Simulation in Audiology training: Making the most of it

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Most New Zealand audiologists will have used some form of simulation during their training. Many of us will remember the vintage electronic masking simulators, or the Parrot software for pure-tone audiometry, but simulation-based learning (SBL) and simulated learning environments (SLEs) have come a long way in recent years. This article discusses the benefits of simulation and proposes a greater uptake of this resource into the Audiology training programmes in New Zealand.

It is important to note that this article was written prior to the COVID-19 outbreak. If anything, the current crisis has highlighted the need to develop resilient mechanisms to enable training of our future members to continue in times of pandemic.

What is simulation?

Simulation is a technique rather than a technology, designed to replicate or amplify real-world experiences for the purposes of teaching or evaluation (Gaba, 2004). Simulations have featured heavily in pilot training for over 90 years, and have been part of medical education since the 1960s (Rosen, 2008). The numerous benefits simulations offer both students and academic programmes has led to a rapid expansion of their use in a variety of healthcare fields, and audiology is no exception.

While this brief summary focuses on the use of simulation in Audiology training, it is important to remember that simulations are also valuable when used for assessment purposes. They are often used in objective structured clinical examinations (OSCEs), as they provide a standardised and reproducible experience for the students being assessed. Readers interested in an in-depth treatment of the use of simulations are directed to the Further Reading section below.

What is "fidelity"?

Fidelity of simulations refers to how closely they match reality. Low-fidelity simulations are often used for training practical tasks, such as making earmould impressions or performing cerumen removal with static, non-computerised manikins (Brown, 2017). High-fidelity simulations target more complex skills and lead to a greater "suspension of disbelief" by the student. The medical schools of the University of Auckland and the University of Otago have both invested in simulation centres that can be made to resemble ICUs or operating theatres, featuring a range of high- and low-tech patient simulators. Regardless of the level of fidelity, the quality of an SLE is largely dependent on the lesson plan that is built around it. The best practice guide to healthcare simulations in Communication Sciences and Disorders published last year (Dudding et al., 2019) reinforced the key components of the pre-brief (familiarising the student with the scenario, equipment, expectations and intended learning outcomes), the scenario itself (i.e. the case), and most vitally, the debrief afterwards. The debrief is where the student receives feedback from the instructor, and is encouraged to engage in self-reflection that facilitates transfer of new learning into their clinical practice (Fanning and Gaba, 2007). An excellent example of the application of these concepts is the SBL programme developed for speech pathology by the University of Queensland (led by Dr Anne Hill) that is freely available on the Speech Pathology Australia website.

What types of simulations are available and do they work?

There are a number of different types of SLE, including those using humans (standardised patients), those involving technologies such as manikins and part-task trainers, and computer-based simulations ranging from simple PC-based activities to fully immersive virtual environments.

Standardised Patients (SPs)

Most health care training programmes will incorporate some form of role-playing with fellow students or instructors, or enlist real patients with particular conditions to take part in training or assessment. Standardised patients (SPs) are a type of high-fidelity simulation (Brown, 2017). They are step up from role-playing, in that they involve individuals (often actors with specific training) who have been given a particular character with their own case history and symptoms. The unfamiliarity of the student with the SP increases the fidelity of the simulation over standard role-playing. Because the same patient can be reused with different students, it provides a degree of consistency for assessments.

Interactions with SPs enable students to build confidence and further develop interpersonal skills such as counselling or delivering difficult news to parents in paediatric cases (English et al., 2007). A study by Wilson and colleagues (2010) at the University of Queensland examined perceptions of SPs in a cohort of 25 Audiology students. Their students reported that their interactions with SPs improved their client interaction abilities in all ten areas assessed (including their confidence, verbal and non-verbal communication, case history and interviewing skills, and ability to give verbal feedback).

A pair of randomised clinical trials conducted in six Australian physiotherapy schools (Watson et al., 2012) examined the effect of replacing one week of a four-week clinical placement with an SLE involving standardised patients, and found no significant difference between the competencies achieved by the students in the SLE group versus those who did the standard four-week clinical placement. In short, they found that 25% of a clinical placement could be replaced with an SP SLE without compromising learning outcomes for the students. Despite these promising outcomes and wide use of SPs in other countries such as Australia, the use of SPs in Audiology is not as widespread in the New Zealand programmes.

