Comparing the pharmacology knowledge and performance of nurses and nursing students in the use of information resources in pediatrics wards: An observational study

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Abstract
Objectives: One of the major duties of nurses is proper medication administration while maintaining patient safety, which requires sufficient knowledge and practice. Any gaps in knowledge used by nurses can lead to irreversible injury or death of the patient. This study is aimed to determine and compare the pharmacology knowledge and performance of nurses and nursing students in using the information resources in pediatrics wards.

Method: This descriptive observational study was performed on 300 nurses and nursing students. Sources of knowledge and performance of nurses and nursing students were analyzed with researcher-made tools to determine their pharmaceutical knowledge, sources of knowledge, and attitudes by independent t-test, chi-square, one-way analysis of variance, Pearson, and Spearman tests.

Result: Three hundred questionnaires were examined. The clinical experience of nurses and students was their most important source of information in drug challenges for 33.7% of the participants. About 24.6% of nurses obtained the required information from specialized books on pediatric medicine. About 17.1% of the participants attained their knowledge from multiple sources (e.g. various available sources such as the Internet, pharmacy books, software, and their experiences and colleagues), while electronic sources and the Internet were the sources of knowledge for 15.5% and 7.7% of the nurses, respectively. Concerning nursing students, 6.3% used books, 41.7% considered colleagues (clinical experiences), 20.8% employed electronic resources, 22.8% used the Internet, and 9.1% relied on multiple sources. There were significant differences in the knowledge and performance of the nurses based on their source of pharmacological knowledge (P < 0.05).

Conclusion: Most of the resources used in the hospital are not up-to-date and evidence-based, and the majority of nurses tend to rely on their clinical experience or their colleagues information for medication administration rather than reading books or searching for up-to-date approaches and information. Nursing students also trust nurses’ clinical experiences more than other sources provided for them including books and Internet. Some action should be taken by the managers for boosting the nurses’ tendency for using up-to-date information resources.

Keywords
Nurse, knowledge resources, medicine, nursing students

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Introduction

Nursing knowledge is founded on a multifaceted basis including science (research and evaluation), experience, and individual perception. This knowledge is developed through questioning and research approaches. In practice, nurses use the experiences gained from patient care and personal learning. The four basic patterns of knowledge development encompass experience, aesthetics, personal knowledge, and ethics. These models gather a set of basic knowledge for nursing practice that not only includes scientific knowledge but also knowledge gained from experience, personal understanding, and moral interpretation and reasoning. Another source of knowledge in nursing relies on intuition, which has been accepted as a part of the evidence in nursing practices with a great deal of importance. Nurses categorize their sources of practical knowledge into four broad classes: social interaction, empirical knowledge, documentation, and prior knowledge. In addition, the results of a study by Estabrook et al. showed that Canadian nurses used the knowledge gained through personal experience, interaction with colleagues, and specific learning from each case and article or textbook in their preferred areas of knowledge. In other studies, professors’ lecturers, recommendations of physicians in various clinical fields, books and magazines, clinical representatives of health care organizations, and the media were mentioned as sources of knowledge with a direct impact on the performance and development of nursing knowledge. Nursing knowledge, however, is influenced by indirect sources as well. Therefore, the development and construction of knowledge in a social context include human interaction, and its legitimacy depends on the values and beliefs of powerful groups in society such as doctors, managers, and politicians. Examination of activities, study behavior, face-to-face presentation and participation in education, information search habits, and descriptive results of nurses indicated that clinical nurse instructors read more professional journals than other nursing groups. The Internet is also available today as an increasingly important source of practical knowledge, but nurses are lagging behind other groups in the use of the Internet in the workplace. It is not clear how nurses confirm the validity of information obtained through Internet search or integrate it with other sources of knowledge in practice without affecting aggregation criteria.

