



Application of gemoy interactive model to improve adolescents' compliance in controlling blood pressure in Tambang Sub-District

Yenny Safitri^{1*}, Muhammad Nurman², Juli Widiyanto³, Yeni Yarnita⁴, Dewi Sulastri Juwita⁵

^{1*), 2, 5} Department of Medical Surgery of Nursing, Universitas Pahlawan Tuanku Tambusai, Bangkinang, Riau

^{3, 4} Department of Nursing, Universitas Muhammadiyah Riau, Pekanbaru, Riau

ABSTRACT

Background: Hypertension among adolescents is an emerging public health concern, especially in rural Indonesian settings such as Tambang Sub-District. **Objectives:** This study investigates the effectiveness of the GEMOY Interactive Model in increasing adolescents' compliance with blood pressure control through an engaging, web-based platform. **Method:** A quasi-experimental design with pre- and post-test control groups was conducted among 80 adolescents aged 15–18 years. **Result:** The intervention group received access to the GEMOY application which includes gamified health education, peer support forums, and self-monitoring features, while the control group received standard education. The results showed a significant improvement in knowledge, self-efficacy, and behavioral compliance ($p < 0.05$) among the intervention group. **Conclusion:** These findings support the use of interactive digital health models in hypertension prevention among youth.

Keywords: Hypertension, adolescent

ABSTRAK

Latar Belakang: Hipertensi pada remaja merupakan masalah kesehatan masyarakat yang semakin mengemuka, khususnya di wilayah pedesaan Indonesia seperti Kecamatan Tambang. **Tujuan:** Studi ini menelaah efektivitas GEMOY Interactive Model dalam meningkatkan kepatuhan remaja terhadap pengendalian tekanan darah melalui platform berbasis web yang menarik. **Metode:** Penelitian menggunakan rancangan kuasi-eksperimental dengan kelompok kontrol pre-test dan post-test pada 80 remaja berusia 15–18 tahun. **Hasil:** Kelompok intervensi mendapatkan akses ke aplikasi GEMOY yang mencakup edukasi kesehatan berbasis gamifikasi, forum dukungan sebaya, dan fitur pemantauan mandiri, sementara kelompok kontrol menerima edukasi standar. Hasil menunjukkan peningkatan yang bermakna pada pengetahuan, efikasi diri, dan kepatuhan perilaku ($p < 0,05$) pada kelompok intervensi. **Kesimpulan:** Temuan ini mendukung penggunaan model kesehatan digital interaktif dalam pencegahan hipertensi pada remaja.

Kata kunci: Hipertensi, remaja

Corresponding author: Yenny Safitri

Department of Medical Surgery of Nursing, Universitas Pahlawan Tuanku Tambusai, Jalan Tuanku Tambusai No 23, Bangkinang, Kabupaten Kampar, Propinsi Riau

Email: yennysafitri@universitaspahlawan.ac.id

INTRODUCTION

Hypertension, commonly perceived as an adult health issue, is increasingly being diagnosed among adolescents worldwide. Recent studies indicate a concerning rise in elevated blood pressure among youth, with approximately 14% of children and adolescents in the United States exhibiting elevated or high blood pressure levels. This trend is attributed to factors such as poor diet, lack of physical activity, obesity, and genetic predispositions (Wisner, 2024). Hypertension is a leading risk factor for cardiovascular morbidity and mortality worldwide, and its early onset in adolescents poses a serious challenge for public health (WHO, 2023). Defined as systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg, hypertension is no longer an issue confined to adults. Global projections by the World Health Organization estimate that by 2025, over 1.5 billion people will suffer from hypertension, with a significant portion originating in adolescence due to early behavioral risk factors. Adolescence is a critical period in life when long-term health behaviors are established. Unfortunately, this stage is often characterized by poor dietary habits, irregular physical activity, increased screen time, and rising experimentation with smoking and caffeine consumption. All of these behaviors are major risk factors for hypertension (Luluk, 2024); (Leszczak, 2024). A cross-sectional study in West Java (Daziah, 2020) found that 62% of adolescents consumed salty snacks more than four times a week, and 18% admitted to regular caffeine intake. In Asia, the prevalence of adolescent hypertension varies significantly across regions. A systematic review covering over 200,000 adolescents reported prevalence rates ranging from 0.7% in urban Bangladesh to 24.5% in urban Malaysia. Urban areas generally exhibit higher rates than rural ones, with East Asia showing the highest overall prevalence at 14.25%, followed by Southeast Asia at 13.16%.

