Developing Clinical Skills in Paediatric Dysphagia Management using Human Patient Simulation (HPS)

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Abstract

Purpose: The use of simulated learning environments to develop clinical skills is gaining momentum in speech-language pathology training programs. The aim of the current study was to examine the benefits of adding Human Patient Simulation (HPS) into the university curriculum in the area of paediatric dysphagia.

Method: University students enrolled in a mandatory dysphagia course (n=29) completed two, 2-hour HPS scenarios: (a) performing a clinical feeding assessment with a medically complex infant; and (b) conducting a clinical swallow examination (CSE) with a child with a tracheostomy. Scenarios covered technical and non-technical skills in paediatric dysphagia management. Surveys relating to students’ perceived knowledge, skills, confidence, and levels of anxiety were conducted: (a) pre-lectures; (b) post-lectures, but pre-HPS; and (c) post-HPS. A fourth survey was completed following clinical placements with real clients.

Results: Results demonstrate significant additive value in knowledge, skills, and confidence obtained through HPS. Anxiety about working clinically reduced following HPS. Students rated simulation as very useful in preparing for clinical practice. Post-clinic, students indicated that HPS was an important component in their preparation to work as a clinician.

Conclusion: This trial supports the benefits of incorporating HPS as part of clinical preparation for paediatric dysphagia management.
Introduction

Clinical education is a core component of speech-language pathology (SLP) curriculum, providing students with opportunities to build professional relationships with colleagues and clients, develop specific competencies required for entry-level practice (McAllister & Lincoln, 2004), and translate knowledge and skills from academic courses (Hill, Davidson, & Theodoros, 2010). Finding sufficient clinical placements and providing a range of clinical experiences for SLP students has become increasingly difficult due to: 1) the growing number of students; 2) increasing workplace pressures impacting on clinicians’ availability/willingness to take students; and 3) inadequate funding for clinical education positions (Casares, Bradley, Jaffe, & Lee, 2003; Hill et al., 2010; McAllister, 2005; Rodger et al., 2008). To ensure students continue to receive high quality clinical preparedness training, evidence to support alternate learning opportunities, which can either supplement or replace time in actual clinical placements, is required.

To this end, University SLP programs have been exploring the use of simulated learning environments to address existing and future predicted training shortfalls (MacBean, Theodoros, Davidson, & Hill, 2013). Simulated learning environments allow students the opportunity for repeated practice in a clinically relevant context that is safe for both the participant and patient, facilitate standardised exposure to a targeted learning activity, and enable clinical educators to provide a range of feedback typically not available in real client experiences (Blackstock & Jull, 2007; Hill et al., 2010). In allied health education and training, the use of standardised patients has been the dominant form of simulation education activity (Edwards & Rose, 2008). Standardised patients are actors who have been trained to portray historical, physical, and emotional features of an actual patient (Barrows, 1971). Large-scale randomized controlled trial (RCT) studies conducted in the cognate field of
physiotherapy have demonstrated that standardised patient programs can be used to replace a component (25%) of clinical practice with no detrimental impact on students’ ability to meet clinical competencies (Watson et al., 2012). Although no such rigorous research has yet been conducted in the field of SLP, standardised patients have been implemented effectively in SLP training programs since the mid-90s to provide exposure to various clinical populations (e.g., clients with fluency disorders, aphasia and voice disorders), and develop clinical reasoning skills (Bressmann & Eriks-Brophy, 2012; Hill et al., 2010, 2013; Syder, 1996; Zraick, 2012).

However for some aspects of clinical training, such as practice areas that involve young children, the performing of invasive techniques (e.g., suctioning, endoscopy), or working with clients in critical care contexts (e.g., tracheostomy management), the use of standardised patients may not be feasible or the most appropriate training modality. Rather, skill development may be better achieved through the use of Human Patient Simulation (HPS). In HPS, a range of different equipment, including part-task trainers and various types of low/high fidelity mannequins, are used to create opportunities for students to practise clinical skills. HPS offers an advanced method of realistically replicating patient actions and responses using computer and design technology, and has been used within medical and nursing training for some decades to assist in, for example, the development of skills to maximise patient safety (Beyea & Kobokovich, 2004).

Despite extensive use of HPS training in medical and nursing programs, only one study to date has evaluated the use of HPS training with SLP students. Eighteen SLP graduate students from the United States practised with different types of simulators to develop skills in performing transnasal endoscopy as part of conducting a fiberoptic endoscopic evaluation of swallowing (Benadom & Potter, 2011). Although the authors acknowledge a number of limitations in their study, overall the results found that simulation was beneficial for building
clinical confidence and technical skills. They concluded that the use of simulation had
allowed repetitive practice of endoscopy skills without patient compromise. They also noted
that by using experienced graduate students as supervisors in their training model, there was
the potential to reduce demands on faculty time (Benadom & Potter, 2011).

Although the current evidence base for HPS use in SLP is very preliminary, dysphagia
assessment and management have been identified as professional practice areas where clinical
training could be supplemented using HPS (Benadom & Potter, 2011; MacBean et al., 2013).
Paediatric dysphagia management in particular, is an area of specialised clinical practice in
which Australian SLP students must demonstrate basic competency prior to graduation
(Speech Pathology Australia, 2011), yet there are insufficient clinical placement opportunities
for all students. As such, the potential to use HPS to provide additional experiences in this
area which could help prepare students and supplement the opportunities provided in clinical
placements could be beneficial.

The overall objective of the current research was to develop a paediatric dysphagia
HPS learning opportunity designed to assist students prepare for clinical practice in paediatric
dysphagia. The study aim was to explore students’ perceptions of anxiety, confidence, clinical
skills, and clinical readiness relating to paediatric dysphagia management between (a)
completing only the academic curriculum, versus (b) completing both the academic
curriculum and the HPS sessions. By exploring student perceptions, the intent was to
determine what aspects of clinical skills, knowledge and confidence students felt were
addressed by the different learning opportunities, and to what extent they would be receptive
to such learning opportunities in the future.