Manikins and part-task trainers

Low fidelity simulations include those designed to teach specific tasks (“part-task trainers”), such as non-computerised manikins. For example, the Canterbury programme uses an ear examination simulator (Kyoto Kagaku Co. Ltd., Japan) that looks a little like a KEMAR head-and-torso simulator, but with eleven sets of interchangeable ears that allow otoscopic examination of a range of pathologies that may not be readily available in a real patient. It also includes artificial cerumen and a selection of foreign objects for students to practice removing. Because the ears have been found to produce a reasonable approximation to a human REUR, the UC programme uses this simulator manikin for REM and RECD teaching, practice and OSCE examinations. While this is considered a low-fidelity simulation, the latest version of the device also produces alerts when the student's manipulation of the ear canal might potentially be painful in a real client.

Another head simulation, CARL (AHead Simulations, Canada) features a camera inside the manikin head for an internal view of earmold impressions or probe-tube placements. The Auckland programme uses a high-fidelity ABR/OAE simulator (Intelligent Hearing Systems, USA) in the form of an infant manikin that produces evoked potential waveforms in response to acoustic stimuli delivered into its ear canal by any commercial evoked potential system.

Computer-based simulations and immersive virtual environments

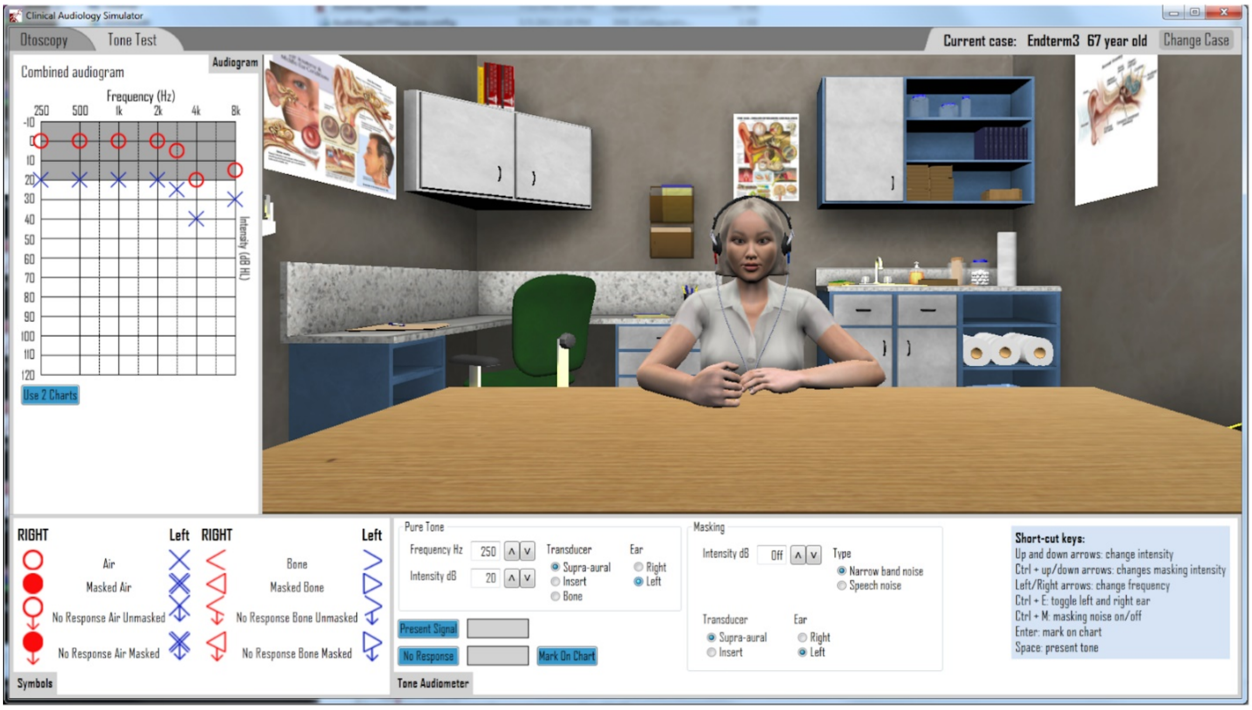

Figure 1: The pure-tone audiometry interface of a New Zealand-developed virtual patient simulator (Heitz, 2013). Reprinted with permission.

