
○ 1
○ 2
○ 3
○ 4
○ 5
○ 6
○ 7
○ 8
○ 9
4. Hospital:
○ AH
○ NUH
○ TTSH
5. Discipline/specialty:
○ Inpatient
○ HD/ICU
○ Outpatient
○ OT
○ EMD
○ Others, please specify: _____

6. Ward number (optional)
○ 0
○ 1
○ 2
○ 3
○ 4
○ 5
○ 6
○ 7
○ 8
○ 9
7. Have you attended any training course on evidence-based practice (EBP)?
○ Yes
○ No

Section II: attitude and knowledge of EBP

8. What is EBP to you? I believe I am adopting EBP when I implement nursing care and make clinical decision based on:
A. patient's subjective and objective data
B. information from text books
C. previous experiences of health care professionals (e.g., nurses, doctors, physiotherapist)
D. research findings
E. patient's value/preference
○ A only
○ D only
○ C and D
○ A, B, C, and D
○ A, C, D, and E
9. Do you agree or disagree with the following statements? (Please shade one bubble for each statement)

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
a. My workload is too high to keep up to date with all new evidences.	○	○	○	○	○
b. I don't like people questioning my clinical practices, which are based on established methods.	○	○	○	○	○
c. I believe EBP has only limited utility.	○	○	○	○	○

d. I prefer using more traditional methods instead of changing to new approaches.	○	○	○	○	○
e. Most research articles are not relevant to my daily practice.	○	○	○	○	○

10. The following statements relate to your skills in performing different EBP activities. How would you rate your ability to:

I am able to:	Poor				Excellent
a. identify clinical issues/problems.	○	○	○	○	○
b. translate a clinical issue/problem into a well-formulated clinical question.	○	○	○	○	○
c. distinguish between different types of questions (e.g., intervention, prognosis, harm, and cost-effectiveness).	○	○	○	○	○
d. conduct online searches (using databases and web search engines).	○	○	○	○	○

When reading research article, I am able to:	Poor				Excellent
e. relate research finding to my clinical practice and point out similarities and differences.	○	○	○	○	○
f. use a check list to assess research articles.	○	○	○	○	○
g. read a research report and have a general notion about its strength and weaknesses	○	○	○	○	○

When applying research recommendation(s), I am able to:	Poor				Excellent
h. apply an intervention based on the most applicable evidence.	○	○	○	○	○
i. evaluate the application of intervention and identify areas of improvement.	○	○	○	○	○

11. Do you agree or disagree that the following barriers have been preventing you from adopting EBP?

Barriers	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
a. Inadequate understanding of research terms used in research articles.	○	○	○	○	○
b. Inability to understand statistical terms used in research articles.	○	○	○	○	○
c. Difficulty in judging the quality of research papers and reports.	○	○	○	○	○

d. Inability to properly interpret the results of research studies.	○	○	○	○	○
e. Difficulty in determining the applicability of research findings.	○	○	○	○	○
f. Inability to implement recommendations of research studies into clinical practice.	○	○	○	○	○
g. Difficulty in finding time at workplace to search for and read research articles and reports.	○	○	○	○	○
h. Insufficient time at workplace to implement changes in their current practice.	○	○	○	○	○
i. Insufficient resources (e.g., equipment, materials) to implement EBP.	○	○	○	○	○
j. Other barriers (please specify): _____	○	○	○	○	○

12. In your opinion, what factors are important for you to adopt EBP?

Factors	Least important				Extremely important
a. Nursing colleagues who embrace EBP	○	○	○	○	○
b. Nursing management who embrace EBP	○	○	○	○	○
c. Given adequate training in EBP	○	○	○	○	○
d. Given protected time to conduct EBP	○	○	○	○	○
e. Access to a system for comprehensive literature searching	○	○	○	○	○
f. Mentoring by nurses who have adequate EBP experience	○	○	○	○	○
g. Others (please specify): _____	○	○	○	○	○

13. How important is it for you to receive training in the following areas of EBP?

Training areas	Least important				Extremely important
a. Understanding what is EBP	○	○	○	○	○
b. Identifying clinical issues for implementing EBP	○	○	○	○	○
c. Conducting literature searches	○	○	○	○	○
d. Conducting critical appraisal of articles	○	○	○	○	○
e. Synthesizing evidence	○	○	○	○	○
f. Implementing recommendations to practice	○	○	○	○	○
g. Understanding research and statistical	○	○	○	○	○

terms and methods
h. Other training areas (please specify): _____   ○   ○   ○   ○   ○

14. In your opinion, what measures are desirable to make EBP initiatives successful in your hospital?

_____

Section III: Use of information resources and literature searching skills

15. How frequently do you use the following sources for nursing care and making clinical decisions? (Please shade one bubble for each row).

