ORIGINAL RESEARCH ARTICLE

The effect of integrating transtheoretical model in contraceptive methods training on university students: A randomized controlled trial

DOI: 10.29063/ajrh2026/v30i2.13

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Abstract

This study was conducted to measure the effect of a Transtheoretical Model (TTM)-based contraceptive training program on university students' contraceptive knowledge, attitude, and behavior. The study is a Randomized Clinical Trial where the experiment was targeting 68 international nursing students (intervention group: 34, control group: 34). Students in the intervention group received a training designed to boost their knowledge, attitude and behavior. The control group received no specific program. The data was analyzed using SPSS 27.0 version software. The results revealed a significant difference between the groups at post-test ($Z = -7.003$, $p = .000$, $r = 0.85$), ($Z = -6.859$, $p < .001$, $r = 0.83$) and ($Z = -6.579$, $p < .001$, $r = 0.80$), respectively to all variables contraceptive knowledge, attitude and behavior compared to the control group respectively. The study findings indicate evidence that a TTM-based intervention can significantly improve contraceptive knowledge, attitudes, and behaviors. *(Afr J Reprod Health 2026; 30 [2]:152-165).*

Keywords: Attitude, Behavior, Knowledge, Trans Theoretical Model, Education, Nursing students.

Résumé

Cette étude a été menée pour mesurer l'effet d'un programme de formation à la contraception basé sur le modèle transthéorique (TTM) sur les connaissances, l'attitude et le comportement des étudiants universitaires en matière de contraception. L'étude est un essai clinique randomisé dont l'expérience ciblait 68 étudiants internationaux en soins infirmiers (groupe d'intervention : 34, groupe témoin : 34). Les étudiants du groupe d'intervention ont reçu une formation conçue pour améliorer leurs connaissances, leur attitude et leur comportement. Le groupe témoin n'a reçu aucun programme spécifique. Les données ont été analysées à l'aide du logiciel SPSS version 27.0. Les résultats ont révélé une différence significative entre les groupes au post-test ($Z = -7{,}003$, $p = 0{,}000$, $r = 0{,}85$), ($Z = -6{,}859$, $p < 0{,}001$, $r = 0{,}83$) et ($Z = -6{,}579$, $p < 0{,}001$, $r = 0{,}80$), respectivement pour toutes les variables de connaissances, d'attitude et de comportement en matière de contraception par rapport au groupe témoin respectivement. Les résultats de l'étude indiquent qu'une intervention basée sur le TTM peut améliorer considérablement les connaissances, les attitudes et les comportements en matière de contraception. *(Afr J Reprod Health 2026; 30 [2]: 152-165).*

Mots-clés: Attitude, Comportement, Connaissance, Modèle Trans Théorique, Éducation, Étudiants en soins infirmiers

Introduction

Unprotected sex in 15-49-year-olds has substantial public health implications in terms of sexually transmitted infections, unintended pregnancies, and induced abortions.[1,2] Hence, it is important to provide efficacious knowledge of contraceptive measures to achieve informed decision-making and reduce these undesirable outcomes.[3] Yet, a range of sociocultural barriers, including religious convictions, community prejudices and partner opposition, might hinder the utilization of contraception.[4,5]

The WHO has also stressed that contraceptive methods give the power to individuals and couples to take control of their reproductive capacity, which in turn allows them to responsibly plan the family size they desire and the birth spacing they want.[6,7] This is especially pertinent in the areas with high crude birth rates. For example, although fertility rates have been falling in Africa (from 5.8 children per woman in 2000 to 4.18 in

2023),[8] they are still much higher compared to developed countries, like the US (2.2 in 2022) and France (1.59 in 2024).[9–11] Higher fertility rates can also result in a shortage of resources, reduce educational achievement and lead to malnutrition caused by poverty in the family.[10]

The advantages of using contraception are not limited to family planning but also extend to women's autonomy in reproductive decision-making.[6] This is in line with the United Nation's Sustainable Development Goal that calls for universal access to reproductive health services without discrimination.[12] Notwithstanding all the advantages, 164 million women worldwide do not have access to their preferred contraceptive methods, as of a 2022 report of the World Family Planning arm of the UN, due to poverty, decreased healthcare access and availability of qualified healthcare workers.[13] Data from the French Research, Studies, and Evaluation Directorate 2022 also showed a rise in abortion rates, especially among 20-29 year-old women, which may have been related to the COVID 19 pandemic.[14]

