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Self-Confidence as a Mediator of Simulation-Based Training on Maternal Delivery Performance: A Theoretical and Statistical Model for Empirical Validation

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Abstract

Simulation-based training is increasingly used in nursing education to provide safe, experiential opportunities for developing clinical competence, particularly in high-risk maternity care. However, evidence that simulation improves performance does not explain the psychological mechanism by which learning translates into observable clinical performance. This article develops and demonstrates a mediation framework in which self-confidence is positioned as the intervening mechanism linking simulation-based training to maternal delivery performance. The framework integrates Adult Learning Theory, Social Cognitive Theory, and regression-based causal mediation analysis. A pretest–posttest control-group quasi-experimental design is specified, with simulation-based training as the intervention, post-intervention self-confidence as the mediator, and maternal delivery performance as the outcome, while baseline confidence and performance are treated as covariates. The statistical demonstration uses a synthetic dataset and PROCESS Model 4 with 5,000 bootstrap resamples; therefore, the numerical results are illustrative and must not be interpreted as findings from actual nurses or patients. In the simulated analysis, the intervention positively predicted self-confidence ($\beta = 1.150$, $p < .001$), self-confidence positively predicted maternal delivery performance ($\beta = 4.800$, $p < .001$), and the indirect effect was statistically different from zero ($ab = 5.520$, 95% bootstrap CI [2.810, 8.650]). The direct effect remained significant ($\beta = 5.200$, $p = .007$), indicating a partial mediation pattern in the synthetic demonstration. The indirect pathway represented approximately 51.5% of the simulated total effect. The study's contribution is therefore methodological and theoretical: it shows how mediation analysis can move evaluation beyond a simple input–output comparison and toward an explicit examination of how confidence may contribute to clinical performance. Empirical validation with real participants is required before the model can support substantive clinical or educational conclusions.

Keywords: Simulation-Based Training, Self-Confidence, Maternal Delivery Performance, Nursing Education

Introduction

Simulation-based training has become an established component of nursing education because it allows learners to practise clinical decision-making and procedural skills in controlled environments before applying them in real patient-care settings. Its value is particularly apparent in maternity care, where emergencies may develop rapidly, and nurses must integrate technical knowledge, communication, prioritisation, and clinical judgement under time pressure. Earlier systematic evidence established simulation as a useful teaching and learning strategy in nursing, while also noting substantial variation in study quality, assessment methods, and intervention design (Cant & Cooper, 2010). More recent evidence continues to support simulation while emphasising that the design and implementation of simulation activities influence learning outcomes (Jackson et al., 2024).

In maternal and obstetric education, simulation has particular relevance to time-critical events such as postpartum haemorrhage, neonatal resuscitation, and shoulder dystocia. Evidence on postpartum haemorrhage drills and simulation suggests potential improvements in selected clinical outcomes, although study quality and design vary and causal conclusions should be interpreted cautiously (Mendez-Figueroa et al., 2022). Recent maternal-care simulation research has likewise reported improvements in clinical skills and short-term self-efficacy, highlighting the educational value of repeated simulation while suggesting the need for reinforcement over time.

A central psychological construct in this process is self-confidence. In nursing education, confidence concerns learners' perceived capability to perform clinical tasks and may influence effort, persistence, decision-making, and responses to challenging situations. The construct overlaps conceptually with self-efficacy, although the terms should not be treated as perfectly interchangeable. Social Cognitive Theory proposes that perceived capability influences behaviour through mechanisms including effort, persistence, and self-regulation (Siwatu & Chesnut, 2014). In simulation settings, mastery experiences, feedback, observation of others, and structured reflection can strengthen such perceptions of capability.

Recent evidence supports an association between simulation and confidence. A 2025 systematic review and meta-analysis of randomised controlled trials found that virtual-reality simulation can influence nursing students' competence and confidence (Ropponen et al., 2025). Nevertheless, parallel improvements do not establish that confidence is the mechanism through which training improves performance. The present article therefore focuses on mediation rather than simple association.

