

Computer Simulation of Medication Administration for Nurses (November 2002)

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Abstract—Student nurses within the UK currently have limited opportunities to participate in the administration of medicines within the clinical environment because of their ever-increasing numbers. It is hoped that the development of a CD ROM, simulating realistic patient scenarios, will allow students and qualified nurses an increased opportunity to develop medication administration skills. It is hoped that the exposure to medication errors in this CD format will increase the nurse's awareness of medication administration, potentially preventing errors from occurring in practice.

Index Terms— Computer, medication, nursing, simulation

I. INTRODUCTION

Computer simulation has been successfully used for many years to train pilots, military and medical personnel¹. Development of these simulations is costly therefore advantages to the learning process need to be identified, such as the simulation being equally or less resource intensive or there is no effective alternative available².

It is perhaps taken for granted that once qualified, nurses who undertake medication administration are competent to perform the skill. However, the literature relating to medicine errors is concerning, indeed the English National Board³ found that the nursing curricula did not adequately address medication education. Students and lecturers felt that taught pharmacology should be made applicable and relevant to nursing practice. A lack of opportunity to practice integrating the knowledge and skills gained from different components of pharmacology knowledge, communication and patient education skills was identified, as were concerns about the variable standard of learning experiences in practice with mentors³. A lack of development of such skills as a student may well affect the student's performance and competence as a qualified nurse.

Medication errors affect a significant number of patients, with between 5 – 17% suffering from adverse effects from drugs⁴. There are 7000 medication doses administered in an average district general hospital (DGH) each day. A 5% error rate would therefore result in approximately 350 medication errors each day in a DGH.

Medication administration has been identified as one of the highest risk areas of nursing practice^{5,6}. The risk factors associated with medication errors include inadequate knowledge and skills, failure to comply with policies and failures in communication⁷. The most common type of errors include giving the wrong medication or dose, using the wrong route or failing to check the patient identity^{5, 8, 9}.

The audit commission calculated that medication errors cost the NHS up to 500 million pounds per year, can increase patient mortality by up to 33% and may result in additional inpatient stay of up to 8.5 hospital days⁴. The report concluded that the majority of medication errors follow a common pattern, are rarely a solo error and up to 46% may be preventable by the introduction of evidence based guidelines, education and modernised information technology. The use of a computerised learning tool that simulates medication administration may provide opportunities to practice and so could help to improve student nurse's competence and potentially help to reduce the number of medication errors.

Another area of concern within the administration of medicines is that nurses (both student and qualified) lack the ability to perform numerical calculations¹⁰. Santamaria et al¹¹ identified a 58% failure rate in the drug calculation competency of new graduate registered nurses, even with access to a calculator. However, simply improving mathematical skills does not improve the nurse's ability to conceptualise what they are required to do when administering a particular drug dosage¹². The literature also demonstrates that achieving and maintaining competence in the calculation of medicines is a problem not just for novices but also for experienced nurses^{13, 14}.

Against this background the authors have designed and produced an interactive computer simulation of the procedure for the administration of medicines by nurses. The CD ROM is aimed at both student and qualified nurses and has two distinct activities:

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1. Patient simulations of the administration of medicines
2. A calculations test to assess the nurse's competence in relation to medication calculations

1. PATIENT SIMULATIONS

The patient simulations require the nurse to administer the medication to each patient in accordance with the prescription but also taking into account the clinical condition of the patient at that time. Recognition of any pharmacological and/or procedural issues that would contra-indicate its administration is also required. UK nurses are obliged to use their professional judgment when administering medicines and not just see it as a mechanistic task¹⁵.

It is suggested that academic programmes do not prepare students adequately for the uncertainties in clinical practice¹⁶ and that students need to recognise the tacit decision making guiding clinical practice¹⁷. It is also recognised that problem solving is central to nursing practice¹⁸ and requires the development of critical thinking and decision making skills². The simulations enable the nurse to develop their problem solving and decision making skills, in a safe environment, using pre-existing knowledge which is seen as an essential component of the decision making process. The closer the links to actual practice within the simulations, the better the learning experience for the students¹⁹. The patient simulations are taken from real-life scenarios to enable the nurses to attach relevance, increasing intrinsic motivation and so improving their educational value²⁰. If the student can attach relevance, the learning that occurs becomes integrated into the existing knowledge and skills²¹.

Exposure to a high number of experiences is also important for developing decision-making skills²². It is not suggested that computer simulation can totally replace actual practice experiences but there are clear learning advantages in working through a number of similar cases in a safe environment.

Nurse education historically used traditional lecturing methods to teach, requiring the student to be passive and emphasising the memorisation of facts fostering superficial approaches to learning. However, a more active and interactive learning environment, which encourages students to make connections between concepts, is thought to promote much deeper approaches to learning^{23, 24}.

Within the simulation students are required to select the medication for administration and then administer it to the patient. If an error has occurred the student will be informed immediately and be given the opportunity to try again or to find out where they went wrong. Immediate formative feedback in simulations has been found to improve learning^{25, 26}.

2. CALCULATION TEST

Students access the test and are required to complete calculations set within the context of nursing to provide relevance. This supports the evidence that simply improving mathematical skills does not improve the nurse's ability to conceptualise what they are required to do when calculating medication doses. Instant feedback can also be accessed in the event of an error or the student can opt to have another attempt.

PERCEIVED BENEFITS

- Inadequate opportunities to practice medication administration within the clinical environment have been identified³. The CD ROM offers extra practice within a wider context of nursing and also offers the experience of rare or unusual cases, which may not be encountered in the clinical environment during the student's allocation.
- The CD ROM offers flexible approaches to learning as students can undertake the activity at a time that is convenient to them. Learning can therefore be structured throughout the day for the student rather than being restricted to opportunities during a set shift.
- The CD ROM takes into account individual learning needs as learning occurs at the individuals own pace. Students can seek repeated exposure to medication administration through the use of the simulation if required. Alternatively students who do not require as much support are not restricted in their learning as they can complete the simulation at a faster pace. Studies have shown that learning time can be significantly reduced for some students by as much as 25-33% when compared to traditional methods^{27,28}. This saving in lecturer time could allow the opportunity to provide support to students who require more assistance in this area.
- The simulation promotes deeper approaches to learning through a problem solving approach. Thus enabling students to make decisions without the pressures of the clinical environment and without causing injury to the patient.
- Promotes the development of more skilled practitioners potentially contributing to a reduction in morbidity and mortality due to medication errors.
- Scenarios are based on actual patient histories to provide realism, which enables the students to attach relevance and contextualise the learning experience.
- Offers instant feedback to try to promote a change in the student's practice

- Offers the opportunity to improve nurses' knowledge of the administration of medicines without increasing lecturing time
- The CD ROM could be used as part of risk assessment strategies within clinical areas to evaluate the competence of, or identify weaknesses of, qualified nurses, particularly for unusual medication scenarios.
- The CD ROM could be used as a developmental tool for nurses who have been involved in a medication error. It could also be used for yearly updates to educate qualified staff regarding new medications, policies and procedures.

Whilst it is recognised that electronic prescribing is becoming more common place for administering medications, nurses will still be required to use their professional judgment regarding the appropriateness of the medication to be administered based on the patient's clinical condition. Electronic prescribing will help to eliminate some of the prescribing errors that occur using the manual system and should also contribute to the reduction of pharmacological errors. The simulation should help nurses become familiar with using computers to administer medication within this technical format.

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