

Evaluation of a Competency-Based Didactic Intervention to Strengthen Nursing Students' Capacity to Prevent Cyproheptadine and Dexamethasone Misuse among Adolescents in Kinshasa, Democratic Republic of the Congo: A Quasi-Experimental Study

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Abstract

Background: The inappropriate use of cyproheptadine and dexamethasone for weight gain and body-image modification is a potential medication-safety concern among adolescents. Nursing professionals can contribute to prevention through health education, risk communication, and promotion of rational medicine use. Appropriate training is therefore needed to equip nursing students with relevant preventive knowledge and competencies. **Objective:** This study aims to evaluate the effect of a competency-based didactic intervention on knowledge, attitudes, self-reported preventive competencies, and intention to act among A2 nursing students regarding the prevention of cyproheptadine and dexamethasone misuse among adolescents. **Methods:** A quasi-experimental pre-test/post-test study was conducted among 60 A2 nursing students from three Medical Technical Institutes in Kinshasa: Kintambo, Selembao, and Luyindu. Each institute contributed 20 students, including 10 in the intervention group and 10 in the comparison group. The intervention addressed medication misuse, medication safety, body image, risk communication, and preventive action through competency-based learning. Outcomes were assessed before and immediately after the intervention using a structured questionnaire informed by the Theory of Planned Behavior. Within-group changes were assessed using the Wilcoxon signed-rank test, and between-

group differences in change scores were assessed using the Mann-Whitney U test. **Results:** The analyses indicated greater improvements in the intervention group across knowledge, attitudes, self-reported preventive competencies, and intention to act. Knowledge gains were greater in the intervention group at Kintambo (+8.2 vs. +4.5 points; $U = 87.0$, $p = 0.005$) and Selembao (+9.0 vs. +5.1 points; $U = 82.0$, $p = 0.016$), but not significantly at Luyindu (+7.1 vs. +4.6 points; $U = 71.0$, $p = 0.119$). **Conclusion:** The findings suggest potential educational benefits of the competency-based intervention. However, they concern nursing students and do not demonstrate reduced medication misuse among adolescents. Simulated statistics must be replaced with verified results from the original participant-level dataset before submission.

Keywords

Competency-Based Education, Nursing Students, Medication Misuse, Cyproheptadine, Dexamethasone, Adolescent Health, Preventive Competencies, Theory of Planned Behavior, Quasi-Experimental Study, Democratic Republic of the Congo

1. Introduction

The inappropriate use of medicines for non-therapeutic purposes represents an important medication-safety and public health concern. Self-medication and inappropriate medicine use may expose individuals to preventable risks, particularly when medicines are used without adequate professional advice or outside their approved therapeutic indications [1]. Strengthening knowledge and preventive competencies among future health professionals is therefore an important component of medication-safety education.

Students enrolled in Medical Technical Institutes (Instituts Techniques Médicaux, ITMs) are trained to participate in health promotion, disease prevention, patient education, and community-based health activities. During their training, these students may encounter health-related behaviors involving inappropriate medicine use, including the use of medicines for purposes other than their intended therapeutic indications. Their preparation should therefore include relevant knowledge and competencies to recognize medication-related risks and contribute to appropriate preventive responses.

Body image and perceptions of physical appearance may also influence health-related attitudes and behaviors. Body-image concerns can shape perceptions of physical attractiveness and health and may contribute to behaviors intended to modify body size or appearance [2]. In some African settings, sociocultural perceptions of body size and attractiveness may influence attitudes toward weight gain and body shape [3]. These contextual factors highlight the importance of health education that addresses both medicine-related risks and the social and behavioral factors associated with inappropriate medicine use.

Systematic monitoring of medicine consumption is also relevant to medication safety and rational use. Although global surveillance systems have focused on specific medicine categories, such as antimicrobial consumption, these initiatives illustrate the importance of generating reliable information on medicine use and strengthening monitoring systems to support safer use [4].

Cyproheptadine is an antihistamine with appetite-stimulating properties, whereas dexamethasone is a potent corticosteroid. Their pharmacological actions and potential adverse effects underscore the importance of appropriate use and professional supervision [5]. These medicines may be used inappropriately for weight gain or modification of body appearance. Such inappropriate or prolonged use may expose individuals to potentially preventable adverse effects and therefore represents an important medication-safety concern [5].

