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Original Article

Simulation-Based Learning in a Resource-Limited Setting: Perspectives of Clinical Medical Students in North-Western Nigeria.

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Abstract

Background: Simulation-based learning (SBL) is an emerging educational methodology that actively engages students and helps bridge the gap between theoretical knowledge and practical clinical skills. It allows students to learn in realistic clinical scenarios using manikins and trained actors (standardized patients) in a controlled learning environment. Well-designed simulation exercises can enhance both technical and non-technical competencies among medical students. This study aimed to assess the knowledge, attitudes, and perceptions of clinical medical students toward simulation-based learning at Ahmadu Bello University, Zaria, North-Western Nigeria.

Methodology: A descriptive cross-sectional study design was employed. Data were collected using a pretested, structured, closed-ended, self-administered questionnaire. A total of 138 clinical medical students of Ahmadu Bello University, Zaria, were selected using a stratified random sampling technique. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 25.0, and results were presented using tables and charts. Associations between categorical variables were assessed using the Chi-square test, with statistical significance set at $p < 0.05$.

Results: The mean age of the respondents was 24.76 ± 1.93 years. More than two-thirds (70.3%) of the respondents had good knowledge of SBL, while the majority demonstrated positive perceptions (90.6%) and positive attitudes (92.7%) toward simulation-based learning. A statistically significant association was observed between attitude and perception toward simulation-based learning as a method of clinical training.

Conclusion: The findings indicate that most respondents possessed good knowledge of simulation-based learning and expressed positive attitudes and perceptions toward its use. The majority were satisfied with SBL as a teaching method. Therefore, simulation-based learning should be incorporated into the medical school curriculum to enhance clinical training.

Keywords: Simulation-Based Learning, Clinical Training, Virtual Reality, Simulation-Based Training.

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Introduction

Simulation-based learning (SBL) is an innovative educational strategy that replicates real-life clinical situations, enabling learners to apply theoretical knowledge within a safe and controlled environment.[1] Unlike traditional teaching approaches that depend largely on lectures, apprenticeship-based training, and limited patient encounters, SBL allows medical students to practice clinical skills without exposing patients to potential harm.[1] Simulation activities may involve the use of high-fidelity mannequins, part-task trainers, standardized patients, computer-based simulations, and virtual reality platforms that reproduce complex clinical environments and decision-making processes.[2] With the rapid expansion of medical knowledge and increasing healthcare complexity, the need for standardized and structured clinical training approaches became evident.[3]

Simulation principles are also utilized in objective structured clinical examinations (OSCE) and life-support training programs such as Basic and Advanced Cardiac Life Support and Trauma Life Support courses.[4] SBL promotes deliberate practice, repetition, structured feedback, and reflective learning, thereby improving clinical competence and student preparedness for professional practice.[3] Simulation-based learning has been recognized as an effective approach for bridging the gap between theoretical instruction and practical application. Evidence demonstrates comparable knowledge acquisition to traditional clinical experiences alongside improved student self-efficacy and clinical judgment.[5]

Despite widespread adoption of simulation-based learning in many high-income countries, implementation remains uneven globally due to financial and infrastructural constraints.[3] Student satisfaction has been identified as an important determinant of learning effectiveness and acceptance of innovative teaching methods. Although SBL has contributed significantly to bridging theoretical and practical learning gaps, newly graduated healthcare professionals continue to demonstrate deficiencies in essential technical and non-technical skills. Studies conducted in the United States revealed persistent theory–practice gaps during transition to clinical work, while research from Ireland reported that approximately 55% of students demonstrated poor competence in three or more clinical skills.[6]

In sub-Saharan Africa, shortages of skilled healthcare professionals further emphasize the need for improved clinical training strategies. Studies from Ethiopia reported students' satisfaction with simulation-based learning at 70.95%, which is lower than findings from other regions.[7] In Nigeria, brain drain, coupled with the limited availability of simulation laboratories, has been documented, with only a small proportion of healthcare professionals reporting access to skills-based simulation facilities.[8] Barriers to effective implementation include limited funding, inadequate equipment and space, insufficient faculty training, time constraints, and low engagement among educators and students.[9, 10]

Expanding access to simulation-based learning, particularly within resource-limited settings like Nigeria, is necessary to improve the quality of medical training and ultimately enhance healthcare delivery and patient outcomes worldwide. Most studies conducted in Africa and Nigeria have primarily focused on nursing students and other health professional students.[11–14] However, this study aimed to assess the knowledge, attitudes, and perceptions of clinical medical students towards simulation-based learning in Ahmadu Bello University Teaching Hospital (ABUTH) in Kaduna State, North-western Nigeria.

