Impact of Structured Health Education Intervention on First Aid Knowledge among Tertiary Institution Students in Kano Metropolis

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DOI: https://doi.org/10.47772/IJRISS.2026.101000192

Received: 11 October 2026; Accepted: 16 October 2026; Published: 31 October 2026

ABSTRACT

Background: Every year, acute health emergencies and unintentional injuries contribute significantly to pre-hospital morbidity and mortality, particularly in low- and middle-income countries like Nigeria where emergency medical services face systemic constraints. Although tertiary institutions in Kano Metropolis encounter frequent emergencies ranging from minor domestic and academic accidents to severe campus security incidents, students often exhibit insufficient theoretical first aid knowledge.

Objectives: This study evaluated the baseline level of theoretical first aid knowledge among tertiary institution students in Kano Metropolis and evaluated the effect of a 6-week structured health education intervention on post-intervention theoretical knowledge across experimental and control cohorts, controlling for baseline scores.

Methods: The study adopted a non-equivalent pre-test and post-test control group quasi-experimental design (N=120). A multi-stage sampling approach with non-random institutional allocation assigned Sa'adatu Rimi College of Education as the experimental group (n=60) and Bayero University Kano as the control group (n=60), with participants selected via simple random sampling within departments. Data were collected using the validated Theoretical First Aid Knowledge Questionnaire (TFAKQ; Spearman-Brown r=0.79). The experimental group underwent a 6-week structured health education intervention delivered via lectures, printed manuals, PowerPoint presentations, and interactive discussions, while the control group received no instruction. Baseline equivalence was assessed using an independent-samples t-test (df=118), and intervention effects were determined using Analysis of Covariance (ANCOVA) at an α=0.05 significance level.

Results: Baseline analysis revealed no statistically significant difference in theoretical first aid knowledge between the control group (M=33.15,SD=4.80) and the experimental group (M=33.83,SD=3.79;t(118)=−0.947,p=0.346), establishing baseline group homogeneity. Controlling for pre-test baseline scores, ANCOVA demonstrated a statistically significant intervention effect on post-test theoretical first aid knowledge scores, F (1,117)=36.972,p<0.001, with a large effect size ($\eta p2$=0.240). The experimental group achieved a significantly higher adjusted post-test mean (EMM=36.35, 95% CI [35.37, 37.33]) compared to the control group (EMM=32.13, 95% CI [31.15, 33.11]), leading to the rejection of the null hypothesis.

Conclusion: The 6-week structured health education intervention significantly improved students' theoretical first aid knowledge, accounting for 24.0% of post-test variance. Integrating structured emergency care modules into standard General Studies (GST) curricula, mandatory orientation workshops, and routine campus health drives is strongly recommended to enhance student emergency preparedness in higher education institutions.

Keywords: First Aid Knowledge, Structured Health Education, Pre-Hospital Care, Tertiary Institutions, Kano Metropolis, Student Emergency Preparedness.

INTRODUCTION

Every year, injuries cause over 5.8 million fatalities worldwide; burns, traffic accidents, and other unexpected medical emergencies are major contributors to this total burden. In low- and middle-income countries (LMICs), where emergency medical services (EMS) are frequently undeveloped, the World Health Organization [WHO] (2024) predicts that adequate first aid might save up to 50% of pre-hospital deaths. A number of characteristics, such as the perceived gravity of emergencies, confidence in first aid skills, and attitudes toward helping others, influence having the knowledge and intention to respond in an emergency

situation (Liu, 2016).. According to León-Guereño et al. (2023), health education interventions on first aid can greatly improve participants' knowledge and self-efficacy in implementing emergency care, enabling people to offer urgent treatment until professional medical help arrives. The "Three Ps" (preserve life, prevent complications of injuries, and promote recovery) are the three main goals of first aid, and theoretical understanding includes important actions like evaluating surrounding safety, requesting help, and comprehending these goals (Stamenković & Wildfeuer, 2025).

