Institutional resources and simulation-based training utilisation among clinical medicine lecturers at Kenya Medical Training College

Kennedy Kinyua Njeru[1*], Catherine A. L. Omasaja[1], Nafisa Bakari[1], Gladys Ndung'u[1], Victoria Koi[1], Carey Francis Okinda[1], David Wafula[1], Hellen Mwangi[1], Leonida Toroitich[1], Lilly O. Wakhungu[1], David K. Ngunjiri[1], Samwel Giteru[1], Oglah Chepchirchir[1], Dika Boru[1], Patrick Ndegwa[1], Kennedy Kiambati[1], Felistus Vinji[1], Geoffrey Korir[1], Annacieta Njeri Njagi[1], Daniel Cheruiyot[3], Kenneth Njue Njeru[2], Kamau Riccarda E. Wanjiru[2], Zippora Okoth[4], Jackson Mwangi[4], Janet Mukelule[1]

[1*] kenkinyua10@gmail.com

[1]Kenya Medical Training College
[2]Kirinyaga University
[3]Murang'a University
[4]KCA University

https://doi.org/10.51867/asarev.3.1.29

ABSTRACT

Simulation-based training (SBT) effectively develops clinical competencies and improves patient safety in healthcare education. Despite investments in simulation infrastructure at Kenya Medical Training College (KMTC), clinical medicine lecturers' utilisation of it remains inconsistent. Guided by Rogers' Diffusion of Innovations Theory, this study assessed the availability and adequacy of institutional resources and their association with SBT utilisation among clinical medicine lecturers at KMTC. An analytical cross-sectional study was conducted among clinical medicine lecturers at selected KMTC campuses. We determined a sample of 154 lecturers using Yamane's formula, and analysed data from 153 respondents. Data were collected using structured questionnaires and analysed using descriptive statistics and multiple linear regressions. The study assessed institutional resources across physical, human, financial, technological, and governance dimensions. Statistical significance was set at $p < 0.05$. The findings revealed substantial inadequacies in institutional resources supporting SBT. Most respondents reported insufficient funding (63.4%), inadequate simulation facilities (62.7%), limited access to trained simulation facilitators or support staff (62.1%), and inadequate technical support (61.4%). Additionally, 56.2% reported limited accessibility of simulation equipment, 51.6% indicated inadequate faculty development opportunities, and 51.0% considered digital infrastructure insufficient. Institutional policy and leadership support received a comparatively higher mean score ($M = 3.05$). Simple linear regression demonstrated a statistically significant positive association between institutional resources and SBT utilisation ($\beta = 0.574$, $R^2 = 0.330$, adjusted $R^2 = 0.325$, $F(1, 151) = 74.272$, $p < 0.001$). Institutional resource adequacy accounted for 33.0% of the variance in reported SBT utilisation. Institutional resource adequacy was significantly associated with SBT utilisation among clinical medicine lecturers at KMTC. Inadequate funding, simulation facilities, trained personnel, and technical support were prominent resource constraints. Strengthening resource allocation, improving accessibility and maintenance of simulation facilities, and institutionalising faculty development may support more consistent utilisation of SBT in clinical medicine education.

Key words: Clinical medicine lecturers; Kenya Medical Training College; Healthcare education; Simulation-based training; Institutional resources for simulation; Resource adequacy for simulation; Utilisation of Simulation.

I. INTRODUCTION

Simulation-based training (SBT) is an educational approach that links theoretical knowledge to clinical practice through structured scenarios, repeated practice, feedback and debriefing. It can facilitate skill development in a controlled learning environment, although effectiveness depends on implementation quality and the learning outcome being assessed (Cant & Cooper, 2017; Motola et al., 2013). Beyond purchasing simulation equipment, programmes require adequate facilities, trained educators and recurrent operational support. In a scoping review of 48 publications from developing countries, Ismail et al. (2024) identified funding constraints, shortages of skilled educators and infrastructural limitations as barriers to uptake. Thus, the presence of a simulation laboratory alone is not evidence that simulation has become part of routine teaching.

Institutional resources affect the conditions under which lecturers can deliver simulation sessions. Physical infrastructure and equipment provide space and tools; technical personnel maintain functionality; faculty development

Licensed Under Creative Commons Attribution (CC BY-NC)

supports scenario design, facilitation and debriefing; and recurrent funding covers consumables and equipment upkeep. Digital platforms and clear scheduling arrangements may also influence practical accessibility. Following simulation instructor training in India, Seethamraju et al. (2022) identified organisational support and trained teams among the conditions affecting subsequent implementation. Their qualitative findings suggest that individual training cannot be considered in isolation from institutional capacity, although they do not quantify a causal effect of resources on teaching frequency.

In sub-Saharan Africa, simulation implementation often takes place in settings facing competing infrastructure and workforce priorities. Alayande et al. (2024), in a scoping review of 26 studies on undergraduate surgical simulation, documented diverse approaches to implementation across the region. Robinson et al. (2024), in a systematic review of 97 studies from low- and middle-income countries, found that 54 (56%) concerned sub-Saharan Africa and that lower-technology simulation modalities were commonly used. These reviews demonstrate the feasibility of different simulation approaches in resource-constrained settings while also showing variation in programme delivery and reporting. Neither review directly estimated the association between lecturers' perceived institutional resources and their frequency of SBT use.