Mediation analysis provides a formal framework for examining whether an intervention's effect on an outcome is transmitted through an intervening variable. Rather than reporting only a total difference between intervention and control groups, mediation decomposes the effect into direct and indirect components. Contemporary mediation practice favours bootstrap inference for indirect effects because the sampling distribution of a product of regression coefficients may be asymmetric (Preacher & Hayes, 2008).

The present article retains the original title and substantive focus of the source manuscript, but makes the contribution more explicit as a theoretical and statistical model for empirical validation. Importantly, the numerical demonstration reported in the source manuscript is based on synthetic data. Accordingly, this revised article does not present the simulated coefficients as real-world evidence. Instead, the results demonstrate how the proposed mediation model operates and how it should be tested when actual nursing data become available.

Literature Review

Simulation-Based Training in Nursing Education

Simulation-based education bridges classroom learning and clinical practice by reproducing selected aspects of patient-care situations in a controlled learning environment. Its pedagogical value lies not simply in repetition, but in the opportunity to practise, receive feedback, reflect on performance, and repeat tasks without exposing patients to avoidable risk. Cant and Cooper (2010) found that medium- and high-fidelity simulation could support knowledge, critical thinking, satisfaction, and confidence, although methodological heterogeneity limited definitive conclusions. More recent systematic evidence continues to show that simulation can improve knowledge and skills, while also demonstrating considerable variability in simulation design and outcome measurement (Jackson et al., 2024).

Competency-based simulation is an important development. Recent evidence indicates that competency-based simulation can produce meaningful gains in procedural skill outcomes compared with non-competency-based simulation. However, translation to clinical behaviour and patient outcomes is less certain (Vermylen et al., 2026). This distinction matters for maternity education: high performance in a controlled simulation environment is valuable, but educators should not assume simulation performance automatically reflects equivalent performance in actual clinical settings.

Self-Confidence and Clinical Performance

Self-confidence is particularly relevant to maternal delivery because nurses may need to act quickly while managing uncertainty, emotional stress, and competing priorities. Confidence can facilitate engagement with difficult tasks and encourage persistence; however, confidence should not be equated automatically with competence. A learner may feel highly confident while possessing incomplete or inaccurate skills. For this reason, objective performance measures such as OSCE scores are especially useful when confidence is included in an explanatory model.

The source manuscript conceptualises confidence through principles associated with Social Cognitive Theory and Adult Learning Theory. Adult Learning Theory emphasises experiential learning, reflection, conceptualisation, and active experimentation (Rutherford-Hemming, 2012). Simulation naturally incorporates these processes because learners encounter a concrete scenario, review their actions during debriefing, reinterpret the experience, and repeat or adapt their responses.

Mediation as an Explanatory Mechanism

The key analytical problem is that an intervention can improve both confidence and performance without confidence necessarily explaining the performance change. Three competing explanations are possible: simulation may improve performance directly through procedural repetition; it may increase confidence and performance independently; or confidence may function as an intervening mechanism through which part of the training effect reaches performance. Mediation analysis is designed to distinguish these pathways conceptually and statistically.

This distinction matters for educational decision-making. If the direct pathway dominates, curriculum developers may prioritise deliberate practice and procedural repetition. If a substantial indirect pathway operates through confidence, structured debriefing, guided reflection, mastery experiences, and feedback may deserve greater emphasis. If confidence is unrelated to objective performance, increasing confidence alone would not necessarily be an appropriate educational target.

Research Gap

Four gaps motivate the proposed framework. First, many simulation studies rely on group comparisons that establish whether scores differ but do not explain the mechanism of change. Second, self-confidence is frequently treated as an outcome rather than as a mediator. Third, baseline differences in confidence and performance can complicate interpretation in non-randomised studies. Fourth, evidence specific to maternal delivery does not yet establish a sufficiently developed mediation framework linking simulation exposure, confidence, and objective performance. The present model addresses these gaps by combining baseline covariate adjustment with regression-based mediation and bootstrap inference.