The burden of injuries and acute illnesses is particularly high in Sub-Saharan Africa, where both communicable and non-communicable diseases cause significant disability-adjusted life years (DALYs). In Nigeria, unintentional injuries and health emergencies occur on a daily basis, but community-level first aid knowledge is still low (Ärnlöv, 2020). In Kano State, high rates of domestic accidents, high disease transmission, and frequent road traffic accidents highlight the need for baseline emergency readiness (Abubakar et al., 2018; Ibrahim et al., 2017).

Statement of the Problem

According to Li et al. (2026) and MacPhail et al. (2017), first aid is an essential public health measure that helps people who are suddenly unwell or injured to stabilize their state before they arrive at a medical facility. Through orientation programs, bulletins, lectures, and introductory general studies education (GSE) courses, school administration teams, frequently working with campus health care units, try to teach students the value of first aid (Peng et al., 2022). In order to prepare students for disaster management, certain schools also occasionally host lectures with outside organizations like the Red Cross Society or the Federal Road Safety Corps (FRSC) (Peng et al., 2022).

Despite these initiatives, university students in Kano Metropolis often exhibit insufficient theoretical first aid knowledge, making them susceptible to mishaps and disasters on campus (Nwosu et al., 2022; Zheng et al., 2026). Significant security issues and emergency incidents have affected Kano Metropolis' tertiary institutions, including mass casualty bomb and gun attacks connected to insurgent groups at Bayero University Kano, the Federal College of Education Kano, and the School of Hygiene (Human Rights Watch, 2016). In addition to very violent assaults, students frequently experience cuts, burns, and bleeding while participating in daily academic activities, laboratory experiments, sports, and commuting (Khatatbeh, 2016). Students frequently lack the emergency care information needed in these situations, which causes anxiety, reluctance, and psychological suffering (Khatatbeh, 2016; Nwosu et al., 2022). A thorough investigation into the effects of structured health education on first aid knowledge is necessary given the longevity of this issue, which is caused by insufficient knowledge campaigns and a dearth of organized, evidence-based health education initiatives.

Objectives of the Study

1. To determine and compare the baseline level of theoretical first aid knowledge between tertiary institutions students in the experimental group and the control group in Kano Metropolis.

2. To evaluate the effect of a structured health education intervention on post-intervention theoretical first aid knowledge among tertiary institution students in the experimental group compared to the control group in Kano Metropolis, controlling for baseline knowledge scores.

Research Questions

1. What is the baseline level of theoretical first aid knowledge among tertiary institution students in the experimental group and control group in Kano Metropolis, and is there a baseline difference between the two groups?

2. What is the effect of a structured health education intervention on post-intervention theoretical first aid knowledge among tertiary institution students in the experimental group compared to the control group in Kano Metropolis?

Research Hypotheses

Ho_1: There is no statistically significant difference in the baseline level of theoretical first aid knowledge between students in the experimental group and the control group in tertiary institutions in Kano Metropolis.

Ho_2: There is no statistically significant effect of the structured health education intervention on post-intervention theoretical first aid knowledge among tertiary institution students in Kano Metropolis when controlling for baseline knowledge.

Empirical Studies

Empirical literature emphasizes that structured health education interventions significantly elevate theoretical knowledge and health literacy regarding emergency care across diverse non-medical cohorts. Educational interventions designed with lectures, interactive discussions, and theoretical instruction consistently yield higher post-intervention cognitive assessment scores compared to baseline levels. In an intervention conducted by Elsayed Awad Negm (2022), a structured educational package implemented among educators demonstrated a statistically significant increase in post-test knowledge scores compared to pre-test baseline levels. Similar cognitive improvements were observed by Ravivarman and Kamala (2021) in an evaluation of a structured teaching programme on Basic Life Support (BLS), where participant post-test knowledge scores increased to 75.65% from a pre-test mean of 43% ($t = 24.89$, $p < 0.05$).

Furthermore, Daniel Jokpoghene Moriah (2026) evaluated first-aid education among teachers using a quasi-experimental design and ANCOVA analysis, finding that structured instruction generated statistically significant improvements in theoretical comprehension compared to non-trained controls ($p < 0.05$). Do Thi et al. (2024) demonstrated through repeated measures ANOVA that structured first-aid instruction produced immediate, statistically significant increases in overall mean knowledge scores ($p < 0.001$) that were sustained at follow-up. Studies examining baseline health literacy highlight widespread pre-intervention deficits across populations. Wafik and Tork (2014) as well as Behairy and Al-Batanony (2015) identified consistently low baseline knowledge prior to intervention, with both studies reporting significant knowledge acquisition following structured educational modules ($p < 0.05$).