In Kenya, resource and faculty-capacity challenges have been reported in health professions training. Kavinya et al. (2023) studied simulation teaching among medical laboratory sciences staff at selected KMTC campuses and identified resource-intensive delivery and demands on instructors. Shikuku et al. (2024a), in a nested qualitative study of pre-service midwifery education, identified staffing, simulation-space, and equipment constraints during curriculum implementation. In contrast, Fant et al. (2022) described a small pilot in Kisumu in which three paediatric faculty members completed mentored simulation training and subsequently delivered a simulation course. These studies show both the challenges and possibilities of simulation implementation but do not directly measure the association between a composite resource-adequacy scale and routine use by clinical medicine lecturers at KMTC. A related KMTC study by Njeru et al. (2026) examined awareness rather than resource adequacy.

Rogers' Diffusion of Innovations Theory provides a framework for understanding how an educational approach moves from awareness and evaluation to adoption and implementation (Rogers, 2003). In this study, perceived resource adequacy is treated as an organisational condition potentially associated with implementation, rather than as a separate stage in the innovation-decision process. The objective was to assess lecturers' perceptions of institutional resource availability and adequacy and examine their association with self-reported SBT utilisation across KMTC teaching locations.

1.1 Statement of the Problem

Although simulation equipment has been introduced at KMTC, the extent to which lecturers consider the supporting resources adequate for routine use remains uncertain. Previous Kenyan studies have documented implementation difficulties, including instructional demands and constraints involving facilities and staff (Kavinya et al., 2023; Shikuku et al., 2024a). However, those studies did not quantify the relationship between perceived overall institutional resource adequacy and reported utilisation among clinical medicine lecturers at KMTC. Moreover, the related KMTC investigation by Njeru et al. (2026) examined lecturers' awareness, which is distinct from resource adequacy.

Without evidence linking lecturers' reported resource conditions to their teaching practices, institutional planning may emphasise equipment acquisition without addressing staff capacity, accessibility or operating arrangements. Accordingly, this study examined the perceived adequacy of resources supporting SBT and the association between a composite resource score and utilisation. The analysis was intended to inform institutional priorities while recognising that cross-sectional self-reports cannot establish causation or replace an objective audit of institutional facilities and budgets.

1.2 Objective of the Study

To assess the availability and adequacy of institutional resources and their association with simulation-based training utilisation among clinical medicine lecturers at Kenya Medical Training College.

II. LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 The Diffusion of Innovations Theory

Rogers' Diffusion of Innovations Theory describes the adoption of new ideas and practices through knowledge, persuasion, decision, implementation, and confirmation stages. Adoption is also influenced by the perceived relative advantage, compatibility, complexity, trialability and observability of an innovation and by characteristics of its social

Licensed Under Creative Commons Attribution (CC BY-NC)

system (Rogers, 2003). These concepts offer a useful way to consider why an educational method may be valued but not consistently implemented.

The theory has been applied beyond its original agricultural context to health services and organisational change. Dearing and Cox (2018) discuss its continuing relevance to the spread of innovations in health systems. In educational institutions, organisational arrangements may enable or impede implementation even when individual educators are aware of an innovation. However, the theory does not by itself specify a causal effect size for resources and should be interpreted alongside evidence about actual implementation conditions.

For the present study, the knowledge and persuasion stages help distinguish lecturers' awareness and perceptions of SBT from its actual use in teaching. Institutional resources are relevant to the conditions under which an adoption decision can be implemented and maintained. Physical facilities, trained personnel, maintenance arrangements and teaching schedules may affect the practicality of routine simulation delivery. Accordingly, the theory guided interpretation of the resource-utilisation association at KMTC, while the study's cross-sectional analysis was limited to estimating an association rather than demonstrating progression through innovation stages (Rogers, 2003).

2.2 Empirical Review

Institutional resources play a central role in the implementation and sustained utilisation of simulation-based training (SBT) in health professions education. These resources encompass physical infrastructure, trained personnel, financial support, technological capacity, and institutional governance. Barlow et al. (2024), in a scoping review examining the application of Healthcare Simulation Standards of Best Practice, found that published simulation studies frequently provided insufficient detail on how educational activities were aligned with established standards. The findings highlighted the importance of structured simulation design, delivery, and evaluation in promoting consistent educational practice. Similarly, Motola et al. (2013), in a best-evidence practical guide, identified curriculum integration, deliberate practice, feedback, debriefing and faculty development as essential components of effective simulation-based education. Together, these studies emphasise that simulation implementation requires coordinated educational and organisational arrangements extending beyond the provision of physical equipment.