One of the important tasks of nurses is to provide correct medication while maintaining the patients’ safety, which requires proper knowledge and performance as any defect in the medication knowledge of the nurses can lead to irreversible damage or death of the patient. In this regard, no specific study has been conducted on nurses’ knowledge resources. However, it has been shown that nurses use the results and the suggestion of researches and studies in their practice and tend to increase patients’ quality of life. Nonetheless, most of the time they do not know how to achieve this goal. Therefore, it is necessary to prevent negligence and help nurses to avoid destructive impacts on patients from evidence-based nursing methods and help them choose the best evidence from available sources. By searching the Science Direct, PubMed, Scopus, Google scholar, Cinahl, and ProQuest databases with keywords based on evidence, knowledge resources, medicine, nurse, and nursing student, several studies were found on knowledge resources and nurses’ performance in adult wards. However, no study was found in this field on pediatric wards. Therefore, this study is aimed to investigate the sources of knowledge used by nurses and nursing students in pediatric wards.

Methods

This descriptive observational study lasted for 5 months from December 2020 by census sampling. Nurses working in pediatric wards and nursing students participating in their educational course in pediatric ward were included in the study based on the inclusion criteria.

Setting and sample

The study samples included the data from two pediatric intensive care units (PICUs), two pediatric surgery departments, three pediatric internal medicine departments, and three pediatric emergency departments of hospitals affiliated with Isfahan University of Medical Sciences. One intensive care unit (PICU) provides care for children with complex heart conditions in need of medical or surgical intervention. The second PICU provides care for a wide range of non-cardiac pediatric medical and surgical diseases. One pediatric surgery unit provides all postoperative general care, and the other surgical department provided postoperative general and neurosurgery care without the need for an ICU. One internal ward also provides care for children with neurological and renal diseases, while the other internal ward offers respiratory and gastrointestinal care. In the third internal ward, infectious patients receive care. These units provide care for pediatric patients of different ages from birth to 21 years old. Nurses received the necessary training before starting their work in these departments.

For nurses, inclusion criteria were having more than 6 months of work experience and consent to participate in the study. Inclusion criteria for students were having no clinical background as a nurse working in other fields and other health care personnel and consent to participate in the study, the reason why this is chosen by the researchers is the fact that in some condition in our country, nursing students are able to work part time in hospitals, although they might have some information related to medication administration in adults, the way in which medications administrate for adults and the pediatrics is completely different, especially in the
means of dosage calculation and maximum concentration of drugs. Exclusion criteria for the nurses included reluctance to continue the study, leaving during the study period, and the nurses who enrolled in higher education level or the ones who had some experiences in nursing without academic education (i.e. LPN). Also, students could freely leave the study without affecting their further education. Moreover, they were excluded from the study if the questionnaire was not correctly completed.

Nursing students of the School of Nursing and Midwifery studying in their 7th and 8th semesters (i.e. final-year students) undergoing internships in pediatric wards were included in the census if met the inclusion criteria. Based on the G-Power software, the initial sample size was determined 280 people considering \( \alpha = 0.05 \), power = 0.95, and \( d = 0.4 \). Taking into account a 15% probability of falling, the total sample size of 320 was considered. Thus, a total of 320 participants (160 nurses and 160 students) were selected based on the inclusion criteria.

**Study tools**

The study tool comprised three parts: the first part of the questionnaire included demographic information, such as gender, education, age, work experience, and employment sector. Questions were also used to gain a general understanding of the nurses’ perspectives. In the second part, a researcher-made questionnaire was prepared according to the views of nurses, students, suggestions of pediatric ward heads, clinical pharmacists, and available texts.\(^{17-19}\) The appearance and content validity of the questionnaire were explored with the help of 10 specialists (three pediatric nursing professors, one clinical pharmacist, two pediatric medical professors, and four senior nursing experts) (CVI = 0.8 and CVR = 0.85). For the reliability of the tool based on Cronbach’s alpha, 12.5% of the total sample (40 people) was used for evaluation (0.735). These 12.5% of the samples did not enter the study due to the time difference of 4 months from the beginning of the study and the validity and reliability of the instrument. The pharmaceutical knowledge questionnaire comprised 20 questions in five areas: preparation and injection (nine statements), family empowerment (four statements), documentation (two statements), side effects (three statements), and medication error (two statements). The answers to the questions were in the form of a 4-point Likert-type scale (correct, “I do not know,” and 2 false answers). Respondents could also write their descriptive answers. Scores ranged from 0 to 100.