In Indonesia, the situation mirrors global trends. A cross-sectional community survey highlighted that non-communicable diseases, including hypertension, account for a significant proportion of adolescent health burdens. High systolic blood pressure beginning in adolescence contributes notably to disability-adjusted life-years (DALYs) in both youth and adulthood. Specifically, in Depok, West Java, a study found that 78.10% of adolescents aged 15 years and above had hypertension. Key contributing factors included family history, nutritional status, and stress levels, with stress identified as the most significant determinant (Sudikno S, 2023) (Trista, 2024). Based on data from the Tambang Community Health Center, there were 42 cases of adolescent hypertension recorded 2024 years from 10.786 cases. Previous studies have identified various factors associated with adolescent hypertension, including obesity, dietary habits, physical inactivity, and socioeconomic status. For instance, a study in Sudan found that each unit increase in BMI was associated with a 12% increase in the risk of developing hypertension among adolescents (Ahmed Ali Hasan, 2023).

However, many of these studies are limited by their cross-sectional design, lack of longitudinal data, and focus on urban populations. There is a need for research that examines these factors in rural contexts to understand the unique challenges and risk factors present in these communities. Furthermore, interventions utilizing interactive multimedia have shown promise in enhancing hypertension prevention behaviors among adolescents. A study in Semarang, Central Java, demonstrated that multimedia interventions significantly improved students' knowledge, attitudes, and practices regarding hypertension prevention. However, the applicability and effectiveness of such interventions in rural settings remain underexplored (Wijayati S. e., 2024). Compounding the issue, adolescents often lack awareness regarding the long-term consequences of hypertension. A study conducted in Pekanbaru showed that 72% of students had low knowledge about blood pressure and its complications, and only 28% could identify salt as a major dietary risk (Rumaisyah, 2023). This lack of awareness is worsened by limited health education exposure in schools and insufficient family or community health engagement.

Furthermore, the rapid rise in digital media consumption among adolescents offers both a challenge and an opportunity. While increased screen time may contribute to sedentary lifestyles, digital platforms can also serve as effective tools for delivering health education. According to a report by the Indonesian Ministry of Communication and Informatics or Kemenkoinfo (2022), over 88% of teenagers regularly access the internet, mostly via smartphones. Leveraging this access for health promotion could bridge the information gap and improve compliance. Several studies have emphasized the role of knowledge, attitude, and behavior in influencing adolescent compliance with hypertension prevention measures. However, conventional health education approaches often fail to engage adolescents due to their passive and non-interactive nature (Zhou, 2023). Interventions that are technology-driven, gamified, and peer-supported have demonstrated significantly better outcomes in adolescent engagement and behavior change (Lydia, 2023) (Leszczak, 2024).

The GEMOY (Game-Education-Mobile for Youth) Interactive Model was developed in response to these challenges. It combines elements of gamified learning, self-monitoring tools, interactive health modules, and peer-led support via web-based platforms. Grounded in the Health Belief Model and Social Cognitive Theory, GEMOY seeks to empower adolescents to take control of their blood pressure through engaging, personalized, and self-directed learning mechanisms. The model is aligned with previous successful applications of mHealth tools, such as the TeenBP App in the United States and the Sihat Remaja digital initiative in Malaysia, both of which demonstrated significant improvements in health literacy and behavioral compliance among youth. This study aims to evaluate the effectiveness of the GEMOY Interactive Model in improving compliance behavior among adolescents in controlling blood pressure in Tambang Sub-District. The study also explores the model's potential to be scaled up as a digital health intervention for adolescent populations in similar rural settings.

RESEARCH METHOD

This research used a quasi-experimental design with two groups: intervention and control, with a pre-test and post-test. The study involved 80 adolescents (40 in each group) aged 15–18 years who were selected through stratified random sampling across four schools in Tambang Sub-District. Intervention: The GEMOY application was provided for 4 weeks. The content included: Gamified hypertension education, Peer discussion groups and Daily self-reporting of salt intake, water consumption, physical activity, and stress levels. Instruments: A structured questionnaire adapted from WHO guidelines (2023) and the Hypertension Knowledge-Level Scale (HK-LS) was used. Blood pressure was measured using digital sphygmomanometers validated by the Ministry of Health (2023). Analysis: Data were analyzed using paired t-tests and ANOVA to assess changes in knowledge, attitudes, and compliance behavior.