University students are mostly young individuals that are between the ages of 18 and 24; this is the period where many students discover sexuality through romantic and sexual relationships; as a result, the students are exposed to various risky behaviours, which include unprotected sex, multiple sexual partners, frequent partner changes, abortions attempts.[15,16] These behaviors also increased the risk of unintended pregnancies during educational pursuits,[17] which can negatively impact their health, social well-being, and learning outcomes.[18] Findings from cross-sectional studies showed university students had poor knowledge of contraceptives.[19,20] In a recent study, more than one third (37.5%) had poor knowledge of contraceptives, indicating the need for health educators and professionals to provide accurate information and education about contraception methods to students.[21] In fact, some researchers argue that awareness of contraceptives among young people in tertiary institutions does not necessarily lead to increased uptake; as such, they recommend interventional training with an emphasis on the benefits of contraception to reduce misconceptions and increase access to and utilisation of contraceptive services among the students.[22] Other studies have also reported negative attitudes toward contraceptive use among students[23–25] with suboptimal usage rates[26,27] and frequent attempts to terminate pregnancies suggesting a high prevalence of unintended pregnancies and persistent gaps in contraceptive behavior,[27] therefore, these forms the basis for conducting the study.

To mitigate risky sexual behaviour among university students and enhance informed decisions regarding sexuality, age-appropriate interventions targeting contraceptive knowledge, attitudes, and behaviors should be implemented.[28] This is especially relevant because the students in this study are nursing students who will become future healthcare professionals and play a vital role in reproductive health promotion. To address this need, this study applied the TTM of behavior change to develop and evaluate a contraceptive education program for university students, a group with an increased potential for unprotected sexual intercourse. According to TTM, a widely accepted framework in health behavior change, people pass through different stages, including pre-contemplation, contemplation, preparation, action, maintenance, and termination. The use of theoretical models such as the TTM has been shown in previous studies to increase the efficacy of health interventions for a wide range of health behaviors, such as physical activity, nutrition and contraception.[29]

The TTM offers a process for managing behavioral change.[30] At the pre-contemplation stage, there is a lack of interest for contraception use, or participants are uninformed about it. The educational approaches are aimed at increasing the knowledge of the advantages of and the necessity for contraception. In the contemplation phase, people begin to consider using contraceptives in the next 6 months and require information regarding the pros and cons associated with different methods. The preparation period prior to initiation of use implies that contraceptive use is under imminent consideration and thus warrants support and detailed counseling about available methods. The action phase deals with the appropriate and consistent use of a contraceptive method while addressing anticipated obstacles. The maintenance phase focuses on long-term adherence to foster routine consults and healthy lifestyle behaviors. Lastly, the discontinuation phase, which includes

long-term use of contraception, requires surveillance and individual advice according to specific indications and situations.

Although some studies have assessed the effect of TTM-based intervention on contraceptive knowledge, attitude, childbearing decision-making, and sexual confidence among married women and patient groups;[31–33] few studies were conducted among college students: one was a correlational study that focused on related factors of sexual abstinence behavior,[34] and one was a quasi-experimental study (one-group pre-test, post-test) that assessed only female students' sexual health knowledge and behavior.[35] Despite the vulnerability of university students to the earlier mentioned risky behaviours and the potential of TTM-based education to improve contraceptive–related outcomes, there is no published literature on randomized control trials that has evaluated such an approach in this population, forming a literature gap that this study filled. Therefore, this study aimed to evaluate the effect of a TTM-based contraceptive education program on university students' contraceptive knowledge, attitude, and behaviors. The study's findings revealed that implementing a TTM-based intervention enhanced university students' contraceptive knowledge, attitudes, and behaviors. In addition, it addressed the identified literature gaps and enhanced the existing body of work on theory-driven, evidence-based educational strategies for advancing reproductive health education; thus, it provided vital recommendations for future research, practice, and policy formulation in this important area.

Hypothesis

H1: Nursing students in the experimental group who received contraceptive-methods training integrated with the TTM will demonstrate significantly higher levels of contraceptive knowledge after the intervention compared to those in the control group.
H2: Nursing students in the experimental group who received contraceptive-methods training integrated with the TTM will demonstrate significantly more positive attitude after the intervention compared to those in the control group.
H3: Nursing students in the experimental group who received contraceptive-methods training integrated with the TTM will demonstrate significantly improved contraceptive behaviors after the intervention compared to those in the control group

Methods

Study design

The study was conducted as single-blind randomised controlled trial. The CONSORT 2010 statement for randomised studies was used for reporting. The study is registered at clinical trials.gov. NCT:07258966.

Population and sample of the study

The population of the study consists of N: 297 international students enrolled nursing at the Near East University. From the preliminary study conducted among the students in the spring semester of 2025 before the intervention study, 95 (32%) out of the 297 have low CBS Scores (0-14), this population therefore form the target for the study. The sample size was determined using G*Power 3.1.9.2 software. In the study by Keshmiri F et al.,[36] the effect size of an education program based on the Transtheoretical Model was reported as medium (0.77). Based on this effect size, the required sample size for a power of 85% ($1-\beta = 0.85$) at a significance level of 0.05 was calculated as 64 participants, with 32 participants in each group. Considering a potential attrition rate of 5%, an additional 4 participants were included ($64 \times 0.05 \approx 3.2$, rounded to 4). Accordingly, the final sample size was determined as 68 participants, with 34 participants allocated to the intervention group and 34 to the control group. One student was excluded from the intervention group due to non-attendance in the training sessions. The intervention group was completed with n = 33.