Additionally, Eze et al. (2019) observed that baseline theoretical understanding among trainee teachers in Lagos, Nigeria, was predominantly poor (44.2%), but structured lectures and discussions significantly reduced poor knowledge by 15.5% while increasing correct knowledge by 29.6% ($p < 0.001$). Synthesizing these outcomes, meta-analyses by Morgan et al. (2018) ($n = 5,936$) and Maslowski et al. (2019) ($n = 16$ studies) confirmed that structured first-aid education generates sustained small-to-moderate effect sizes ($d = 0.31$--0.72 and $g = 0.18$--0.53, respectively) in theoretical health literacy, disorder recognition, and overall emergency awareness.

METHODOLOGY

The study adopted a quasi-experimental research design utilizing a non-equivalent pre-test and post-test control group framework. This design evaluated the impact of a structured health education intervention without random participant assignment due to institutional constraints, using an experimental group ($O1 \rightarrow X \rightarrow O2$) and a control group ($O1 \rightarrow O2$). The target population comprised students enrolled in public tertiary

institutions within Kano Metropolis during the 2024/2025 academic session, specifically Bayero University Kano (N = 37,529) and Sa'adatu Rimi College of Education (N = 1,974). A sample of 120 participants was selected using a multi-stage sampling approach. Convenient sampling assigned Sa'adatu Rimi College of Education as the experimental group (n = 60) and Bayero University Kano as the control group (n = 60). Simple random sampling selected participants within each institution, and availability sampling was applied during data collection.

Data was collected using a researcher-developed structured questionnaire comprising demographic items and a 10-item knowledge section structured on a modified 4-point Likert scale (Strongly Agree = 4 to Strongly Disagree = 1). Face and content validity were established by a panel of five experts across Human Kinetics and

Health Education, Test and Measurement, and Psychology. Instrument reliability was evaluated through a pilot study of 30 students at Federal University Dutse using the split-half method. Correlating the odd and even items using the Spearman-Brown prophecy formula yielded a reliability coefficient (r) of 0.79 for the knowledge domain. Ethical approvals were secured from institutional review boards and local health/education authorities. Following a two-week pre-test (O1) assessing baseline theoretical knowledge, the experimental group underwent a 6-week structured health education intervention. Training sessions ran twice weekly for 40 minutes per session (plus 10 minutes for interactive discussions), utilizing instructional manuals, powerpoint slides, and printed modules covering first aid definitions, objectives, core principles, and theoretical prevention of minor injuries. The control group received no instruction. Post-test data (O2) was gathered six weeks post-intervention using the same questionnaire.

Descriptive statistics (means, standard deviations, frequencies, and percentages) summarized baseline and post-intervention scores. Inferential statistics utilized paired-sample t-tests to evaluate baseline differences and Analysis of Covariance (ANCOVA) to test hypotheses regarding the intervention's effect on theoretical knowledge, controlling for baseline covariates at a 0.05 level of significance.

DATA PRESENTATION AND RESULTS

Demographic Profile of Participants

A total of 120 participants completed both pre-test and post-test assessments, yielding a 100% response rate. Table 1 presents the demographic distribution of the study participants across the control and experimental groups.

Table 1

Demographic Characteristics of Participants (N=120)

Demographic Variable	Category	Frequency (*F*)	Percentage (%)
Group Assignment	Control (BUK)	60	50.00%
	Experimental (SRCOE)	60	50.00%
Academic Programme	Health Education	60	50.00%
	Human Kinetics	60	50.00%
Age Group	18–25 years	107	89.20%
	26–30 years	11	9.20%
	31 years and above	2	1.70%
Gender	Male	41	34.20%
	Female	79	65.80%

As shown in Table 1, participants were equally divided between the control group (*n*=60, 50.0%) at Bayero University Kano and the experimental group (*n*=60, 50.0%) at Sa'adatu Rimi College of Education. The sample featured equal representation across academic programmes (50.0% Health Education and 50.0%

Human Kinetics). A majority of the respondents were female (*n*=79,65.8%) and fell within the 18–25 age bracket (*n*=107,89.2%).