RESULTS OF STUDY

Participant Characteristics:

The majority were female (56.3%), aged 16–17 years (64%), and had moderate baseline knowledge about hypertension.

Variable	Intervention Group	Control Group
Pre-Intervention Score	50.34 ± 7.28	53.52 ± 6.03
Post-Intervention Score	78.10 ± 5.28	60.21 ± 5.45
Reduced Salty Snacks (%)	88%	-
Daily Physical Activity (%)	86%	-
Regular BP Checks (%)	52%	-

Group	Mean±SD	Mean Diff (95%CI)	t	pValue	Effect Size
Intervention Group (before)	52.1 ± 7.8	-3.18	-2.25	0.0275	-0.48
Control Group (before)	53.4 ± 6.9				
Intervention Group (post)	78.3 ± 5.2	17.88	17.73	< 0.001	3.33
Control Group (post)	59.7 ± 6.1				

Variable	Chi-square	P Value
Reduced_Salty_Snacks	5.01	0.0251
Daily_Physical_Activity	4.57	0.0325
Regular_BP_Checks	3.14	0.0766

Behavioral Changes Observed:

- 85% of intervention participants reduced salty snack consumption
- 72% engaged in daily physical activity
- 63% practiced regular BP checks via school clinic

DISCUSSION

This study aimed to assess the effectiveness of an intervention program on improving hypertension-related knowledge and behavioral practices among adolescents aged 16–17 years. The intervention group showed significant improvements across multiple dimensions, including knowledge scores, lifestyle behaviors (reduction in salty snack consumption, physical activity, and blood pressure monitoring), and overall health engagement compared to the control group. The results are discussed in detail below:

1. Baseline Characteristics

The participant profile revealed that 56.3% of participants were female, and the majority (64%) were in the 16–17 age group. Baseline knowledge of hypertension was classified as moderate for most participants. These findings align with earlier studies suggesting that adolescent girls are more likely to engage in health-related programs and that awareness of non-communicable diseases, such as hypertension, is typically limited at the school level (Nguyen H. T., 2021). The sample profile indicated a predominantly female group (56.3%) aged 16–17 years, with moderate baseline knowledge of

hypertension. Adolescents in this age range are undergoing critical cognitive development and are highly responsive to peer and digital interventions, making them suitable targets for preventive health education (Raj, 2020).

Adolescence is a critical developmental stage where individuals begin to form lifelong health habits. At this age, cognitive maturity enables better comprehension of health information; however, peer influence and lifestyle experimentation also peak, making this group vulnerable to unhealthy choices (Sawyer, 2022). Targeting adolescents in this window of opportunity is vital for long-term non-communicable disease (NCD) prevention, as early interventions can significantly alter risk trajectories.

The female majority in the intervention group may have influenced the responsiveness to health education, as previous studies suggest adolescent girls tend to be more receptive to preventive health behaviors and nutrition-related messaging compared to boys (Sharma & Mahajan, 2021; Alshammari et al., 2023). Therefore, future research should consider gender-specific approaches when designing adolescent health interventions to enhance engagement across both sexes.

2. Knowledge Score Improvements

The results of this study affirm that the GEMOY Interactive Model has a significant and positive impact on adolescent compliance in managing blood pressure. The intervention group showed a marked improvement from a pre-intervention mean score of 52.1 ± 7.8 to 78.3 ± 5.2 post-intervention, while the control group improved only slightly from 53.4 ± 6.9 to 59.7 ± 6.1 . The significant p -value (< 0.001) in the post-test comparison between groups indicates a robust effect of the intervention, beyond what might be expected from standard health education. The intervention group demonstrated a significant increase in knowledge scores after the program (Mean difference = $+27.76$, $p < 0.001$), while the control group showed only a modest improvement. This suggests that the educational intervention was both informative and transformative, likely due to interactive, adolescent-centered methods such as gamification, peer-led discussions, and visual content delivery. The effect size for post-intervention comparison (3.33) indicates a large and clinically meaningful impact (Cohen, 1988). These findings are consistent with previous interventions that used structured digital or school-based health programs among adolescents (Kumar R. &, 2022) (Wang X. e., 2024)

3. Behavioral Changes

a. Reduction in Salty Snack Consumption

- **88%** of adolescents in the intervention group reported a decrease in salty snack intake.
- The chi-square test yielded a statistically significant association ($\chi^2 = 5.01$, $p = 0.0251$).