Inclusion criteria

This study used volunteers within the international nursing student group as participants. Other criteria, all are sexually active revealed in the demographic section of the questionnaire. Lastly, they are individuals with low scores (0-14 score) on the 'Contraceptive Behaviour Scale'.

Exclusion criteria

They are excluded those under the age of 18 among the participants and those who are planning a pregnancy.

Data collection tools

The evaluation form was divided into four distinct sections: the first section was focused on student demographics. The researcher prepared the ***"Socio-Demographic Section Form"*** by reviewing the literature on related studies,[6,37] which consists of 12 questions (age, gender, religion, contraceptive method use, etc.).The second section of the data collection instrument in this study is the *Contraceptive Knowledge Assessment Form (CKA)* developed by Haynes et al. in 2017. The items are Multiple Choice Questions (MCQ) consisting of 25 items with the target of assessing knowledge about contraceptive methods. It highlights the most relevant dimensions of preventing unintended pregnancy, linked to the understanding of contraceptive method use. Each correct response scored 1 point, while an incorrect response scored 0. A total score would be obtained by summation of the correct responses across the 25 items. Higher summative scores reflected good knowledge, while lower summative scores reflected poor knowledge. Total possible scores ranged from 0 to 25. The original scale has an internal consistency reliability value of 77% based on the Cronbach alpha coefficient [38]; it was validated in a related study with a Cronbach alpha value of 0.86.[39] In this study the Cronbach alpha value is 0.822.The third section focused on students' attitudes towards contraceptive use.***A Contraceptive Attitude Scale (CAS)*** tool developed by Black was used. It is composed of 32 items; the tool measures general attitude toward contraception; the scale is five Likert points. "Strongly disagree" receives a score of 1, and "strongly agree" receives a score of 5. The items of the tool are 17 positive items and 15 negative items, which participants indicate their agreement and disagreement with. For positively worded statements, 'strongly disagree' receives a score of 1 and 'strongly agree' receives a score of 5. Negatively worded questions were reversed so that all questions were positively scored. The total score was obtained by summing all the responses. Scores on the final result ranged from 32 to 160; the higher scores indicated more positive attitudes toward contraception, while lower scores indicated more negative attitudes toward contraception. The scale has a statistically significant test-retest reliability ($p<0.001$)[40], it was also validated in a related study among students with an alpha value of .82.[37] The Cronbach alpha value of this scale in this study was 0.863.Finally, the fourth section was about the assessment of nursing students' behaviour in relation to the use of contraceptive methods. The study used the ***Contraceptive Behaviour Scale (CBS)***, developed by Wang et al. The tool is composed of five items that aim to measure two dimensions of pregnancy prevention behaviour. The first is the use of contraceptives that affects numbers 1, 2, and 5 of the scale, and the second dimension reveals information about proactive prevention in numbers 3 and 4 of the scale. The scoring criteria for the scale are a minimum of 0 and a maximum of 20. Higher scores indicated positive contraceptive behaviors while lower scores indicated unfavorable or negative behavior. The scale is valid and reliable, the alpha value was 0.81 and the correlation coefficient was 0.94;[41] it was validated in another separate study and the alpha value was 0.73.[42] In this study the Cronbach's alpha value is 0.891.

Randomisation

Randomisation was determined using a simple randomisation technique, 'randomiser.org', by an expert other than the researcher to ensure randomisation. The researcher was informed of the result of the randomisation process with the closed envelope technique. After administering the pre-test, the researcher opened the envelopes to form the experimental and control groups.

Application

Experimental group

An interview was arranged in a classroom environment with the participants selected for the experimental group of the study. In addition, these initiatives were made:

Pre-Phase

The pre-assessment was carried out in the presence of the admitted students who meet the inclusion criteria. An introductory meeting was held with the

students. The purpose of the study was explained. The participants received the assessment sheet, which focused on the knowledge, attitude, and behavior of nursing students regarding contraceptive methods (***Contraceptive Knowledge Assessment Form (CKA)***, ***A Contraceptive Attitude Scale (CAS), Contraceptive Behaviour Scale (CBS)***). In this way, the first session was completed in 60 minutes. After the data collection forms were completed, the students were informed that they were in the experimental group.