The third instrument consisted of a 20-item performance checklist whose reliability was assessed by the coefficient of agreement of two observers in 10 drug positions \( (r = 0.8) \). This checklist was developed by the researcher after observing the participants’ performance; the average of three observations was taken into account.

**Data collection method**

The studied nurses were selected by the census method from a list of all nurses in the target wards. The list of all students was obtained from the course manager of the nursing faculty, then the students who were in the final-year of their education had been chosen for enrolling in the study based on inclusion criteria.

To provide information about the purpose, potential risks, and benefits of participating in the study for the nurses, the lead researcher (first author) attended a ward staff meeting. The nurses were explained how to complete the questionnaire. They were also informed that one colleague of the research team will be present in the ward to observe their performance (resource use and pharmacological performance). To reduce the effect of the researcher’s presence on the performance of the nurses, the researcher was present in the ward for several months in several shifts. Students were referred during the internship and entered the study after coordination with their professor.

In total, 156 nurses and 144 students completed the research questionnaire. The nurse had the opportunity to add more relevant information which might not be included in the questions. The performance of the participants was observed by the researcher three times during drug administration, and the average value was calculated as the overall performance and the researcher filled the performances checklist while observing them.

**Statistical analysis**

The collected data were statistically analyzed by SPSS version 16 software using independent t-test, chi-square, one-way analysis of variance (ANOVA), and Spearman tests. The open-ended questions were also considered to gain a general understanding of the nurses’ point of view. After summarizing the descriptive answers, they were examined for accuracy and analyzed using content analysis.

**Ethical considerations**

The researcher referred to selected hospitals after receiving the code of ethics from the ethics committee of Isfahan University of Medical Sciences with the ID of IR.MUI.RESEARCH.REC.1398.731 and obtaining written permission from the School of Nursing and Midwifery of the Isfahan University of Medical Sciences. Then, the researcher presented the letter of introduction and explained the objectives of the research to the officials of the center to obtain their consent and cooperation. The samples meeting the inclusion criteria were selected, and the nurses and students were invited to take part in the research. To comply with the ethical standards, written consent was obtained from the participants, after providing them with sufficient information on
the objectives and procedures of the study. Privacy and confidentiality of information were guaranteed throughout the research.

Results

Out of 310 questionnaires distributed among nurses and students, 300 of them were acceptable for study (156 nurses (52%) and 144 students (48%).) Around 151 females (97.5%) and 4 males (2.5%) nurses were included. Among students, 90 (62%) female and 54 males (48%) students participated in the study. The majority of respondents (91%) had bachelor’s degrees while 14 (9%) cases had a master’s degree in the nursery. The age of nurses and students participating in the study was 32.29±4.09 and 23.6±0.8 years, respectively. Out of 156 respondents, 8.3% had less than 1 year of work experience. It is obvious that 43.8% of nurse participating in this study had more than 10 years of experience. The mean work experience in different departments was significantly different (p<0.05) (Table 1).

The source of nurses’ medication information was statistically different in different wards (p<0.05). According to the results, 32.7% of nurses found the answer to their medical questions and challenges from colleagues, 24.7% used available books, 17.1% obtained necessary data from several sources, 15.5% used electronic sources, and only 7.7% of the nurses referred to the Internet. Among students, 6.3% used books, 41.7% referred colleagues, 20.8% used electronic resources, 22.8% applied the Internet, and 9.1% obtained the required knowledge from multiple sources (Table 2).

Seventy percent of nurses stated that “Referring to books in the wards will cause families’ distrust.” This was the case for 55% of students. Ninety-six percent of nurses believed that “for better and more up-to-date services, new resources and articles should be used in the hospital” (Table 3).