Materials and Methods

Study Area

This study was conducted at Ahmadu Bello University Teaching Hospital (ABUTH), one of the largest tertiary hospitals in Northern Nigeria. The hospital was established in 1967 as an institute of health according to the statutes of the university. All clinical medical students (400l to 600l) attend lectures and bedside teaching in the teaching hospital.

Study Participants

A descriptive cross-sectional study was conducted among clinical medical students (400L, 500L, and 600L) of Ahmadu Bello University Teaching Hospital, Zaria, to assess the knowledge, attitude, and perception toward Simulation-Based Learning. The minimum sample size(n) was estimated by using Cochran's formula.[15]

$$\mathbf{N}= \frac{Z^2 \times p \times q}{d^2}$$

Where N = minimum sample size required

Z = the standard normal deviate, set at 1.96, which corresponds to 95% confidence interval

P=proportion in the target population estimated to have a particular characteristic of interest. The percentage of students having good knowledge in a study in South West Nigeria was 11.9%.[11]

p= complementary probability=1-p=0.881

d^2=degree of accuracy required= 0.05

n= 1.96^2 x 0.119 x 0.881 / 0.05^2

n=161

In consideration of non-response rates, 10% was added.

Sample size will be 161+16=177

However, since the population of clinical medical students is less than 10,000, a finite correction was applied to arrive at a minimum sample size of 138 students to be sampled.

Finite correction Nf = $\frac{n}{1+n/N}$.[15]

N =estimate of the population of 400l,500l and 600l students =425

Nf = 177/ [1+(177/425)]

Nf =177/1.42 = 125

Taking into account a non-response rate of 10%

10% of 125 =12.5. approximately 13

Therefore, the minimum sample size =125+13=138

A stratified random sampling technique was used to select 138 students with Proportional allocation to ensure fair representation from each level. A structured self-administered questionnaire adapted from previous studies [16–18] was used to collect data. The questionnaire was scripted online and administered to respondents via electronic means. A total of 10% (14) clinical medical students of Kaduna State University Teaching Hospital were used for pre-testing. The coefficient of Cronbach's Alpha was 0.80, indicating good reliability.

Data management and analysis

The scoring system for knowledge, attitude, and perception was adopted from a previous study.[11] Seven (7) questions were used to assess the knowledge of SBL. Each correct response scored 1, whereas a wrong answer scored 0. Score of 1-3 was categorized as poor knowledge, 4-5 were categorized as fair knowledge while above 6 were categorized as good knowledge. Attitude was assessed using 7 questions, responses

were categorized using the 5- point Likert scale, with a total of 35. Scores of 7-21 categorized as Negative attitudes, while score of 22-35 was categorized as Positive attitudes. Perception was assessed using 10 questions, responses were categorized using the 5- point Likert scale, with a total of 50. Scores of 10-30 categorized as Negative perception, while score of 31-50 was categorized as Positive perception.

The data was downloaded from Kobo Toolbox® servers in Excel format and then exported to IBM SPSS Statistics (version 25.0) for analysis. Frequency distributions were generated for all categorical variables. For bivariate analysis, Pearson chi-square, or, where appropriate, Fisher's exact test, was used to check for associations between different categorical variables. For decision-making, a *p*-value less than 0.05 was considered statistically significant. Results were presented in tables.

Ethical approval for the study was obtained from the Health Research Ethics Committee of Ahmadu Bello University Teaching Hospital on 24th March 2025 (HRP number: IRB00014024). For each of the respondents, verbal informed consent was obtained prior to participation, with options to either voluntarily participate, freely decline, or withdraw at any time during the study without any adverse consequences.