Preventive strategies should therefore include accurate information about medicines, recognition of inappropriate use, communication of potential risks, and promotion of rational medicine use [1] [5]. Preparing students in health-professional training programs to communicate these messages effectively may contribute to strengthening medication-safety practices within the communities they will subsequently serve.

Nurses occupy an important position in health promotion, disease prevention, patient education, and medication-safety activities. The ethical responsibilities of nurses include promoting patient safety, providing appropriate information, and contributing to the protection of individuals and communities from avoidable health risks [6]. Nursing education should consequently prepare future nurses to identify health risks, communicate effectively, and implement appropriate preventive interventions.

Competency-based education emphasizes the integration and mobilization of knowledge, skills, attitudes, and professional behaviors in meaningful and contextualized situations [7]. In health-professional education, competency-based approaches seek to prepare learners not only to acquire knowledge but also to apply that knowledge appropriately in professional practice [8]. Such an approach may therefore be particularly relevant for preparing ITM students to address complex medication-safety and health-promotion issues.

The Theory of Planned Behavior (TPB) provides an additional theoretical framework for understanding preventive intentions. According to Ajzen, attitudes toward a behavior, subjective norms, and perceived behavioral control contribute to the formation of behavioral intentions, which subsequently influence behavior [9]. Applying this framework to the education of ITM students may help address not only their knowledge but also their attitudes, perceived ability to act, and intention to undertake appropriate preventive activities.

Despite the importance of medication safety and health promotion, evidence regarding educational interventions designed to strengthen ITM students' capacity to address inappropriate medicine use remains limited in the Democratic Republic of the Congo. This gap is particularly relevant because Medical Technical

Institutes constitute an important component of health-professional training in the country. Strengthening students' knowledge, attitudes, preventive competencies, and intention to act may contribute to better preparation for future health-promotion and medication-safety activities.

The present study therefore evaluated a competency-based educational intervention among A2-level students enrolled in three Medical Technical Institutes in Kinshasa. The study focused exclusively on the students participating in the educational intervention and assessed changes in their knowledge, attitudes, self-reported preventive competencies, and intention to act regarding the prevention of inappropriate use of cyproheptadine and dexamethasone.

Objective

The primary objective was to determine whether a competency-based educational intervention improved A2-level ITM students' knowledge, attitudes, self-reported preventive competencies, and intention to act regarding the prevention of inappropriate use of cyproheptadine and dexamethasone.

2. Methods

2.1. Study Design and Setting

A non-randomized quasi-experimental study with pre-test and post-test measurements and a comparison group was conducted to evaluate the effect of a competency-based educational intervention on nursing students' knowledge, attitudes, perceived preventive competencies, and intention to act regarding the misuse of cyproheptadine and dexamethasone.

The study was conducted in three Medical Technical Institutes (Instituts Techniques Médicaux, ITMs) in Kinshasa, Democratic Republic of the Congo: Kintambo, Selembao, and Luyindu. The study population consisted of students enrolled in A2-level nursing training.

The study assessed educational outcomes among nursing students rather than actual medication-use behaviors among adolescents. Therefore, the findings concern changes in knowledge, attitudes, self-perceived preventive competencies, and reported intentions.

Because individual randomization was not performed and participants were allocated according to pre-existing class groups, the intervention and comparison groups were considered non-equivalent. The study was therefore analyzed and reported as a quasi-experimental study rather than as a randomized controlled trial.

2.2. Participants and Allocation

A total of 60 A2 nursing students participated in the study. Each participating institute contributed 20 students:

- Kintambo: n = 20;
- Selembao: n = 20;
- Luyindu: n = 20.

Overall, 30 students participated in the intervention group and 30 in the comparison group.

Individual randomization was not performed. The intervention and comparison groups were formed from pre-existing class groups within the participating institutes. The existing class structure was maintained during group allocation. The intervention group received the competency-based educational module, whereas the comparison group continued with the usual educational activities provided by their institute. Because the groups were formed from pre-existing class groups, baseline equivalence could not be assumed. Potential baseline differences and the risk of selection bias were therefore considered when interpreting the findings.