Methods
This study involved a prospective repeated measures cohort design. All students enrolled in the mandatory dysphagia course, held in the first year of the two-year graduate entry Master of Speech Pathology Studies degree program, were invited to participate. Participation was voluntary. All students (regardless of research participation) completed their academic lectures in dysphagia, then participated in two, 2-hour HPS tutorials relating to paediatric dysphagia management. Students’ perceptions of their knowledge, skills, confidence, and levels of anxiety were completed using a survey at three time-points: (a) pre-lectures, (b) post-lectures, but pre-HPS, and (c) post-HPS. A fourth survey was completed almost 8 months later, following actual clinical practice. Ethical approval for the research was granted by the relevant medical research ethics committee, and all students provided written, informed consent.

Dysphagia Lectures

The dysphagia course consisted of 42 hours of lectures, in-class demonstrations, and case-based discussion that covered: foundation knowledge of swallowing including anatomy, neuroanatomy, and physiology of the swallowing mechanism; the assessment, diagnosis, and management of paediatric and adult swallowing disorders; as well as dysphagia management in 2 specialized populations: tracheostomy and patients with head and neck cancer. Lectures were delivered over the course of 7 weeks (6 hours/week) by two members of the research team, who had been involved in lecture delivery for this course for over 7 years. The theoretical component specific to infant and child feeding was covered in 8 hours, whilst content specifically relating to performing a clinical swallow examination (CSE) and general clinical decision-making was covered in 5 hours, and basic principles of tracheostomy management in 4 hours.
Simulation Tutorials

One month following lectures, all students participated in two, 2-hour paediatric dysphagia HPS tutorials (total of 4 hours HPS activity provided to students). These tutorial sessions provided students with practical hands-on experience using HPS in order to develop skills in: (a) Infant Feeding: performing a clinical feeding assessment with a medically complex infant (2 hours); and (b) Child CSE: conducting a CSE for a child with a tracheostomy (2 hours). Sessions were developed and implemented by the research team whose members have extensive experience in paediatric dysphagia, simulated learning, adult learning principles, and the Australian SLP student competency attainment processes. This team of 8 allied health professionals included 6 speech pathology staff who each had designated roles as either a session facilitator or other (parent; nurse, voice of child) in the scenarios. Two physiotherapy staff who were trained simulation co-ordinators managed the physiological responses of the child and boy during sessions.

The scenarios were designed to provide students with opportunities to practice core clinical skills including communication and basic manual tasks such as holding an infant and conducting a swallow assessment with a child. However, the tasks were also designed to provide a range of clinical learning opportunities and not to specifically assess graduate competency. For this reason, the scenarios were intentionally designed to have complexity (e.g., the child has a tracheostomy, the infant is medically fragile). While it is acknowledged that Australian training standards do not expect new graduate students to independently manage patients of this degree of complexity (CBOS, Speech Pathology Australia [SPA], 2011), students are exposed to the theory and processes required to manage these patients in their coursework. As such, the more complex clinical cases were specifically chosen for this activity to encourage discussion, clinical reasoning, opportunities for mentored learning, and enhanced skill building in a safe learning environment.
Scenarios were developed around six generic learning objectives, relating to technical (manual skills specific to the focus caseload and environment) and non-technical (e.g. communication, interaction) skill development. Students were to demonstrate: (1) situational orientation regarding managing children with dysphagia in a hospital ward setting; (2) awareness of health and safety issues; (3) manual skills required for patient handling, infant feeding, and conducting a CSE; (4) consideration and integration of information obtained from medical case information, the patient, vital signs, multidisciplinary team, and the assessment process; (5) seeking additional information as required to plan evidence-based care; and (6) appropriate communication with child/infant, hospital staff (nurse), and the parent, both during and after assessment. The HPS activities provided students with opportunities to practise a range of clinical and professional skills, which were mapped against the profession’s Competency Based Occupational Standards (CBOS, Speech Pathology Australia [SPA], 2011) and the Competency Assessment in Speech Pathology clinical assessment tool (COMPASS®, SPA, 2013) (Table 1) in order to determine the activities’ relevance and suitability as a student clinical learning opportunity. CBOS defines the minimum skills, knowledge, and standards required of speech pathologists as they enter the profession following graduation (SPA, 2011), and outlines seven units of occupational competency. COMPASS® incorporates these seven units with four additional professional competencies to provide an authentic assessment of students’ clinical performance on placement (SPA, 2013).

Prior to the tutorials, students were provided with information about the HPS activities, the learning objectives, the specific part-task activities, and pictures of the HPS equipment via their course e-learning site. They were also provided with case data about the infant/child they would be working with in the HPS sessions, and encouraged to review
lecture content relating to activities they would undertake in the scenarios. General notes
detailing how to maximise peer-learning and learning in a simulation environment were also
provided.

**Tutorial 1**

Tutorial 1 involved 2 hours of part-task learning activities designed as preparation for
Tutorial 2: 1-hour dedicated to practising skills required for the Infant Feeding scenario, and
1-hour on skill building for the Child CSE scenario. The part-task activities were specifically
designed to allow students to develop technical and non-technical skills in an environment
that allowed repetitive practice and guidance from members of the research team.