Most audiologists will be familiar with computer-based simulations such as Parrot Software's Audiology Clinic (Parrot Software, USA), Otis the Virtual Patient (Innoforce, Liechtenstein), or AudSim Flex (Nova Southeastern University, USA). The Wilson et al. (2010) study mentioned previously reported that the use of the Parrot audiometry simulator significantly improved their participants' audiometry skills in six of the eight areas trained. Otis The Virtual Patient (Innoforce, Liechtenstein) contains 100 exercises covering a range of patients and pathologies, and comes with its own audiometry textbook. The Simucase platform, a higher fidelity software programme which is increasingly being used in New Zealand Speech Therapy programmes, also has a range of audiology-specific modules (https://www.simucase.com/audiology).There has even been a locally developed virtual patient prototype – the Clinical Audiology Simulator (CAS; Heitz, 2013), which includes history-taking, otoscopy, as well as pure-tone and speech audiometry that follows NZAS protocols (Figure 1). The fidelity of such simulators is continuously increasing: A new "Artificial Patient" simulation (Kocian et al., 2018) features clients who give false responses, realistic reaction times, and accurate simulation of masking.

Why consider increasing the use of simulation?

There are two main sources of pressure on Audiology training programmes to increase student numbers. First, there is sector pressure to meet the growing demand for Audiologists. It is estimated that 25% of new employees in the private sector are overseas-qualified Audiologists. This is a clear indication that the current training model is not meeting sector demands. Second, there is internal university pressure to increase student enrolments. The high staff-to-student ratio in the Audiology programmes required for on-site training translates to increased expenses to run those programmes, relative to non-clinical programmes.

In addition to the high staff-to-student ratio, clinical placement capacity is a key constraint on the growth of Audiology programmes in New Zealand. A consensus document from the Australian audiology programmes (Wilson et al., 2011) agreed that there were two main ways in which SLEs could increase clinical placement capacity. First, if students gain skills via simulation *before* the start of their clinical placements, they would potentially require fewer hours of placement to attain competency. This improved readiness in turn might encourage more clinicians to take students for placement, as it would result in a decrease in supervisor workload. This approach has some evidence to support it (Brown, 2017). Secondly, if simulations were of sufficient quality so as to remove the need for certain types of placements, this would increase the direct-contact placements available for more advanced students. Furthermore, the use of SLEs can provide students with clinical experiences they may not otherwise have on a regular basis (e.g., cases of acoustic neuromas; Brown, 2017). Thus the use of simulation both contributes to the students' practical learning and allows existing clinical placement capacity to run in a more efficient manner.

Competency-based training and simulation

The benefits in efficiency described above may not be fully realised if we continue to specify a minimum number of direct-contact hours for our students. Competency-based medical education (CBME) approaches focus on outcomes rather than processes (Frank, Snell, & Ten Cate, 2010). CBME shifts the focus away from time spent in training to enhancing and measuring student skills. It is learner-centred and promotes self-efficacy and self-reflection (Frank et al., 2010). In CBME, students learn important life-long clinical skills such as reflective practice and self-moderation. This approach has been used to train physicians in the UK, Australia and New Zealand (Frank et al., 2010).

Since 2011, the New Zealand Speech-language Therapists Association (NZSTA) has used a competency model (the Competency Based Occupational Standards (CBOS) for Speech Pathologists) for graduate entry to their professional body. Competency is measured by a standardized tool (COMPASS; McAllister et al., 2006) and programmes are required to demonstrate that students have achieved entry level competence in both paediatric and adult services. Both Audiology programmes in New Zealand assess the clinical competencies of their students at multiple times throughout their degrees. The Canterbury MAud programme currently utilises a Clinical Competency Tool that is based on COMPASS principles, applied to an audiology context. This document was developed in 2014 by visiting Erskine fellow Dr Louise Brown (James Cook University) in conjunction with the Clinical Education team. MAud students meet with Clinical Educators a minimum of four times during the programme in order to map their clinical performance in a range of technical, procedural and interpersonal competencies. Students are required to attain entry level in all competencies before graduating from the Auckland and Canterbury programmes.

