

# Comparing Nurse Practitioner Student Diagnostic Reasoning Outcomes in Telehealth and Face-to-Face Standardized Patient Encounters

Laurie Posey, EdD; Christine Pintz, PhD, FNP-BC, WHNP-BC, RN, FAANP; Quiping (Pearl) Zhou, PhD, RN; Karen Lewis, PhD, CHSE; Pamela Slaven-Lee, DNP, FNP-C, CHSE; and Chaoran Chen, MEd

**Introduction:** Standardized patient (SP) encounters support development of nurse practitioner (NP) students' diagnostic reasoning ability in a uniquely authentic way. Telehealth technologies present an opportunity to increase access to SP experiences. **Aim:** We evaluated NP students' diagnostic reasoning performance in telehealth-enabled SP encounters (TSPEs) compared to face-to-face SP encounters (FSPEs). **Methods:** This study used a randomized, crossover design. A convenience sample of 41 participants were assigned to one of four treatment groups: FSPE/pneumonia first, TSPE/pneumonia first, FSPE/asthma first, or TSPE/asthma first. Faculty evaluators used the Diagnostic Reasoning Assessment (DRA) to rate students' observed diagnostic reasoning performance and SOAP (subjective, objective, assessment, and plan) notes and assessed whether their diagnoses were correct. **Results:** There were no significant differences in students' DRA scores or ability to make the correct diagnosis between TSPE and FSPE. However, a sequence effect was noted for DRA score. Students who experienced TSPE first had significantly lower DRA scores than on their subsequent FSPE encounters. In addition, both sequence of cases and sequence of encounters had a significant effect on students' ability to make the correct diagnosis. Students who experienced either asthma or FSPE first were more likely to obtain the right diagnosis. **Conclusion:** This study provides evidence that students can demonstrate equivalent diagnostic reasoning in TSPEs and FSPEs. Future research should investigate the effectiveness of TSPEs in different settings to teach and assess varied clinical practice competencies with diverse groups of NP students.

*Keywords:* Diagnostic reasoning, nurse practitioner education, standardized patients, telehealth, virtual simulations

Diagnostic reasoning is the ability to make an actionable diagnosis based on clinical data (Rajkomar & Dhaliwal, 2011) and is one of many essential nurse practitioner (NP) independent practice competencies. Diagnostic reasoning is a problem identification process that leads to clinical decisions about a patient problem (Bowen, 2006). NP students must learn to collect and analyze appropriate clinical data to develop differential diagnoses and formulate a treatment plan for a patient (Appel, Wadas, Talley, & Williams, 2013). Evidence of diagnostic reasoning is observed in students' ability to use advanced assessment skills to differentiate between normal, variations of normal, and abnormal findings and to employ screening and diagnostic strategies to develop correct diagnoses (National Organization of Nurse Practitioner Faculties, 2017). The attainment of diagnostic reasoning skills is essential for NP students to practice effectively and safely (Croskerry, 2009) and is an important component of academic preparation leading to successful licensure. Developing sufficient diagnostic reasoning ability requires practice and clinical

experience; however, gaining clinical experience is sometimes difficult with the challenge of securing sufficient clinical placements. Educational programs must explore alternative ways to prepare learners for the complexities of independent practice (Giddens et al., 2014).

## Clinical Simulations With Standardized Patients

One alternative to real patient encounters is clinical simulations in which NP students engage with standardized patients (SPs). SPs are lay people trained to present as symptomatic patients with specific medical conditions in the context of carefully scripted case scenarios. These scenarios provide equivalent experiences for each student (Barrows, 1993). SP encounters offer a more authentic educational experience than high-fidelity mannequins, which are limited in the ability to replicate realistic human characteristics and contextual responses within an unfolding patient encounter. Active learning strategies such as the use of SPs encourage inter-

gration of classroom and clinical experience, optimally leading to improved clinical performance (Duff, Miller, & Bruce, 2016).

One benefit of SP simulations is the ability to develop and assess clinical skills in a way that closely replicates the performance demands of the practice setting (Poindexter, Hagler, & Lindell, 2015). SP simulations are widely used in medical residency training, and there is notable evidence of their effectiveness in improving students' clinical skills (Cleland, Abe, & Rethans, 2009; Zabar et al., 2010). The inclusion of SP encounters allows educators to perform summative evaluations of clinical competencies, such as diagnostic reasoning, that reflect students' ability to examine key elements of a patient encounter in a unified, measurable, and reproducible fashion (Khattab & Rawlings, 2008). It also provides opportunities for formative assessment with feedback to support the development of NP students' diagnostic reasoning within increasingly complex situations (Robbins & Hoke, 2008).