Based on observations and open responses, the use of cell phones and scientific books was, however, limited in the wards. Newly translated sources were not available. Knowledge resources of nurses in pediatric wards only included their colleagues, personal experiences, in-service

| Table 1. Work experience in pediatric wards. |
|---------------------------------------------|
| Ward           | Surgical ward | Internal ward | Emergency ward | PICU | p*  |
| Work experience in pediatric wards          |                |                |                |      |     |
| Less than 1 year                             | Count | 1                  | 6                | 2                | 4          | 0.000 |
| %                                           |       | 3.8%              | 11.1%            | 6.5%             | 8.9%       |
| 1–5 years                                   | Count | 9                  | 16               | 9                | 14         |
| %                                           |       | 34.6%             | 29.6%            | 29.0%            | 31.1%      |
| 6–10                                        | Count | 4                  | 8                | 5                | 10         |
| %                                           |       | 15.4%             | 14.8%            | 16.1%            | 22.2%      |
| 10<                                         | Count | 12                 | 24               | 15               | 17         |
| %                                           |       | 46.2%             | 44.4%            | 48.4%            | 37.8%      |
| Total                                       | Count | 26                 | 54               | 31               | 45         |
| %                                           |       | 100.0%            | 100.0%           | 100.0%           | 100.0%     |

*Fisher’s exact test.

| Table 2. Source of receiving drug information (challenging cases) in different pediatric wards. |
|-----------------------------------------------|
| Nurses’ drug knowledge source                | Total | p*  |
|                                              | Book   | Colleague | Electronic resources | Internet | Multiple sources |
| Pediatric wards Surgical wards               | Count  | 10       | 9          | 3       | 1             | 3  | 26 | .000 |
| %                                            |       | 38.5%    | 34.6%     | 11.5%   | 3.8           | 11.5% |
| Internal                                     | Count  | 14       | 17        | 8       | 2             | 13 | 54 |
| %                                            |       | 25.9%    | 31.5%     | 14.8%   | 3.7%          | 24.1% |
| Emergency                                    | Count  | 6        | 7          | 5       | 7             | 6  | 31 |
| %                                            |       | 19.4%    | 22.6%     | 16.1%   | 22.6%         | 19.4% | 100% |
| PICU                                          | Count  | 5        | 19        | 13      | 2             | 6  | 45 |
| %                                            |       | 11.1%    | 42.2%     | 28.9    | 4.5%          | 13.3% | 100% |
| Student                                      | Count  | 9        | 60        | 30      | 32            | 13 | 144 |
| %                                            |       | 6.3%     | 41.7%     | 20.8%   | 22.2%         | 9.1% | 100% |
| Total                                        | Count  | 45       | 112       | 59      | 43            | 41 | 300 |
| %                                            |       | 13.7%    | 37.3%     | 19.7%   | 14.3%         | 13.7% | 100% |

*Chi-square.
training courses, and basic knowledge. These restrictive laws were somehow extended to students as the use of cell phones was prohibited for nursing students in most wards.

A significant correlation can be found between the level of education and the use of valid scientific sources ($r = 0.7$). As nurses with master’s degrees used books and articles and students counted on experienced nurses as a reliable source ($p < 0.05$).

There was also a significant relationship between work experience and using the source of personal experiences ($r = 0.56$) such that experienced nurses had more confidence. Students also tried to consult experienced nurses.

The mean score of pharmacological knowledge of different pediatric wards exhibited a significant difference ($p < 0.05$): pediatric surgery ward ($62.31 \pm 18.63$), pediatric internal medicine ward ($57.31 \pm 12.23$), pediatric emergency ward ($60.97 \pm 12.93$), pediatric intensive care ward ($56.67 \pm 12.6$), and nursing students ($44.13 \pm 19.72$). Moreover, the average pharmaceutical knowledge was examined based on the source used in different areas of knowledge. The highest average score was observed among the book users ($69.1 \pm 8.4$). There was also a statistically significant difference between the knowledge of the users of different sources ($p < 0.05$) (Table 5).

