Integration of Pharmacology Learning Events to Prevent Medication Errors

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Abstract

Nursing students participate in the same medication-related activities than professional nurses. During their clinical training, they become part of the drug management process. Therefore, we consider them a target population for teaching/learning agendas aimed to prevent medication errors.

Considering this approach, we designed a teaching/learning procedure consisting of a five-learning action sequence, included in the nursing curriculum at the University of Cadiz (Spain).

The first two actions were held in a collaborative learning environment with a b-learning procedure. The aim was to teach Pharmacology through a discussion forum on medication errors and a case-based activities. The 3rd learning action was a voluntary training activity. Its aim was to practice some pharmacology contents learned on previous semesters in a clinical setting. Before this activity, a therapeutic guide was designed, and then used by the students as a self learning reference tool. The last two activities were developed as the final graduation project.

In order to assess the guide implementation, two questionnaires were administered to the students. One included lock and unlock questions about student´s contribution in the medication administration process and the most used drugs in the clinical areas where they were assigned. This questionnaire also included questions about the detection of medication errors and possible mistakes made by the students, perceived learning achievement quality, satisfaction with the practical training and questions regarding the different parts of the therapeutic guide and its usefulness. The second questionnaire was a brief questionnaire about the students' knowledge of the subject of Pharmacology.

Results suggested that most of the students considered that the therapeutic guide was useful to reinforced their knowledge of Pharmacology and it helped to link theoretical information with clinical practice.

Students positively evaluated usefulness of this tool and, although we are aware that this is a first report, we hope that this programme will help us to further search on medication errors prevention.

1. Introduction

The medication use process (MUP) facilitates the correct use of medication (over-the-counter and prescription-only medicines) through clinical indication or by self medication (Aspden et al., 2006). This process can also help us to identify where medication use problems happen, what opportunities exist to solve them, and which technologies may be beneficial in this continuum.

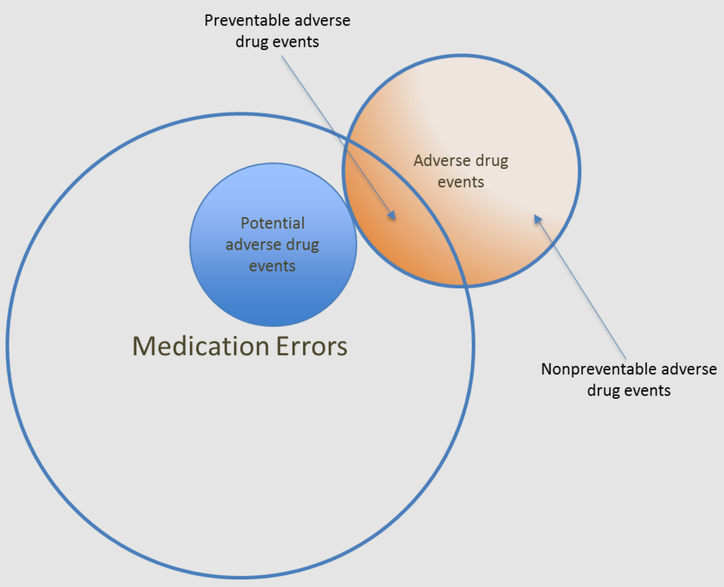
Medication errors (ME), defined as any mistake occurring in MUP: prescribing, transcribing/ documenting, dispensing, administering and monitoring compromise patient safety, and regardless of whether an injury occurred or whether the potential for injury was present, must be considered as health preventable events (Zhu and Weingart, 2014).

Among different health professionals involved in the MUP, nurses can play a fundamental role in preventing ME:

1. By detecting errors or mistakes before the drug administration.
2. During the administration process (last step to stop harm).
3. By notifying the adverse drug events, potential adverse drug events, and medication errors without harm (figure 1).
4. Participating in health education activities in order to get a more responsible patient self-medication, as an essential part of self-care.

Figure 1

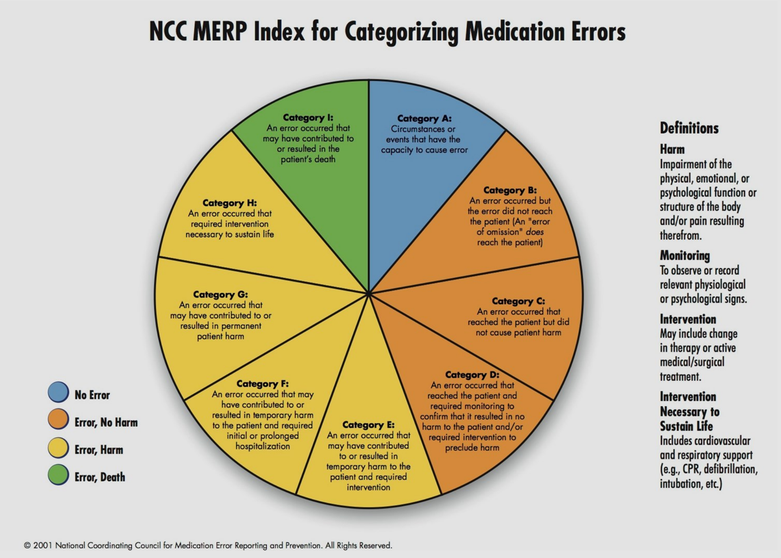
Relationship among medication errors, adverse drug events, preventable adverse drug events, close-call adverse drug events, and adverse drug reactions (modified from Gandhi, Seger and Bates, 2000).