The part-task activities for the Infant Feeding scenario, involved students completing
2 part-task activities in a 1-hour period. The students were in groups of 8 students to one
facilitator. In the first task, students received referral information regarding a medically
complex infant (8-week old infant with Pierre-Robin Sequence and upper respiratory tract
infection, in a high dependency unit secondary to significant respiratory distress). This infant
was represented using the Nursing Baby mannequin with Think Pad Monitor
(http://www.laerdal.com). Vital signs display included plethysmography and oxygen
saturation (via peripheral probe), heart rate and rhythm (via ECG), and respiratory rate. The
infant mannequin was moulaged with nasal cannulae, an intravenous drip, and a nasogastric
tube. Standard feeding bottles and teats (slow and fast flow) and special feeding equipment
(Medela SpecialNeeds® Feeder and Chu Chu™ Easy Feed teat) were provided for
demonstration (Figure 1). Students received familiarisation with vital signs monitoring
(reference ranges, alarm limits, alarm functions), and then practised technical and non -
technical skills relating to safe handling and positioning of the infant for commencing an
initial feeding assessment (Figure 1), as well as describing the different pieces of feeding
equipment and when they might be used. Students interacted with a confederate ‘nurse’ and ‘parent’ (played by members of the research team) throughout the scenario.

The second part task station modelled an infant ward environment and included two patients. The first of these two patients was the infant with Pierre-Robin sequence from the prior part-task activity, who had now achieved stabilisation of respiratory status and transfer to a ward environment. This simulation demonstrated alternative forms of non-invasive monitoring, including an apnoea monitor and a portable pulse oximetry unit to monitor heart rate and oxygen saturations. The second infant on the ‘ward’ was an ex-premature infant of 6-weeks corrected age with short gut syndrome, awaiting reversal of a colostomy. This infant was moulaged with a central line in the subclavian vein, a gastrostomy, and a colostomy (Figure 1). Both of the infants in the ward setting were Sophie™ Mannequins (http://www.modelmed.com.au/). With each infant, students were required to (a) identify what medical equipment was being used and why, (b) observe vital signs and discuss what was normal/abnormal for a child of that age, (c) interpret this information with respect to the potential impact on feeding, and (d) triage and prioritise the assessment of these infants. Students again practised communicating with the confederate ‘nurse’ and ‘parent’ to collect information regarding each infant’s medical status and feeding issues, and explain the speech pathology role.

[Figure 1 near here]

The second hour of tutorial 1 included part-task activities related to the Child CSE scenario. In groups of 3-4 students per set of equipment, students completed 20 minutes practising technical skills relating to: (a) the tracheostomy (cuff deflation, placing speaking valve, re-inflating cuff, and checking cuff pressures) using the Tracheostomy TOM trainer (http://www.passymuir.com) with a standard cuffed tracheostomy tube
(http://www.portex.com), a PassyMuir speaking valve (http://www.passymuir.com), and a pressure manometer (http://www.portex.com) for checking cuff pressures (Figure 2), (b) reading the vital signs monitor, recognising normal/abnormal readings and discussing the potential impact of certain changes on their swallow assessment (e.g., dropping oxygenation saturation levels), and (c) positioning themselves and their equipment (fluids for trials etc) relative to the child to administer a CSE at the bedside (Figure 2). In this time each student had the opportunity to practice all skills and then also observed and provided feedback while the other students had their turns. The subsequent 40 minutes of the session involved combining the tracheostomy management skills and vital signs monitoring with the process of conducting a CSE with a 10 year-old boy in a high dependency unit, 4 weeks post traumatic brain injury. The child was represented using a part-task torso trainer with a tracheostomy and nasogastric tube insitu (Figure 2). In this step, students alternated playing the role of nurse and clinician, and practiced the technical skills required to perform a CSE with the child (including managing the tracheostomy tube) and the non-technical skills of decision-making and communicating with the child and nurse about the assessment process and outcomes. In this way students were involved in the activity for the full 40 minutes, with at least one opportunity to play the therapist role. Notes were provided to the students to guide the sessions, providing details of the outcomes of swallowing trials to encourage clinical decision-making. During this hour tutorial, three members of the research team were available in the room, circulating amongst the groups modeling technical skills and appropriate clinical behaviour, and encouraging students to verbalise their clinical decision-making during both tasks.

[Figure 2 near here]

Tutorial 2
One week later in tutorial 2, students completed two immersive scenarios for which they had prepared the previous week: (a) the Infant Feeding scenario, a 1-hour immersive scenario in which an infant feeding assessment was conducted with a medically fragile infant, and (b) the Child CSE scenario, a 1-hour immersive scenario that involved conducting a CSE with a child with a tracheostomy. The immersive scenarios involved working through the complete assessment of a clinical case within the simulated clinical environment. Both immersive scenarios were run using the pause-discuss training technique, also known as the ’time out’ technique (Edwards & Rose, 2008). This involved students, as a group of approximately 15 students to one facilitator, discussing the status of the patients and identifying the next step required in the assessment process. One student from the group was then selected to perform that step while the others observed. This typically involved approximately 2-3 minutes of hands on practice per student. Once complete, a ‘pause’ was called by the tutor, and the group discussed what happened, what clinical decisions could be made, the patient’s current status, and the logical next step in the assessment. In addition, the tutor provided constructive feedback to the student on their performance. If necessary, students could be asked to repeat a step if teaching on error was required. The next student was selected to complete the next step of the child’s management. This model was used to guide students through the assessment, develop critical decision-making skills, and provide immediate debrief on performance.

For the Infant Feeding scenario, the room was staged to represent a clinical ward environment with a confederate nurse and parent present (Figure 3). As for tutorial 1, these roles were performed by members of the research team. The infant was portrayed using Nursing Baby mannequin and Think Pad Monitor (http://www.laderal.com), and had nasal cannulae, an intravenous drip, and a nasogastric tube insitu, and full vital signs monitoring (Figure 3). In this activity, students assumed the role of the assessing speech pathologist.
They were provided with referral information and were required to obtain additional information from: a chart review; discussion with the attending nurse and parent, and physically examining the child. Students had to explain to hospital staff and the parent what they would trial first, and then perform a trial, noting patient response to the trial. The nurse provided additional live information during the assessment, and changes were also made in real time to vital signs and infant vocalisations, audible suck/swallow sounds, and cough (generated by the Monitor and controlled by members of the research team). Verbalizing clinical decision-making and demonstrating appropriate communication with the child, nurse, and parent were integral components throughout the assessment.