**Discussion**

Studies conducted on Iranian nurses revealed that nurses who believe in the importance of research and practice tend to use evidence-based resources which is not, however, always possible.\(^{20}\) Evidence-based practice is said to have benefits such as improving the quality of care and outcomes of patient care, positive clinical outcomes, standard care, and increasing satisfaction with nursing care.\(^{21}\) It is also claimed that nurses do not learn, understand, or believe in research results and do not use research findings as they do not know how to apply these results.\(^{22}\)

One of the most important clinical practices of nurses is their pharmacological knowledge\(^{23}\) because nurses spend about 40% of their working time in hospitals giving medication to patients.\(^{24}\) An increasing population of patients taking more than one drug leads to a significant change in patients’ medication regimens, prescribing drugs in general by nurses and the need for nurses to educate patients about

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**Table 3. Nurses’ drug knowledge source.**

| Source of clinical pharmaceutical knowledge | Nurse | Student | $p^*$ |
|---------------------------------------------|-------|---------|-------|
| The last time you received training on drug preparation and injection | Less than 1 year | 56.5% | 48.3% | 0.092 |
| | More than 1 year | 43.5% | 51.8% |
| Is it permissible to use the book in the ward? | Yes | 65% | 90% | 0.000 |
| | No | 35% | 10% |
| | I don't know | |
| Does the use of the book in the ward lead to distrust of the patient’s families in you? | Yes | 83.7% | 56% | 0.000 |
| | No | 16.3% | 44% |
| Will using the book in drug challenges lead to a negative view of your colleagues? | Yes | 56% | 78% | 0.000 |
| | No | 44% | 22% |
| Do you have access to the internet in the ward? | Yes | 70% | 95% | 0.006 |
| | No | 30% | 5% |
| Do you typically use your previous experiences in new situations? | Yes | 66.4% | 72.1% | 0.062 |
| | No | 33.6% | 27.9% |
| Sources of clinical pharmaceutical knowledge | Basic knowledge from the School of Nursing | 58.6% | 79.4% | 0.000 |
| | Experience | 10.5% | 5% |
| | In-service training | 19.8% | 1.1% |
| | Specialized books | 2.7% | 4.5% |
| | Internet | 7.4% | 10% |

$^*$Chi-square.
drugs and their side effects are among the reasons for the increasing importance of pharmacological knowledge for nurses.25

This study showed that the sources of knowledge used by nurses are often experience-based evidence (37.3%) rather than research-based sources which can be mostly due to previous knowledge and intuition. The information shared by fellow nurses is one of the most important resources during drug challenges. However, the nurses knew that the actions had to be evidence-based and the evidence had to be investigative. Consistent with this study, Easterbrooks et al.8 found that Canadian nurses preferred individual knowledge gained through personal experience and interaction with colleagues and patients, over articles or textbooks.

Analysis of the mean score of drug performance also indicated statistical differences in the performance of nurses and nursing students in different areas of medication. Steady with this study, Grandell-Niemi et al. showed that there seems to be a significant difference between nurses’ and students’ mathematical and dosage calculation skills. Nurses’ skills were better than those of graduating nursing students.26
The nurses and student users of the books had higher mean performance scores than other recourse users which shows the importance of the resources used for medication performance. This may be due to incorrect medical data available in other sources and the lack of proper translation of the knowledge produced in research.\textsuperscript{27}

A significant correlation was also observed between the degree and the use of valid scientific sources such that nurses with a master’s degree applied books and articles while students relied on experienced nurses as a valid resource. A study examining activities, study behavior, participation in education, and information-seeking habits indicated that clinical nurse educators read professional journals more than other nursing groups.\textsuperscript{28}

In another study, a positive relationship was found between education level and applied sources of knowledge, and the highest level of education was the only factor that showed a positive effect on the use of research-based sources.\textsuperscript{29}

The results also showed a significant relationship between work experience and using the personal experiences since experienced nurses were more confident in their skills and more applied their clinical experience and basic knowledge. Students also tried to use the experiences of skilled nurses. About 43.8\% of the nurses participating in this study had more than 10 years of work experience, which means that they have dropped out of their basic nursing education program. This is while nurses could have 20 to 30 years of service in the workforce and continue to work. Even assuming that all of them have research-based education, the evidence that they have been taught and used is not up to date. Nurses may always use their basic training as a source of practical knowledge.\textsuperscript{30} This often makes sense because anatomical and physiological information remains reasonably valid; however, much of the learned content is invalid and may not be valid at the time of learning.

