Knowledge Assessment and Information Needs of Oncology Nurses Regarding Inpatient Medication

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Although several studies have evaluated the frequency and consequences of medication errors, few have explored their causes. In particular, nurses’ knowledge regarding medications has been evaluated minimally. This survey was conducted to determine how nurses master medications prescribed to their patients to determine problems nurses may have with prescribed drugs and identify possible support tools. A questionnaire was created and presented to nurses in a French cancer center. A majority of the respondents correctly identified pharmaceutical classes and medications, as well as administration and storage conditions. However, side effects, contraindications, and drug-drug interactions were not adequately identified. Nurses reported facing problems mainly related to drug administration, drug storage, and generic drugs and their therapeutic equivalence. Multiple tools are in development to help nurses in these areas. This collaborative study between pharmacy and care wards identifies some difficulties nurses have regarding drugs and will help to establish improvement measures within the hospital.

Patient safety and medication errors have become a major concern for healthcare institutions and authorities worldwide (Michel, Quenon, Djihoud, Tricaud-Vialle, & de Sarasqueta, 2007). The Enquête Nationale sur les Evénements Indésirables graves liés aux Soins, or the French National Study on Adverse Events Related to Care (ENEIS), estimates the human toll to be 50,000–80,000 serious adverse events linked to medications per year during patient hospitalization, whereas about 2% of hospitalizations are the result of serious adverse events related to medications. Events occurring during hospitalization are evaluated at 1.4 per 1,000 hospitalization days in the sector of medicine, surgery, and obstetrics (Michel et al., 2007). An estimated 44,000–98,000 patients die each year in the United States as a result of preventable medical errors, exceeding the annual mortality rates attributable to breast cancer (Berenholtz, Dorman, & Pronovost, 2003). Although such mortality data are not available in France, an update of the ENEIS study estimated preventable life-threatening adverse events linked to care at 0.7% (Michel et al., 2010).

Medication errors are classified according to the degree of achievement (i.e., whether the error reached the patient), the seriousness of the clinical consequences, the error type, the stage in the medication use process, and the causes (National Coordinating Council for Medication Error Reporting and Prevention, 1996). Twenty-seven percent to 54% of patients have a history of medication errors, and 19%–75% are unintentional. More than 27% of medication errors could be avoided if medical training was improved, the pharmacy provided access to drug databases, and closer contact with patients occurred (Barber, Rawlins, & Dean Franklin, 2003; Tam et al., 2005). Many errors are related to nurses’ preparation of treatments before administration (e.g., wrong drug, solvent error, wrong dose, omission), the stage of administration itself (e.g., wrong patient, wrong route of administration, physicochemical incompatibility), and noncompliance with the duration of infusion (Taxis & Barber, 2003; Wirtz, Taxis, & Barber, 2003). Physicians, pharmacists, pharmacy technicians, and nurses all are sources of medication errors. However, nurses, pharmacists, and pharmacy technicians notice about 90% of medical errors that could or have occurred (Ashcroft & Cooke, 2006). Therefore, collaboration between pharmacists and nurses is paramount to improve the quality of the drug supply.
chain and decrease the risk of medication errors. Nevertheless, identifying the medication-related problems that nurses may have is difficult for the pharmacy staff.

To improve health care and collaboration with nurses, the authors have sought to better understand that problem. The first aim of the current study was to evaluate nurses' knowledge of medications. An audit was conducted, using a short question-answer approach with nurses from two wards in a hospital in France. The nurses completed a questionnaire that assessed their knowledge and information needs regarding the therapies prescribed to hospitalized patients with cancer in their care. The findings helped the team to better understand nurses' difficulties relative to medications and to identify tools that would help them use drugs with greater security and safety.

Methods

Setting

The study was conducted in a 130-bed French regional cancer center that treats adult oncologic and hematologic malignancies. The wards were similar in terms of the types of medicine nurses administered to patients.

Design

The audit was chosen as a reference method to assess professional practices (National Health Service, Clinical Governance Team, 2005). The support of management, ward heads, and healthcare executives was obtained. The project was submitted to management and healthcare authorities and validated by the local scientific committee. The authors defined a communication policy when the project was decided, and information about the study was circulated in the wards. The project was presented to nurses, and informed consent was obtained.