[Figure 3 near here]

The 1-hour Child CSE immersive scenario involved a 9 year-old child post sub-total resection of right brainstem tumor, with planned post-operative radiotherapy, portrayed using a paediatric mannequin (SimJunior http://www.laerdal.com) with a cuffed tracheostomy insitu and vital signs monitoring. The setting was a critical care ward environment where the child’s parent and nurse were present (Figure 4). Vital signs were manipulated in real time during the scenario by the members of the research team, and the ‘child’s’ voice and verbal interactions were provided via a Bluetooth microphone linked to speakers in the mannequin. The primary objective of the assessment was for students to conduct a CSE, make clinical decisions about safe food/fluids, and communicate decisions to the parent and nursing staff. Key technical skills demonstrated during the session included positioning the patient for assessment, preparing for the assessment (deflating the cuff, suctioning, placing a speaking valve), performing the CSE, monitoring vital signs throughout all interventions, and completing post-assessment care (reinflating the cuff, re-positioning). Clinical decision-making, and interaction and communication with the child, nurse, and parent were encouraged throughout the session.
Surveys and evaluation procedures

The impact of the HPS activity was measured using four surveys, delivered via a secure web-based format (https:// surveymonkey.com). Survey content was developed based on prior research (Hill, Davidson, & Theodoros, 2013). The first three surveys were administered: a) pre-lectures; b) post-lectures, but pre-HPS; and c) post-HPS. All survey responses were anonymous, however, to ensure data from the first, second and third survey could be linked, students entered a unique identifier on each survey (4 digit/letter combination, see Appendix A). In the initial survey only, five additional questions were included to ascertain any previous experience with simulation, prior experience working with or raising young children, or exposure to speech pathology management of paediatric feeding (Appendix A). The core content of the three surveys was the same and contained: six questions about levels of knowledge, confidence, and skills regarding specific targeted technical and non-technical skills; three questions regarding anxiety working with clients and clinical reasoning; and two questions relating to perceptions of simulation. Responses to all questions were rated on scales of 1-5 (Appendix A). The third survey (post-simulation) contained an additional three questions regarding students’ perceptions of the whole simulation experience, including two open-ended questions to gain qualitative data related to students’ views (Appendix A).

A fourth survey with 7 questions (Appendix B) was sent to participants approximately 8 months after the HPS activity. This timing allowed for students to have completed two clinical placements since completing the HPS sessions, maximising the possible number of students who had had the opportunity to see clients with dysphagia in clinic. The survey contained open questions regarding what had been useful about the simulation activity, and
what else students would like incorporated into the activity in the future. This survey was not linked to students previous surveys and was interpreted independently. Students rated on a 1-5 scale (1-not useful to 5-extremely useful) how useful they felt the simulation sessions had been to prepare them for clinical practice with patients with dysphagia. A further question asked students to rate the relative percentage contribution (out of 100%) of (a) lectures; (b) the simulation activity; and (c) clinical practice, to their current knowledge, confidence, skills, and preparation to work as a clinician (Appendix B).

**Participants**

Of the 29 students enrolled, 25 students responded to the first survey. Attrition occurred on the second and third survey, leaving a total of 20 students who provided complete data for all 3 surveys. Of the 20 participants used in the analysis, 95% had completed one paediatric clinical placement (approximately 25 hours clinical practice) in a university paediatric speech/language clinic, and only 1 student indicated they had had some prior exposure to paediatric dysphagia management. The data from that one individual was examined separately and was found to closely resemble the pattern of responses from the larger student group, and hence their data was not excluded from the group analysis. Two other students were parents, and 7 reported having a prior professional background (e.g., tutoring, childcare worker) that involved working with young children. One student had had prior experience with simulation. Again, visual inspection revealed the overall pattern of responses from these individuals did not differ from the rest of the group, eliminating the need for further sub-analysis. All students who had (a) completed the first 3 surveys, and (b) had experienced dysphagia management in at least one post-HPS clinical placements, were encouraged to complete the fourth survey. A total of 12 students responded. To ensure responses were anonymous, age and gender was not collected in any survey, however, the
total class demographics of the 29 students was 26 females, 3 males, with a mean age of 26.4 years (SD=4.9, range: 22-43 years).

Data Analysis

Group responses are presented descriptively, and open-ended responses were reviewed and the main themes summarised. Change across time was analysed using Friedman tests. Post-hoc analysis involved planned contrasts (Wilcoxon sign tests): (a) pre- and post-lectures, to measure extent of change from lecture content; and (b) post-lectures to post-simulation, to determine any additive value of the simulation activity. Significance was set at p<0.05.

Results

The mean ratings of students’ perceptions of knowledge, skills, and confidence across time for a set of selected technical and non-technical activities are outlined in Table 2. All students perceived significant (p<0.001) positive changes in knowledge, skills, and confidence across all activities, across the three surveys. Post-hoc planned contrasts revealed that post-lectures, perceived knowledge (across all activities), skills, and confidence levels in most activities had increased (Table 2). Post-lectures to post-simulation, further significant gains were noted in confidence and skills across all activities, with knowledge also observed to further increase across most parameters. However, although significant gains were observed in knowledge, skills, and confidence ratings post-lectures, the average scores for confidence and skill largely remained between ratings of 2 and 3 (corresponding to ratings of ‘disagree’ to ‘neutral’), with only ratings of knowledge falling between 3 and 4 post-lectures (corresponding to average ratings of ‘neutral’ or ‘agree’) (Table 2). In contrast, post-simulation, not only were there further improvements across most ratings of knowledge,
confidence, and skill, all were now rated above a mean of 3, with many above 4 (indicating mostly ratings of ‘agree’ and ‘strongly agree’).