NP students who engage in SP encounters report them to be a realistic, challenging, and valuable means of developing clinical skills (Ebbert & Connors, 2004). SP simulations have improved (a) NP students' final examination scores, preceptor evaluations, course satisfaction scores, and self-evaluations in a health assessment course (Kurz, Mahoney, Martin-Plank, & Lidicker, 2009); (b) learner confidence in conducting a physical assessment and case history (Loomis, 2016); (c) knowledge related to integrating cultural humility into a health assessment (Ndiwane, Baker, Makosky, Reidy, & Guarino, 2017); (d) interpersonal and communication skills (Lin, Chen, Chao, & Chen, 2013); and (e) students' demonstrated and perceived clinical competency in preparation for the clinical practicum setting (Rutherford-Hemming, 2012). Several exploratory studies have used SP encounters in NP programs, but none have evaluated diagnostic reasoning as an outcome (Kowitlawakul, Chow, Salam, & Ignacio, 2015; Payne, 2015; Schram & Mudd, 2015).

Despite these benefits, the use of the SP simulation modality appears to be limited in NP education (Rutherford-Hemming, Nye, & Coran, 2016). Cost and logistical challenges may contribute to its limited adoption. On-campus simulation labs are expensive to build, manage, and maintain, and they may not be available to many NP programs (Cleland et al., 2009). The use of SP simulations is further limited within online NP programs where students need to travel to an on-campus simulation center.

### **Technology-Enabled Simulations**

NP educators have explored various technology-enabled simulation modalities as alternatives to face-to-face SP encounters (FSPEs). Ballman, Garritano, and Beery (2016) described the successful use of case studies in which students interacted with video recordings of SPs to develop diagnostic reasoning skills in a guided, web-based format. Simulations involving digital patients are used to build clinical assessment skills, and there is evidence students are engaged and learn from these experiences

(Dutile, Wright, & Beauchesne, 2011; Kelley, 2015). Digital virtual patients, ranging from multimedia case-based learning to high-fidelity human characters using artificial intelligence to closely mimic real patients, are also widely used throughout medical education (Kononowicz, Zary, Edelbring, Corral, & Hege, 2015). While some of these digital simulations are highly sophisticated and may include virtual patients, who respond dynamically to student decisions, they can be complicated, are expensive to develop, and may fail to provide the same level of authenticity as interacting with a live person.

Telehealth technologies may offer a viable alternative to FSPEs. For example, Grady (2011) piloted the Virtual Clinical Practicum with nursing students and found that the students were very satisfied with the learning experience. A similar study evaluated medical residents' acceptance of remote SP experiences using Skype. While most residents agreed or strongly agreed the web-based format was a practical and effective means of teaching communication skills, 80% expressed a preference for face-to-face clinical encounters and 58% reported technical difficulties (Langenau, Kachur, & Horber, 2014). To promote doctor of nursing practice (DNP) advanced practice registered nurses (APRN) students' use of and comfort with telehealth technologies, Rutledge, Haney, Bordelon, Renaud, and Fowler (2014) successfully integrated FSPEs and telehealth-enabled SP encounters (TSPEs) into a DNP program, and those encounters helped develop students' telehealth knowledge and skills. Outside of nursing, two different feasibility studies of virtual SP platforms reported that online technologies were an effective means of delivery (Berg et al., 2007; Palmer et al., 2015). Notably, none of the studies identified differences in outcomes between TSPEs and FSPEs.

TSPEs may be a feasible and effective means of offering simulated distance clinical experiences to increase experiential learning and assessment opportunities for NP students. Widespread adoption of TSPEs for the development and assessment of NP clinical competency requires evidence that this approach is logistically practical and educationally effective. The purpose of this study was to assess whether students' diagnostic reasoning performance in TSPEs and FSPEs would be equivalent.

Institutional review board approval through an expedited review by the George Washington University Office of Human Research (IRB# 041607) was obtained before the study. Participation was voluntary, and each participant signed an informed consent form.

## **Methods**

### **Study Design**

A randomized crossover design was employed, exposing the participants to two SP encounters. The participants acted as their own controls, reducing the error variance. The independent variable was the encounter type (TSPE or FSPE) and the depen-

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