Simulations can be used as part of CBME and fit naturally into this kind of training because they can be designed to target specific areas of relevance to each competency. If a student develops competency in an area more rapidly, they no longer need to receive clinical hours in that area, thus making the patient/client 'resource' available for other students who had not yet achieved competency. This combined approach would improve the quality of training and allow clinical teachers flexibility to use the resources where they are most needed.

Development of a competency-based approach, that also incorporates simulation, would promote (and require) engagement between NZAS clinicians and the university MAud programmes over what competencies were appropriate, what level is required, and how to model/specify competency. It is important to be careful when breaking down overall clinical performance into discrete competence areas – competencies must be integrated with overall performance and be demonstrated multiple times to avoid turning clinical competency training into a 'box-ticking' exercise.

While the NZSTA does not now specify a minimum number of contact hours, the New Zealand speech-therapy programmes still document them so as to enable their graduates to be internationally mobile. International mobility for our students is also an aim for the Audiology programmes, and so counting of hours is likely to continue for the foreseeable future. However, moving to a hybrid model, as has been done in the speech therapy sector, may enhance our ability to increase student numbers while ensuring they have obtained the required clinical skills.

The endorsement agreement between NZAS and the two MAud programmes currently prescribes a minimum of 250 professional contact hours across a range of categories (adult and child assessment, amplification and rehab). A maximum of 50 of these hours can be observation, with the remaining 200 hours being obtained through direct contact. The agreement does not currently consider simulated experience to be relevant to the counted contact hours, and it is clear that simulation is *doing, not observing*. The accumulated evidence of the benefit of simulations has led the American Speech-Language-Hearing Association (ASHA) to allow up to 20% of the direct clinical hours required in speech-language pathology programmes to be obtained through clinical simulation (excluding debrief time). The allowed figure is currently 10% of the supervised clinical practicum in AuD programmes in the USA, and 15% in the Canadian Audiology and Speech and Language Pathology programmes. We propose that the endorsement agreement be adapted to include up to 20% simulation in the mandated 200 direct contact hours.

Conclusion

Simulation can take several forms: the use of actors, the use of software-based systems, virtual reality, and electronic devices to simulate real patients. These have varying fidelity and should be used with care in appropriate parts of training. The benefits are many: particularly reduced load on patients, availability outside traditional working hours, the capacity to simulate rare conditions, the opportunity to provide consistency in training, the ability to allow skills to be practiced while keeping clients safe, and building self-confidence in student learning. But simulation must be used properly and effectively. There are good guidelines for its use in medical training, and these advocate the inclusion of: feedback and debriefing, deliberate practice (repetition of key activities), integration of the simulation into the rest of the curriculum, the benefits of using it alongside competency learning, having a range of difficulty, the necessity of capturing clinical variation, and its use as part of individualised learning. Simulation can be used to develop audiological competencies quickly by allowing focus on key areas and repetition in a shorter timeframe than real-world clinical experience is able to provide, and by doing so in a safe learning environment that reduces the risk to the students and clients alike.

Based on literature from a variety of health care professions, it has been established that simulated learning opportunities can enhance and accelerate students' early learning, and provide objective means for measuring clinical competencies (Preisler et al., 2015). This, combined with a competency-based model, can allow the learning experience to be more flexible and cater for different learning styles and trajectories. Finally, simulation-based learning can "speed up" the early training process (Preisler et al., 2015), thereby reducing the need to rely on arbitrarily set "clock hours". This shift in our approach to clinical education could help us address the sector and university pressures on the Audiology profession, and allow us to meet the growing demands of the profession while delivering 21st-century education to our students.

Acknowledgements:

Thanks to Nicole Borland, Kate Cook, Jonny Grady, Sharon Mein-Smith, Min Cheol Roh, and Gina Tillard, for their valuable contributions to this article.

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