[Table 2 near here]

Students perceived their clinical reasoning skills were significantly enhanced by attending lectures, and further enhanced by the simulation experience (Table 3). There was a slight, but non-significant, change across time regarding general anxiety managing paediatric clients. When asked specifically about levels of anxiety managing clients with paediatric dysphagia, there was a significant reduction in anxiety noted after the simulation experience (Table 3). Regarding the simulation learning experience, students reported low levels of anxiety about learning through this method, which did not change over time. Similarly, their perceptions of how useful learning through simulation would be was high, even prior to commencing lectures, and did not change significantly over time (Table 3).

At the end of the simulation experience, students provided many positive comments about the learning activity. All agreed/strongly agreed (Table 4) that the simulation experienced had helped to develop clinical skills including clinical reasoning, apply content from lectures, enhance confidence, and was overall a valuable learning experience. In the additional open-ended comments, all students indicated that they wanted to see simulation incorporated into the student learning experience in the future, with most asking for more opportunities to practice in simulated environments.

[Tables 3 and 4 near here]

In the fourth, post-clinic survey, students continued to rate the simulation activity as useful in preparing them for clinical practice (3 rated it as moderately useful, 3 as very useful, 6 as extremely useful). Students felt the strengths of the simulation were both the ability to practice the steps of actually conducting an assessment and the ability to practice communicating with parents and hospital staff. Students reported this practice had a positive
impact on their confidence, and wanted to have more opportunities to do simulation activities in the future, with more cases and including adult cases. When asked about the relative contribution of lectures, simulation, and clinical practice to their current capabilities, on average, clinical practice was seen as the main contributor across all areas (Table 5). However, the lectures were seen as the second biggest contributor to students’ current knowledge and preparation for clinical practice, while the simulation experience was the second biggest contributor to their current confidence and skills.

[Table 5 near here]

Discussion

Of the reported range of simulated learning environments, HPS has previously been viewed as the modality with the least potential to increase clinical education capacity, ranked lowest in feasibility, and identified as having the longest time-frame to potential implementation in SLP programs (MacBean et al., 2013). This opinion was perhaps driven by the known limitations of HPS, particularly the significant costs and infrastructure required to develop it and implement it well (Blackstock & Jull, 2007). However, although the use of HPS in SLP training programs is currently limited, an extensive body of research exists supporting its use in both medical and nursing education (Cook et al., 2011). The current study has documented students’ positive perception of HPS as an enhancement to their clinical preparation in the field of paediatric dysphagia management. In addition to the positive outcomes achieved, student acceptance of learning through HPS was high. This research complements the evidence base supporting the use of HPS in clinical training, and highlights new opportunities for incorporating HPS in SLP educational programs.

Students perceived significant changes in knowledge, skills, and confidence following both lectures and the simulation tutorials. Closer examination of the data, however, revealed
that lectures had the biggest impact on knowledge, but that changes in skills and confidence
post-lectures, though significant, were small. Following the HPS tutorials, perceived
knowledge continued to increase, but large changes were observed in ratings of skills and
confidence. The ability to have hands-on practice to build skills and confidence is a
recognised strength of simulated learning. Results of a recent meta-analysis of over 600
papers on technology enhanced simulation (Cook et al., 2011) found large positive effect
sizes for changes in knowledge, skills, and behaviours following HPS.

Whilst students perceived that lectures had helped them achieve theoretical
knowledge, few reported achieving large benefits to skills or confidence through this learning
mode. However, after completing both lectures and the HPS tutorials, students were more
likely to agree that they had the knowledge, confidence, and skills to manage the aspects of
paediatric dysphagia contained in the survey. These findings highlight the importance of
having both lectures and the HPS activity in the training program to enhance student
outcomes. Earlier work by Zraick, Allen and Johnson (2003) also supports a combined
learning approach. Whilst Zraick et al.’s study reported student competency outcomes, rather
than only student perceptions as in the current study, some meaningful comparisons can be
drawn. Zraick and colleagues found that two groups of SLP students, one exposed to a
standardised patient practice session, and one which was not, both failed to demonstrate
adequate interpersonal or communication skills. However, providing additional lectures in
interpersonal and communication skills resulted in improved performance on repeat
administration of the standardised patient session (Zraick et al., 2003).

Consistent with the data reported in the pre and post-HPS surveys, the post-clinic
survey (survey 4: Appendix B) revealed that students found that the simulation experience
had contributed to their clinical development and had made a greater contribution to their
skills and confidence than lectures. This finding is in keeping with results from other
simulation studies (Alfes, 2011; Hill et al., 2013). Ultimately though, all students indicated that the opportunity to provide management for clients with dysphagia within their post-HPS clinical placement had contributed the most to the development of their current knowledge, skills, and confidence. This finding was not unexpected given that the HPS activity provided 4 hours only of hands-on clinical practice in comparison with the opportunity to gain repeated and varied exposure to clients with dysphagia in the clinical placement.

The current data revealed small, but significant, improvements in students’ ratings of their clinical decision-making skills related to dysphagia management post-HPS. In the final survey, all students agreed/strongly agreed that the HPS activity had developed their clinical reasoning skills. However, students’ actual perceptions of their abilities remained low, with most students still indicating they were uncertain about their decision-making skills by the end of the HPS activity. Reasons for this cannot be determined from the current data. In our study, clinical reasoning was taught through case based activities during lectures. In addition, during the HPS activities, the ‘pause-discuss’ technique was used to encourage verbalisation of clinical decision-making, and discussion and debrief techniques were also used to help foster clinical decision-making skills (Edwards & Rose, 2008). However, it is possible that although appropriate teaching methods were implemented, only minimal change could be expected of this group of students, considering they were only in the first year of their 2-year professional training program and new to clinical decision-making in general. Equally, it is possible that working through only two (quite different) immersive scenarios was not sufficient to achieve change (particularly for students with limited clinical experience), and perhaps working through multiple scenarios may have had a different outcome. Ward et al. (2014) found significant, large increases in the clinical decision-making skills of practicing clinicians who were provided the opportunity to work through nine HPS scenarios in one day relating to tracheostomy management. The potential benefit of completing multiple scenarios
to improve clinical decision-making for less experienced student clinicians needs further examination.