Results

A total of 138 questionnaires were completed by clinical medical students, yielding a response rate of 100%. Table 1 presents the sociodemographic characteristics of the respondents. The mean age was 24.76 ± 1.93 years, with the majority (55.8%) aged 25–29 years. Most respondents were male (53.6%), while 58.0% were Hausa. The majority were Muslims (83.3%) and single (88.4%).

Table 1: Socio-demographic characteristics of clinical medical students of ABUTH, Zaria, March 2025 (**n=138)**

Variable	Frequency	Percentage
Age (years)		
20-24	59	42.8
25-29	75	54.3
30-34	4	2.9
Sex		
Male	74	53.6
Female	64	46.4
Ethnicity		
Hausa	80	58.0
Yoruba	14	10.1
Igbo	4	2.9
Others (Ebira, Nupe, Fulani)	40	29.0
Level of study		
400	65	47.1
500	46	33.3
600	27	19.6

Religion		
Islam	115	83.3
Christianity	23	16.7
Marital Status		
Single	122	88.4
Married	16	11.6

Table 2 shows the knowledge of medical students toward simulation-based learning. A large proportion of students had heard of simulation-based learning (SBL) 124 (89.9%) and had prior experience with it 101 (73.2%). The vast majority, 126 (91.3%), believed that SBL improves clinical skills. Additionally, nearly half of the respondents, 67 (48.5%), identified Clinical skills training as the clinical area where SBL is most applicable. After computing individual scores and grading of the respondents' knowledge, a total of 97(70.3%) respondents were found to have had good knowledge, 36 (26.1%) had fair knowledge, while the remaining 5 (3.6%) had poor knowledge.

Table 2: Knowledge of clinical medical students toward simulation-based learning in ABUTH, Zaria. (n=138).

Variable	Frequency	Percent
Have you heard of simulation-based learning		
Yes	124	89.9
No	14	10.1
Previous experience with simulation-based learning		
Yes	101	73.2
No	37	26.8
What do you understand by SBL?		
A teaching method involving role-playing and practical scenarios	77	55.8
Hands-on practice using mannequins	45	32.6
An alternative to lectures and textbooks	10	7.3
Not sure	6	4.3
How did you first learn about SBL		
Lectures	60	43.5
Seminar	45	32.6
Internet	13	9.4
Peers	11	8.0
Others	8	6.5
What are the benefits of simulation-based learning in medical education (multiple choice)		

Improves clinical skills	126	91.3
Enhances patient safety	75	54.4
Increases confidence	91	66.0
Reduces anxiety	94	68.1
Others	1	0.7
Which areas of medical education do you think SBL is most applicable		
Clinical skills training	67	48.5
Emergency response	40	29.0
Patient communication	21	15.2
Surgery	10	7.3
What types of simulation-based learning have you been exposed to		
Mannequin-based simulation		
virtual reality	40	29.0
Standardized patient simulation	30	22.0
None	60	43.5
	8	5.5

Table 3 shows the attitudes of medical students toward simulation-based learning**.** A substantial proportion of respondents strongly agreed that simulation-based learning (SBL) enhances understanding of medical concepts (43.5%), provides a safe environment for learning from mistakes (52.9%), and is beneficial for medical education (44.9%). Additionally, 50.7% agreed that SBL is engaging and enjoyable, 39.9% reported increased confidence in their clinical skills after participating in simulation sessions, 32.6% preferred SBL to traditional teaching methods, and 44.2% supported its integration into the medical curriculum at all levels**.** After computing individual scores and grading the respondents' attitudes, a total of 128 (92.7%) respondents were found to have had positive attitudes, while the remaining 10 (7.3%) had negative attitudes.

