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Is high fidelity human patient (mannequin) simulation, simulation of learning?

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SUMMARY

This paper explores the application of evaluation of high fidelity human patient (mannequin) simulation emerging in nursing education. The ramifications for use in mental health nursing are examined. A question is posed: Is high fidelity human patient (mannequin) simulation limited to being a "simulation of learning"? Explicit research that traces learning outcomes from mannequin, to clinical practice and hence consumer outcomes, is absent in mental health. Piecing together research from psychology addressing cognitive load theory and considering the capacity for learners to imitate desired behaviour without experiencing deep learning, the possibility is real that simulation of learning is the outcome of high fidelity human patient (mannequin) simulation applications to mental health nursing.

The contention of this paper that there is a risk that learning with high fidelity human patient (mannequin) simulation (HPS) is to learn how "to simulate". As simulators are used in the evaluation of the simulated activity, what may be learnt is how to drive the simulator as opposed to patient care. As HPS allows complex clinical practice to be replicated, it might be assumed that this supports higher order learning (Holtschneider, 2007). Complexity and cognitive load theory would suggest otherwise. Mental health nursing involves a range of complex skills that are of a different type than the mastery of procedural protocols. This places mental health nursing preparation that incorporates HPS at particular risk of involving simulation of learning.

Pedagogical Features of HPS

HPS is portrayed to be the current sign of contemporary education in nursing (for example see the systematic review by Cant and Cooper (2010)). Fidelity comprises two notions that are not yet fully reconciled. It refers to both 'engineering' fidelity (or authenticity)—whether the simulation looks realistic; and, 'psychological fidelity'—whether the simulator requires accurate behavioural responses to engage in the learning experience (Norman et al., 2012 p 637). Use of electronically controlled mannequins as patient models with increasingly sophisticated physiologically-responsive parameters is growing internationally (McKenna et al., 2007; Murray et al., 2008; Nehring, 2008; Nursing and Midwifery Council, 2007). Nursing websites feature clusters of students seriously regarding the 'plastic man' in his bed. The narrative of these sites positions HPS as an established pedagogy (McGarry et al., 2011). However, examination of the literature suggests otherwise.

Internationally, HPS represents a significant investment by Nursing Schools. Purchase price is self-evidently one form of investment with each mannequin costing upward of $(US)80,000 (Norman et al., 2012). Such monetary investment especially if by governments frequently arouses interest in determining the outcome of their largesse (National Council of State Boards of Nursing Inc, 2009). This acts as a driver for the production of measures of effectiveness. These are primarily addressed through utilisation reports, rather than the development of accurate tools to evaluate HPS facilitated learning (Tanner, 2011; Yuan et al., 2012).

The investment value of HPS is also mediated by the teaching time requirements. Small groups are often best suited to sessions with the mannequin (Kaplan et al., 2012). This necessitates less time for other learning activities so opinion is emerging in the peer reviewed literature that pressure may be experienced across the curriculum resulting from the adoption of this pedagogy (Blazeck and Zewe, 2013; Bray et al., 2009). One possible remedy is to incorporate additional subjects and

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learning objectives into the simulation sessions. Many nursing subjects (e.g. ethics, law, communication) have potential for integration (Lapkin et al., 2010). Such integration may also increase the fidelity created in the use of HPS improving learning outcomes, if viewed through the lens of situated learning (Kneebone et al., 2005). Situated learning theory posits that much learning is unintentional and occurs in part through legitimate peripheral participation situated in authentic activities, contexts and culture (Lave and Wenger, 1991).

HPS Use in Mental Health Nursing Preparation

Mental health nursing despite its long history of using other simulation modalities such as standardised patients, film and role play, has been slow to adopt this new simulation technology (McGarry et al., 2012). The paucity and variable quality of clinical placements in mental health make the controlled opportunities of this pedagogy an important part of a solution (Mental Health Nurse Education Taskforce, 2008). Positive placement and teaching experiences in mental health have been shown in a series of Australian studies to be significantly linked with choice to become a mental health nurse (Happell, 2008a, b, 2009; Happell et al., 2008). The potential of providing these positive experiences more predictably by the use of HPS in mental health nursing subjects is attractive.

Types of Evaluation in HPS

Evaluation of HPS has been dominated by the use of a satisfaction survey approach, largely based on participant satisfaction (Cato et al., 2009; Reilly and Spratt, 2007; Smith and Roehrs, 2009). Published papers detail self-reports of students of their increasing confidence and self-efficacy (Feingold et al., 2004; Kardong-Edgren et al., 2009). However, a systematic review that compared physicians' self-rated assessment with external assessors' observations lead the veracity of self-assessment being queried (Davis et al., 2006). The 725 articles that were located of studies using quantifiable and replicable measures from the United Kingdom, Canada, United States, Australia and New Zealand yielded only 17 that met all inclusion criteria. Studies that were of students only, comparisons of self-report, articles about the development of tools or specialty society self-assessment programs, were excluded from the study. The 20 articles that resulted, which compared self and external assessor measures, established that in 65% of the cases, there was little, no, or even an inverse relationship between self-assessment and that of external assessors. Only 35% of studies demonstrated positive associations. Further, the authors reported that in a number of studies those least skilled physicians were the most confident—a result asserted to be common with findings in other professions (Davis et al., 2006).