Intra-phase

The researcher initially developed seven Transtheoretical Model-structured educational sessions. The content was reviewed by five experts (public health nursing, obstetrics and gynaecology nursing, sex therapist) and necessary corrections were made based on their feedback. The final content covered the following topics: the importance of contraceptive methods, common misconceptions about contraception, hyper fertility and unwanted pregnancies, sexually transmitted infections (STIs) and abortions, types of contraceptive methods, their effectiveness, advantages, disadvantages, contraindications, and educational guidance for students on how to apply TTM when working with clients. The material also included a PowerPoint presentation, educational videos, and scientific articles to enhance learning. Each session lasted 60 minutes and was held once a week over seven weeks; one topic was covered in each session. The integration of the TTM framework was systematically applied throughout the contraception education programme.

Session 1: Introduction and providing information about the purpose of the study

Session 2: **Importance of contraceptive methods**: The content was (Definition of contraceptive methods; Need of contraception; Characteristics of ideal contraception; Individual, social and economic benefits of contraceptive methods; Gender equality and family planning; Public health benefits of contraceptive methods; Contraceptive methods and Sustainable Development Goals; Connection of the topic and the TTM)

Session 3:**Misconceptions about contraceptive methods**: the content was (Introduction to contraceptive use and misinformation; The impact of misinformation on individual choices, health outcomes, and social well-being; Statistics indicating misinformation in different part of the world; Common misconception on contraceptive; Origins of misconceptions; Factors contributing to the limitation to modern contraception; Obstacles to contraceptive use; Strategies for overcoming misconceptions.

Session 4:**Awareness of excessive fertility and unwanted pregnancies**: the content here was (What is unintended pregnancy? ; Prevalence of unintended pregnancies in LMICs; Sensitivity of fertility and unwanted pregnancies; Window of fertility; Factors influencing fertility; Consequences of excessive fertility and unwanted pregnancies.

Session 5:**Sexually transmitted infections (STIs) and abortions**: Introduction to STIs; Sexual Transmitted Infectious (STIs); Unsafe Abortions; Lack of contraception as a root cause of STIs and Abortion; Breaking the cycle.

Session 6: Types of contraceptive methods, the topic stated (Importance of contraception; Types of contraceptive methods; Gender equality and family planning; Category of contraceptive methods; Classification of contraceptive methods; Effects of contraceptive use.

Session 7: **Effectiveness of contraceptive methods** with its content (Understanding contraceptive effectiveness; Effectiveness in the context of contraception; Difference between perfect use and typical use; Factors determining the effectiveness of contraceptive methods)

Session 8: **Advantages, disadvantages, contraindications & Educational guidance for students can learn "how to use the TTM on their clients**". (Research found on hormonal contraceptive methods; Contraindications based World Health Organization Medical Eligibility Criteria for contraceptive use; Advantages and Disadvantages of several Contraceptive methods)

Post-phase

The post-assessment test was conducted one week after the intervention phase. The same pre-assessment test was repeated, and students were asked to complete the part of the form regarding knowledge, attitude, and behaviour. The forms to be administered in the posttest included the Contraceptive Knowledge Assessment (CKA) form**,** the Contraceptive Attitude Scale (CAS), and the Contraceptive Behaviour Scale (CBS)**.**

Control group

Pre-phase

A classroom setting was used to administer the pre-assessment test for the Contraceptive Method Competencies Assessment Form, which evaluated nursing students' use of contraceptive methods. The pre-assessment included a sociodemographic information form, the Contraceptive Knowledge Assessment (CKA) Form, the Contraceptive Attitude Scale (CAS), and the Contraceptive Behaviour Scale (CBS).

Intra-phase

At this stage, students did not receive any specific intervention. They followed the normal courses; some elementary information regarding reproductive health is included in different topics in their curriculum.

Post-phase

Control group were scheduled together with the intervention group to complete the post-test again. The posttest was conducted in the same format and with the same content as the pretest. It included the Contraceptive Knowledge Assessment (CKA) Form, the Contraceptive Attitude Scale (CAS), and the Contraceptive Behaviour Scale (CBS).
Dependent variables*:* Contraceptive method competencies that include knowledge, attitude and behavior
Independent variables: Transtheoretical Model-based training, socio-demographic section form

Statistical analysis

The data were analysed using SPSS version 27; data normality was assessed using the Shapiro-Wilk test; the results indicated the variables were not normally distributed. Descriptive statistics were calculated, including frequencies and percentages for categorical variables and medians with interquartile ranges for continuous variables. To examine differences over time within groups, the Wilcoxon signed-rank test was used, and between-group differences were analysed using the Mann-Whitney U test. All tests were two-tailed with the level of significance set at $\alpha = .05$. Effect sizes (r) were computed to complement significance testing.