Excess sodium intake is strongly linked to elevated blood pressure in youth populations ((WHO), 2023). The reduction in salty food consumption reflects the effectiveness of the intervention in instilling dietary awareness and encouraging healthy substitutions. The result echoes findings from (Mirmiran, 2021) which reported a 35–40% salt reduction adherence among high school students after health education programs.

b. Daily Physical Activity

- **86%** of participants reported engaging in at least 30 minutes of daily physical activity.
- This was significantly associated with the intervention ($\chi^2 = 4.57$, $p = 0.0325$).

Physical inactivity is a major risk factor for adolescent hypertension. Promoting moderate-to-vigorous physical activity through school-based challenges, tracking devices, or gamified apps is increasingly (Patterson, 2022) Increased physical activity among the intervention group may also be attributed to enhanced motivation and self-efficacy driven by goal-setting and group challenges embedded in the intervention module.

c. Regular Blood Pressure Monitoring

- **52%** of the intervention group regularly checked their BP through school clinics.
- The chi-square value ($\chi^2 = 3.14$) and $p = 0.0766$ suggest a positive trend, albeit not statistically significant.

Although this behavioral change did not reach statistical significance, the increase from baseline is clinically relevant. Previous studies have reported challenges in regular BP monitoring among adolescents due to lack of access and limited understanding of its importance (Sreedharan, 2021). Integrating BP check-ups into routine school health services may enhance sustainability of such behavior.

4. Statistical Analysis and Effect Sizes

The comparative t-tests demonstrated significant differences between the intervention and control groups:

- Pre-test Mean Difference: -3.18 ($p = 0.0275$; effect size = -0.48) indicates a moderate effect.

- **Post-test Mean Difference:** 17.88 ($p < 0.001$; effect size = 3.33), which is a very large effect size per Cohen's criteria.

This magnitude of improvement is indicative of a well-designed, age-appropriate, and culturally sensitive educational tool. A high post-intervention score reflects not just cognitive knowledge acquisition but also potential translation into practice. The observed behavioral shifts support the hypothesis that improving knowledge about hypertension can foster significant health behavior changes when accompanied by accessible interventions and peer support, particularly in adolescent settings.

5. Theoretical Framework Alignment

The outcomes of this study align with the constructs of the Health Belief Model (HBM):

- **Perceived Susceptibility & Severity:** Improved awareness of hypertension risks led to increased motivation to adopt healthy behaviors.
- **Perceived Benefits:** Participants recognized the tangible benefits of lifestyle changes, such as feeling more energetic or experiencing weight control.
- **Cues to Action:** Interactive content and peer-led discussions served as prompts to act.
- **Self-Efficacy:** Demonstrated in the ability to reduce salt intake and increase physical activity.

These findings are supported by similar studies using HBM in adolescent health education (Alkhalidi, 2020) ; (Zhou, 2023). Additionally, Social Cognitive Theory (SCT) provided an important lens for understanding how peer influence and observational learning shaped behavior. The peer forums within GEMOY offered emotional support, social modeling, and positive reinforcement critical elements for behavior adoption in adolescents. (Bandura, 1986) emphasizes that self-regulation and social reinforcement are essential for lasting behavior change, particularly during adolescence.

Moreover, the COM-B model (Capability, Opportunity, Motivation–Behavior) supports the mechanisms through which GEMOY affected change. The platform enhanced capability through education, created opportunity via digital accessibility, and fostered motivation through interactive rewards, peer dynamics, and self-monitoring tools.

6. Implications for Public Health and Policy Relevance

This study provides compelling evidence that early, school-based, digital interventions can influence adolescent health behaviors. Programs like GEMOY demonstrate how digital health tools can bridge the gap in health education, particularly in underserved rural settings such as Tambang Sub-District. With over 88% of Indonesian adolescents being smartphone users (Kemenkominfo, 2022), mobile health (mHealth) interventions are highly scalable and cost-effective.

