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Community Medicine

PERCEPTIONS OF SIMULATION-BASED TRAINING AND GAME-BASED LEARNING AMONG MEDICAL AND SURGICAL PRACTITIONERS: A CROSS-SECTIONAL STUDY FROM SOUTH INDIA

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ABSTRACT Simulation is a highly effective method often used in medical training. Simulation-based medical education provides a way for healthcare professionals and patients to experience medical scenarios without actual risk to health or safety.Traditional training for medical novices carries real risks for both learners and patients. Simulation-based training offers a safer, controlled environment, but little is known about how practitioners in resource-limited settings like India view these methods—especially simulation-based video games. Understanding these perceptions is essential for successful curriculum integration. Understanding practitioner perceptions is crucial for effective integration of simulation-based training (SBT), especially in low- and middle-income countries where safe clinical training is essential. This study aimed to: (1) assess South Indian practitioners' perceptions of SBT effectiveness; (2) evaluate acceptance of simulation-based video games; and (3) identify implementation barriers and recommendations.

KEYWORDS : Traditional training, Simulation-based training (SBT), OSCE methods

INTRODUCTION

Traditional medical education's "see-one, do-one" approach comes with some obvious drawbacks. The steep learning curve puts novice clinicians and patients at risk (1)

Simulation-based training (SBT) provides a safer, controlled environment for developing critical technical and non-technical skills (2)

With advances like high-fidelity mannequins, virtual reality, and simulation-based video games, these methods have shown measurable improvements in competency and learner confidence. But, challenges—especially in lower-resource settings—are still very real (3,4)

Although substantial international evidence supports the effectiveness of SBT, there remains a notable gap in understanding how practitioners in India perceive it—particularly concerning game-based learning (5,6)

Previous studies indicate that both high-fidelity and screen-based simulations help maintain neonatal resuscitation skills (7)

Clinical simulations have been shown to improve academic performance among medical students (8)

Joseph et al. found that 72.5% of South Indian medical students held positive views toward simulation, with 90.7% agreeing it aids in skill development (9)

Kundra and Cherian noted major barriers in India, such as limited resources and inadequate infrastructure (10)

As medical knowledge expanded and healthcare became more complex, the need for standardized, reproducible training methods became evident.(11)

The use of simulation in medical training dates back to the 1960s, with the development of Resusci Anne, a mannequin designed for practicing cardiopulmonary resuscitation (CPR).(12)

Since then, simulation technology has advanced dramatically, encompassing many modalities, including high-fidelity mannequins, virtual reality (VR) environments, standardized patients, and hybrid simulations.(13)

These tools allow learners to practice and master diverse clinical skills, from basic procedures to complex surgical techniques.(14)

High-fidelity simulators are sophisticated, lifelike mannequins capable of mimicking various physiological responses and medical conditions. These simulators allow learners to practice procedures such as intubation, chest tube insertion, and advanced cardiac life support in a realistic setting (15)

Studies have shown that high-fidelity Simulation improves skill acquisition and retention compared to traditional training methods.(16)

Moreover, it enhances learners' confidence and reduces anxiety, critical for effective performance in high-stakes clinical environments.(17)

These tools create immersive, interactive environments where learners can practice surgical techniques, navigate complex anatomical structures (18)

Manage critical care scenarios without the constraints of physical simulators.(19)

VR training has been particularly beneficial in surgical education, where it provides a risk-free platform for practicing intricate procedures and allows for repeated practice until proficiency is achieved. (20)

Methodology

Study Design And Setting

Cross-sectional survey conducted in tertiary teaching hospitals and public health facilities in Guntur, Andhra Pradesh, India. These chosen settings offer diverse patient populations and established training programs.

Selection Of Participants

The statistical universe comprised practicing medical and surgical practitioners with ≥2 years of clinical experience, and who were actively involved in patient care. Participants unwilling were excluded.

Sample size was determined using a conservative expected prevalence of 90% for simulation acceptance, based on the 96% acceptance rate reported among students by Joseph N et al.,(9) with a 95% confidence level and 5% precision, yielding a minimum sample of 138 participants. To enhance representation and sub-group analyses, 200 practitioners were selected using stratified convenience sampling at departmental meetings and social gatherings, ensuring equal numbers from the medical and surgical departments.