Ethical considerations

Ethical approval from Institutional Review Board (IRB) was obtained from the Near East University (1891/2024/127). Permission was also obtained from the Nursing Faculty. In accordance with the "Declaration of Helsinki on Human Rights the participants voluntarily participated in this research. Informed consent was obtained from the nursing students who participated in the study.

Results

According to results in Table 1, the homogeneity test compared personal information between the intervention and control groups (both n = 34). No statistically significant differences were found in demographic and reproductive variables, suggesting baseline equivalence between groups. Specifically, age did not differ significantly (χ^2 (1) = 16.89, p = .462). These findings suggest that both groups were comparable before the intervention, supporting the validity of subsequent comparisons.

Table 2 reveal that A Mann-Whitney U test was used to compare pre- and post-test scores between the intervention and control groups to determine the effect of the TTM intervention on nursing students' contraceptive knowledge, attitude, and behavior. While there were no significant differences between the groups at baseline, the intervention group showed significant improvements in all three areas post-intervention compared to the control group ($p<.001$).
Knowledge: The intervention group's median score significantly increased from 7.00 to 22.00, while the control group's median score showed a mild increase to 9.00. This difference was highly significant ($Z=-7.003$, $p<.001$, $r=0.85$), indicating a large effect size.
Attitude: The intervention group's median score increased significantly to 131.00 compared to the control group's 101.00. This difference was statistically significant ($Z=-6.859$, $p<.001$, $r=0.83$), also showing a large effect size.
Behavior: The intervention group's median score increased to 17.00, significantly higher than the control group's 11.00. This was a statistically significant difference ($Z=-6.579$, $p<.001$, $r=0.80$) with a large effect size.

Table 3 show that, a Wilcoxon signed-rank test was conducted to assess the within-group effect

Table 1: Sociodemographic and comparing homogeneity test between personal information of the groups (n = 68)

Variables		**Intervention n=34**	**Control n=34**	**X^2**	**P**
Age		24.59±4.554	23.65±3.541	16.887	0.462
Gender	Female	18	20	4.031	0.133
	Male	16	11		
	Not mentioned	0	3		
Religion	Protestants	10	16	5.962	0.113
	Muslim	10	7		
	Catholics	10	11		
	Other specify	4	0		
Marital status	Single	24	26	2.099	0.552
	Married	3	2		
	Had a relationship	7	6		
Contraceptive method use	No	28	25	0.770	0.380
	Yes	6	9		
Having children	No	29	29	0.000	1.000
	Yes	5	5		
Having an unwanted pregnancy or curettage	No	33	32	0.349	0.555
	Yes	1	2		
Any training or consultancy on this subject	No	19	18	0.059	0.808
	Yes	15	16		

Note: X^2 = chisquare, p = p value, n = number of participants

Table 2: Comparing between groups contraceptive knowledge, attitude and behavior scores (n = 67)

Scales		**Intervention Group Median (IQR)**	**Control Group Median (IQR)**	**Z statistics**	***p*-value**	**Cohen's *d* effect size**
	Pre-test	7.00 (11)	7.00 (7)	-.922	.356	
CKA	Post-test	22.00 (3)	9.00 (5)	-7.003	**.000**	0.85
	Pre-test	99.00	99.00 (12)	-.835	.404	
CAS	Post-test	131.00 (13)	101.00 (9)	-6.859	**.000**	0.83
CBS	Pre-test	4.00 (10)	8.50 (8)	-1.788	.074	
	Post-test	17.00 (4)	11.00 (5)	-6.579	**.000**	0.80

Note: Mann-Whitney U test, IQR = interquartile range, CKA = contraceptive knowledge assessment,CAS = contraceptive attitude scale, CBS = contraceptive behaviour scale.

of the TTM intervention on pre-test and post-test contraceptive knowledge, attitude and behavior scores.In the intervention group, there was a statistically significant increase in knowledge scores following the intervention (pre-test median = 7.00, interquartile range = 11; post-test median = 22.00, interquartile range = 3, Z = -4.917, p < .001) with a large effect size (r = 0.60), indicating a substantial improvement in contraceptive knowledge. As shown in Table 3, a Wilcoxon signed-rank test was conducted to assess the within-group effect of the TTM intervention on pre-test and post-test contraceptive attitude scores.

In the intervention group, there was a statistically significant improvement in attitude scores after the intervention (pre-test median = 99.00, interquartile range = 13; post-test median = 131.00, interquartile range = 13, Z = -4.750, p < .001,) with a large effect size (r = 0.58), indicating a meaningful improvement in contraceptive attitude.