The importance of institutional readiness is further demonstrated by Ismail et al. (2024), who conducted a scoping review of 48 studies examining challenges and opportunities affecting simulation uptake in developing countries. The review identified academic, professional, and resource-related factors influencing implementation. Major challenges included high simulator costs, shortages of trained simulation educators, inadequate curricular integration and limited institutional support. Conversely, institutional leadership commitment, educator interest, protected teaching time and opportunities for faculty development were identified as facilitators of adoption. The findings demonstrated that sustainable simulation programmes depend on the interaction between financial investment, professional capacity and organisational support. They further highlighted the importance of aligning simulation resources with institutional teaching priorities rather than treating equipment procurement as an independent measure of implementation readiness.

Seethamraju et al. (2022) examined factors influencing the implementation of simulation-based education following faculty training in India. The qualitative study involved interviews with 11 educators selected from 76 participants who had attended a simulation instructor-development workshop. Thematic analysis identified management support, trained teams and appropriate resource sourcing as major implementation enablers. In contrast, inadequate infrastructure, insufficient teaching time and the absence of an established simulation culture constrained implementation. Participants also identified curricular integration, improved organisational systems and greater institutional awareness as important measures for strengthening simulation delivery. These findings demonstrate that faculty training must be accompanied by institutional arrangements that enable educators to translate acquired competencies into regular teaching practice.

Technological resources have also expanded opportunities for simulation delivery, particularly where access to specialised facilities or local expertise is limited. Yasser et al. (2023), in a scoping review of 29 publications, examined the utilisation and effectiveness of telesimulation in healthcare education. The review found that telesimulation was applied to procedural skills, patient management, and team-based training using various videoconferencing platforms and simulation modalities. Although technical challenges were reported, telesimulation was generally well received, and quasi-experimental studies demonstrated improvements in learning outcomes. Similarly, Gerstenberger et al. (2023) investigated medical students' experiential learning through telesimulation at the University of Utah. The study involved satisfaction responses from 114 fourth-year medical students and qualitative analysis of responses from 66 participants. More than 90% expressed positive views regarding simulation realism, debriefing quality, and group size. These findings demonstrate the potential of digital approaches to complement conventional simulation delivery and broaden access to

Licensed Under Creative Commons Attribution (CC BY-NC)

experiential learning. Their implementation nevertheless requires suitable technological systems, facilitation capacity, and institutional arrangements that support remote learning activities.

Evidence from low- and middle-income countries further demonstrates the adaptability of simulation to different resource environments. Robinson et al. (2024), in a systematic review of 97 studies evaluating simulation-based education using Kirkpatrick Level 4 outcomes, found that 54 studies (56%) were conducted in sub-Saharan Africa. Simulation modalities included mannequins in 49 studies (51%), scenario-based simulation in 46 (47%), and synthetic part-task trainers in 21 (22%). Among 81 studies assessing statistical significance, 75% reported at least partial improvement in Level 4 outcomes. The review demonstrated that meaningful educational and clinical outcomes can be achieved using different simulation modalities, including relatively low-technology approaches. These findings support the adaptation of simulation methods to available institutional resources while maintaining alignment with intended competencies and clinical training requirements.

Within sub-Saharan Africa, Alayande et al. (2024) examined the implementation of simulation-based learning for undergraduate essential surgical education through a scoping review of 26 studies. Most of the published studies originated from Eastern Africa (78%), while simulation-based learning was not documented for 65% of the essential surgical procedures considered. The review also identified limited continuity of simulation programmes and variation in the procedures, educational methods, and institutional contexts represented. These findings reveal substantial differences in the development and application of simulation-based education across the region. The limited coverage of essential procedures and uneven continuity of programmes highlight the importance of institutional capacity, sustained resource allocation and curricular planning in expanding simulation beyond isolated training initiatives.

Najjuma et al. (2020) investigated stakeholder perceptions concerning the establishment of medical simulation-based learning at Mbarara University of Science and Technology in Uganda. The researchers employed a qualitative design involving seven key informant interviews with faculty and institutional administrators and three focus group discussions with medical and nursing students. Thematic analysis identified considerable institutional support for introducing simulation as a complementary teaching approach. However, participants expressed concerns about the acceptability of learning with non-living models, availability of human resources, and sustainability in the absence of external funding. The findings demonstrated the importance of securing institutional commitment while addressing staffing and financial requirements for long-term implementation. They also highlighted the need for simulation programmes to be embedded within existing educational structures to promote continuity.

More direct evidence on the relationship between institutional conditions and simulation practice was provided by Wubale et al. (2024) in Ethiopia. The researchers conducted an institutional mixed-methods study involving 212 nurse and midwife educators from six teaching institutions in Bahir Dar, complemented by eight qualitative interviews. Of the respondents, 121 (57.1%) were classified as having good simulation practice, while 91 (42.9%) demonstrated poor practice. Multivariable logistic regression identified simulation experience, previous training, educational qualifications, and perceived costs as statistically significant factors associated with practice. Qualitative findings further identified inadequate classroom space, resource shortages, insufficient training and weaknesses in institutional preparation as implementation challenges. These findings demonstrate that simulation utilisation is associated with both educator-related characteristics and institutional conditions, particularly the availability of practical training opportunities and resources required for regular teaching.