The questionnaire was designed with three parts. The first part obtained the career history of nurses, the length of time they had cared for the patient selected for inquiry, and the nurses' self-evaluation of their knowledge of medications. The second part was devoted to knowledge about drugs. Questions regarded the medications of one of the patients in their care. In the third part, support tools that the pharmacy could provide nurses were proposed and nurses were asked for their priorities.

Before each interview, where the questionnaire was administered, the authors studied the patient medical records and analyzed all prescribed drugs. A distinction was drawn between anticancer drugs and other medications. Questions dealt with indications, pharmaceutical class, compound name, existence of a generic drug, usual dosages, method of administration, storage, side effects, monitoring, major contraindications, and drug-drug interactions. For every drug, the side-effects profile was analysed to highlight those that were most important. To reduce bias, the study team established that no knowledge of the criteria or a standard response of minor criteria, such as hypersensitivity and digestive disorders, corresponded to a lack of knowledge. If all major criteria were reported, the information was considered known. For example, in the case of a morphine derivative, nurses should be able to demonstrate knowledge of side effects such as respiratory distress and constipation. For cisplatin, knowledge of renal toxicity and its emetogenic potential must be known. The French drug database Vidal® was used, as it serves as a reference in France and is accessible to all nurses.

Data Collection and Analysis

Only RNs were interviewed: nine in oncology (all nurses from this ward) and 17 in hematology (five nurses were not available during the study period). The questionnaire was administered using a semistructured interview (20–45 minutes) with each nurse in a private area (i.e., office). Results of the questionnaires were analyzed and presented using Microsoft® Excel® software.

Results

The mean age of participants was 27 years (SD = 3.4). The nursing staff had worked for about four years (SD = 2.8), including almost two years (SD = 1.3) in the ward where they presently worked. Nurses had difficulties managing patients throughout their stay (e.g., irregular time schedules, posting to variable rooms from one day to the next). The patient whose treatment served as the basis for the interview had been cared for by the nurse for a mean of six days (range = 1–40 days).

Twenty of the 26 nurses considered their knowledge of medications to be of an intermediate level. Each nurse was interviewed about a mean of six drugs (range = 4–11 drugs, depending how many their own patients were on), including at least one anticancer therapy. A total of 156 drugs were investigated. Eighty-four percent of pharmaceutical classes were known, as well as 95% of indications. However, only 32% of the compounds were named with the proper International Nonproprietary Name.

<table>
<thead>
<tr>
<th>TABLE 1. Drugs Correctly Identified by Participants on the Questionnaire</th>
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<td><strong>Section</strong></td>
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<td>Contraindications</td>
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<td>Drug-drug interactions</td>
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<td><strong>N = 156</strong></td>
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Note: A total of 26 nurses completed the questionnaire, and the number of drugs each was asked about ranged from 4–11.
Nonproprietary Name, and more than half of the generic drug names had not been mastered. About 94% of dosages were familiar to participants. Nurses were able to explain the method of administration for 98% of the drugs and their administration time in 52%. The storage of products was known in 96% of cases. Nurses knew the side effects for 48% of drugs and the monitoring methods for 54%. Contraindications and interactions with other drugs were not known for 63% and 82%, respectively, of the investigated products (see Table 1).

Knowledge of anticancer drugs and other treatments was similar. However, the preparation methods, time of administration, and infusion duration for cytotoxic drugs were not very well known; nurses instead were relying on therapeutic protocols provided by the pharmacy. Interactions with other drugs went practically unrecognized (see Figure 1).

Forty-six percent of the nurses said they consulted the Vidal drug database several times per week, and 54% estimated that they experienced problems related to a lack of knowledge about the medications from time to time. The problems nurses mentioned having on the questionnaire, relative to medications, were, in order of frequency, difficulties with notions of therapeutic equivalents and generic drugs (89%); storage conditions (81%); and dilution, reconstitution, and administration methods (79%). Problems linked to contraindications and dosages were less common (see Figure 2). Ninety-two percent of participants had never consulted the local drug formulary. In general, nurses felt that the pharmacy provided them with answers from time to time (35%) or often (27%).

Three types of resources were identified to help nurses in their work: drug information sheets (particularly for antibiotics and anticancer drugs), tables on drug administration, and tables on storage. In addition, the nursing staff was interested in training, computer tools, equivalency tables, chemotherapy procedures, and outlines of the times of administration.