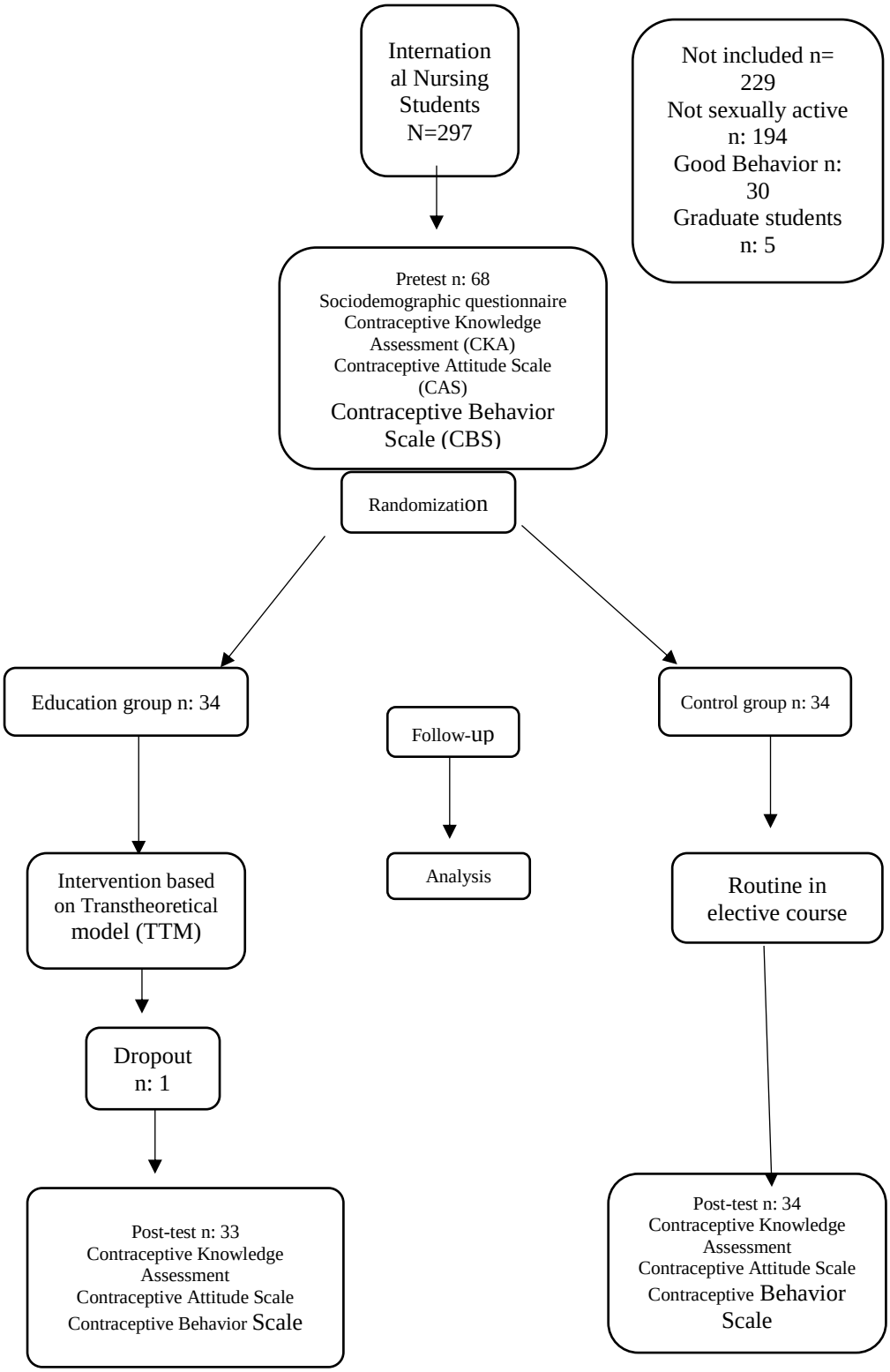

Figure 1: Flow chart of the second phase of the study

Table 3. Comparing within intervention groups contraceptive knowledge, attitude and behavior pre-test and post-test score (n = 33)

Scales	Pre test Median (IQR)	Post test Median (IQR)	Z statistics	*p*-value	Cohen's *d* effect size
CKA	7.00 (11)	22.00 (3)	-4.917[b]	**.000**	0.60
CAS	99.00 (13)	131.00 (13)	-4.750[b]	**.000**	0.58
CBS	4.00 (10)	17.00 (4)	-5.015[b]	**.000**	0.61

Note: Wilcoxon Test, IQR = interquartile range, CKA = contraceptive knowledge assessment, CAS = contraceptive attitude scale, CBS = contraceptive behaviour scale.

