

Reducing Errors in Pharmaceutical Calculations Educating & Training Medical Staff



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Objectives

Pharmaceutical dose calculation is the mathematical process through which the dose, rate and unit of drug are determined according to the clinical needs of the patient. This is an essential tool among the daily activities of pharmacists, nursing staff and physicians.

Pharmaceutical calculation errors occur among physicians and nursing staff. They constitute about 11% of all medication errors and are caused by lack of training and/or skill (e.g.: Wong, 2010) Pharmaceutical calculations are an integral part of pharmacy and nursing training, but are not included in physician training curricula. We decided, at Meir MC in Israel, to develop a unique project to increase awareness, knowledge and skill in pharmaceutical calculations, among treating staff, to improve the quality and safety of patient treatment.

The aims were to check opinions, knowledge and self-confidence of medical interns in performing pharmaceutical calculations and to improve their skills.

Methods

- ★ The target population was all 44 medical interns who worked at Meir Medical Center in 2011.
- ★ Subjective and objective data were collected using pre-test/post-test questionnaires developed for the study.
- ★ The questionnaires included statements that examined the attitudes of respondents.
- ★ Their ability to perform drug dose calculations was tested by five practical exercises.
- ★ Developed and taught a course.
- ★ Summarized data and gave recommendations for the future.

Results

Total: 42 questionnaires (22 pre-test and 20 post-test). In the pre-test, only half, mentioned they had previous training in pharmaceutical calculations. All stated it was insufficient. Overall opinion was that pharmaceutical calculations are important for professional daily functioning ($x=4.59$, $SD=1.36$, on a scale of 1 to 6). Before the intervention, most (20/22) indicated they encountered pharmaceutical dose calculation exercises that they were unable to solve, at least once in their work.

Perceived self-confidence increased from an average of 2 before the training course, to 3.6 after it. The perceived degree of difficulty in solving the exercises after the training course decreased by 50% (Table 1).

Interns' ability to answer objective questions improved by the post-test (Table 2).

Incorrect answers included both over-doses and under-doses.

Conclusions

This project has clinical significance for the quality and the safety of patient care. Raising awareness, knowledge and skills of the medical staff can contribute to minimizing errors in medicinal treatment.

We strongly recommend essential education in pharmaceutical calculation for all medical staff. Prevention of pharmaceutical dose calculation errors through training seems feasible.

The project is a pioneering, unique, breakthrough pilot.

We suggest that the findings of this study be implemented in other institutions, including schools of medicine.

It is a pharmacist's duty to contribute minimizing medication errors.

Leading and teaching this subject by **hospital pharmacists** will **significantly empower the pharmacist's role and its contribution to safe medical treatment.**

Table 1: Changes in Attitudes

Question	Scale	Pre-test (\bar{X})	Post-test (\bar{X})	P-value
I felt confident performing all the calculations	1-6	2	3.6	< 0.001
Difficulty felt while answering objective knowledge questions	1-10	8.94	4.78	< 0.001
No significant differences in other attitudes between pre- and post-tests				

Table 2: Overall scores on the 5 practical exercises improved after the training course

Questionnaire	Number of questionnaires	Average correct score	Standard deviation
Pre-test	22	32.7%	34.11%
Post-test	20	51%	28.63%

P=0.067

Discussion

- ★ Safe dispensing of medication demands accurate dose calculations.
- ★ The data support the success of the training program in improving knowledge, skills and confidence of the staff that perform dose calculations.
- ★ The percentage of correct answers increased, but did not reach 100%.
 - Work constraints might have prevented some interns from attending all five sessions; some attended only one meeting.
 - We believe that training physicians in pharmaceutical dose calculations should be structured.
 - One option is a mandatory course for all medical school students.
- ★ The project led hospital management to train the following teams: physicians and nurses in the Pediatric and Internal Medicine wards, medical interns, medical students in clinical training, all new physicians, and nurses starting to take shift responsibility.
- ★ The process of administering medications is complex, with many stages, during which pharmacists and nurses oversee several checkpoints. These points help to ensure the quality and safety of drug therapy. Likewise, computerized systems and medical protocols are important components of safe medication administration.