Theoretical Framework and Hypotheses

The proposed framework integrates Adult Learning Theory and Social Cognitive Theory. Simulation provides a concrete learning experience. Through guided reflection, feedback, observation, and repeated practice, the learner interprets the experience and develops stronger perceptions of capability. These confidence-related changes may then facilitate persistence, attention, adaptive decision-making, and execution during subsequent clinical performance assessment (Rutherford-Hemming, 2012; Siwatu & Chesnut, 2014).

Conceptually, the model is: Simulation-Based Training (X) → Self-Confidence (M) → Maternal Delivery Performance (Y), with baseline self-confidence and baseline performance entered as covariates.

Path a represents the effect of simulation training on post-intervention self-confidence. Path b represents the effect of self-confidence on post-intervention performance after controlling for training and baseline covariates. Path c′ represents the direct effect of training on performance after accounting for self-confidence. The indirect effect is ab, and the total effect is c = c′ + ab.

Hypotheses

H1: Simulation-based training has a positive effect on post-intervention self-confidence after controlling for baseline self-confidence and baseline maternal delivery performance.

H2: Post-intervention self-confidence has a positive effect on maternal delivery performance after controlling for simulation-based training and baseline covariates.

H3: Self-confidence mediates the relationship between simulation-based training and maternal delivery performance, such that the indirect effect is positive and its 95% bootstrap confidence interval excludes zero.

Methodology

Research Design

The intended empirical study uses a quantitative pretest–posttest control-group quasi-experimental design. Nursing staff assigned to an intervention condition receive simulation-based training, while the comparison group receives conventional didactic instruction covering the same clinical content. Baseline confidence and performance are assessed before the intervention, followed by post-intervention assessment. The design aims to establish temporal ordering between the intervention, mediator, and outcome while reducing bias from baseline group differences through covariate adjustment.

Empirical Protocol and Synthetic Statistical Demonstration

A critical clarification is required for publication integrity. The source manuscript specifies a planned empirical sample of 120 nurses (60 intervention and 60 control), but its Results section reports a synthetic demonstration involving 60 cases (30 intervention and 30 control). This revised article treats 120 as the proposed empirical sample and 60 as the synthetic dataset used for statistical illustration. Consequently, none of the reported means, coefficients, p-values, or confidence intervals should be interpreted as observations collected from actual nurses at King Fahad Medical City. Empirical conclusions require analysis of the planned real-world dataset.

Participants and Intervention Protocol

The proposed empirical population comprises nursing staff working in maternity and neonatal units. The protocol specifies at least six months of clinical experience in maternal care and no previous exposure to the specific simulation protocol. The intended empirical sample is 120 nurses, allocated by unit assignment to an intervention group and a control group. The intervention consists of three 90-minute simulation sessions over two weeks covering postpartum haemorrhage management, shoulder dystocia resolution, and neonatal resuscitation. The comparison condition receives conventional didactic instruction covering the same clinical content without the experiential simulation component.

Measurement

Self-confidence is operationalised through the Nursing Self-Confidence Scale (NSCS), described in the source manuscript as a 20-item Likert-type measure with scores ranging from 20 to 100. Maternal delivery performance is assessed using an Objective Structured Clinical Examination (OSCE) adapted for obstetric emergencies, scored from 0 to 100 using a standardised checklist covering procedural steps and clinical decision-making. Baseline and post-intervention measurements use the same instruments to improve comparability.

The source manuscript reports content review of the OSCE checklist by three maternal-fetal medicine experts and an intraclass correlation coefficient of 0.92 based on double-rating of 20 participants. Treat these values as part of the proposed or synthetic study documentation unless they can be independently demonstrated from the actual empirical dataset and validation records.

Statistical Analysis

The mediation model is estimated using ordinary least squares regression corresponding to PROCESS Model 4 (Hayes, 2013). The mediator equation estimates post-intervention self-confidence from the intervention indicator and baseline covariates. The outcome equation estimates post-intervention maternal delivery performance from the intervention, self-confidence, and baseline covariates. The indirect effect equals the product of paths a and b.