In Kenya, Fant et al. (2022) evaluated a virtual simulation faculty-development programme implemented through a partnership between Maseno University and Northwestern University in Kisumu. The pilot intervention involved three paediatric faculty members who participated in four didactic sessions and six virtually mentored simulation sessions. Seven clinical scenarios were developed, and the trained educators subsequently delivered a week-long simulation programme involving 50 medical students. Faculty members demonstrated improvements in debriefing skills and successfully implemented simulation sessions within their local training environment. The intervention illustrated the feasibility of developing local simulation teaching capacity through virtual mentorship and collaborative programme design. The findings provide an example of how faculty development and institutional partnerships can support simulation implementation without requiring all specialist expertise to be available locally.

Shikuku et al. (2024b) examined the feasibility of a blended continuous professional development programme involving 120 midwifery educators from 81 training institutions in Kenya and Nigeria. Using a mixed-methods intervention design, the researchers assessed changes in knowledge, confidence, and practical teaching competencies following online learning and face-to-face training. Mean knowledge scores increased from 52.4% to 80.4%, while confidence in applying selected pedagogical skills improved from 2.7 to 3.7 on a four-point scale ($p < 0.001$). The educators also demonstrated improvements in teaching-plan preparation and practical teaching skills. However, internet connectivity, technological access, costs, and time constraints were identified as challenges to programme participation.

Licensed Under Creative Commons Attribution (CC BY-NC)

These findings highlight the importance of faculty development as a human resource investment and the contribution of reliable technological and organisational support to training delivery.

Related implementation challenges were identified by Shikuku et al. (2024a) in a nested qualitative study conducted within a cluster randomised trial involving 20 Kenyan colleges. Focus group discussions involved 20 midwifery educators and eight mentors, with additional feedback obtained from students. Participants valued simulation, scenario-based teaching, peer learning, and structured feedback as methods for improving clinical education. Nevertheless, implementation was affected by faculty shortages, heavy workloads, inadequate simulation space, limited equipment, and insufficient clinical mentorship. The study also identified gaps in equipment inventory management and replenishment. These findings demonstrate how limitations in physical infrastructure, staffing, and operational support can affect the consistent delivery of competency-based clinical training, even where educators have received preparation in simulation teaching methods.

At Kenya Medical Training College (KMTC), Kavinya et al. (2023) investigated challenges affecting the application of simulation-based teaching among medical laboratory sciences educators. The researchers employed a mixed-methods cross-sectional design involving 47 lecturers and 11 campus principals, using questionnaires, interviews, checklists, and observations. All 47 lecturers (100%) identified educational validity as a consideration influencing simulation implementation, while 39 (83.0%) demonstrated an understanding of simulated laboratory experiences. Nevertheless, 46 respondents (97.9%) considered simulation resource-intensive, and an equal proportion reported that it placed considerable demands on instructional staff. Additional challenges included inadequate infrastructure, shortages of trained instructors, unreliable internet connectivity, and insufficient simulation models. The study established that simulation-based teaching was not applied uniformly across the participating departments, highlighting differences in institutional preparedness and operational capacity within KMTC. Njeru et al. (2026) further examined SBT awareness among clinical medicine lecturers at KMTC through an analytical cross-sectional study involving 153 respondents. The findings showed that 90.2% recognised the patient-safety benefits of simulation, although awareness of institutional guidance and operational arrangements was less consistent. Awareness demonstrated a statistically significant positive association with self-reported utilisation ($\beta = 0.305$, $R^2 = 0.093$, $p < 0.001$), explaining 9.3% of the variation in utilisation scores. These findings indicate that awareness is associated with simulation use, while also highlighting the importance of examining the institutional conditions under which lecturers translate awareness into teaching practice.

Collectively, international, regional and Kenyan evidence demonstrates that SBT implementation depends on the availability, accessibility and coordinated management of institutional resources. Physical facilities and equipment provide the infrastructure for simulation, while trained educators, technical personnel, financial support, digital systems and institutional governance facilitate their effective application. The evidence also demonstrates that resource constraints may affect the continuity and consistency of simulation programmes, particularly in institutions operating across multiple training locations. Although previous studies have identified important implementation challenges, quantitative evidence establishing the association between perceived institutional resource adequacy and SBT utilisation among clinical medicine lecturers remains limited. The present study therefore examined this relationship at KMTC, focusing on physical, human, financial, technological and governance resources to inform institutional planning and sustainable integration of simulation into clinical medicine education.

III. METHODOLOGY

3.1 Research Design

A descriptive and analytical cross-sectional survey design was used. Data was gathered from clinical medicine lecturers from KMTC campuses at one time (February – April 2026). Descriptive statistics were used to capture resource availability and resource adequacy, and multiple regression was used to determine the extent to which resource domains (physical, human, financial, technological, and governance) predicted SBT implementation.