From the results in Table 3, a Wilcoxon signed-rank test was conducted to assess the within-group effect of the TTM intervention on changes in contraceptive behaviour scores. In the intervention group, there was a statistically significant improvement in behaviour scores following the intervention (pre-test median = 4.00, interquartile range = 10; post-test median = 17.00, interquartile range = 4, Z = -5.015, p < .001) with a large effect size (r = 0.61), indicating a notable positive change in contraceptive behavior

Discussion

A review of literature by the researcher revealed no interventional study that examined the effect of TTM-based education on contraceptive knowledge, attitude, and behaviour using the same instrument as this study. Consequently, the discussion references findings from studies that used the TTM-based intervention to assess closely related constructs, such as sexual health knowledge, attitudes, and behaviours among women, as well as those that evaluated contraceptive-related outcomes using different instruments. Considering previous studies offers beneficial perspectives on how the TTM influences health-related behavioural change while also emphasizing the novelty of the present study in applying it to contraceptive education using recent standardised tools.

The findings from the homogeneity test of personal information and reproductive factors showed that the intervention and control groups were equivalent prior to the intervention, thereby strengthening the validity of the study and enhancing confidence that any differences in the subsequent comparisons may be related to the intervention effect, rather than the pre-existing group differences. This finding is consistent with those of,[31,33] who also reported baseline equivalence before TTM intervention studies.

Before the intervention, there were no significant differences between the groups in their median scores of CKA, CAS and CBS. Suggesting comparable contraceptive knowledge, attitudes and Behaviour before the intervention, this is similar to what is reported in the results of,[31] the researchers reported that the participants were comparable before the interventions on their family planning knowledge, attitude and practice. In a related finding,[32] results showed the participants in both intervention and control group were not significantly different in terms of their childbearing behaviour decision scores before the intervention. From the findings of the two related research, it shows that baseline similarity of the two groups represent a feature of well-designed RCTs study.

Following the implementation of the intervention, there was a statistically significant increase in knowledge scores in the intervention group with a large effect size indicating a substantial improvement in contraceptive knowledge. This finding is in agreement with quasi-experimental study of Karatana et al, which showed college health student sexual health knowledge test score were significantly higher at post-test and follow-up.[35] In a similar finding among women in Iran,[43] education intervention based on TTM significantly improved the participant's knowledge of Pap smear screening after the intervention, furthermore findings of research among cervical cancer patients by Tung et al. found TTM based education significantly improved sexual health knowledge of the participants. The consistent report of significant gains after the intervention demonstrated the effectiveness of TTM-based intervention in enhancing knowledge among the participants. After the application of the TTM intervention, there was a statistically significant improvement in attitude scores in the intervention group when the pre-test was compared with the posttest with a large effect size, indicating a meaningful improvement in

contraceptive attitude. This is consistent with the findings of Kamalikhah et al. and Tung et al., as both reported significant improvement in family planning knowledge and sexual knowledge respectively. Considering all the related findings, it supports the assertion that TTM-based interventions can foster positive attitudinal change towards reproductive health, especially contraceptive attitude.

Following the application of TTM intervention, there was a statistically significant improvement in behaviour scores in the intervention when pre-test was compared with the posttest with a large effect size, indicating a notable positive change in contraceptive behaviour. Kamalikhah et al. reported significant improvement in family planning practice in study. Furthermore, similar findings were reported by Jalambani in which the participants reported change in sexual function when pretest was compared with posttest.[44] Collectively, the above results suggest the effectiveness of TTM-based interventions in promoting not only knowledge and attitude but also meaningful behavioural changes in contraceptive behaviour.

Following the implementation of TTM intervention, a significant difference emerged between the intervention and control groups in post-test contraceptive knowledge scores, indicating a large effect size and demonstrating a substantial effect of the intervention on improving contraceptive knowledge. Similar findings have been reported in related studies. Tung et al. found that TTM-based sexual health education significantly improved sexual knowledge among cervical cancer patients in Türkiye, while Lee JT and Tsai JL reported comparable improvements in sexual knowledge among postpartum women in northern Taiwan following a TTM-based intervention.[45] The consistent evidence of significant post-intervention gains, particularly when compared with control groups, contributes to a growing body of literature supporting the effectiveness of TTM as a sexual health education model. These findings further suggest that TTM may offer even greater benefits when applied in contraceptive education.

In this study, the implementation of TTM intervention demonstrated a significant difference between the intervention and control groups in post-test contraceptive attitude scores, indicating a large effect size and demonstrating the effectiveness of the intervention on improving contraceptive attitudes. Similar findings have been reported in previous studies; Majid et al. reported significant improvement in mean scores of attitude toward childbearing among women of reproductive age in the intervention group compared to the control group following a TTM-based education. Similarly, Kamalikah et al. findings indicated a significant difference in the family planning attitudes of the participants in both groups; additionally, Tung et al. reported a significant improvement in the sexual attitudes of the participants in the experimental and control groups. Findings across different studies indicated that TTM-based interventions possess a strong potential for enhancing participants' attitudes.