Table 3: Attitudes of clinical medical students toward simulation-based learning in ABUTH, Zaria. (n=138)

Variable	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
SBL enhances my understanding of medical concepts	60(43.5%)	59(42.7%)	11(8%)	6(4.3%)	2(1.5%)
Simulation provides a safe environment to learn from mistakes	73(52.9%)	52(37.7%)	6(4.4%)	4(2.9%)	3(2.1%)
SBL engaging and enjoyable	50(36.2%)	70(50.7%)	12(8.7%)	3(2.2%)	3(2.2%)

Feel more confident in clinical skills after participating in simulation sessions	53(38.4%)	55(39.9%)	20(14.5%)	6(4.3%)	4(2.9%)
Prefer SBL over traditional teaching methods	31(22.5%)	45(32.6%)	34(24.6%)	26(18.8%)	2(1.5%)
Simulation should be integrated into the medical curriculum at all levels	44(31.9%)	61(44.2%)	21(15.2%)	8(5.8%)	4(2.9%)
SBL is beneficial for medical education	62(44.9%)	61(44.2%)	9(6.5%)	3(2.2%)	3(2.2%)

Table 4 shows the perception of medical students toward simulation-based learning. Most respondents agreed that simulation-based learning (SBL) enhances clinical reasoning skills (47.8%), can create a highly realistic environment (53.6%), provides a safe and reproducible learning setting (55.8%), may improve patient safety (52.2%), increases confidence in managing real-life clinical situations (35.5%), and is relatively costly (30.4%). However, a notable proportion expressed neutral opinions regarding whether SBL hampers team role identity in emergency situations (34.5%), reduces ethical concerns with repeated use (36.2%), leads to deterioration in patient communication skills, and is more effective than traditional teaching methods (39.1%). After computing individual scores and grading of the respondent's perception, a total of 125 (90.6%) respondents were found to have positive perception, while the remaining 13 (9.4%) had negative perception.

Table 4: Perception of clinical medical students toward simulation-based learning in ABUTH, Zaria (n=138)

Variable	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
SBL scenarios will minimize teachers' efforts in clinical teaching	26(18.8%)	50(36.2%)	30(21.7%)	28(20.3%)	4(3.0%)
SBL enhances your clinical reasoning skills	40(29.0%)	66(47.8%)	16(11.6%)	14(10.1%)	2(1.5%)
SBL can create a highly realistic, safe, and reproducible learning environment	38(27.5%)	74(53.6%)	16(11.6%)	6(4.4%)	4(2.9%)
SBL might improve patient safety	33(23.9%)	77(55.8%)	20(14.5%)	4(2.9%)	4(2.9%)
SBL improves your confidence in handling real-life clinical situations	40(28.9%)	72(52.2%)	14(10.1%)	7(5.1%)	5(3.7%)
SBL is relatively costly	30(21.7%)	49(35.5%)	47(34.1%)	8(5.8%)	4(2.9%)
SBL will hamper the role of team efforts by minimizing role identity in an emergency situation	12(8.7%)	44(31.9%)	48(34.8%)	26(18.8%)	8(5.8%)
Constant usage of SBL leads to deterioration in communication skills with the patients	20(14.5%)	42(30.4%)	36(26.1%)	32(23.2%)	8(5.8%)
Repeated usage of SBL is important in reducing ethical issues	15(10.9%)	60(43.5%)	50(36.2%)	10(7.3%)	3(2.1%)

SBL is more effective compared to traditional teaching	12(8.7%)	33(23.9%)	54(39.1%)	34(24.6%)	5(3.7%)

Table 5 shows the association between socio-demographic characteristics of medical students and attitudes toward simulation-based learning. There is a significant association between ethnic group and attitudes toward simulation-based learning

Table 5: **Association between socio-demographic characteristics and attitudes of clinical medical students ABUTH, Zaria, March 2025. (n=138)**

Variables	Attitude		Test Statistics	P value
	Negative n(%)	Positive n(%)		
Age group (Years)				
20-24	5(5.9)	80(94.1)	χ^2=5.060	0.370
25-29	3(6.8)	41(93.2)		
30-34	1(11.2)	8(88.8)		
Sex				
Male	5(7.8)	59(92.2)	χ^2=0.057	0.533
Female	5(6.8)	69(93.2)		
Ethnic group				
Hausa	7(6.4)	73(93.6)	FE=7.533	0.041
Igbo	-	4(100.0)		
Yoruba	3(21.4)	11(78.6)		
Others	-	40(100.0)		
Religion				
Christianity	2(9.5)	19(90.5)	χ^2=1.91	0.662
Islam	8(6.8)	109(93.2)		
Marital Status				
Single	10(8.2)	112(91.8)	*FE=1.414	0.372
Married	-	16(100.0)		
Level of study				
400	6(9.2)	59(90.8)	χ^2=2.742	0.316
500	1(2.2)	45(97.8)		
600	3(12.5)	24(87.5)		