3.2 Study Location

The study was carried out in 43 selected KMTC campuses that train Diploma in Clinical Medicine and Surgery in both urban, peri-urban, and rural settings. While KMTC has a standardised curriculum across the country, there are significant differences in the simulation infrastructure, staffing, and funding at different campuses and therefore the need for comprehensive national coverage.

3.3 Study Population

Licensed Under Creative Commons Attribution (CC BY-NC)

The target population was the 250 clinical medicine lecturers from 43 selected campuses. This population was suitable because these lecturers are directly involved in the delivery of the curriculum and are the ones who will decide whether or not SBT is implemented in training programmes.

3.4 Sampling Technique

A two-stage sampling technique was used. Forty-three (43) campuses offering Clinical Medicine were selected to represent geographical and institutional diversity. Stage two involved simple random sampling of individuals in each campus, with equal probability of selection, from the computer-generated list of the individuals in the official departmental lists.

3.5 Sample Size

The size of the sample was calculated by the formula of Taro Yamane (1967): $n = N/(1 + N(e)^2)$. The sample size was determined to be 154 respondents with $N = 250$ and $e = 0.05$. Proportional allocation allocated respondents to campuses based on: $n_i = (N_i/250) \times 154$.

3.6 Inclusion and Exclusion Criteria

Lecturers who were actively involved in the study period in clinical medicine were included. Those faculty not assigned to clinical medicine teaching, administrative staff not involved in teaching, and those on extended leave were excluded.

3.7 Data Collection

Data were gathered using a self-administered structured questionnaire that was administered physically. The questionnaire consisted of five parts: demographic; physical and technological resources; human resource capacity; financial and governance resources; and SBT implementation levels. Resource availability/adequacy was assessed using five-point Likert scales; frequency questions were used to determine how often resources were implemented, and open-ended items were used to identify specific resource gaps.

3.8 Validity and Reliability

Five clinical medicine lecturers at KMTC Machakos Campus who were not in the main sample were used as pilots for the instrument. Content validity was achieved by having three medical education experts and two senior lecturers at KMTC review the content.

3.9 Ethical Considerations

The KCA University Research Ethics Committee, NACOSTI research permit, and KMTC administration gave ethical approval. Informed consent was obtained for voluntary participation, anonymity, and confidentiality. Data was kept on de-identified and encrypted devices.

3.10 Data Analysis

SPSS Version 27 was used to analyse data. Resource availability was summarised using descriptive statistics (frequencies, percentages, means and standard deviations). Using multiple linear regression, the contribution of each resource domain to SBT implementation was determined:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \varepsilon$$

Y = SBT implementation, X_1–X_5 = physical, human, financial, technological, and governance resources, respectively. A p value of < 0.05 was considered significant.

IV. RESULTS & DISCUSSION

4.1 Results

4.1.1 Access to facilities and support staff

The study evaluated the availability of trained simulation facilitators and technical support staff to the lecturers and the availability of funding to support ongoing SBT activities. In terms of access to trained facilitators or technical support, only 19.6% agreed or strongly agreed and 62.1% disagreed or strongly disagreed (Mean = 2.32, SD = 1.098). For funding adequacy, 15.7% agreed/strongly agreed that funding was adequate and 63.4% disagreed/strongly disagreed (Mean = 2.39, SD = 1.107). A general feeling of inadequacy was expressed in both indicators.

Licensed Under Creative Commons Attribution (CC BY-NC)

Table 1

Access to Facilities and Support Staff

Statement	SD%	D%	N%	A%	SA%	Mean	SD
I have access to trained simulation facilitators or technical support staff.	26.8	35.3	18.3	18.3	1.3	2.32	1.098
Funding and resources are sufficient to sustain regular SBT activities.	20.3	43.1	20.9	9.2	6.5	2.39	1.107

4.1.2 Digital Infrastructure and Facilities

In terms of sufficiency of simulation facilities, the mean score was 2.38 (SD = 1.082) with 17.6% agreeing or strongly agreeing that quantity and quality were sufficient to meet the needs of teaching, and 62.7% disagreed or strongly disagreed. Digital infrastructure adequacy was rated as 2.61 (SD = 1.119) with 24.2% agreeing or strongly agreeing and 51.0% disagreeing or strongly disagreeing. Both showed that there was a perceived lack of facilities, with physical facilities being rated lower than digital infrastructure.

Table 2

Digital Infrastructure and Facilities

Statement	SD%	D%	N%	A%	SA%	Mean	SD
The quantity and quality of simulation facilities at my campus meet my teaching needs.	20.9	41.8	19.6	13.7	3.9	2.38	1.082
Digital infrastructure adequately supports SBT at my campus.	17.0	34.0	24.8	19.6	4.6	2.61	1.119

4.1.3 Technical and Institutional Support

Only 15.1% agreed or strongly agreed that technical support is readily available when equipment problems occur, with 61.4% disagreeing or strongly disagreeing (Mean = 2.36, SD = 1.043). In terms of institutional policies and leadership support for SBT implementation, 36.6% agreed or strongly agreed, 32.7% disagreed or strongly disagreed, and 30.7% were neutral (Mean = 3.05, SD = 1.126). Technical support was considered as poor and institutional policy support was considered as moderate.