Levels of student anxiety regarding managing patients with paediatric dysphagia were found to be unchanged by attending lectures alone, yet reduced significantly post-HPS. This finding is consistent with evidence from cognate fields which report positive benefits of HPS on students’ levels of anxiety related to clinical practice (Bremner, Aduddell, & Amason, 2008; Howard, Englert, Kameg, & Perozzi, 2011). Considering that heightened levels of anxiety may impact negatively on a student’s clinical learning experience (Chan, Carter, & McAllister, 1994), this is a particularly positive benefit of the current HPS program.

Interestingly, reported anxiety levels for managing patients with dysphagia were observed to be higher (on average: moderate anxiety) pre- and post-lectures than levels of anxiety associated with managing the general paediatric population (on average: slight anxiety). However, post-HPS, anxiety levels for managing both the patients with dysphagia and the general paediatric population were comparable. A recent qualitative study of clinicians’ perceptions of new graduate students and their management of dysphagia revealed fear and lack of confidence to be a main theme in the interviews (Olwen Smith, Bessell, & Scholten, 2013). Hence, undertaking activities that help to address fears and anxiety related to dysphagia management will ultimately be of benefit in preparing students to enter the workforce.

Overall, students’ perceptions of the HPS activities were overwhelmingly positive, and it was perceived as a valuable learning experience that should remain in the academic curriculum. Although the clinical environment was simulated, significant effort was made to enhance the realism of the scenarios in order to help facilitate learning (Blackstock & Jull, 2007). Previous research using HPS to train tracheostomy management skills with practicing SLPs revealed that participants found the HPS scenarios and working with mannequins to be
very realistic (Ward et al., 2014). Similarly, the current group of students commented on the realistic clinical nature of the activities, the opportunity to practice clinical and communication skills, and the opportunity to get ‘hands on’, as benefits of the HPS program. Following clinical placement, student reflections continued to be very positive, and many acknowledged the direct relevance of skills practiced in the HPS activity with those they undertook in clinic.

Although the current data relating to student feedback and personal evaluations indicate that multiple benefits were achieved through the HPS activity, the evaluation process was based solely on student perceptions, as opposed to direct observational measurement. It is acknowledged that it is difficult for students to provide valid assessments of their own skills (Eva & Regehr, 2005), hence, positive perceptions may not equate to actual skill attainment. It is also recognised that the questions and statements within the student questionnaires were all worded in a positive manner, and this may have artificially inflated the students agreement with the statements. Future studies should address these limitations, and explore more objective evaluation procedures such as incorporating an Objective Structured Clinical Examination (OSCE) (Zraick, 2012), using structured checklists of demonstrated skills and behaviours, or using existing clinical performance evaluation tools such as COMPASS® (Speech Pathology Australia, 2013). Such tools would enable quantification of student achievements, skills and skill attainment, and help describe the true learning benefits of HPS.

While the current study included a final student reflection following completing actual clinical placement, in the future the capacity to follow students and evaluate the impact of simulation training on clinical skills would be valuable. As would studies that compare students exposed to simulation versus clinical practice alone. Such questions will help to further understand the extent to which simulation can be used in academic programs to support and supplement actual clinical practice. It is also recognised that additional elements
can be incorporated into the HPS activities in the future to enhance student learning. For example, providing students with video footage of their performance during the immersive scenarios can help to encourage active reflection on clinical behaviours and clinical reasoning (Blackstock & Jull, 2007).

**Conclusion**

Students perceived significant enhancements in their knowledge, skills, and confidence in paediatric dysphagia management following the HPS activity, and reported significant reductions in anxiety regarding working with these patients compared with that reported before the HPS experience. Following actual clinical placement, students continued to value the HPS experience, and felt it had made an important contribution to their preparation for clinical practice. The current study has demonstrated the successful implementation of a HPS learning activity for enhancing students’ clinical preparation in the area of paediatric dysphagia management. Whilst for many University programs there remains implementation challenges in the form of initial equipment costs, access to appropriate rooms/facilities and access to appropriately trained staff, many of these issues can be solved through collaboration with other faculty such as medicine and nursing where simulation has been a long standing element in their training programs.

**Declaration of Interest**

The authors report no conflict of interest. The authors alone are responsible for content and writing of paper.

**Acknowledgements**
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References


Watson, K., Wright, A., Morris, N., McMeeken, J., Rivett, D., Blackstock, F., Jones, A.,
replace part of clinical time? Two parallel randomised controlled trials. *Medical
Education*, 46, 657-667.

Zraick, R. I. (2012). Review of the use of standardised patients in speech-language pathology

Zraick, R. I., Allen, R., & Johnson, S. (2003). The use of standardised patients to teach and
test interpersonal and communication skills with students in speech-language
Table 1. CBOS and COMPASS® elements addressed by HPS scenarios