*** FE = Fisher's Exact**

Table 6 shows the association between attitudes and knowledge toward simulation-based learning. There is no statistically significant association between attitude and knowledge.

Table 6: Association between attitude and knowledge toward simulation-based learning of clinical medical students ABUTH, Zaria, March 2025 (n=138)

Knowledge	Positive attitude n(%)	Negative attitude n(%)	Test statistics	P value
Good	91(93.8)	6(6.2)	*FE =1.162	0.628
Fair	32(88.9)	4(1.1)		
Poor	5(100)	-		

*** FE = Fisher's Exact**

Table 7 shows the association between attitudes and perceptions toward simulation-based learning. There is a statistically significant relationship between the grading of attitude and perception ($p<0.001$).

Table 7: Association between attitude and perception of clinical medical students of ABUTH, Zaria, March 2025 (n=138).

Perception	Positive attitude n(%)	Negative attitude n(%)	Test statistics	P value
Positive	121(94.5)	7(5.5)	χ^2=32.324	0.000
Negative	4(40.0)	6(60.0)		

Discussion

This study explored the knowledge, attitudes, and perceptions of clinical medical students toward simulation-based learning (SBL) in a resource-limited setting. The findings revealed that a substantial proportion of students demonstrated good knowledge, positive attitudes, and perceptions toward simulation-based learning. These findings further support the growing recognition and relevance of SBL as an important strategy for strengthening clinical competence, particularly in settings where clinical exposure may be variable.

The mean age of the respondents was 24.76 ± 1.93 years, which is higher than the mean age of 22.02 ± 1.65 years reported in a similar study conducted in South-West Nigeria.[11] This difference may be explained by variations in study populations and training structures. Furthermore, the predominance of male participants (53.6%) and respondents from the Hausa ethnic group (58%) contrasts with findings from studies conducted in Addis Ababa, Ethiopia, and South-West Nigeria, where female participants (67.7%) and Yoruba respondents (97.1%) predominated, respectively.[11, 13] These differences likely reflect

regional demographic variations and institutional characteristics rather than differences related to simulation-based learning itself.

The majority of the respondents (70.3%) demonstrated good knowledge of SBL, which is consistent with findings from Addis Ababa, Ethiopia, where 59.6% of participants had good knowledge.[13] However, this proportion is higher than that reported in similar studies from South-West Nigeria and India, where only 33.1% and 41.7% of respondents, respectively, demonstrated good knowledge.[12,17] This implies that clinical medical students of Ahmadu Bello University are knowledgeable about simulation-based learning as a clinical training method, likely due to previous experience during the OSCE examination adopted by some departments. Previous studies have similarly shown that increased exposure to simulation activities is associated with better understanding and appreciation of its role in clinical education.[19]

In terms of attitudes toward SBL, most of the respondents (92.7%) demonstrated positive attitudes. In contrast to similar studies done, in Saudi Arabia (54.1%) of the respondents showed positive attitude towards SBL, and in middle eastern countries positive attitude have a mean of 68.29, and in Jordan where positive attitude have a mean of 131.1[14, 20, 21] These variations may be explained by differences in measurement tools, study designs, and characteristics of the study populations. Nonetheless, the high level of positive attitudes observed in this study is consistent with previous research demonstrating strong acceptance of SBL among medical students.[22] The positive attitude towards simulation-based learning in clinical medical students of ABU Zaria can be attributed to several factors. These include simulation-based learning provides a safe and controlled environment for students to practice and learn clinical skills without the fear of harming patients. Secondly, simulation-based learning can be tailored to individual learning needs and styles, allowing students to learn at their own pace.[1]