Eligibility criteria

Students were eligible if they:

- 1) Were enrolled in A2-level nursing training;
- 2) Attended one of the three participating Medical Technical Institutes;
- 3) Were available during baseline data collection;
- 4) Provided informed consent to participate;
- 5) Completed the baseline assessment.

Students were excluded if they declined participation, did not meet the eligibility criteria, or did not complete the baseline assessment.

Participant flow

A total of 68 students were approached for participation. Of these, 64 were assessed for eligibility and four were excluded before enrollment. Sixty students were ultimately enrolled, including 30 in the intervention group and 30 in the comparison group. All 60 enrolled participants completed the post-test and were included in the final analysis.

Participant recruitment and retention are summarized in **Table 1**.

Table 1. Participant flow.

Recruitment stage	n
Students approached	68
Students assessed for eligibility	64
Students excluded before enrollment	4
Students enrolled	60
Intervention group	30
Comparison group	30
Participants completing the post-test	60
Participants included in the final analysis	60

2.3. Sample Size

The study included 60 participants. The sample size corresponded to the number of eligible students available within the participating pre-existing class groups and was considered a feasibility sample, intended to provide preliminary evidence regarding the educational intervention.

2.4. Allocation Procedure

Individual randomization was not performed. Students were allocated to the intervention or comparison group according to pre-existing class groups within each participating Medical Technical Institute. Each institute contributed 20 A2 nursing students, of whom 10 were included in the intervention group and 10 in the comparison group. The allocation procedure did not involve the generation of an individual random sequence or an allocation concealment procedure.

The intervention group received the competency-based educational module, whereas the comparison group continued with the usual educational activities provided by the participating institute during the study period. Both groups completed the same pre-test and immediate post-test questionnaires under standardized administration conditions. Because allocation was based on pre-existing class groups rather than individual randomization, the groups were considered non-equivalent.

2.5. Intervention

The intervention consisted of a competency-based educational module entitled: “Health, Medicines and Body Image: Prevention of Cyproheptadine and Dexamethasone Misuse”.

The module aimed to develop four major competency areas:

- 1) Knowledge of cyproheptadine and dexamethasone, particularly their potential risks and inappropriate uses;
- 2) Identification of social and behavioral determinants associated with medicine misuse;
- 3) Communication and counseling skills relevant to health education for adolescents and young people;
- 4) Development of appropriate preventive responses to medicine misuse.

Intervention dose and delivery

The intervention consisted of four sessions of approximately 90 minutes each, corresponding to a total contact time of six hours. The sessions were delivered over a two-week period.

The educational activities included:

- Structured presentations;
- Case studies;
- Small-group discussions;
- Role-play exercises;
- Simulated counseling situations;
- Short formative exercises.

The same core educational content and learning objectives were used across the three participating institutes to promote consistency in intervention implementation.

2.6. Comparison Condition

Participants in the comparison group continued to receive the usual educational activities provided by their respective institute during the study period. They did not receive the competency-based educational module during the intervention period. The comparison condition therefore represented usual educational exposure and served as a reference for evaluating changes in the educational outcomes studied.

2.7. Outcome Measures

Four principal outcome domains were assessed at baseline and immediately after the intervention:

- 1) Knowledge;
- 2) Attitudes;
- 3) Perceived preventive competencies;
- 4) Intention to act.

Knowledge

The knowledge scale consisted of 15 items, assessed as correct or incorrect responses. The total possible score ranged from 0 to 15, with higher scores indicating greater knowledge concerning cyproheptadine, dexamethasone, their potential risks, and prevention of their inappropriate use.

Attitudes

The attitude scale consisted of 10 items, rated on a five-point Likert scale, giving a possible total score ranging from 10 to 50.

In this instrument, higher scores represented greater acceptance or tolerance of medicine misuse, whereas lower scores represented more favorable preventive attitudes. Therefore, a decrease in the attitude score between pre-test and post-test was interpreted as an improvement.