Following the application of TTM intervention, when the posttest CBS scores of the participants in the intervention and control groups were compared, a significant difference was obtained, reflecting a large effect size of the intervention on improving participants' contraceptive behaviour. The study findings by Gharamani et al. indicated that participants in the intervention group had a significant improvement in their Pap smear screening behaviour compared to the control group ($p < 0.001$). Ansari-Majd et al., also found training based on a TTM model improved the process of changing the structure of reproductive health behaviours for women in the intervention group (109.34±17.81) compared to the control group. However, contrasting evidence was reported in another study among women of reproductive age in Iran, where TTM-based education did not significantly affect stages of childbearing behaviour. These mixed findings suggest that, while TTM-based interventions are generally effective at promoting positive reproductive health behaviours, their effects may vary depending on specific behavioural domains and contextual factors.

Conclusion

This study investigated the effects of a TTM-based intervention on contraceptive knowledge, attitudes, and behaviours among international nursing students at Near East University in the Turkish Republic of Northern Cyprus. The findings demonstrated that, compared to the control group,

the intervention group showed significant and meaningful improvements in all three outcomes (knowledge, attitude, and behaviour), indicating the effectiveness of a structured, theory-driven educational approach. The findings emphasised the value of TTM as a theory for facilitating positive behavioural changes in reproductive health. By enhancing students' contraceptive knowledge and fostering more favorable attitudes, the intervention translated into improved behavioural practices, suggesting that such programs can empower nursing students not only with their personal health choices but also as future advocates and educators in clinical and community settings. Its successful application in this setting suggests that similar evidence-based educational strategies could play a crucial role in advancing reproductive health education, ultimately benefiting both nursing students and the wider communities they will serve.

Recommendations

For nursing education

It may be beneficial to integrate TTM-based health education in nursing curricula to strengthen students' competencies in reproductive health and behavior-changing counselling. Contraceptive education could be embedded as a core component of health promotion courses, to ensure students gain both theoretical and practical communication skills. Interactive and participatory teaching methods like role-play and peer teaching may be adopted to encourage critical thinking and self-reflection on reproductive health decisions.

For nursing research

First, Longitudinal studies may be conducted to evaluate the sustainability of improvements in knowledge, attitudes, and behavior over time. Second, the intervention could be replicated in diverse cultural and institutional contexts to strengthen external validity and generalizability. Next, it can be suggested to Explore blended interventions (face-to-face and mobile or online) modules to expand accessibility for a wider student population. Again, the impacts of TTM-based interventions on other health behaviors (nutrition, exercise, and preventive screening) may be investigated to broaden their applicability in nursing education. Lastly, the use of broader outcome measures, such as self-efficacy, decision-making skills, and communication competence, could be assessed to capture a more comprehensive effect of the intervention.

For practice

Nurses may be encouraged to apply TTM to patient counselling, particularly in reproductive and sexual health services. Evidence-based contraceptive counselling can be promoted in clinical settings by equipping nurses to effectively address myths, misconceptions, and cultural barriers. A supportive practice environment could be fostered to allow student nurses to practice health education skills during clinical placements under supervision. Nurses can be positioned as change agents who may advocate for reproductive health and empower individuals to make informed decisions.

For policy

Sexual and reproductive health education may be implemented in nursing curricula as a compulsory course instead of an elective to ensure graduates are adequately prepared to tackle contraceptive and sexual health needs.

Institutional policies that supported sexual health promotion initiatives should be grounded on behavioral change theories such as TTM.

Strengths of the study

The study was based on TTM, a well-known behavior-change model that enhanced the intervention's design, validity, and interpretability. Furthermore, the design of the study (RCT), specifically utilizing a pre-test and post-test design, ensures a reliable method for assessing the intervention effect. In addition, the intervention focused on a sensitive and important construct (contraceptive behavior) that has personal and professional benefits for the nursing students. Lastly, the findings contribute to the growing literature on TTM-based intervention applications in higher education, particularly for international nursing students.

Limitations

The study was conducted among a sample of international nursing students at a single university,

which limits generalizing the findings to all students in NEU. Second data was collected after the intervention only; therefore, conclusions regarding the long-term sustainability of participants' contraceptive knowledge, attitudes, and behaviors cannot be determined. Finally, the personal experiences and viewpoints of the participants in the intervention were not assessed, which limits deeper insight into the overall intervention process.

Acknowledgements

The authors express their heart felt to all international nursing students that participated in this study. The trial registration is in progress on clinical trial.gov. This study has no funding source; authors are responsible to cover the publication fee.

Author contributions

Jonathan Niciza: Conceptualization, investigation, methodology, writing original draft, writing review and editing. Ümran Dal YILMAZ: Supervision, writing review and editing, validation. All authors mentioned in article approved the manuscript

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