In this study, most respondents perceived that SBL could help address the challenge of limited patient availability, provide exposure to a wide range of clinical scenarios, and offer opportunities to learn from rare clinical cases, findings that are consistent with previous reports.[23] Similarly, studies from India have shown that a substantial proportion of students recognize simulation as an effective tool for deliberate practice without compromising patient safety, which aligns with the observations from this study.[12, 24]

According to this study, the aggregate proportion score of respondents with a positive perception of simulation-based learning was (90.4%). This is higher in comparison to other studies in similar settings, which reported positive perception rates ranging from (50%) to (70%) in South West, Nigeria, and Addis Ababa, Ethiopia.[11, 13] This finding showed that ABUTH medical students believed that SBL can create a highly realistic, safe, and reproducible learning environment, improve confidence in handling real-life clinical situations, and might improve patient safety.[25]

Furthermore, the bivariate analysis demonstrated a significant association between students' attitudes and perceptions toward SBL, consistent with findings from studies conducted in Ethiopia, Jordan, and other Middle Eastern countries.[13, 14, 21] This relationship may reflect the fact that positive learning experiences and acceptance of simulation as a training modality are likely to influence students' overall perceptions of its effectiveness and educational value.

Limitations

This study was conducted in a single institution, which may limit generalizability and introduce response and recall bias. There is also the possibility of social desirability bias due to reliance on self-reported data. Furthermore, the cross-sectional design limits the ability to assess changes in perceptions over time. Multivariate analysis (logistic regression) was not performed due to the small sample size; future studies should consider larger samples to allow for more robust analysis. In addition, only clinical medical students

were included; pre-clinical medical students and other health professional trainees may have different perspectives and levels of exposure to simulation-based learning, which warrants further investigation.

Conclusion

In conclusion, although medical students demonstrated good knowledge, as well as positive attitudes and perceptions toward simulation-based learning, traditional methods of clinical teaching remain predominantly practiced within the institution. Integrating simulation-based education across all levels of medical training is essential to address challenges such as inconsistent clinical exposure, variability in teaching and supervision, and concerns related to patient safety.

Conflict of Interest: None

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Reference

[1] Ziv A, Wolpe PR, Small SD, Glick S. Simulation-based medical education: an ethical imperative. *Simul Healthc.* 2006;1(4):252-6. doi:10.1097/01.SIH.0000242724.08501.63..

[2] Weller JM. Simulation in undergraduate medical education: bridging the gap between theory and practice. *Med Educ.* 2004;38(1):32-8.

[3] Elendu C, Amaechi DC, Okatta AU, Amaechi EC, Elendu TC, Ezeh CP, Elendu ID. The impact of simulation-based training in medical education: a review. *Medicine (Baltimore).* 2024;103(27):e38813

[4] Lateef F. Simulation-based learning: just like the real thing. *J Emerg Trauma Shock.* 2010;3(4):348-52.

[5] Rome C. The impact of simulation-based learning experience on critical thinking acquisition. Gardner-Webb University; 2012.

[6] Offiah G, Ekpotu LP, Murphy S, Kane D, Gordon A, O'Sullivan M, Sharifuddin SF, Hill AD, Condron CM. Evaluation of medical student retention of clinical skills following simulation training. *BMC Med Educ.* 2019;19(1):263. doi:10.1186/s12909-019-1696-7.

[7] Jamie AH, Mohammed AA. Satisfaction with simulation-based education among bachelor of midwifery students in public universities and colleges in Harar and Dire Dawa cities, Ethiopia. *Eur J Midwifery.* 2019;3:19. doi:10.18332/ejm/114165..

[8] Ezeaka C, Fajolu I, Ezenwa B, Chukwu E, Patel S, Umoren R. Perspectives of medical students on simulation-based training: the Nigerian experience. *Pan Afr Med J.* 2022;43:16. doi:10.11604/pamj.2022.43.16.33161.

[9] Jansen DA, Johnson N, Larson G, Berry C, Brenner GH. Nursing faculty perceptions of obstacles to utilizing manikin-based simulations and proposed solutions. *Clin Simul Nurs.* 2009;5(1):e9-16. doi:10.1016/j.ecns.2009.09.007.