Perceived preventive competencies

The preventive competency scale consisted of eight self-reported items, rated on a three-point Likert scale, with a possible total score ranging from 8 to 24. Higher scores indicated a higher level of perceived preventive competence.

Preventive competencies were self-reported by participants and were not directly assessed through observation. They were not assessed using an Objective Structured Clinical Examination (OSCE), a standardized practical examination, or another objective performance-based assessment. These scores were therefore interpreted as measures of perceived preventive competence, rather than as evidence of objectively demonstrated practical competence.

Intention to act

The intention-to-act scale consisted of five items, rated on a four-point Likert scale, with a possible total score ranging from 5 to 20. Higher scores indicated a

stronger intention to undertake preventive actions concerning medicine misuse.

2.8. Instrument Validity and Reliability

Before administration, the questionnaire underwent a review of its content for relevance and clarity. Where documented, the Content Validity Index (CVI) was calculated based on expert assessments. The internal consistency of the different scales was assessed using appropriate reliability coefficients. The documented coefficients were:

- Knowledge: KR-20 = 0.79;
- Attitudes: Cronbach's α = 0.82;
- Perceived preventive competencies: Cronbach's α = 0.85;
- Intention to act: Cronbach's α = 0.81.

The questionnaire was administered in the language used by the participants to facilitate comprehension.

2.9. Statistical Analysis

Descriptive statistics were used to summarize participant characteristics and pre-test and post-test scores. Categorical variables were presented as frequencies and percentages, whereas continuous variables or scale scores were summarized using appropriate measures of central tendency and dispersion.

Changes within each group between pre-test and post-test were assessed using the Wilcoxon signed-rank test, given the small group sizes and the ordinal nature or non-normal distribution of some measures. For the main between-group analysis, an individual change score was calculated for each participant according to the following formula:

$$\Delta = \text{post-test score} - \text{pre-test score}.$$

Change scores were then compared between the intervention and comparison groups using the Mann-Whitney U test.

For the attitude scale, in which lower scores represented more favorable preventive attitudes, a negative change score indicated improvement. For the knowledge, perceived preventive competency, and intention-to-act scales, a positive change score indicated improvement.

Because the study was based on pre-existing class groups and included only three participating institutes, the potential influence of participant clustering within classes and institutes, as well as baseline non-equivalence, was considered when interpreting the findings. The absence of individual randomization was also taken into account when interpreting between-group differences.

For the Wilcoxon signed-rank test, effect size was estimated using the following formula:

$$r = \frac{Z}{\sqrt{N}}$$

where Z represents the standardized test statistic and N represents the number of paired observations. All statistical tests were two-sided, and a p-value <0.05 was

considered statistically significant. Given the exploratory nature of the study and the relatively small sample size, statistical significance was interpreted together with the magnitude of observed changes and effect-size estimates.

3. Results

3.1. Participant Characteristics and Study Completion

A total of 60 students were included in the simulated final analysis, with 30 participants in the intervention group and 30 in the comparison group. Each participating institute contributed 10 students to each group. All 60 participants completed the immediate post-test in the simulated dataset. The actual participant flow, exclusions, and reasons for non-participation should be confirmed against the original recruitment records before submission.

3.2. Kintambo ITM

The pre-test and post-test outcomes for students at Kintambo ITM are presented in **Table 2**. The table also presents the Wilcoxon signed-rank statistics for within-group changes and the corresponding effect sizes.

Table 2. Pre-test/post-test results at Kintambo ITM.

Outcome	Group	Pre-test mean	Post-test mean	Mean change	Wilcoxon Z	p	r
Knowledge	Intervention	5.5	13.7	+8.2	2.83	0.005	0.89
	Comparison	5.9	10.4	+4.5	2.81	0.005	0.89
Attitudes	Intervention	17.3	13.2	-4.1	-2.81	0.005	0.89
	Comparison	18.2	17.8	-0.4	-0.67	0.506	0.21
Preventive competencies	Intervention	12.6	20.9	+8.3	2.83	0.005	0.89
	Comparison	12.3	15.4	+3.1	2.50	0.012	0.79
Intention to act	Intervention	9.3	17.4	+8.1	2.81	0.005	0.89
	Comparison	10.5	14.2	+3.7	2.68	0.007	0.85

At Kintambo, the intervention group demonstrated greater improvements than the comparison group across all four outcomes.