To optimize impact, national stakeholders should:

- Integrate digital modules like GEMOY into school curricula.
- Train teachers and school nurses to deliver gamified health education.
- Establish routine BP monitoring in schools.
- Expand mHealth platforms to sustain behavior change through regular engagement.

In the context of rising adolescent NCDs, early intervention is critical. Programs that are evidence-based, theory-informed, and digitally adaptive offer a feasible and impactful solution to mitigate future health burdens (WHO, 2023).

7. Limitations and Future Directions

Despite these promising results, the study faced limitations. The 4-week intervention period may not be sufficient to capture sustained behavior change or physiological outcomes such as blood pressure normalization. Additionally, reliance on self-reported data for dietary intake and physical activity could introduce bias. Future studies should incorporate biometric measurements (e.g., BMI, blood pressure, lipid profiles) and wearable devices for objective tracking. The sample size ($n = 80$) also limits generalizability. Scaling the study across various regions and including diverse demographic groups will enhance external validity. Moreover, parental involvement absent in this intervention should be considered in future implementations, as it plays a vital role in reinforcing health behaviors, particularly in home environments.

Impact on Health Behaviors: Lifestyle Shifts

1. Salt Intake Reduction

The intervention prompted 88% of participants to reduce salty snack consumption a statistically significant behavioral shift ($\chi^2 = 5.01, p = 0.0251$). This is notable because high sodium intake is a direct contributor to elevated blood pressure, particularly in younger populations (WHO, 2023). Behavioral theories such as the Theory of Planned Behavior (Ajzen, 1991) support the notion that perceived behavioral control and intention, when combined with accurate knowledge, lead

to behavioral change. Digital modules that simulate the effects of sodium on the body, provide recipes for low-salt snacks, and include peer testimonies are particularly impactful in reducing adolescent reliance on processed foods (Villarreal, 2021).

2. Increase in Daily Physical Activity

Eighty-six percent (86%) of participants began engaging in daily physical activity. This statistically significant outcome ($\chi^2 = 4.57, p = 0.0325$) supports prior research indicating that when adolescents are educated on the health benefits of movement and provided with realistic options they are more likely to incorporate physical activity into their routine (Patterson, 2022). Notably, many digital interventions that include goal tracking, step counters, or rewards systems have proven effective in motivating adolescents (Wang X. e., 2024). This study’s success may reflect such motivational elements embedded in the intervention content.

3. Regular BP Monitoring Behavior

Although not statistically significant ($\chi^2 = 3.14, p = 0.0766$), more than half (52%) of intervention participants began checking their blood pressure regularly via school clinics. While this behavior may take longer to normalize, the positive trend shows growing awareness of the importance of regular monitoring. Research shows that adolescents do not usually see themselves as at-risk for conditions like hypertension, leading to low motivation for regular monitoring unless cues to action are present (Klein, 2021). By providing school-based opportunities for BP monitoring and integrating it into classroom activities or health weeks, schools can facilitate this long-term behavior.

Theoretical Frameworks in Action

The effectiveness of the intervention reflects the practical application of the Health Belief Model (HBM) and Social Cognitive Theory (SCT):

HBM Component	Application in Intervention
Perceived Susceptibility	Personal stories and risk quizzes reinforced vulnerability.
Perceived Severity	Visuals and simulations of long-term hypertension effects were used.
Perceived Benefits	Clear connections between behavior and health outcomes were shown.
Perceived Barriers	Peer discussions addressed obstacles such as taste preferences.
Cues to Action	Mobile app reminders and health games acted as behavioral nudges.
Self-Efficacy	Goal-setting and progress tracking boosted confidence.

This aligns with (Zhao, 2021), who highlighted the utility of HBM in adolescent health interventions when paired with practical applications. Furthermore, SCT emphasizes the role of observational learning, which was likely present in this study through peer-led discussions or role-play elements (Bandura, 1986). This improvement aligns with the Health Belief Model (HBM), which posits that health behavior is determined by perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy. Adolescents exposed to GEMOY gained enhanced perceptions of susceptibility and severity of hypertension, particularly due to the engaging and contextualized health messages presented through gamification. These elements likely lowered psychological barriers and increased motivation to act. The interactive features of GEMOY, such as gamified education, daily feedback, peer forums, and goal tracking, provided both internal (self-motivation) and external (peer and app-based reminders) cues to action. This aligns with findings by (Zhou, 2023), which showed that mobile health platforms significantly increased medication adherence and lifestyle compliance among adolescents with chronic conditions.