In-service training has been recently emphasized. Basic nursing education continues to play an ongoing role as a source of practical knowledge. The results showed that the pharmaceutical information from courses and conferences (in-service training) composed 19.8\% and 1.1\% of specialized knowledge on patient care among nurses and students, respectively.

The Internet has found increasing importance as a source of clinical knowledge as it can provide quick access to online and everyday professional and public information while being only a practical source of knowledge. The results showed that the average frequency of knowledge resources in nurses expressing occasional use of the Internet was lower than other groups (net use of the Internet among nurses was only 13.7\%), which was in line with another study showing that nurses are clearly behind other groups in the application of the Internet in their workplace.\textsuperscript{31}

Although technical expertise may be an influential factor, especially in the older ages accounting for most working nurses today, the impact of other factors such as Internet information, efficiency at the workplace, organizational infrastructure support, and nurses’ work value may be higher.\textsuperscript{32,33}

Therefore, search skill training, retrieval skills, and online search techniques for evidence-based medical information are critical in evidence-based practice during nursing training.\textsuperscript{31} Another important but unclear point is how nurses interpret the accuracy and validity of information obtained through searching or how they integrate them with other sources of knowledge without the effect of aggregate criteria and apply them practically.

A review of the literature indicated that most nursing activities in recent decades have been based on experience, intuition, and untested theories.\textsuperscript{34}

Unfortunately, many nursing practices are still based on experience, intuition, and common sense with no theoretical basis. Moreover, the limited number of published books, occasional attendance in congresses and symposia, lack of time to read journals, and the limited use of the Internet have guided the nurses toward using relatively poor research-based sources.\textsuperscript{35}

Advances in career practices and the improvement of knowledge accumulation can only be achieved through scientific research. Therefore, research works should be focused on useful, important, original, and interesting issues. Special attention should be also paid to the integration of research findings with the clinical experience.

Limitations

The results of the study were obtained from the pediatric wards of several hospitals affiliated with the University of Medical Sciences; thus the results cannot be generalized to all nurses in all wards. Moreover, nurses did not give a clear answer to the question of how they trust the results obtained from the sources and use them in the hospital. Therefore, it is recommended to examine this issue with in-depth qualitative research. A researcher-made tool was used in this study; whose validity and reliability should be checked. About 12.5\% of the total samples that were used for the reliability of the tool based on Cronbach’s alpha, due to the time difference of 4 months from the beginning of the study and the fact that these 12.5\% people may have received other trainings, despite valuable data, did not enter the main study.

Conclusion

Most of the medicine-related resources used in the hospital are based on intuition and do not rely on the results of recent research works. Most nurses apply their basic clinical knowledge and personal experience.

Surprisingly, nursing students also trust nurses’ clinical experiences more than other sources and willingly accept their guidance. This trend requires the special attention of nursing managers. Therefore, it is recommended to start a
research promotion program by the Deputy of Nursing. With the help of nursing schools, it is also suggested to link the research findings to the clinical treatments in a case-by-case discussion to encourage critical thinking and professionalism among nurses and nursing students. Practical use of research evidence is highly recommended in the clinical setting.

The biggest change in nursing performance occurs when nurses use research results; that is, providing research-based evidence is highly recommended in the clinical setting. Practical use of research findings to the clinical treatments in a case-by-case discussion to encourage critical thinking and professionalism. With the help of nursing schools, it is also suggested to link the research promotion program by the Deputy of Nursing. The biggest change in nursing performance occurs when nurses use research results; that is, providing research-based evidence is highly recommended in the clinical setting. Practical use of research findings to the clinical treatments in a case-by-case discussion to encourage critical thinking and professionalism.

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Author’s contribution

F.K. conceived and designed the study, provided administrative, technical or logistical support. A.S. performed collection, assembly, possession of raw data (doing experiments). F.J. performed critical revision of the article for important intellectual content. N.A. and A.S. performed provision of study material or patients. S.K. edited and approved the article.

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Supplemental material

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