[10] Miller A, Bull RM. Do you want to play? Factors influencing nurse academics' adoption of simulation in their teaching practices. *Nurse Educ Today.* 2013;33(3):241-6. doi:10.1016/j.nedt.2012.07.011

[11] Odole AC, Odunaiya NA, Ojo OS, Fatoye F, Mbada CE, Fatoye CF, Fafolahan AO, Akinpelu AO. Knowledge and perception of physiotherapy students and lecturers about the involvement of simulated patients in clinical examinations at **physiotherapy training institutions in South-West Nigeria. *Bull Fac Phys Ther.* 2024;29(1):77. doi:10.1186/s43161-024-00226-0.**

[12] Bisht R, Bahuguna P, Sushma N, et al. Knowledge and perception on simulation based education (SBE) among the nursing fraternity in India. *Int J Food Nutr Sci.* 2023;12:306-16.

[13] Teni MT, Gebretensaye T. Knowledge and perception towards clinical simulation in teaching undergraduate nursing students among nurse educators working at teaching institutions in Addis Ababa, Ethiopia. *Int J Afr Nurs Sci.* 2019;10:81-6. doi:10.1016/j.ijans.2019.01.011.

[14] Raman S, Arulappan J, Al Zaabi O, et al. Undergraduate nursing students' attitude and perception toward high-fidelity simulation-based education in a Middle Eastern country. *SAGE Open Nurs.* 2024;10: [Epub ahead of print]. doi:10.1177/23779608241280836.

[15] Cochran WG. *Sampling techniques.* 3rd ed. New York: John Wiley & Sons; 1977.

[16] Agha S, Alhamrani AY, Khan MA. Satisfaction of medical students with simulation based learning. *Saudi Med J.* 2015;36(6):731. doi:10.15537/smj.2015.6.11640

[17] Jasman H, Alias AH, Kamaruddin MA, Mahmud A. Perception of medical undergraduates on aspects of knowledge, skills, and attitude towards basic simulation laboratory UKM. *Arab J Bus Manag Rev (Kuwait Ch).* 2022;11(3):1. doi:10.xxxx/ajbmr.2022.xxx.

[18] Joseph N, Rai S, Jain A, Nelliyanil M, Kotian S. Perception towards problem based learning among medical students of a private medical college in South India. *Br J Med Med Res.* 2015;9(5):1-10.

[19] Okuda Y, Bryson EO, DeMaria S, et al. The utility of simulation in medical education: what is the evidence? *Mt Sinai J Med.* 2009;76:330-43. doi:10.1002/msj.20127.

[20] AlBalawi I, Alqahtani JS, Al Ghamdi SS, et al. Health sciences students' attitude, perception, and experience of using educational simulation in Saudi Arabia: a cross-sectional study. *Nurs Rep.* 2022;12:620-8. doi:10.3390/nursrep12040065.

[21] Gharaibeh B, Hweidi I, Al-Smadi A. Attitudes and perception of baccalaureate nursing students toward educational simulation. *Cogent Educ.* 2017;4: [Epub ahead of print]. doi:10.1080/2331186X.2017.1360063.

[22] Cook DA, Hatala R, Brydges R, et al. Technology-enhanced simulation for health professions education: a systematic review and meta-analysis. *JAMA.* 2011;306:978-88. doi:10.1001/jama.2011.1234

[23] White A, Maguire MB, Brannan J, Brown A. Situational awareness in acute patient deterioration: identifying student time to task. *Nurse Educ.* 2021;46(2):82-6

[24] Philippon AL, Truchot J, De Suremain N, et al. Medical students' perception of simulation-based assessment in emergency and paediatric medicine: a focus group study. *BMC Med Educ.* 2021;21:1-12. doi:10.1186/s12909-021-02783-5.

[25] Hamstra SJ, Brydges R, Hatala R, et al. Reconsidering fidelity in simulation-based training. *Acad Med.* 2014;89:387-92. doi:10.1097/ACM.0000000000000130.