The value of such self-assessment measures has thus been substantially discredited leading some theorists to suggest that the very notion of self-assessment requires re-formulation to explore the sources of its variance (Eva and Regehr, 2011). This prompted Kardong-Edgren et al. (2010) to advocate that instrument development utilising self-report and satisfaction be suspended.

A number of researchers are working to refine tools to measure learning outcomes from the use of HPS in nursing (Lasater, 2007; Prion, 2008; Radhakrishnan et al., 2007; Todd et al., 2008). Much of this work is still limited by small samples, and scope of clinical application. The focus has been on developing or improving the utility of existing tools to measure different learning domains (Adamson et al., 2012) such as the development of improved observational assessment methods. However, Tanner (2011 p491) criticised such efforts remarking how "little investment there has been in developing suitable measures for the assessment of learning outcomes, particularly those relevant for a practice discipline".

Two approaches for understanding evaluation paradigms have been suggested by examination of medical education literature to have particularly efficacious application to HPS (Adamson et al., 2012). These approaches are Kirkpatrick's levels of evaluation (Kirkpatrick, 1994) and the adaption to HPS of the translational model developed by the National Institute of Health by McGaghie et al. (2011). The translational model evaluates the extent to which new knowledge moves from (or is translated from) scientific discovery in the laboratory to application at the bedside. This model applies to the extent to which learning (or new student knowledge) moves from the simulation environment to practice changes.

Kirkpatrick's (1994) four level model of evaluation has been identified in a review of published simulation evaluation instruments as also having potential for application (Adamson et al., 2012). The four levels of Kirkpatrick's model are labelled reaction, learning, behaviour and outcomes. These levels, it is suggested in Adamson et al.'s review, could gain additional utility if combined with the descriptions of simulation evaluation developed by Boulet et al. (2011). Boulet et al.'s descriptions of simulation evaluation comprise the following four categories—how learners reacted to the learning process, extent of knowledge gain, capacity to perform learned skills on the job and impact of the training program (for example on patient safety).

This up-date of Adamson et al. (2012)'s prior review highlights the importance of any educational (or research) endeavour to transfer new knowledge (or learning) from HPS, class room or research bench to patient outcome. The work clarifies the different levels of HPS evaluation, that is, learner knowledge and skill gain within the learning environment, applied in the clinical setting and/or by improved patient outcomes. There are no impediments within this evaluative model to the psychomotor, affective and cognitive domains of learning. All may be subject to this continuum of evaluation settings. In addition, the importance of the durability and application of learning are fundamental to the model.

A shortcoming of both the up-dated review (Adamson et al., 2012) and the original review (Kardong-Edgren et al., 2010) is that they are not systematic reviews of the literature. Rather they claim to be a review of "…current representative samples of many different ways of evaluating clinical abilities" (Kardong-Edgren et al., 2010 p e26). Hence, the relative strengths and limitations are difficult to discern.

This conceptualisation of evaluation does represent a considerable challenge in application. The logistical problem of tracing learning gains into clinical environments is one of these problems. Tools that reliably and validly assess performance in clinical placements are contested (Gaba, 2004). The capacity to ensure inter-rater reliability and assessment of equivalent situations is almost impossible to guarantee, as clinical presentations are varied and dynamic.

Challenges for Evaluation in HPS

HPS faces challenges in common with any clinical evaluation or evaluation in general. These difficulties include inherent bias and subjectivity of evaluation based on direct observation; situational environment of the evaluation that is affected by actions of others including the responses of patients; and the dynamic nature of a clinical environment that precludes equivalent evaluation circumstances between students (Saewert and Rockstraw, 2012).

There is a well recognised difficulty in securing clinical placements that can guarantee required learning (Mental Health Workforce Advisory Committee, 2010; National Health Workforce Taskforce, 2008; Nursing and Midwifery Council (UK), 2010). But these difficulties can result in a default position of only formative assessment and summative assessments being undertaken in HPS (Jeffries, 2005, 2006). Evaluation of student learning by application in clinical practice and then by improved patient outcome is not yet suggested to be viable (Adamson et al., 2012).

There is an assumption apparent in this context that supports the contention of this paper that there is a risk the learning itself is "to simulate". That is as simulators are used in the evaluation of the