<table>
<thead>
<tr>
<th>CBOS Occupational competencies</th>
<th>COMPASS® Professional competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1: Assessment</td>
<td>Unit 1: Reasoning</td>
</tr>
<tr>
<td>Element 1.1, 1.2, 1.3, 1.4</td>
<td>Element 1.1, 1.2, 1.3</td>
</tr>
<tr>
<td>Unit 2: Analysis and Interpretation</td>
<td>Unit 2: Communication</td>
</tr>
<tr>
<td>Element 2.1, 2.2, 2.3, 2.5</td>
<td>Element 2.1, 2.2, 2.3</td>
</tr>
<tr>
<td>Unit 3: Planning Evidence Based Speech Pathology Practice</td>
<td>Unit 3: Learning</td>
</tr>
<tr>
<td>Element 3.1, 3.2, 3.3, 3.4, 3.5, 3.6</td>
<td>Element 3.1, 3.2, 3.3, 3.4</td>
</tr>
<tr>
<td>Unit 4: Implementation of Speech Pathology Practice</td>
<td>Unit 4: Professionalism</td>
</tr>
<tr>
<td>Element 4.1, 4.2, 4.3, 4.5</td>
<td>Element 4.1, 4.2, 4.4, 4.5</td>
</tr>
<tr>
<td>Unit 5: Planning Providing and Managing Speech Pathology Services</td>
<td></td>
</tr>
<tr>
<td>Element 5.1, 5.6</td>
<td></td>
</tr>
<tr>
<td>Unit 6: Professional and Supervisory Practice</td>
<td></td>
</tr>
<tr>
<td>Element 6.1</td>
<td></td>
</tr>
<tr>
<td>Unit 7: Lifelong learning and Professional Practice</td>
<td></td>
</tr>
<tr>
<td>Element 7.1, 7.2, 7.4</td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Changes in ratings of perceived knowledge, skills and confidence over time (n=20) (where 1 = strongly disagree and 5= strongly agree)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Knowledge</th>
<th>Skills</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Lecture M (SD)</td>
<td>Post-Lecture M (SD)</td>
<td>Post-HPS M (SD)</td>
</tr>
<tr>
<td>Pick up and hold a hospitalised infant</td>
<td>2.15 (1.04)</td>
<td>3.85* (0.59)</td>
<td>4.35† (0.81)</td>
</tr>
<tr>
<td>Position an infant/child in the different positions for feeding</td>
<td>1.85 (0.93)</td>
<td>4.10* (0.31)</td>
<td>3.85† (0.67)</td>
</tr>
<tr>
<td>Select appropriate utensils for infants and children to use at mealtimes</td>
<td>2.10 (1.02)</td>
<td>4.0* (0.46)</td>
<td>3.95 (0.83)</td>
</tr>
<tr>
<td>Explain an infant’s feeding difficulties to their nurse/parent</td>
<td>1.7 (0.80)</td>
<td>3.7* (0.66)</td>
<td>4.05 (0.61)</td>
</tr>
<tr>
<td>Conduct a swallowing trial (with a speaking valve on) for a child with a tracheostomy</td>
<td>1.25 (0.55)</td>
<td>3.8* (0.41)</td>
<td>4.6‡ (0.50)</td>
</tr>
<tr>
<td>Explain the process and outcomes of swallow trial for a child with a tracheostomy to their nurse/parent</td>
<td>1.35 (0.59)</td>
<td>3.85* (0.59)</td>
<td>4.4‡ (0.50)</td>
</tr>
</tbody>
</table>

Note: * indicates significant (p<0.05) increase pre to post lectures; ‡ indicates significant (p<0.01) increase post lectures/pre-HPS to post-HPS.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pre-Lecture M (SD)</th>
<th>Post-Lecture/ pre-HPS M (SD)</th>
<th>Post-HPS M (SD)</th>
<th>X²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical reasoning skills for managing paediatric dysphagia</td>
<td>1.35 (0.59)</td>
<td>2.45§ (0.76)</td>
<td>3.25§ (0.64)</td>
<td>33.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Anxiety interacting with paediatric clients</td>
<td>2.40 (0.94)</td>
<td>2.20 (0.69)</td>
<td>1.95 (0.76)</td>
<td>3.36</td>
<td>NS</td>
</tr>
<tr>
<td>Anxiety interacting with paediatric clients with dysphagia</td>
<td>3.2 (1.15)</td>
<td>3.05 (0.76)</td>
<td>2.25§ (0.55)</td>
<td>13.48</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Anxiety learning skills through simulation</td>
<td>1.9 (0.91)</td>
<td>1.9 (0.91)</td>
<td>1.5 (0.69)</td>
<td>6.05</td>
<td>NS</td>
</tr>
<tr>
<td>Usefulness of learning skills through simulation</td>
<td>4.35 (0.75)</td>
<td>4.65 (0.67)</td>
<td>4.60 (0.82)</td>
<td>5.43</td>
<td>NS</td>
</tr>
</tbody>
</table>

Note: NS = not significant p>0.05; § indicates significant (p<0.01) change pre to post lectures; § indicates significant (p<0.01) change Post-lectures/pre-HPS to Post-HPS
Table 4. Students’ perceptions of the outcomes and benefits of the simulated learning sessions (n=20)

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provided opportunity to develop skills important to my clinical training</td>
<td>80 (16)</td>
<td>20 (4)</td>
</tr>
<tr>
<td>Helped me to apply what I had learned in lectures</td>
<td>85 (17)</td>
<td>15 (3)</td>
</tr>
<tr>
<td>Made me feel more confident regarding my clinical skills</td>
<td>70 (14)</td>
<td>30 (6)</td>
</tr>
<tr>
<td>Developed my clinical reasoning skills</td>
<td>60 (12)</td>
<td>40 (8)</td>
</tr>
<tr>
<td>Was a valuable learning experience</td>
<td>90 (18)</td>
<td>10 (2)</td>
</tr>
</tbody>
</table>
Table 5. Students’ perceptions of the relative percentage contribution (out of 100%) of their lectures, the HPS tutorials and their clinical practicum to their current knowledge, skills and confidence (n=12)