### Discussion and Clinical Implications

One of the difficulties for the pharmacy is to determine the problems that departments have in the use of medications (Taxis & Barber, 2003; Wirtz et al., 2003). Therefore, audits about medications are important, as Couilliet, Michel, Fuchs, Haller, and Guillaume (2001) showed the discrepancy between the practical knowledge of nurses on the application of bandages and their theoretical knowledge gaps. With regard to current recommendations, clinical knowledge and local treatment generally were inappropriate. The inconsistency between the most used strategies and actual guidelines was the result of insufficient initial and continuous training of nurses.

Some studies previously evaluated nurses’ knowledge of drugs. However, they suffered from some bias, including a lack of control over the process of completing the questionnaires, using a theoretical approach, or selecting drugs commonly administered in a specified ward (Dilles, Vander Stichele, Van Bortel, & Elseviers, 2011; Ndosi & Newell, 2009). In addition, medication errors at the administration stage occur most frequently during routine situations (Valentin et al., 2009). In the current study, each nurse completed the questionnaire during a private interview, and the authors evaluated drugs that really were administered by the nurse to patients and not simply drugs commonly used in the wards. Despite a few difficulties regarding time schedules, most of the staff was interviewed. The anonymity of the questionnaire and the nonpunitive approach reassured the nurses and removed their initial reticence.

A positive relationship between experience and pharmacologic knowledge was identified in a study by Ndosi and Newell (2009). Significant differences were observed in scores obtained by nurses in different career levels, with senior staff achieving higher scores. That could be because nurses’ career levels increase with experience and possibly more opportunities for formal or self-directed learning. Nurses in the current study had less experience, which may have contributed to the findings. That may constitute a limitation to the generalizability of the current study’s results.

In a study by Valentin et al. (2009) on administration errors, the most frequent errors were related to time of administration and missed medication, followed by wrong dose, drug, and route. In the current study, most nurses gave satisfactory answers to drug names, indications, dosages, methods of

![FIGURE 1. Comparison of Nurses’ Knowledge of Chemotherapy Drugs and Nonchemotherapy Drugs](image-url)
administration, and storage conditions of products, as was shown in a similar study (Ndosi & Newell, 2009).

In the study by Valentín et al. (2009), staff reported the use of drugs with recently changed brand names as a contributing factor for error in 18% of medication events. In the current study, more than half of generic drugs were not known, and that lack of knowledge may be underestimated.

Studies have shown that recommendations for infusion duration often are not well known or not complying with, which results in serious medication errors (Taxis & Barber, 2003; Wirtz et al., 2003). That lack of knowledge was not found during the current study’s interviews with the nurses, a majority of whom knew the preparation methods, infusion duration, and administration times, at least for nonchemotherapeutic drugs. Preparation methods, infusion duration, and administration times were less mastered with regard to cytotoxic drugs, which may be linked to anticancer infusions being centrally prepared by the pharmacy.

Almost half of the nurses in the current study consulted information in the drug database several times a week, and almost 25% of them consulted the database only once a week. They attributed that to a lack of time and the fact that the information is too exhaustive and does not allow them to get down to essential facts. Specifically, they consult the database when a new therapy is introduced in the ward or when seeking a therapeutic equivalent or a generic drug. The same situation holds for the use of the drug formulary on the hospital’s intranet. In fact, most of the nurses did not know of it and had never used it. Poor circulation of this information source by the pharmacy may be a contributing factor and should be considered.

Inadequate pharmacy services also have been considered as contributing factors to errors occurring in wards (Krähenbühl-Melcher et al., 2007). In response to the question about the role of the pharmacy in providing drug information, opinions diverged, with a tendency to consider that the pharmacy’s participation was sufficient in frequency. Consolidating those relationships so that better communication can occur between the pharmacy and the nursing wards will make it possible to improve knowledge about medications, better understand the needs of caregivers, and understand the errors that occur (Sulosari, Suohon, & Leino-Kilpi, 2011).

In the current study, nurses evaluated their knowledge as intermediate. That is consistent with a study by King (2004), suggesting that although nurses have a limited understanding of pharmacology, they recognize the need for pharmacology knowledge in practice and are dissatisfied with nursing schools’ teaching of pharmacology. That also was emphasized by Dilles et al. (2011).