Table 3

Technical and Institutional Support

Statement	SD%	D%	N%	A%	SA%	Mean	SD
Technical support is available promptly when simulation equipment issues arise.	20.9	40.5	23.5	11.8	3.3	2.36	1.043
Institutional policies and leadership at my campus actively support SBT implementation.	9.2	23.5	30.7	26.8	9.8	3.05	1.126

4.1.4 Accessibility, Training and Scheduling

In terms of equipment availability for use when required for teaching, 17.6% agreed or strongly agreed and 56.2% disagreed or strongly disagreed (Mean = 2.43, SD = 1.099). The mean score for adequacy of faculty development programmes was 2.61 (SD = 1.148), with 21.5% agreeing or strongly agreeing and 51.6% disagreeing or strongly disagreeing. In terms of fairness of scheduling and booking systems, 32.0% agreed or strongly agreed, 38.0% disagreed or strongly disagreed, and 30.1% were neutral (Mean = 2.92, SD = 1.127).

Table 4

Accessibility, Training and Scheduling

Statement	SD%	D%	N%	A%	SA%	Mean	SD
Simulation equipment is accessible to me when I need it for teaching.	22.2	34.0	26.1	13.7	3.9	2.43	1.099
KMTC provides adequate faculty development programs for SBT.	16.3	35.3	26.8	13.7	7.8	2.61	1.148
Scheduling and booking systems allow fair access to simulation facilities.	10.5	27.5	30.1	23.5	8.5	2.92	1.127

Licensed Under Creative Commons Attribution (CC BY-NC)



Licensed Under Creative Commons Attribution (CC BY-NC)

4.1.5 Resources and SBT Utilisation Regression

The regression model was used to explore the predictive power of the existing resources on SBT utilisation. The model was R = .574, R^2 = .330, and adjusted R^2 = .325, which means that resources accounted for 33.0% of the variance in utilisation. The model was statistically significant, $F(1, 151) = 74.27$, $p < .001$. The unstandardised coefficient for resources was B = .569 (SE = .066), with a standardised coefficient of $\beta = .574$, $t = 8.62$, $p < .001$. The constant was B = 1.673 (SE = .177), $t = 9.46$, $p < .001$.

Table 5

Regression Model Summary

Model	R	R^2	Adj. R^2	F	df1	df2	Sig.
1	0.574	0.330	0.325	74.272	1	151	0.000

Table 6

Regression Coefficients

Predictor	B	SE	β	t	Sig.
Constant	1.673	0.177	—	9.463	0.000
Existing Resources	0.569	0.066	0.574	8.618	0.000

4.2 Discussion

The results showed that human resource capacity was extremely low at KMTC, with 62.1% of clinical medicine lecturers indicating that they did not have access to trained simulation facilitators or technical support staff. This is consistent with the findings of Seethamraju et al. (2022), who showed that the lack of trained facilitators and technicians greatly restricted the use of SBT in routine practice in low-resource settings around the world. Likewise, in Uganda, Najjuma et al. (2020) found a significant negative correlation between lack of technical support staff and the frequency of simulation sessions in institutions because lecturers wasted valuable teaching time trying to troubleshoot the equipment. In a multi-country study in Sub-Saharan Africa, Ismail et al. (2024) also found that there is a significant shortage of simulation-savvy personnel, and that local improvisation is a major way of filling human resource gaps. The overall results indicate that human resources are a major challenge to SBT implementation in resource-limited environments such as KMTC.

The second most important limitation was financial resources (63.4% of lecturers disagreed that the funding was adequate to support regular SBT activities). This aligns with Robinson et al. (2024), who found that there was a lack of lifecycle budgeting and cost transparency in LMICs, which means that administrators lack evidence for sustainable scale-up. Alayande et al. (2023) also noted that most of the simulation programmes in Sub-Saharan Africa were funded by short-term donors and faced sustainability issues when the funding ended. Van Tetering et al. (2025) also reported on the lack of recurrent supplies and maintenance funds in Kenyan training facilities, which made most of the infrastructure unusable. These converging results indicate that KMTC's financial structure is not designed to have the recurrent budgetary mechanisms that are required for the ongoing functioning of SBT.

62.7% rated the physical infrastructure as inadequate, supporting Barlow et al. (2024), who reported that comprehensive simulation centres were needed to enable frequent SBT, integrated into the curriculum. Alayande et al. (2023) found that there are huge infrastructural differences between the institutions in Sub-Saharan Africa, with many having only basic task trainers and not integrated simulation suites. Del-Castillo-Miranda et al. (2025) reported that simulation programmes in Kenya were greatly limited due to the lack of physical facilities and technical assistance for the use of complex equipment. Digital infrastructure was slightly better but still lacking, with 51.0% rating it inadequate. This aligns with the findings of Gerstenberger et al. (2023) that learner satisfaction with telesimulation was dependent on the proper technical setups and Yasser et al. (2023) that technical reliability was a prerequisite for remote simulation to yield learning outcomes similar to in-person simulation.