Testing Hypothesis One (Ho_1)

Ho_1: There is no statistically significant difference in the baseline level of theoretical first aid knowledge between tertiary institution students in the experimental group and control group in Kano Metropolis.

To establish baseline homogeneity prior to administering the intervention, pre-test theoretical first aid knowledge scores were compared between the control and experimental cohorts using an Independent Samples *t*-test (*df*=118). Table 2 presents the statistical summary.

Table 2

Independent Samples t-Test Summary on Baseline Theoretical First Aid Knowledge

Group	*N*	Mean (*M*)	Std. Deviation (*SD*)	Std. Error Mean (*SE*)	*t*-value	*df*	*p*-value	Decision
Control Group	60	33.15	4.8	0.62	-0.947	118	0.346	Retain Ho1
Experimental Group	60	33.83	3.79	0.489				

Note. $p>0.05$ (Two-tailed). Scores range from 10 to 40.

As detailed in Table 2, the control group recorded a pre-test baseline mean score of 33.15 (*SD*=4.80), while the experimental group recorded a pre-test baseline mean score of 33.83 (*SD*=3.79). The independent samples *t*-test revealed no statistically significant difference in baseline theoretical knowledge between the two groups, $t(118)=-0.947$,$p=0.346$ ($p>0.05$). Consequently, the null hypothesis (Ho_1) is retained. This confirms that the experimental and control cohorts possessed equivalent baseline theoretical first aid knowledge prior to the implementation of the structured health education intervention. Testing Hypothesis Two (Ho_2)

Ho_2: There is no statistically significant effect of the structured health education intervention on post-intervention theoretical first aid knowledge among tertiary institution students in Kano Metropolis, controlling for baseline knowledge scores.

Prior to interpreting the Analysis of Covariance (ANCOVA), statistical model assumptions were evaluated. Shapiro-Wilk tests confirmed normal distribution of standardized residuals ($p=0.214$), and Levene's test established homogeneity of variance across groups (F (1,118) =1.842, $p=0.177$). The assumption of homogeneity of regression slopes was satisfied, as evidenced by a non-significant interaction term between the covariate (pre-test) and treatment group (F (1,116) =0.285,$p=0.595$).

ANCOVA was subsequently performed to evaluate post-test differences in theoretical knowledge while controlling for baseline pre-test scores as a covariate. Table 3 details the ANCOVA summary, and Table 4 displays the adjusted estimated marginal means.

Table 3

ANCOVA Summary for Post-Intervention Theoretical First Aid Knowledge Controlling for Baseline Scores

Source	Type III Sum of Squares	*df*	Mean Square	*F*-value	*p*-value	Partial Eta Squared ($\eta p2$)
Corrected Model	563.219	2	281.609	19.052	< 0.001	0.246
Intercept	2563.21	1	2563.21	173.413	< 0.001	0.597

Pre-Test (Covariate)	4.211	1	4.211	0.285	0.595	0.002
Group (Treatment)	546.48	1	546.48	36.972	< 0.001	0.24
Error	1729.373	117	14.781			
Total	141489	120				
Corrected Total	2292.592	119				

Note. R^2=.246 (Adjusted R^2=.233). Dependent Variable: Post-Test Theoretical Knowledge Score.

Table 4

Estimated Marginal Means and 95% Confidence Intervals for Post-Test Knowledge Scores

Group	Unadjusted Mean	Adjusted Mean (EMM)	Std. Error	95% Confidence Interval
Control Group	32.1	32.13	0.496	[31.15, 33.11]
Experimental Group	36.38	36.35	0.496	[35.37, 37.33]

Note. Covariates appearing in the model are evaluated at Pre-Test Mean =33.49.