Statistical inference for the indirect effect uses non-parametric bootstrapping with 5,000 resamples and a bias-corrected 95% confidence interval. Mediation is interpreted as statistically supported when the confidence interval for ab excludes zero. This approach is preferable to relying exclusively on the Sobel test because indirect effects may have non-normal sampling distributions (Preacher & Hayes, 2008).

The model also requires attention to causal identification. Temporal ordering, adequate measurement, and control of important confounders are essential. Baseline covariates can reduce observed baseline imbalance but cannot eliminate unmeasured confounding. Prior clinical experience, motivation, personality characteristics, and intervention fidelity may affect both confidence and performance. Accordingly, interpret the mediation results as mechanistic evidence rather than definitive causal proof unless stronger experimental identification is achieved.

Statistical Power

The source manuscript proposes an empirical sample of 120 participants based on small-to-moderate expected mediation paths and Monte Carlo power considerations. Retain this sample-size rationale as a planning consideration, not as evidence that the synthetic dataset itself has achieved empirical power. For the eventual empirical study, rerun the power analysis using the final measurement scales, allocation ratio, expected attrition, covariate structure, and the smallest educationally meaningful indirect effect.

Results of the Synthetic Statistical Demonstration

The following results reproduce the statistical pattern reported in the source manuscript, but they are explicitly labelled as synthetic. They demonstrate the proposed analytical framework rather than report clinical observations.

Descriptive Statistics

Variable	Simulation group (n=30)	Control group (n=30)
Post self-confidence	Mean = 4.250; SD = 0.680	Mean = 3.100; SD = 0.720
Post-maternal delivery performance.	Mean = 88.400; SD = 5.200	Mean = 76.500; SD = 6.100
Reliability	α = 0.890	α = 0.910

The synthetic intervention group showed higher post-intervention self-confidence and performance. These descriptive differences are consistent with the hypothesised direction but do not, by themselves, establish mediation.

Regression and Mediation Estimates

Path	β	SE	t	p	95% CI
Path a: Training → Self-confidence	1.150	0.180	6.389	< .001	[0.789, 1.511]
Path b: Self-confidence → Performance	4.800	0.950	5.053	< .001	[2.895, 6.705]
Direct effect c′	5.200	1.850	2.811	.007	[1.492, 8.908]
Indirect effect ab	5.520	1.450	N/A	< .001 (bootstrap)	[2.810, 8.650]
Total effect c	10.720	2.100	5.105	< .001	[6.512, 14.928]

The synthetic regression results support the direction specified in the hypotheses. The intervention coefficient for Path a is positive and statistically significant, indicating that the simulated training condition is associated with higher self-confidence. Path b is also positive and statistically significant, indicating that higher post-intervention confidence is associated with higher performance after controlling for training and baseline covariates. The direct effect remains statistically significant after introducing the mediator.

The bootstrap indirect effect is 5.520, with a 95% bias-corrected confidence interval of [2.810, 8.650]. Because the interval does not include zero, the synthetic demonstration meets the stated statistical criterion for mediation. The pattern is consistent with partial mediation because both the indirect and direct effects remain statistically significant.

Effect Decomposition

The indirect effect represents approximately 51.5% of the synthetic total effect (5.520/10.720), while the direct effect represents approximately 48.5%. This decomposition should not be interpreted as a population estimate; it demonstrates how mediation analysis can quantify a proposed psychological pathway within a statistical model.

Comparison with Conventional Analysis

The source manuscript reports that an independent-samples t-test on the synthetic post-intervention performance scores produced t (58) = 8.12, p < .001. Such a test can establish a group difference, but it cannot determine whether the difference operates partly through confidence. Likewise, regression excluding the mediator yields the total effect but cannot decompose it into direct and indirect pathways. The mediation model therefore provides additional explanatory information rather than simply another test of group difference.

Sensitivity Checks

The source manuscript reports that the bootstrap confidence interval remained similar when resamples were varied across 1,000, 5,000, and 10,000. Removal of cases with standardised residuals beyond ±3 also left the indirect effect statistically significant. These checks indicate numerical stability within the synthetic demonstration, but they do not establish robustness in a real clinical sample.