15a. Print information sources

	Never				Always
1. Textbooks	○	○	○	○	○
2. Journal articles	○	○	○	○	○
3. Newspapers	○	○	○	○	○
4. Pamphlets/handouts (produced by health care companies, hospitals)	○	○	○	○	○
5. Reference books (e.g., medical dictionaries, encyclopedias)	○	○	○	○	○
6. Other print information sources (please specify): _____	○	○	○	○	○

15b. Electronic information sources

	Never				Always
1. Nursing e-books	○	○	○	○	○
2. Digital medical and nursing libraries	○	○	○	○	○
3. Medical databases (e.g., CINAHL)	○	○	○	○	○
Hospital resources					
4. Electronic SOP (i.e., work instructions, support documents)	○	○	○	○	○
Internet resources					
5. Google (websites providing information about a specific medicine, treatment or symptom)	○	○	○	○	○
6. Online tutorials provided by professional associations, medical libraries, and overseas hospitals	○	○	○	○	○
7. Blogs on EBP	○	○	○	○	○
8. UpToDate and MD Consult	○	○	○	○	○
9. Other e-information sources (please specify):	○	○	○	○	○

_____

15c. Human information sources	Never				Always
1. Ward colleagues	○	○	○	○	○
2. Nursing supervisor	○	○	○	○	○
3. Nursing management staff	○	○	○	○	○
4. Nursing research committee/evidence-based nursing group	○	○	○	○	○
5. Doctors	○	○	○	○	○
6. Professional friends working in other hospitals and clinics	○	○	○	○	○
7. Other human information sources (please specify): _____	○	○	○	○	○

16. What search options do you use while searching online databases and web search engines?
(Please shade on bubble for each search option).

Search options	Never				Always
1. Quick/basic search	○	○	○	○	○
2. Advanced search	○	○	○	○	○
3. Index browsing (e.g., author, title, source)	○	○	○	○	○
4. Truncations/wildcards (e.g., "*," "?")	○	○	○	○	○
Boolean operators/connectors					
5. "OR" operator	○	○	○	○	○
6. "AND" operator	○	○	○	○	○
7. "NOT" or "AND NOT" operators	○	○	○	○	○
8. Proximity operators (e.g., W/nn and PRE/nn)	○	○	○	○	○
9. Search limits (e.g., publication date, document type, full text)	○	○	○	○	○
10. Medical Subject Headings (MeSH)	○	○	○	○	○

17. Do you know how the use of different Boolean and proximity operators can change the search results?

Search features	No	Yes	Not sure
"AND" operator	○	○	○
"OR" operator	○	○	○
"NOT" or "AND NOT" operator	○	○	○
Proximity" operator (e.g., W/nn; PRE/nn)	○	○	○

18. Suppose you need to conduct a search on MEDLINE on the topic "Effect of cigarettes on lung cancer." Which of the following search statements will be more appropriate for this topic? (Please shade only one bubble).
○ Effect of cigarettes on lung cancer
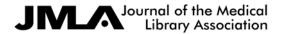○ Cigarettes AND lung cancer
○ Effect AND cigarettes AND lung cancer

○ (Cigarettes OR smoking OR tobacco) AND ("Lung Cancer" OR "Lung Tumor" OR "Lung Neoplasm")
○ Cigarettes AND smoking AND tobacco AND "Lung Cancer" AND "Lung Tumor" AND "Lung Neoplasm"

Thank you very much for your participation in this survey. Please submit the completed questionnaire to your nurse manager by dropping it into the box provided in the nursing managment office.

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Table 1
Reliability test of the questionnaire

Areas of interest	Number of items	Cronbach's alpha (α)
Attitude	5	0.681
Skills	9	0.897
Barriers	9	0.873
Important factors to adopt evidence-based practice (EBP)	6	0.919
Important training fields for EBP	7	0.954
Information resources	19	0.890
Information literacy skills	14	0.869