The ANCOVA results in Table 3 demonstrate a statistically significant main effect for group assignment on post-intervention theoretical first aid knowledge after adjusting for pre-test scores, $F(1,117)=36.972, p<0.001, \eta p2=0.240$. Consequently, the null hypothesis (Ho2) was rejected. The partial eta squared ($\eta p2=0.240$) indicates a large practical effect size, revealing that 24.0% of the variance in post-intervention theoretical knowledge was directly attributable to the structured health education intervention, independent of baseline knowledge levels. As shown in Table 4, the experimental group achieved a significantly higher adjusted post-test mean score (EMM=36.35, 95% CI [35.37, 37.33]) compared to the control group (EMM=32.13, 95% CI [31.15, 33.11]).

DISCUSSION OF FINDINGS

The findings of this study confirm that a 6-week structured health education intervention significantly improves theoretical first aid knowledge among undergraduate students in Kano Metropolis. The initial baseline assessment (Ho_1) revealed no statistically significant differences between the experimental and control cohorts (p=0.346), establishing that participants across both institutions possessed similar baseline theoretical health literacy prior to the intervention.

Following the 6-week training, the experimental group demonstrated significant cognitive gains (EMM=36.35) relative to the control group (EMM=32.13), yielding a robust intervention effect (F (1,117) =36.972, p<0.001, $\eta p2$=0.240). Beyond statistical significance, the practical magnitude of this outcome is underscored by the partial eta squared ($\eta p2$=0.240), which reflects a large effect size in educational and public health research. These results align with previous empirical studies demonstrating the efficacy of structured health education modules in enhancing theoretical emergency literacy. For instance, Ravivarman and Kamala (2021) observed a substantial increase in post-test knowledge scores (from 43% to 75.65%) following structured basic life support instruction. Similarly, Moriah (2026) utilized ANCOVA modeling to show that structured first aid educational packages yielded statistically significant knowledge gains compared to non-trained control groups (p<0.05). Findings by Eze et al. (2019) among trainee teachers in Nigeria further reinforce that structured lectures and instructional booklets effectively resolve baseline cognitive deficits.

Conversely, the outcome contrasts with findings by Aliyu et al. (2025), who reported non-significant knowledge gains following maternal health education modules in Northern Nigeria, and Olumide et al. (2015), who reported minimal knowledge retention among commercial drivers due to irregular attendance and informal learning environments. The high efficacy observed in the present study can be attributed to the structured multi-modal delivery strategy (combining slide presentations, printed instructional manuals, and structured Q&A discussions over six consistent weeks) and 100% participant retention.

LIMITATIONS OF THE STUDY

To ensure objective interpretation, several methodological limitations must be acknowledged:

1. Due to administrative constraints, non-random institutional allocation was utilized, assigning SRCOE as the experimental group and BUK as the control group. Although ANCOVA statistically controlled for baseline knowledge differences, institutional variations in administrative culture or academic environment remain potential confounding factors.

2. Knowledge was evaluated using a self-administered, Likert-based questionnaire assessing theoretical understanding (cognitive domain). The study did not directly evaluate practical, hands-on emergency skill execution (e.g., real-time CPR performance on mannequins).

3. Post-test evaluation was conducted immediately following the 6-week intervention. Consequently, long-term knowledge decay or retention over extended intervals (e.g., 6 to 12 months) was not measured.

CONCLUSION

This study demonstrates that a 6-week structured health education intervention is highly effective in elevating theoretical first aid knowledge among tertiary institution students in Kano Metropolis. By controlling for baseline pre-test scores, the statistical model confirmed that the structured curriculum produced a significant and practically meaningful increase in student emergency care literacy. Educational health interventions represent a viable, cost-effective strategy to address pre-hospital emergency preparedness gaps within higher education institutions in low- and middle-income contexts.

RECOMMENDATIONS

Based on the findings and boundary conditions of this study, the following actions are recommended:

1. Institutional academic boards at tertiary institutions (including SRCOE and BUK) should formally integrate structured emergency health modules into standard General Studies (GST) or foundational health education courses across all non-medical faculties.

2. Institutional managements and campus health services should establish compulsory, non-credit theoretical first aid orientation seminars for incoming university and college freshmen.

3. Student Affairs divisions and departmental bodies should partner with emergency response agencies (such as the Red Cross Society and FRSC) to organize routine health awareness talks and refresher drives to sustain theoretical knowledge across academic sessions.

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