61.4% of lecturers rated technical support as poor, which is consistent with Najjuma et al. (2020) and Seethamraju et al. (2022) who found that lack of technical personnel is one of the basic challenges to the frequency and quality of SBT. Institutional policy support was seen as moderate (Mean = 3.05) and there was a significant proportion of neutral responses (30.7%), indicating that there was some variation in how policy was communicated across campuses. Formal governance structures and protected teaching time were essential enablers to institutionalising simulation practice in Nigerian medical schools (Elundu et al., 2024), and simulation integrated into assessment and progression criteria proved effective in institutionalising simulation practice globally (Barlow et al., 2024). At KMTC, the institutional support is

Licensed Under Creative Commons Attribution (CC BY-NC)

moderate, indicating a gap in governance-implementation that needs to be addressed through targeted policy dissemination.

A 51.6% rated faculty development as inadequate, which is consistent with Fant et al. (2022), who showed that a combination of virtual faculty development and on-site practice resulted in increased confidence in facilitation and ongoing SBT activities in Kisumu, Kenya. Shikuku et al. (2024) also reported that CPD helped Kenyan educators to enhance their simulation teaching knowledge, but the availability of consumables remained a challenge. Njeru et al. (2026) also noted that although considerable funds have been invested in KMTC simulation facilities, the utilization of the facilities is still limited due to poor accessibility of resources and limited institutional awareness.

The regression analysis showed that the existing resources were a statistically significant predictor of SBT utilisation ($\beta = .574$, $p < .001$), accounting for 33.0% of the variance. This result reinforces Rogers' (2003) Diffusion of Innovations Theory, which suggests that adequate resources help to overcome the perceived complexity and move from the persuasion stage to the implementation stage. But the other 67.0% of the unexplained variance suggests that there are not enough resources for sustained implementation. Seethamraju et al. (2022) separated out resource access and capacity to implement, showing that operational training and mentorship were essential to get resources to sustained pedagogical practice. Fant et al. (2022) confirmed that cascade mentorship and protected instructional time considerably boosted lecturer confidence and regular utilisation in Kenyan settings. The results indicate that for sustainable implementation of SBT at KMTC, there is a need to have a holistic and integrated approach that involves decentralised resource allocation, structured faculty development and a clear governance mandate.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This study found that existing resources significantly predict SBT utilisation among clinical medicine lecturers at KMTC, with 33.0% of the variance accounted for. But all resource domains (human capacity, financial allocations, physical infrastructure, technical support, and faculty development) were rated as inadequate. Resources are interdependent, and a lack of any resource affects the overall implementation. The integration of SBT at KMTC requires a holistic approach and investment that is budgeted for the entire life cycle of the SBT, and not just the equipment.

5.2 Recommendations

There is a need to decentralise and make recurrent budgetary allocations for simulation consumables and maintenance in all campuses at KMTC. Faculty development programmes should be institutionalised with structured faculty development programmes with cascade mentorship. Technical support units should be in place per tier of campus.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Funding Declaration

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

REFERENCES

Alayande, B. T., Forbes, C., Masimbi, O., Kingpriest, P., Shimelash, N., Wina, F., Hey, M. T., Philipo, G. S., Abahuje, E., Robertson, J. M., Yule, S., Riviello, R. R., & Bekele, A. (2024). The implementation of simulation-based learning for training undergraduate medical students in essential surgical care across sub-Saharan Africa: A scoping review. *Medical Science Educator, 34*(1), 237-256. https://doi.org/10.1007/s40670-023-01898-6

Barlow, M., Heaton, L., Ryan, C., Downer, T., Reid-Searl, K., Guinea, S., Dickie, R., Wordsworth, A., Hawes, P., Lamb, A., & Andersen, P. (2024). The application and integration of evidence-based best practice standards to healthcare simulation design: A scoping review. *Clinical Simulation in Nursing, 87*, Article 101495.

Cant, R. P., & Cooper, S. J. (2017). Use of simulation-based learning in undergraduate nurse education: An umbrella systematic review. *Nurse Education Today, 49*, 63-71. https://doi.org/10.1016/j.nedt.2016.11.015

Dearing, J. W., & Cox, J. G. (2018). Diffusion of innovations theory, principles, and practice. *Health Affairs, 37*(2), 183-190. https://doi.org/10.1377/hlthaff.2017.1104

Licensed Under Creative Commons Attribution (CC BY-NC)

Del Castillo Miranda, J. C., Oweidat, M., Abady, E., Shehadeh, M. H., Aziz, M. M., Onyejesi, C. D., & Alsabri, M. (2025). Enhancing pediatric emergency care in low-resource settings through simulation-based training: A narrative review. *SAGE Open Pediatrics, 12*, Article 30502225251319883. https://doi.org/10.1177/30502225251319883

Fant, C., Olwala, M., Laanoi, G. M., Murithi, G., Otieno, W., Groothuis, E., & Doobay Persaud, A. (2022). Virtual faculty development in simulation in sub-Saharan Africa: A pilot training for pediatricians in Kisumu, Kenya. *Frontiers in Pediatrics, 10*, Article 957386. https://doi.org/10.3389/fped.2022.957386