Discussion

The framework's central contribution is its shift from an efficacy question- whether simulation improves performance- to a mechanism question: through which pathway performance changes. The synthetic demonstration is consistent with the proposition that self-confidence can constitute one such pathway. This interpretation aligns conceptually with Adult Learning Theory, in which experiential practice and reflection create opportunities for learners to reinterpret experience and improve subsequent action (Rutherford-Hemming, 2012). It is also compatible with Social Cognitive Theory, which places perceived capability among the psychological processes that influence behavioural engagement and persistence.

The result is also consistent with the wider simulation literature, although it should not be interpreted as independent empirical confirmation of the synthetic coefficients. Simulation has been associated with gains in competence and confidence, including in virtual-reality applications (Ropponen et al., 2025). Recent evidence on competency-based simulation further suggests that well-structured, outcome-oriented simulation can improve procedural skill acquisition, while also highlighting uncertainty regarding transfer to real clinical behaviour and patient outcomes (Vermylen et al., 2026).

Implications for Nursing Education

If empirical validation reproduces the proposed mediation mechanism, simulation curricula should not treat confidence building as an incidental by-product. Debriefing, guided reflection, structured feedback, repeated mastery experiences, and psychologically safe practice opportunities can be deliberately integrated into the intervention. However, confidence should be calibrated against objective performance. The educational goal is not simply to make learners feel more confident; it is to develop appropriately calibrated confidence that corresponds to demonstrable competence.

This distinction is especially important in maternal care. Overconfidence without adequate competence could be harmful in high-stakes clinical situations, whereas low confidence despite adequate competence could inhibit decisive action. Future instruments should therefore combine self-confidence scores with objective performance measures and, where possible, calibration indices that capture the correspondence between perceived and actual ability.

Theoretical Contribution

The theoretical contribution lies in integrating experiential learning, perceived capability, and causal mediation into a single explanatory framework. Rather than conceptualising Adult

Learning Theory merely as a rationale for simulation, the model proposes an observable psychological pathway through which experiential learning may influence performance. This creates a bridge between educational theory and quantitative mechanism testing.

Methodological Contribution

The methodological contribution is using baseline-adjusted mediation analysis in a quasi-experimental nursing education context. Traditional pretest–posttest comparisons can establish whether change occurs, but provide limited information about the process producing that change. Regression-based mediation with bootstrap inference provides a more granular framework for separating direct and indirect components of an intervention effect (Preacher & Hayes, 2008; Hayes, 2013).

Limitations

Several limitations require explicit acknowledgement. First, the numerical findings are based on synthetic data and cannot be generalised to nurses, maternity units, King Fahad Medical City, or any other clinical population. Second, the source manuscript distinguishes between a planned empirical sample of 120 and a synthetic demonstration sample of 60; the revised article preserves this distinction. Third, the quasi-experimental design does not provide the same causal identification as randomisation. Baseline adjustment reduces observed imbalance but does not remove unmeasured confounding.

Fourth, self-confidence is self-reported and may be influenced by response bias. Fifth, a single post-intervention assessment cannot determine whether gains persist. Sixth, the standard mediation model assumes a particular causal ordering and does not automatically account for treatment–mediator interaction. Finally, simulation performance may not transfer completely to real clinical practice. These limitations mean that the framework should be regarded as a structured basis for empirical testing rather than a completed causal claim.

Directions for Future Research

Future empirical work should implement the proposed protocol with the planned real-world sample and preregister the analysis before examining outcomes. Longitudinal follow-up at three, six, and twelve months would allow researchers to determine whether confidence-mediated effects persist. Multi-site replication would also help establish generalisability beyond a single clinical institution.

A second priority is to extend the single-mediator model to multiple mediators. Procedural knowledge, situational awareness, teamwork, communication, stress, and anxiety may operate alongside self-confidence. Multiple-mediator or moderated-mediation models could therefore better represent simulation mechanisms. Objective physiological indicators of stress could also be incorporated where ethically and practically appropriate.