2. Objectives

1. Integrate applied pharmacology contents about medication errors in undergraduate nursing degrees through a sequenced learning strategy.
2. Improve skills in medication management by nursing students in order to train them to prevent medication errors.
3. Obtain preliminary information to design teaching strategies and single activities about medication errors performed or detected by nursing students during their clinical training.

Figure 2



3. Learning Events

We designed a teaching/learning procedure consisting of five learning actions of applied pharmacology as an integrated part of the nursing curriculum at the University of Cadiz (Spain). These activities were sequenced during 3rd, 4th and 8th semesters, when the teaching of Pharmacology (9 ECTS, students = 59), Practicum I (18 ECTS, students = 59) and Final Work Degree subjects (6 ECTS, collaborator students = 2), were carried out, respectively, during the academic year 2012-2013.

The first two actions were held in a collaborative learning environment with a b-learning configuration for teaching pharmacology in the Nursing Degree (Lorenzo et al. 2012). The community of inquiry was created by means of an hybrid learning environment with activities integrated both in face-to-face and in online settings. A case-based activity was designed to improve calculations skills through 25 situations in which the students had to solve problems (working individually and in long-term groups) about prescription understanding and interpretation, dosage and intravenous infusion speed control. We also developed assessments and discussions in both environments. The students had up to 15 days to complete the activity, which was evaluated based on participation criteria and assessment of their calculation skills.

The second learning action consisted in a discussion forum about 8 situations in which different ME were involved (categories NCC MERP, in brackets) (figure 2): wrong route (F), error of omission (C), potential adverse drug event related to prescription (B), known drug allergy (E, F, G, H, I), drug-drug interaction (E, F, G), wrong doses (C and D) and no medication error.

The main questions to promote the discussion were: Are there any ME? Is it an adverse drug reaction? What can the nurse do to prevent this type of error? Access to online forum was open for 20 days in order to do the activity. The final discussions and conclusions were done in a face-to-face meeting (2 hours).

The third learning action was a voluntary training activity in which participated 51 of 59 students (86,4%) enrolled in the Practicum I (figure 3). Its aim was to apply pharmacology learning outcomes that they had worked in the previous semester. Before this activity, a therapeutic guide was developed by collaborator students (September to April), and then used by the participants as a self-learning tool. The guide consisted on 61 data sheets with basic information about the most prevalent drugs used in the clinical areas involved.

The last two activities consisted on two Final Degree Projects assigned to the collaborators students (Vidal, 2013; Aloum 2013).

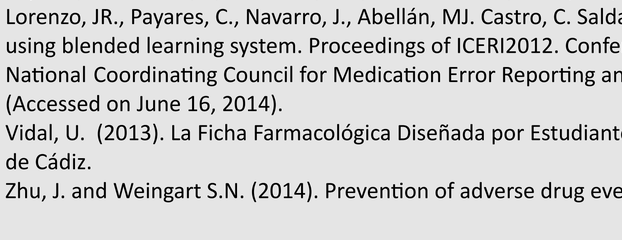
In order to analyse the guide implementation, two questionnaires were administered to the students. One included lock and unlock questions about student contribution in MUP and the most used drugs in the clinical areas where they were assigned. This questionnaire also included questions about the detection of ME and possible mistakes made by the students. The second questionnaire was a brief questionnaire about the students' drug management knowledge.

We present data about ME detected and made by the students during their clinical practices period, as well as the main results about drugs and administration routes used.

Figure 3

Students Profile (Pharmacology and Practicum I) subjects

Age	ECTS Enrolled	Access to University	Access Grade
		Selectividad (64.7%)	
23.25 years (SD=8.11)	62.35 (SD=5.44)	Professional Formation Courses (27.4%)	10.68 (DS=2.82)
		> 25 years (2.0%)	
		> 40 years (4.0%)	



4. Implementation Analysis: Third Learning Event

The questionnaires were completed by 40 students (67.8%). The participation in the preparation and administration of drugs by different administration routes was high, with data very similar for the oral route (75%) and the subcutaneous or intramuscular route (74.4%), and much higher for intravenously (95%).