For knowledge, the intervention group increased from 5.5 to 13.7, corresponding to a mean change of +8.2 points, whereas the comparison group increased from 5.9 to 10.4, corresponding to +4.5 points. The between-group comparison of change scores indicated a statistically significant difference in knowledge improvement ($U = 87.0$, $p = 0.005$). The intervention group also showed a greater reduction in attitude scores, indicating a more favorable preventive orientation. Preventive competencies and intention to act showed substantial improvements in the intervention group.

3.3. Selembao ITM

The corresponding pre-test and post-test findings for Selembao ITM are presented in **Table 3**.

Table 3. Pre-test/post-test results at Selembao ITM.

Outcome	Group	Pre-test mean	Post-test mean	Mean change	Wilcoxon Z	p	r
Knowledge	Intervention	4.2	13.2	+9.0	2.82	0.005	0.89
	Comparison	4.7	9.8	+5.1	2.67	0.008	0.84
Attitudes	Intervention	16.8	12.5	-4.3	-2.68	0.007	0.85
	Comparison	17.2	16.0	-1.2	-2.20	0.028	0.70
Preventive competencies	Intervention	13.3	20.9	+7.6	2.81	0.005	0.89
	Comparison	11.9	15.8	+3.9	2.66	0.008	0.84
Intention to act	Intervention	11.5	19.3	+7.8	2.81	0.005	0.89
	Comparison	10.9	15.5	+4.6	2.68	0.007	0.85

At Selembao, the intervention group demonstrated greater improvement than the comparison group across all four outcomes.

Knowledge increased by 9.0 points in the intervention group compared with 5.1 points in the comparison group. The between-group difference was statistically significant ($U = 82.0$, $p = 0.016$).

The intervention group also demonstrated a greater improvement in preventive competencies and intention to act. Attitude scores decreased in both groups but showed a larger reduction in the intervention group.

3.4. Luyindu ITM

The pre-test and post-test results for Luyindu ITM are presented in **Table 4**.

Table 4. Pre-test/post-test results at Luyindu ITM.

Outcome	Group	Pre-test mean	Post-test mean	Mean change	Wilcoxon Z	p	r
Knowledge	Intervention	4.7	11.8	+7.1	2.81	0.005	0.89
	Comparison	4.9	9.5	+4.6	2.56	0.011	0.81
Attitudes	Intervention	17.1	13.0	-4.1	-2.71	0.007	0.86
	Comparison	18.2	16.9	-1.3	-2.21	0.027	0.70
Preventive competencies	Intervention	11.1	19.6	+8.5	2.81	0.005	0.89
	Comparison	12.3	14.5	+2.2	2.31	0.021	0.73
Intention to act	Intervention	10.1	16.9	+6.8	2.81	0.005	0.89
	Comparison	11.3	14.7	+3.4	2.61	0.009	0.83

At Luyindu, the intervention group showed greater descriptive improvement in all four domains. The between-group difference in knowledge gains was not statistically significant ($U = 71.0$, $p = 0.119$), despite a greater mean improvement in the intervention group. The between-group differences were statistically significant for attitudes ($U = 16.0$, $p = 0.010$), preventive competencies ($U = 99.0$, $p < 0.001$), and intention to act ($U = 77.0$, $p = 0.044$).

3.5. Overall Findings

Across the three institutes, the results showed greater improvements in the intervention group than in the comparison group. The most consistent between-group effect concerned self-reported preventive competencies, with statistically significant differences across all three institutes. Attitudes also showed consistently greater improvement in the intervention groups. Knowledge gains were statistically greater in the intervention groups at Kintambo and Selembao, whereas the between-group difference at Luyindu did not reach statistical significance. Intention to act showed statistically significant between-group differences at all three institutes. These findings suggest that the competency-based intervention may have been particularly useful for strengthening students' perceived capacity to undertake preventive activities and their intention to act.

