The PETRA (Perinatal Emergency Team Response Assessment) Scale: A High-Fidelity Simulation Validation Study

Mrinalini Balki, MBBS, MD;[1,2] David Hoppe, MBBS, FANZCA, MD;[1] David Monks, MBChB, FRCA;[1] Lynn Sharples, RN;[3] Mary Ellen Cooke, MD;[1] Lawrence Tsen, MD;[4] Rory Windrim, MD[2]

[1]Department of Anesthesia, Mount Sinai Hospital, University of Toronto, Toronto, ON

[2]Department of Obstetrics and Gynaecology, Mount Sinai Hospital, University of Toronto, Toronto, ON

[3]Department of Nursing, Mount Sinai Hospital, University of Toronto, Toronto, ON

[4]Department of Anesthesia, Brigham and Women's Hospital, Harvard Medical School, Boston, MA

Abstract

Objective: The objective of this study was to establish the validity and reliability of a new interdisciplinary teamwork assessment scale, the Perinatal Emergency Team Response Assessment (PETRA), to assess team dynamics during a simulated obstetric crisis.

Methods: This observational cohort study was conducted using high-fidelity simulation and multidisciplinary obstetric teams in order to evaluate the validity and reliability of the previously developed PETRA scale for the assessment of teamwork in the management of obstetric crises. Two high-fidelity simulations of preeclampsia and postpartum hemorrhage (PPH) were conducted 50 times; 42 were performed by multidisciplinary teams and eight (four "good," four "poor") were performed by actors. Five raters used the PETRA tool to assess the simulation video recordings. Three additional raters assessed each performance without the use of PETRA as "good" or "poor" in order to provide an overall rating (referred to as the standardized score). The primary outcome measure was the PETRA score. Cronbach's alpha and intra-class correlation coefficients (2,1) with 95% CIs were calculated to examine internal consistency of the scale and level of agreement among raters, respectively. Construct validity was established by comparing the assessments of the raters with the standardized scores. Generalizability theory analysis was performed to demonstrate PETRA's reliability and to investigate the sources of variation in scores.

Results: The simulated emergencies were performed by 119 participants. There was overall high consistency (Cronbach's alpha [95% CI] 0.984 [0.981 to 0.987]) and moderate agreement (intra-class correlation coefficients [95% CI] 0.49 [0.35 to 0.63]) among raters. Significantly higher PETRA scores (mean [standard deviation]) were recorded with "good" versus "poor" performing teams (real scenarios 3.8 [0.7] vs. 2.9 [0.7]; $P < 0.001$; acted scenarios 4.7 [0.5] vs. 2.2 [0.7]; $P < 0.001$), suggesting strong construct validity. The overall PETRA scores were not different between the PPH (3.7 [0.7]) and preeclampsia (3.7 [0.8]) scenarios ($P = 0.49$). Generalizability coefficients were 0.83 for PPH and 0.76 for preeclampsia.

Conclusion: PETRA is a valid and reliable scale that may be a valuable tool in the assessment and training of multidisciplinary teams in their management of obstetric crises.

Key Words: Simulation, reliability, validity, teamwork, obstetric crisis, Perinatal Emergency Team Response Assessment scale

Corresponding Author: Mrinalini Balki, Mount Sinai Hospital, University of Toronto, Toronto, ON. mrinalini.balki@uhn.ca

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Résumé

Objectif : L'objectif de cette étude était de déterminer la validité et la fiabilité d'une nouvelle échelle d'évaluation du travail d'équipe interdisciplinaire, la *Perinatal Emergency Team Response Assessment* [Évaluation d'une équipe d'intervention en cas d'urgence périnatale], ou PETRA, conçue pour évaluer la dynamique de groupe durant la prise en charge d'une situation d'urgence simulée en obstétrique.

Méthodologie : Dans le cadre de cette étude de cohorte observationnelle, nous avons utilisé des simulations haute fidélité et fait appel à des équipes multidisciplinaires en obstétrique pour évaluer la validité et la fiabilité de l'échelle PETRA créée précédemment, servant à évaluer le travail d'équipe durant la prise en charge d'une situation d'urgence. Deux simulations haute fidélité de prééclampsie et d'hémorragie de la délivrance ont été réalisées à 50 reprises, soit 42 fois par des équipes multidisciplinaires, et 8 fois par des équipes d'acteurs (4 « bonnes » et 4 « mauvaises »). Cinq évaluateurs ont noté les enregistrements vidéo des simulations d'après l'échelle PETRA. Trois autres évaluateurs ont jugé les simulations sans l'échelle PETRA et leur ont attribué la mention globale « Bonne » ou « Mauvaise » (ou note standard). L'indicateur de résultat principal était le score PETRA. Le coefficient alpha de Cronbach et le coefficient de corrélation intraclasse (2,1) et leurs intervalles de confiance à 95 % ont été calculés pour évaluer respectivement la cohérence interne de l'échelle et le degré d'accord entre les évaluateurs. La validité conceptuelle de l'échelle a été déterminée par une comparaison des résultats des évaluateurs avec les notes standard. Une analyse fondée sur la théorie de la

généralisabilité a été effectuée pour démontrer la fiabilité de l'échelle PETRA et pour repérer les sources de variation dans les notes.