All the participants (100%) provided information about the 3 most used medicines in their nursing care unit. 120 records of drugs were grouped according to the second level of the Anatomical Therapeutic Chemical Classification System (ATC) (figure 4). Most of the drugs belonged to the group of other analgesics and antipyretics (24.2%): paracetamol, metamizole, dexketoprofen trometamol and ketorolac; proton pump inhibitors (16.7%): omeprazole; antibacterial for systemic use (12.5%): beta-lactamic antibiotics; diuretics (10%): furosemide; and antithrombotic agents (8,3%): enoxaparin sodium. The most frequent administration routes for these substances were intravenously (62,2%) and orally (23,8%).

Seven students (17.9%) detected any error or mistake in MUP (figure 5), 3 cases were in relation to the administration of intravenous bolus of furosemide, 1 with the preparation of omeprazole, 1 related with not recording the nursing action after the drug was administered and 1 was a double error, a substance type and an administration route errors. Moreover, there was a student that considered a photosensitivity reaction to metamizole as a ME.

Another 7 students (17.9%) made some ME during their practice (figure 6). Of these, 5 were administration to the wrong patient, 1 was related to the inadequate speed of intravenous infusion and another with a bad rotulation of medication.

Figure 4

Drugs Must Frequently Used by the Students

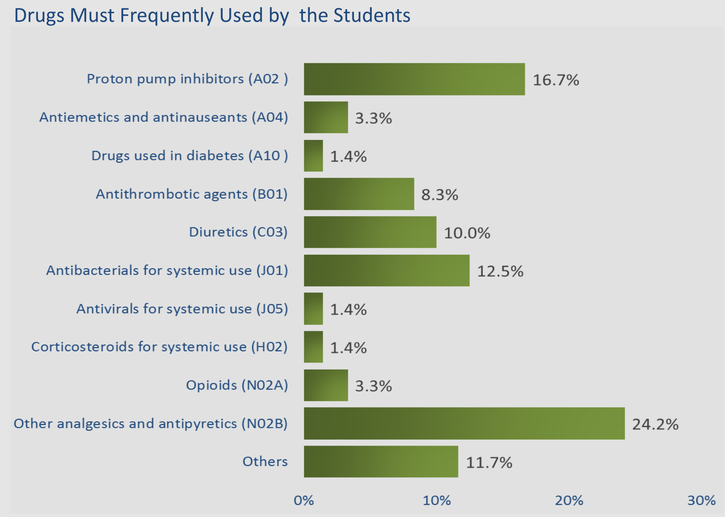


Figure 5

Have you observed some medication error in your clinical unit?

Medication errors detected by students in clinical units (N=7)

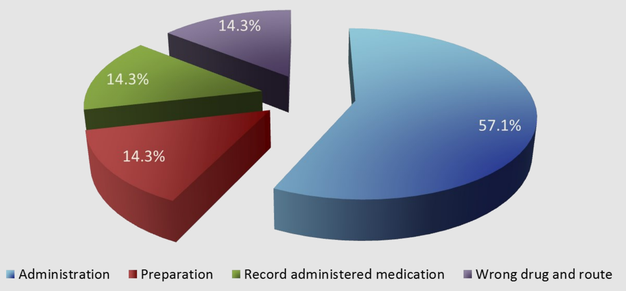
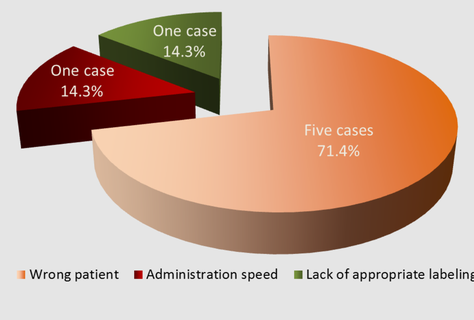


Figure 6

Could you have made any medication error during your clinical training?

Number of students involved (N=7)



5. Conclusions

1. Medication errors are inherent to clinical practice itself and are a public health problem that must be addressed from adequate training of the various professionals involved in the delivery of health services, individually and as members of a team whose common aim should be to improve the health and quality of life of patients and their environment.

2. Undergraduate nursing students are involved in MUP during their clinical training as much in hospitals as in primary care, because they perform the same clinical activities than nursing professionals - although under their supervision -, so they should be considered as a target population for teaching and learning prevention strategies oriented to observe, detect, monitor and report medication errors.

3. The high involvement in the administration of parenteral medicines (most often intravenously), is a risk factor for severe adverse drug events due to errors or mistakes. Indeed, we need to pay special attention in this issue from the preventive point of view.

4. There is a good perception of the students about their learning on medication management, a fact that is consistent with its wide participation on a voluntary basis in third learning event designed.

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