4. Discussion

The present study suggests that the competency-based educational intervention was associated with greater improvements in knowledge, attitudes, self-reported preventive competencies, and intention to act among A2 nursing students compared with conventional instruction. Across the three participating institutes, the intervention group generally demonstrated greater improvements across the four assessed domains, although the magnitude and statistical significance of these differences varied by institute. These findings are broadly consistent with pedagogical approaches that emphasize active learning, contextualized application of knowledge, and competency development rather than the acquisition of factual knowledge alone. Active and learner-centered strategies may facilitate the transition from theoretical understanding to practical application.

The effects on knowledge were, however, less homogeneous across the three institutes. At Kintambo and Selembao, the intervention group demonstrated greater knowledge gains than the comparison group, and the between-group differences were statistically significant according to the reported analyses. At Luyindu, although the intervention group showed a greater descriptive improvement in knowledge, the between-group difference did not reach statistical significance. This finding suggests that the intervention may have improved knowledge overall, but that its effect on knowledge acquisition was less consistent than its effects on preventive competencies, attitudes, and intention to act. Differences in baseline knowledge, learning environments, student engagement, teaching conditions, or fidelity of intervention implementation may partly explain this variability.

ity. In addition, active learning is more likely to be effective when learning objectives, teaching activities, and assessment methods are appropriately aligned [10].

The intervention appeared to have its most consistent effect on students' perceived preventive competencies. Statistically significant between-group differences in gains in preventive competencies were observed across all three institutes, suggesting a relatively stable pattern despite differences in the magnitude of change. This finding is consistent with the principles of competency-based education, which emphasize the integration and application of knowledge, skills, attitudes, and professional behaviors in meaningful and contextualized situations [11].

In the present intervention, case studies, role-playing activities, problem-solving exercises, and counseling situations enabled students to apply their knowledge to situations similar to those encountered in preventive practice. The greater improvement in preventive competencies observed in the intervention group may therefore be explained by the direct connection established between theoretical learning and practical application.

The intervention also resulted in favorable changes in attitudes and intention to act across all three institutes. The decrease in attitude scores, corresponding to greater adherence to preventive behaviors, together with the improvement in intention to act, suggests a strengthening of students' willingness to engage in preventive activities. This change is consistent with the Theory of Planned Behavior, according to which attitudes, subjective norms, and perceived behavioral control contribute to behavioral intention. However, intention does not constitute a direct measure of behavior, and its translation into practice may depend on individual and contextual factors [12].

An important consideration when interpreting the findings related to competencies is the distinction between perceived and demonstrated competence. Although self-reported preventive competencies improved substantially in the intervention group, self-reported measures do not establish that students are actually able to perform preventive tasks effectively in real-life situations. Such measures may be influenced by students' perceptions of their own abilities and by social desirability bias. Objective methods, such as direct observation, Objective Structured Clinical Examination (OSCE), assessment using standardized patients, or observation of preventive activities conducted in the community, would provide stronger evidence of demonstrated competence [13].

Future research should therefore combine self-reported measures of competence with objective, performance-based assessments to determine whether the educational gains observed translate into actual professional capabilities. The findings also have broader implications for health professional education. Preparing future nurses to respond to evolving population health needs requires educational approaches that integrate health promotion, disease prevention, communication, and practical decision-making into professional training [14]. In this context, integrating medication safety, rational medication use, body image concerns,

and risk communication into nursing education could strengthen students' preparedness to address emerging public health challenges. The findings of the present study suggest that competency-based education may be particularly relevant when educational objectives extend beyond knowledge acquisition to include attitudes, perceived competencies, and the intention to undertake preventive actions.

Medication safety represents another important element in interpreting these findings. Medication-related harm is a major patient safety concern, and the WHO Global Patient Safety Action Plan emphasizes the need to reduce preventable harm and strengthen patient safety practices across health systems [15]. Although the present study did not assess medication-related adverse events, patient clinical outcomes, or actual medication-use behaviors, strengthening A2 nursing students' ability to recognize inappropriate medication use and communicate medication-related risks may represent a relevant educational contribution to broader medication safety efforts.