Methods Of Measurement

A validated 20-item questionnaire with sections including, 15 Likert-scale (1–5) items on perceptions of simulation-based training (SBT) and game-based learning and 5 open-ended questions addressing barriers and recommendations. Reliability (Cronbach's α = 0.88) and content validity (CVI = 0.91) were established. Pilot testing with 12 practitioners ensured clarity. No interventions were implemented as this study was observational in nature.

Data Collection Procedure

Data were collected in person (60%) and online (40%) with a 48-hour completion window. Surveys were administered during departmental sessions and social gatherings. Confidentiality and anonymity were maintained. There were no instances of dropouts; all 200 practitioners who were invited to participate completed the survey in its entirety.

Outcome Measures

Primary Outcomes:

Perceptions Of SBT's Effectiveness For:

- Skill development
- Error reduction
- Confidence building
- Acceptance of simulation-based video games

Secondary Outcomes:

- Identification of barriers
- Recommendations for broader implementation

Statistical Analysis

Data analysis conducted using IBM SPSS v27 and NVivo 12. Quantitative data summarized as, Frequencies, Means, and 95% confidence intervals for proportions (Wilson score method; see Tables 1–3). Ordinal logistic regression used to examine predictors of positive perceptions (significance set at p<0.05). Cochran-Armitage trend test applied to assess trends in video game acceptance by experience. Subgroup comparisons performed using Chi-square and Mann-Whitney U tests. Qualitative responses thematically analyzed by two independent coders (κ = 0.82).

Ethical Approval

This study was approved by the Institutional Ethics Committee of Katuri Medical College (IEC/KMCH/2024/G-19). All participants provided written informed consent. Study reporting followed the Consensus-Based Checklist for Reporting of Survey Studies (CROSS) guidelines, available at equator-network.org.

RESULTS

Participant Characteristics:

All 200 practitioners responded (100%). Specialties: internal medicine (28%), surgery (22%), OB-GYN (18%), pediatrics (12%), orthopedics (10%), anesthesiology (6%), others (4%). Most had 2–5 (38%) or 6–10 (32%) years experience.

Perceptions Of Simulation-Based Training:

Perceptions were strongly positive (Table 1), with all means significantly above neutral (p<0.001). Highest agreement: error reduction (91%), skill development (86.5%), confidence (83%). Video game acceptance was moderate (74.5%).

Table 1. Practitioners' Perceptions Of Simulation-based Training (n=200)

Statement	Mean ± SD	Agreement (%)†	95% CI‡
Simulation reduces clinical errors	4.31 ± 0.61	91.0	86.8 – 94.3
Simulation develops procedural skills	4.18 ± 0.74	86.5	81.4 – 90.8
Simulation enhances confidence	4.12 ± 0.68	83.0	77.4 – 87.8
Video games useful for training	3.85 ± 0.92	74.5	68.1 – 80.3
Would recommend simulation	4.06 ± 0.79	81.5	75.7 – 86.5

Footnotes:

- **Mean ± SD:** Mean score with standard deviation on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree).
- **†Agreement (%):** Percentage of participants who agreed or strongly agreed (scores 4–5).
- **‡95% CI:** 95% confidence interval calculated using Wilson score method.
- **SBT:** Simulation-based training.

Specialty-Based Differences

Surgical specialties showed significantly higher odds of positive perceptions than medical specialties (OR 2.34; 95% CI 1.45–3.78; p<0.001), with greater agreement that SBT reduces errors (95.0% vs. 89.2%; 95% CIs 89.0–97.9 vs. 81.4–94.0; p=0.048).

Table 2. Agreement With "Simulation Reduces Clinical Errors" By Specialty

Specialty	n	Agreement (%)†	95% CI‡
General surgery	44	95.5	85.1 – 98.8
Orthopedics	20	95.0	76.4 – 99.1
Obstetrics-gynecology	36	94.4	82.0 – 98.5
Internal medicine	56	89.3	78.7 – 95.0
Anesthesiology	12	91.7	64.6 – 98.5
Pediatrics	24	87.5	69.0 – 95.7
Other specialties (Dermatology, Pschiatry)	8	75.0	40.9 – 92.9
Total	200	91.0	86.8 – 94.3

Footnotes:

- **n:** Number of participants per specialty.
- **†Agreement (%):** Percentage of participants who agreed or strongly agreed that simulation reduces clinical errors.
- **‡95% CI:** 95% confidence interval (Wilson score method).
- **SBT:** Simulation-based training.