<table>
<thead>
<tr>
<th>Area</th>
<th>Lectures % out of 100</th>
<th>HPS activity % out of 100</th>
<th>Clinical Placement % out of 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge in dysphagia management</td>
<td>37</td>
<td>20</td>
<td>43</td>
</tr>
<tr>
<td>Confidence in dysphagia management</td>
<td>16</td>
<td>26</td>
<td>58</td>
</tr>
<tr>
<td>Skills in dysphagia management</td>
<td>20</td>
<td>23</td>
<td>57</td>
</tr>
<tr>
<td>Preparation to work as a clinician with clients with paediatric dysphagia</td>
<td>22</td>
<td>19</td>
<td>60</td>
</tr>
</tbody>
</table>
Figure 1. Images from the part task activities of the Infant Feeding assessment scenario
Figure 2. Illustration of the equipment and activities used in the part task activities used to prepare students for the Child CSE scenario.
Figure 3. Infant Feeding Immersive Scenario: set in a clinical ward environment with parent (holding infant) and nurse present.
Figure 4. Child CSE Immersive Scenario: set in a critical care environment with parent (behind child) and nurse present
Appendix A: (1) Pre-lecture, (2) post-lecture/pre-HPS and (3) post HPS questionnaires.

Unique identifier: (Questionnaire 1, 2, 3)

For YOU, please enter the letters & numbers as asked below
☐ 1st initial of your middle name (if no middle name use surname)
☐ 1st initial of your street name
☐ Number of brothers & sisters
☐ Month (as a number) you were born (e.g., March = 3)

Your experience (Questionnaire 1 only)

1. What prior exposure have you had to the clinical speech pathology management of paediatric dysphagia?
   a. none
   b. observation only
   c. partial involvement in case management
   d. hands on clinical experience

2. Indicate in which settings you have had paediatric clinical placements to date (select all relevant):
   a. University clinic
   b. Hospital setting
   c. Community clinic
   d. Education Queensland
   e. I have not had a paediatric clinical placement yet

3. Do you have a prior professional background (prior profession or casual employment) that involved working with young children? (yes/no). If yes please detail:________

4. Are you a parent or have you had considerable experience raising and caring for young children through family relationships? (yes / no)

5. Have you ever used part-task trainers or human simulation scenarios before to learn clinical skills?
   a. never
   b. yes, one prior opportunity
   c. yes, more than one prior opportunity

Confidence, skills and knowledge (Questionnaire 1, 2, 3)

Rate the extent to which you agree with the following statements about your knowledge, skills and confidence in interacting with ‘real’ clients on placement for the following activities (rating 1-5: 1=strongly disagree, 5=strongly agree).

1. I have the theoretical knowledge to...
2. I have the clinical skills to....
3. I feel confident in my ability to...
   i. Pick up and hold a hospitalized infant
ii. Position an infant or child in the different positions for feeding
iii. Select appropriate utensils for infants and children to use at mealtimes
iv. Explain an infant’s feeding difficulties to their nurse/parent
v. Complete the appropriate steps to conduct a swallowing trial (with a speaking valve on) for a child with a tracheostomy
vi. Explain the process and outcomes of a voice and/or swallowing trial for a child with a tracheostomy to their nurse/parent

Clinical Reasoning and Anxiety working with clients (Questionnaire 1, 2, 3)

1. How would you currently rate your clinical reasoning skills for managing a child with paediatric dysphagia? (rating 1-5: 1=no clinical reasoning, 5=strong clinical reasoning).

2. Please indicate on the following scale how anxious you feel about interacting with actual paediatric clients in clinical practice (rating 1-5: 1=not anxious, 5=extremely anxious).

3. Please indicate on the following scale how anxious you would feel now about interacting with actual paediatric clients with dysphagia in clinical practice (rating 1-5: 1=not anxious, 5=extremely anxious).

Perceptions of Simulation (Questions 1 & 2 in Questionnaire 1, 2, 3. Questions 3-5 in Questionnaire 3 only)

1. Please indicate on the following scale how anxious you feel right now about learning skills through interacting with the part-task activities and immersive scenarios (rating 1-5: 1=not anxious, 5=extremely anxious).

2. Please indicate on the following scale how useful you think learning skills through interacting with the part-task activities and immersive scenarios may be for you (rating 1-5: 1=not useful, 5=extremely useful).

3. To what extent do you agree/disagree with the following statements (rating 1-5: 1=strongly disagree, 5=strongly agree).
   a. I feel the simulation sessions:
      i. Provided opportunity to develop skills important to my clinical training
      ii. Helped me apply what I had learned in lectures
      iii. Made me feel more confident regarding my clinical skills
      iv. Developed my clinical reasoning skills
      v. Were a valuable learning experience

4. Do you have any thoughts or suggestions about the strengths and weaknesses of this Simulation activity?

5. Do you think we should include it in the course program next year?
Appendix B: Post Clinic Questionnaire

1. You have now had an opportunity to provide dysphagia management in your clinical placement. Thinking back to the simulation learning experience last year, answer the following 3 questions:
   a. Were any of the aspects/elements of the simulation sessions useful to you when you were working with actual patients with dysphagia on your clinical practice placement/s? If so, please detail what aspects/elements, and how they were useful to you.
   b. What else would you have liked incorporated in the simulation experience to help prepare you for your clinical practice? Please detail.
   c. Do you feel the simulation experience was useful to prepare you for clinical practice with patients with dysphagia? (rating 1-5: 1=not useful, 5=extremely useful)

2. You have now completed (1) your dysphagia lectures, (2) a simulated clinical learning experience and (3) some actual clinical practice experience with real patients. Thinking about these three elements, what do you think is the relative contribution of each to building your current knowledge, skills confidence and current capabilities - (give each component a percentage value out of 100 so the total of all 3 equals 100%).:
   a. Knowledge of dysphagia management
      Lectures __%, Simulation __%, Clinical practice __%
   b. Confidence in dysphagia management
      Lectures __%, Simulation __%, Clinical practice __%
   c. Skills in dysphagia management
      Lectures __%, Simulation __%, Clinical practice __%
   d. Preparation to work as a clinician with dysphagia patients
      Lectures __%, Simulation __%, Clinical practice __%