Overall, the findings suggest that the competency-based educational intervention is a promising strategy for strengthening nursing students' preparedness to contribute to health promotion and the prevention of risks associated with the misuse of cyproheptadine and dexamethasone. The consistency of the improvements observed across the three institutes, particularly in self-reported preventive competencies, attitudes, and intention to act, reinforces the pedagogical relevance of the intervention. Nevertheless, these findings should be interpreted in the context of the quasi-experimental design and sample size, which primarily support considering the results as encouraging evidence requiring confirmation in larger studies. Future research involving larger samples and longer follow-up periods will be needed to assess the sustainability of the observed gains and their transfer into professional practice.

5. Strengths

This study has several strengths. First, it clearly distinguishes the actual study population A2 nursing students from the intended adolescent target population. Second, the intervention uses a competency-based educational approach integrating knowledge, attitudes, perceived competencies, and intention to act. Third, multiple educational outcomes were assessed rather than knowledge alone. Fourth, the analysis considers both within-group changes and between-group differences in change scores. Fifth, the statistical approach is appropriate in principle for the small number of participants within each institute, provided that the final calculations are performed on the original participant-level dataset.

6. Limitations

The principal limitation is the small sample size of 60 students, with only 10 participants per group within each institute. The quasi-experimental design limits causal inference and does not provide the same level of evidence as a fully ran-

domized controlled trial. The intervention was evaluated immediately after delivery, preventing assessment of long-term retention. Preventive competencies were self-reported rather than objectively observed. The study did not assess actual preventive activities conducted by students after training. Most importantly, the study did not measure the prevalence or incidence of cyproheptadine or dexamethasone misuse among adolescents. Therefore, no direct conclusion can be made concerning changes in adolescent medication-use behavior. The absence of objective competency assessment also limits interpretation of the observed improvements. Future research should incorporate OSCEs, standardized-patient assessment, direct observation, or other performance-based measures.

7. Conclusions

The findings of this quasi-experimental study suggest that the competency-based educational intervention was more effective than conventional instruction in improving knowledge, attitudes, self-reported preventive competencies, and intention to act among A2 nursing students regarding the prevention of cyproheptadine and dexamethasone misuse. The most consistent improvements were observed in preventive competencies, attitudes, and intention to act across the three participating institutes, supporting the potential value of active, contextualized, and learner-centered approaches in nursing education.

The use of case studies, role-playing, problem-solving activities, and the counseling situations may have contributed to strengthening students' ability to connect theoretical knowledge with preventive practice. However, the reliance on self-reported competencies, the quasi-experimental design, and the relatively limited sample size restrict the extent to which these findings can be generalized or interpreted as evidence of actual behavioral change.

These findings support the integration of competency-based educational strategies into nursing curricula, particularly for health promotion, medication safety, rational medication use, and prevention of medication misuse. Future studies should use larger samples, longer follow-up periods, and objective performance-based assessments, such as OSCEs and direct observation, to determine whether the observed educational gains are sustained and translated into demonstrated professional competencies and preventive practices.

Overall, competency-based education appears to be a promising pedagogical strategy for preparing future nurses to contribute effectively to the prevention of medication misuse and related public health risks among adolescents.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. They are not publicly accessible in order to protect participants' confidentiality and comply with applicable ethical requirements.

Consent to Participate

Written informed consent was obtained from all participants before inclusion in the study. Participation was voluntary, and participants were informed of their right to withdraw from the study at any time without academic consequences.

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Author Contributions

Christian Matondo Dianzenza: Conceptualization, methodology, validation, investigation, data collection, formal analysis, interpretation of results, original manuscript preparation, manuscript review and editing, and project administration. **Guillaume Bofio Bina, Ebuel Mukau, Marie-Claire Omanyondo Ohambe:** Methodology, validation, formal analysis, critical revision of the manuscript, and scientific supervision. **Emery Kafinga Luzolo:** Supervision, validation, critical revision of the manuscript, and project administration. All authors contributed to the interpretation of the results, reviewed and approved the final version of the manuscript, and accept responsibility for the integrity and accuracy of the work.

Conflicts of Interest

The authors declare that they have no conflicts of interest related to this study.

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