Experience-Related Trends

Video game acceptance significantly decreased with more clinical experience (p=0.003).

Table 3. Video Game Acceptance By Experience Level

Experience (years)	n	Acceptance (%)†	95% CI‡
2–5	76	84.2	74.4 – 90.8
6–10	64	75.0	63.0 – 84.0
11–15	44	68.2	53.2 – 80.2
>15	16	56.3	32.0 – 77.9
Total	200	74.5	68.1 – 80.3

Footnotes:

- **n:** Number of participants per experience category.
- **†Acceptance (%):** Percentage agreeing or strongly agreeing that video games are useful for training.
- **‡95% CI:** Confidence interval calculated with Wilson score method.

Predictors Of Positive Perceptions

Ordinal regression showed surgical specialty (OR=2.34, p<0.001) and fewer years of experience (OR=0.85 per 5-year increase, p=0.041) significantly predicted positive perceptions.

Qualitative Themes

Four Main Themes Emerged (κ=0.82):

- Effectiveness for skill development (89%)
- Learner engagement (76%)
- Implementation barriers (82%)
- Integration recommendations (94%)

Surgical specialties emphasized effectiveness more than medical (95.2% vs 84.8%, p=0.013); younger practitioners were more engaged (85.5% vs 56.3% for >15 years, p=0.002).

DISCUSSION

This first comprehensive study of South Indian medical and surgical practitioners revealed strong support for simulation-based training in skill development (86.5%), error reduction (91.0%), and confidence building (83.0%). These results address a significant knowledge gap regarding clinician perspectives in resource-limited environments.

Our results align with Sun et al.'s 27.9% OSCE improvement with simulation (3) and Singh et al.'s 90% pain management simulation proficiency,(6) reflecting practitioners' strong belief in simulation's efficacy. Yet, our moderate video game acceptance (74.5%) diverges from higher rates among students internationally (90-91%) (4) suggesting more conservative attitudes in experienced clinicians.

Indian studies reveal lower acceptance among students (Joseph et al. 72.5%)[9] compared to our practitioners' 86.5% skill development agreement, highlighting experiential insight's role in appreciating simulation. Kundra and Cherian emphasize persistent resource and infrastructure barriers in India,echoed by our 82% citing cost concerns.(10)

High acceptance correlates with recognition of traditional training limitations and patient safety. Surgical specialties' greater acceptance (OR=2.34, 95% CI: 1.45–3.78, p<0.001) reflects procedural focus. Generational technology adoption differences appear; simulation-based video game acceptance declines with experience (OR=0.85 per 5-year increase, 95% CI: 0.73–0.99, p=0.041). Qualitative data confirm cost and infrastructure as critical hurdles.

Indian medical education faces challenges such as resource constraints, high patient volumes, and hierarchical training that impede simulation adoption. Nonetheless, practitioners value its benefits.

Implications

Findings support National Medical Commission's initiatives: phased adoption from low-cost to high-fidelity simulators, regional simulation centres, government-backed grants and partnerships. These measures can improve healthcare training quality and reduce risks of traditional methods.

Limitations

The 100% response rate from surveys minimized non-response bias but risks social desirability bias. Convenience sampling could over-represent innovation-friendly practitioners, possibly inflating acceptance. The single-district study limits generalizability. Cross-sectional design prevents causal inference. Further multi-regional, longitudinal studies are needed.

Future Directions

Longitudinal tracking of SBT perceptions, cost-benefit analyses, and implementation studies remain priorities.

CONCLUSION

Simulation-based education enables medical learners to practice and refine clinical skills without risking patient safety; enhancing competence and confidence.Several studies include the ability to engage in continuous and consistent practice on different clinical procedures, reduce the risks and consequences of errors for both students and patients, provide immediate feedback and advice, utilize real equipment and techniques, easily repeat scenarios, and tailor cases to meet educational needs South Indian practitioners strongly endorse simulation training despite cost and infrastructure challenges. Specialty and experience differences highlight the need for tailored, cost-effective solutions to expand SBT within resource-constrained Indian medical education.

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