More than half of participants judged that they regularly encounter difficulties with drugs. The most frequent problems are research of therapeutic equivalents and generic drugs, conservation, and administration issues. That explains nurses’ expectations from the pharmacy. Documents such as summaries of all generic drugs stocked by the pharmacy or tables of pharmaceutical equivalents, administration, and storage represent the most awaited help that nurses ask from the pharmacy. However, nurses obtained good results on conservation and administration knowledge. That paradox probably is linked to the nurses’ role in the department; nurses are in charge of the drugs’ order to the pharmacy, and thus have to find the equivalents or generic versions of prescribed medications. Nurses also reconstitute and dilute drugs before administration (except for chemotherapeutic drugs) and must store them properly. Despite a good level of practical knowledge, those activities make up an integral part of their profession, and the support of summary tables could be helpful and comforting.

In addition, nurses feel they do not repeatedly face problems related to drug combinations and contraindications. At the same time, their knowledge in those two areas does not appear to have been assimilated. In response, nurses consider that the responsibility for verification of contraindications and drug-drug interactions lies with the physician. However, nurses should have a good knowledge base of medications to avoid potential drug-drug interactions, particularly in older adult patients. Therefore, nurses may underestimate the importance of contraindications and interactions. In addition, nurses have a crucial role in patient education, where a complete overview of drugs is mandatory (Sulosari et al., 2011).

In a study by Alibhai, Han, and Naglie (1999) of 47 older adult patients without cancer, only 30% reported receiving written instructions on their medications from their physician or pharmacist. Having nurses provide that information could improve patient adherence (Wendt, 1998). A plan for improvement is being implemented. Standardized and simplified information sheets are being designed to include the main characteristics of each pharmaceutical class and the associated drugs, summarized in tables. The first focus was on the antibiotics and anticancer drugs used most often in the oncology or hematology wards. Second, administration tables were requested, and include reconstitution and dilution solutions, shelf-life after reconstitution and dilution, major

![FIGURE 2. Percentage of Nurses Who Said They Encountered Problems in Each Knowledge Area](image-url)
Implications for Practice

- Nurses have greater knowledge of indications and administration of drugs than side effects, contraindications, and drug-drug interactions, of which they tend to underestimate the importance in medication errors.
- Nurses consult drug databases most when a new therapy is introduced in the ward or when seeking a therapeutic equivalent or a generic drug.
- Clinical pharmacists should help by providing materials on medications (e.g., information sheets, administration tables) and by proposing continuing education programs on pharmacology.

monitoring elements, and infusion duration. They should be easy to use, highly legible, and laminated. As a priority, plans exist to create the administration tables for antibiotics. Next, a table that includes most of the generic drugs and therapeutic equivalents used in the study’s center should be created. In addition, the pharmacy will design summary tables on the storage of drugs, eye drops, or syrups after opening, and of drugs kept below 8°C. Finally, nurses are looking for updated chemotherapy procedures and an information sheet on the handling of cytotoxics. Therapeutic tools and durations for IV administration are not highly requested.

Limitations of the current study include a small sample size and using only an oncology and hematology setting, preventing generalization to other nursing professionals. Nurses’ practices in pharmacotherapy are more dependent on the working setting rather than the educational level (Dilles, Vander Stichele, Van Rompaey, Van Bortel, & Elseviers, 2010). In addition, the need for information support tools identified in this study have to be considered with the short professional experience of nurses. A study by Vaz (1986) showed that reading professional literature was a function of years in practice; nurses in the beginning or latter parts of their career read more than did other groups. Those results suggest that young nurses, as in the current study, probably have increased needs for information support tools.

Conclusion

This is the first study to evaluate the knowledge of nurses regarding the medications used by their patients. The results are in accordance with previous works that used a more theoretical approach. Nurses’ knowledge of drugs mainly depends on their practice; they usually master administration issues, but lack information on side effects, contraindications, and drug-drug interactions. Most nurses have few post-nursing school pharmacology education opportunities and rely on drug databases for self-directed learning, although the current study’s results show less than half of nurses access drug databases several times a week. Collaboration between pharmacists and nurses should be a major objective, particularly to work on nurses’ training regarding pharmacotherapy. That may be effective to help improve patient counseling, increase side-effect reporting, and prevent medication errors.

References

Tam, V.C., Knowles, S.R., Cornish, P.L, Fine, N., Marchesano, R., &


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