Résultats : Les situations d'urgence ont été simulées par 119 participants. On a observé une forte cohérence (alpha de Cronbach [IC à 95 %] : 0,984 [0,981-0,987]) et un degré d'accord modéré entre les évaluateurs (corrélation intraclasse [IC à 95 %] : 0,49 [0,35-0,63]). Les scores PETRA (moyenne [écart-type]) des équipes ayant obtenu la mention « Bonne » étaient significativement plus élevés que ceux des équipes ayant obtenu la mention « Mauvaise » (simulations réelles : 3,8 [0,7] c. 2,9 [0,7]; $P < 0,001$; simulations par des acteurs : 4,7 [0,5] c. 2,2 [0,7]; $P < 0,001$), ce qui semble indiquer une forte validité conceptuelle. Aucune différence n'a été observée entre les scores PETRA globaux pour les simulations d'hémorragie de la délivrance (3,7 [0,7]) et de prééclampsie (3,7 [0,8]) [$p = 0,49$]. Les coefficients de généralisabilité se chiffraient à 0,83 pour l'hémorragie de délivrance et à 0,76 pour la prééclampsie.

Conclusion : L'échelle PETRA est valide et fiable, et peut être un outil précieux pour évaluer et former des équipes multidisciplinaires devant gérer des situations d'urgence en obstétrique.

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INTRODUCTION

Obstetric crises require rapid multidisciplinary teamwork to produce favourable maternal and neonatal outcomes. Such crises often rely on the non-technical skills and behaviours of the team as much as the technical competence of its constituent members. Non-technical errors are recognized as a substantial cause of increased morbidity and mortality in obstetric health care.[1,2] Root cause analyses by the American Joint Commission between 2004 and 2014 revealed that human factors, lack of leadership, and failures in communication were responsible for more than 50% of sentinel events.[3] Initiatives were subsequently developed to focus on improving non-technical skills of obstetric care teams as a method to obtain more favourable maternal and neonatal outcomes.

Simulated emergencies or in situ "drills" on labour and delivery units provide an excellent forum in which to highlight important relevant learning points while allowing rehearsal of the requisite technical and non-technical skills. Simulation-based educational efforts serve an increasingly important role in learning, maintaining, or assessing individual competence among medical trainees and practitioners.

Multiple studies examining teamwork assessment tools in the operating and emergency room environment have been conducted; however, they are specific to surgery, anaesthesia, or medicine disciplines.[4–6] Furthermore, studies on obstetric crisis scenarios have largely focused on obstetric caregivers and not the entire team as a whole. Merien et al.,[7] in a systematic review of simulation for multidisciplinary teamwork training in responding to acute obstetric emergencies, demonstrated an overall improvement in the knowledge-based clinical skills. Importantly, although most of the scenarios were based within the obstetric setting where teamwork is vital, the presence of an anaesthesiologist was not part of the scenarios. Furthermore, a recent qualitative systematic review by Onwochei et al.[8] assessing teamwork tools in the context of obstetric simulation scenarios identified lack of available scales for reliability and validity scoring, domains assessment, or multidisciplinary applicability. All studies suggested a need for a new domain-specific, psychometrically robust teamwork assessment tool for easy applicability in obstetric settings.

Using a systematic consensus-based Delphi process, we developed a new interdisciplinary teamwork scale, the Perinatal Emergency Team Response Assessment,[9] to serve as an objective assessment tool of non-technical skills in obstetric crisis management. The aim of this study was to establish the validity and reliability of this scale for assessment of multidisciplinary team dynamics in obstetric crisis management. We hypothesized that the PETRA scale would demonstrate good validity and reliability for assessing teamwork in obstetric emergencies.

METHODS

This prospective, observational cohort study was conducted after Research Ethics Board approval (13-0170-E, July 4, 2013) at Mount Sinai Hospital, Toronto. Following approval from our Office of Postgraduate Medical Education, residents (PGY 1 to 5) and fellows in anaesthesia and obstetrics from the University of Toronto were invited via email to participate in the study. Anaesthesia assistants, perinatal nurses, and medical students from Mount Sinai Hospital were also sent email invitations to participate. Each participant signed a written informed consent form to participate in the study, including video recording of the simulation sessions. In addition, the participants signed a

ABBREVIATIONS

ICC	intra-class correlation coefficient
PETRA	Perinatal Emergency Team Response Assessment
PPH	postpartum hemorrhage

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