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Simulated patient cases using DecisionSim™ improves student performance and satisfaction in pharmacotherapeutics education

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ABSTRACT

Background and Purpose: Pharmacy education is continuously evolving and incorporation of technology is more prevalent. Computer-based patient cases are being utilised to illustrate complex concepts and develop clinical decision-making skills by enabling deliberate practice and continued feedback to scaffold student learning. Simulations are received positively by students but there is limited information on the benefit to student performance. The study aim was to determine the benefits of computer-based cases for oncology therapeutics in terms of student satisfaction and performance.
Educational activity and setting: Computer based oncology cases were designed using DecisionSim™ technology and introduced to final year pharmacy students. Student satisfaction was measured using a questionnaire with a 5-point Likert scale (1 strongly agree to 5 strongly disagree), and an option for open-ended comments. Performance was measured using results of assessment items in the oncology course compared to a similar course (psychiatric/neurology).
Findings: Students found the simulated oncology cases engaged them in learning (median 1.5), had a role in therapeutics education (median 1), and developed decision making skills (median 1). Thematic analysis of open comments suggested it was most beneficial as a self-directed study tool. The students performed significantly higher ($p < 0.05$) in the oncology end of semester exam (78.6 ± 8.6) compared to psychiatric/neurology (70.7 ± 9.6).
Summary: A computer-based simulation for oncology pharmacotherapeutics can engage students and develop decision making skills. DecisionSim™ enhanced both student satisfaction and performance in management of oncology cases, and is a beneficial educational tool for teaching complex therapeutic topics to pharmacy students.

Background and purpose

Technology has pervaded many aspects of education and has begun to become a standard of pharmacy education. Core competency subjects including clinical pharmacology and therapeutics have conventionally been taught through traditional teaching modalities and learning activities including case studies, group discussions, presentations, oral examinations and problem-based learning (PBL) modules.[1–3] These activities encourage active learning and are often student-centred, a result of the shift in the

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education paradigm toward a more hands-on, learner-centred model.[4–6]

Burgeoning innovation and availability of technology has created a learner expectation of its inclusion in educational practice.[7,8] A number of technology-enhanced activities are employed in health education, particularly for medicine and nursing practice, which have included the use of virtual patients, simulations, and games.[9,10] These modes are used most prevalently to teach practical skills and cement theoretical knowledge, by bridging the gap between classroom learner and practitioner.[10,11] One such example of a branched-narrative model is DecisionSim™, delivered by Kynectiv Inc, derived from the vpSim™ created by the Laboratory for Educational Technology at the University of Pittsburgh.[12] Computer-based simulation platforms, like DecisionSim™ are particularly beneficial for teaching complex clinical concepts and specialised topics that are often not encountered in traditional placement scenarios, such as oncology pharmacotherapeutics.[3] The simulation provides an opportunity to promote clinical reasoning and decision-making skills and apply theoretical knowledge in a safe environment.[12–14] Computer-based simulations are usually repeatable activities, that can be accessed anywhere at any time and provide learners with added learning flexibility while promoting deliberate practice.[15] In particular, branched simulations permit students to take a number of different pathways depending on their decision, ultimately reaching a certain outcome dependent on the route taken.[3,16] The branched-outcome model also allows provision of immediate feedback detailing the appropriateness of decisions made and treatment outcomes of a virtual patient.[17]

Simulations that foster clinical decision-making skills for healthcare education, have been shown to promote self-directed learning, thereby encouraging life-long learning, a desirable quality in a health professional.[12] These teaching practices can promote a highly effective learning environment for complex clinical topics, as is covered in a therapeutics course, particularly when used to augment existing core teaching practices like lectures and problem-based learning sessions.[3] Issenburg[18,19] identified a number of features desirable of simulation for health education including immediate feedback and repetitive practice, both of which can be easily achieved using computer-based simulation. Being able to repeat a simulation activity allows the learner to exemplify deliberate practice, assisting in the mastery of a skill or concept until it becomes fluid or second-nature.[20,21] Simulation-based medical education with deliberate practice has demonstrated superiority to traditional clinical education for achieving specific clinical skill goals.[16] Feedback is also identified as an important element of deliberate practice and simulation for health education.[16,18] The use of feedback in simulation throughout the learning experience is critical to the promotion of effective learning.[22] Computer-based simulation is able to provide feedback throughout the learning activity, rather than being limited to only after the activity has been completed. In effect, consistent feedback can be used to scaffold the learning experience, guiding the student throughout the process.[23,24]

There is increasing literature regarding the introduction of technology-based cases in health education. However, despite many positive reports regarding student satisfaction, there is limited information regarding the benefit in terms of student performance in assessment. Further to this there is conflicting evidence with both improvement[17] and no improvement[25] to student outcomes reported. In addition, Benedict et al.[12] have reported increased outcomes in tests scores immediately after use of simulations but no sustained effect on knowledge retention. Further to this, there is limited information on the benefit of branched technology on student performance, in particularly on student decision-making and critical thinking skills regarding therapeutic cases. Therefore, this study aimed to examine both the qualitative and long-term quantitative effects of the introduction of a computer-based simulation for oncology pharmacotherapeutics, integrated for the first time into an oncology therapeutics course for pharmacy students.

Educational activity and setting

The Griffith University Bachelor of Pharmacy (BPharm) program is a four year undergraduate degree leading to registration as a pharmacist in Australia. Therapeutics is taught throughout the program with the topic of oncology delivered in the final year of the program as the subject Integrated Pharmacotherapeutics (IP) oncology. Problem-based cases are utilised for application of knowledge and are traditionally are in a paper-based format. In Semester 1 2016, the oncology cases were delivered through DecisionSim™ technology. These cases focussed on management of oncological emergencies such as febrile neutropenia, hypercalcaemia, and tumour lysis syndrome and were developed by a combination of academia and pharmacists working in the oncology field. Each case may require students to make a range of decisions including as examples appropriate anti-emetic therapy according to the oncological regime, suggested dose, and timing of filgrastim to prevent febrile neutropenia, and choice of antimicrobial therapy for a penicillin allergic patient that has developed febrile neutropenia.

The students were introduced to DecisionSim™ during a workshop in the second half of their course after the mid-semester exam. The three hour workshop was facilitated by faculty members. Students were orientated to DecisionSim™ at the start of the workshop after which they could complete up to three cases at their own pace with faculty members available for debriefing and further instruction as required. Access to the technology remained until after the end of semester (EOS) exam with students able to login to the technology on any computer with internet access. The EOS exam was comprehensive and included material taught throughout the semester, however 50% of the EOS exam consisted of cases assessing application of knowledge and testing clinical decision making skills.

Upon completion of the workshop introducing DecisionSim™, students were invited to complete an anonymous survey evaluating the use of the technology in therapeutics teaching. Student perceptions were rated on a five point Likert scale with 1 being strongly agree to 5 being strongly disagree, to statements regarding DecisionSim™ technology, and open comments with free text were also invited. Ethics approval was granted by Griffith University Research Ethics Committee 2016/310.

Results for the student assessment items were compared for the year using DecisionSim™ technology, i.e. 2016 to a subsequent offering of the course in 2017 using no DecisionSim™ technology. Comparisons were made for assessment items both prior to introduction of DecisionSim™ (i.e. mid-semester exam) and after (i.e. EOS exam) and for overall grades. Results were reported as