Gerstenberger, J. P., Hayes, L., Chow, C. J., & Raaum, S. (2023). Medical student experiential learning in telesimulation. *Journal of Medical Education and Curricular Development, 10*, Article 23821205231216067. https://doi.org/10.1177/23821205231216067

Ismail, F. W., Ajani, K., Baqir, S. M., Nadeem, A., Qureshi, R., & Petrucka, P. (2024). Challenges and opportunities in the uptake of simulation in healthcare education in the developing world: A scoping review. *MedEdPublish, 14*, Article 38. https://doi.org/10.12688/mep.20271.1

Kavinya, M. P., Lugulu, J., & Mosol, P. (2023). Examining the challenges affecting the application of innovative simulation-based teaching and learning among teaching staff in selected Kenya Medical Training College campuses offering medical laboratory sciences in Kenya. *International Journal of Tropical Diseases, 6*, Article 071. https://doi.org/10.23937/2643-461X/1710071

Motola, I., Devine, L. A., Chung, H. S., Sullivan, J. E., & Issenberg, S. B. (2013). Simulation in healthcare education: A best evidence practical guide. AMEE Guide No. 82. *Medical Teacher, 35*(10), e1511-e1530. https://doi.org/10.3109/0142159X.2013.818632

Najjuma, J. N., Bajunirwe, F., Twine, M., Namata, T., Kyakwera, C. K., Cherop, M., & Santorino, D. (2020). Stakeholder perceptions about the establishment of medical simulation-based learning at a university in a low resource setting: A qualitative study in Uganda. *BMC Medical Education, 20*, Article 379. https://doi.org/10.1186/s12909-020-02301-3

Njeru, K. K., Okoth, Z., & Mwangi, J. (2026). Level of awareness of simulation-based training among clinical medicine lecturers at Kenya Medical Training College. *Science Mundi, 6*(1), 457-467. https://doi.org/10.51867/scimundi.6.1.39

Robinson, S. J. A., Ritchie, A. M. A., Pacilli, M., Nestel, D., McLeod, E., & Nataraja, R. M. (2024). Simulation-based education of health workers in low- and middle-income countries: A systematic review. *Global Health: Science and Practice, 12*(6), Article e2400187. https://doi.org/10.9745/GHSP-D-24-00187

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Seethamraju, R. R., Stone, K. P., & Shepherd, M. (2022). Factors affecting implementation of simulation-based education after faculty training in a low-resource setting. *Simulation in Healthcare, 17*(1), e113-e121. https://doi.org/10.1097/SIH.0000000000000549

Shikuku, D. N., Bar-Zeev, S., Ladur, A. N., Allott, H., Mwaura, C., Nandikove, P., Uyara, A., Tallam, E., Ndirangu, E., Waweru, L., Nyaga, L., Bashir, I., Bedwell, C., & Ameh, C. (2024a). Experiences, barriers and perspectives of midwifery educators, mentors and students implementing the updated emergency obstetric and newborn care-enhanced pre-service midwifery curriculum in Kenya: A nested qualitative study. *BMC Medical Education, 24*, Article 950. https://doi.org/10.1186/s12909-024-05872-7

Shikuku, D. N., Mohammed, H., Mwanzia, L., Ladur, A. N., Nandikove, P., Uyara, A., Waigwe, C., Nyaga, L., Bashir, I., Ndirangu, E., Bedwell, C., Bar-Zeev, S., & Ameh, C. (2024b). Evaluation of the feasibility of a midwifery educator continuous professional development (CPD) programme in Kenya and Nigeria: A mixed methods study. *BMC Medical Education, 24*, Article 534. https://doi.org/10.1186/s12909-024-05524-w

van Tetering, A. A. C., de Vries, E. L., Ntuyo, P., van den Heuvel, E. R., Fransen, A. F., van der Hout-van der Jagt, M. B., Namagembe, I., Byamugisha, J., & Oei, S. G. (2025). Mono-professional simulation-based obstetric training in a low-resource setting: Stepped-wedge cluster randomized trial. *JMIR Medical Education, 11*, Article e54911.

Wubale, M. A., Assaye, A. M., Wondyifraw, H. G., Guadie, B. A., & Beyene, M. M. (2024). Clinical simulation practice and associated factors among nurse and midwife educators working at teaching institutions in Bahir Dar, Ethiopia: A mixed methods study. *BMC Nursing, 23, Article 945*. https://doi.org/10.1186/s12912-024-02640-2

Yamane, T. (1967). *Statistics: An introductory analysis* (2nd ed.). Harper & Row.

Yasser, N. B. M., Tan, A. J. Q., Harder, N., Ashokka, B., Chua, W. L., & Liaw, S. Y. (2023). Telesimulation in healthcare education: A scoping review. *Nurse Education Today, 126*, Article 105805. https://doi.org/10.1016/j.nedt.2023.105805

Licensed Under Creative Commons Attribution (CC BY-NC)