Finally, future studies should compare high-fidelity simulation, virtual reality, competency-based simulation, and different debriefing strategies. Recent systematic evidence indicates that simulation design elements vary considerably and that reporting remains inconsistent (Jackson et al., 2024). More precise intervention reporting will improve replication and enable stronger cross-study comparisons.

Conclusion

This article presents a theoretical and statistical model in which self-confidence mediates the relationship between simulation-based training and maternal delivery performance. The framework combines Adult Learning Theory, Social Cognitive Theory, baseline-adjusted regression analysis, and bootstrap mediation inference. The synthetic demonstration produces a positive training-to-confidence pathway, a positive confidence-to-performance pathway, and a statistically significant indirect effect, while retaining a significant direct effect. The pattern therefore illustrates partial mediation within the synthetic dataset.

The principal conclusion is methodological rather than clinical: mediation analysis can provide a more informative account of simulation effectiveness by examining how psychological and educational mechanisms contribute to performance. Treat the reported numerical findings solely as a statistical demonstration. Definitive claims require validation using the planned empirical sample and real clinical data.

References

Anselmi, L., Binyaruka, P., & Borghi, J. (2017). Understanding causal pathways within health systems policy evaluation through mediation analysis: An application to payment for performance (P4P) in Tanzania. Implementation Science, 12, 126.

Cant, R. P., & Cooper, S. J. R. (2010). Simulation-based learning in nurse education: Systematic review. Journal of Advanced Nursing, 66(1), 3–15. https://doi.org/10.1111/j.1365-2648.2009.05240.x

Hayes, A. F. (2013). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. Guilford Press.

Imai, K., Keele, L., & Tingley, D. (2010). A general approach to causal mediation analysis. Psychological Methods, 15(4), 309–334.

Imai, K., Keele, L., & Yamamoto, T. (2010). Identification, inference and sensitivity analysis for causal mediation effects. Statistical Science, 25(1), 51–71.

Jackson, M., McTier, L., Brooks, L., & Wynne, R. (2024). Impact of simulation design elements on undergraduate nursing education: A systematic review. Clinical Simulation in Nursing, 89, 101519. https://doi.org/10.1016/j.ecns.2024.101519

Mendez-Figueroa, H., Bell, C. S., Wagner, S. M., Pedroza, C., Gupta, M., Mulder, I., Lee, K., Blackwell, S. C., Bartal, M. F., & Chauhan, S. P. (2022). Postpartum haemorrhage drills or simulations and adverse outcomes: A systematic review and Bayesian meta-analysis. The Journal of Maternal-Fetal & Neonatal Medicine, 35(26), 10416–10427. https://doi.org/10.1080/14767058.2022.2128659

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behaviour Research Methods, 40, 879–891. https://doi.org/10.3758/BRM.40.3.879

Ropponen, P., Tomietto, M., Pramila-Savukoski, S., Kuivila, H., Koskenranta, M., Liaw, S. Y., & Mikkonen, K. (2025). Impacts of VR simulation on nursing students' competence, confidence, and satisfaction: A systematic review and meta-analysis of randomised controlled trials. Nurse Education Today, 152, 106756. https://doi.org/10.1016/j.nedt.2025.106756

Rutherford-Hemming, T. (2012). Simulation methodology in nursing education and adult learning theory. Adult Learning, 23(3), 129–137.

Siwatu, K. O., & Chesnut, S. R. (2014). The career development of preservice and inservice teachers: Why teachers' self-efficacy beliefs matter. In H. Fives & M. Gill (Eds.), International handbook of research on teachers' beliefs. Routledge.

Vermylen, J. H., Cohen, E. R., Cook, D. A., McGaghie, W. C., Issenberg, S. B., Arnold, J., et al. (2026). Competency-based simulation training for procedural skills: A systematic review and meta-analysis. Simulation in Healthcare, 21(4), 231–240. https://doi.org/10.1097/SIH.0000000000000895

White, H., & Sabarwal, S. (2014). Quasi-experimental design and methods. Methodological Briefs: Impact Evaluation, No. 8. UNICEF Office of Research.