Furthermore, the Social Cognitive Theory provides additional explanatory power, emphasizing the role of observational learning and peer influence. The peer forums integrated into the GEMOY platform provided not only informational support but also emotional reinforcement, allowing participants to model and mirror healthy behaviors. Adolescents are developmentally more responsive to peer validation, and the design of GEMOY capitalized on this social dynamic to drive compliance. Behavioral outcome data further strengthens this interpretation. A significant proportion of participants in the intervention group reported behavior change, including 85% reducing salty snack intake, 72% engaging in daily physical activity, and 63% conducting regular BP checks. Chi-square analysis confirmed statistically significant associations between high post-intervention compliance scores and behavior change in salt intake ($p = 0.025$) and physical activity ($p = 0.033$). This supports the assertion that the GEMOY model not only imparts knowledge but also facilitates sustainable lifestyle changes.

The design of the GEMOY application featuring daily reminders, self-tracking tools, interactive quizzes, and gamified feedback promoted intrinsic motivation while providing external cues to action. This dual approach is supported by behavior change frameworks such as the COM-B model (Capability, Opportunity, Motivation – Behavior), which suggests that lasting change requires addressing all three domains. GEMOY successfully enhanced capability through education, created opportunity via platform accessibility, and stimulated motivation through rewards and peer dynamics. Importantly, the intervention was conducted in a rural setting (Tambang Sub-District), where access to formal health

education is often limited. This suggests that web-based models like GEMOY are particularly valuable in low-resource or underserved communities, bridging the gap between traditional health services and the growing digital proficiency among adolescents. According to national data (Kemenkominfo, 2022), over 88% of Indonesian teens are active internet users, primarily through smartphones, making mHealth an accessible and scalable strategy.

However, this study is not without limitations. The 4-week intervention period may be too short to capture long-term behavioral adoption or clinical outcomes such as blood pressure normalization. Additionally, reliance on self-reported data, especially regarding diet and physical activity, may introduce social desirability or recall bias. Future studies should consider biometric endpoints (e.g., BMI, blood pressure trend, physical fitness) and the use of wearable devices to objectively monitor behavior. Moreover, while the findings are promising, the sample size ($n = 80$) limits generalizability. Expanding this model to different geographic areas and including diverse demographic profiles would provide more robust evidence. Additionally, parental involvement, which was not included in this study, may play a crucial role in reinforcing adolescent behavior change, especially in home dietary practices and health monitoring.

Behavioral changes such as reduced salty snack intake (85%) and increased daily activity (72%) are consistent with studies that highlight the role of youth-oriented, participatory interventions in forming healthy habits (Leszczak, 2024). Adolescents respond well to digital rewards, social comparisons (leaderboards), and autonomy in decision-making, all of which are embedded in the GEMOY model. In addition, the social cognitive theory proposed by (Bandura, 1986) supports these findings, stating that self-regulation and observational learning from peers improve behavior change outcomes. The peer forums within GEMOY allowed for modeling healthy behavior, emotional encouragement, and social reinforcement essential for adolescents navigating peer pressure and identity formation. Moreover, previous digital health programs such as “Sihat Remaja” in Malaysia and “TeenBP” in the U.S. reported similar improvements in knowledge and behavioral compliance using mobile and web-based strategies. These interventions reinforce the efficacy of technology-driven models for chronic disease prevention in youth populations.

This study reinforces the growing consensus that adolescent hypertension prevention must start early, be school-based, and integrate digital health strategies. Governments and health ministries should:

- Incorporate digital health modules into national adolescent health curricula.
- Train school teachers and nurses in delivering interactive hypertension modules.
- Integrate routine BP monitoring into school clinics.
- Leverage mobile apps to reinforce key behaviors and reminders.

Such interventions are not only cost-effective but scalable. With NCDs becoming the leading global cause of adolescent disability-adjusted life years (DALYs) (WHO, 2023), early interventions like this study's model can yield significant public health benefits. Despite these promising results, this study faced limitations. The intervention duration of 4 weeks may not fully capture sustained behavior change. Self-report bias may also affect the accuracy of behavior tracking. A longer-term follow-up, biometric validations (BMI, lipid profile), and parental engagement are needed to reinforce outcomes. In conclusion, the GEMOY Interactive Model demonstrates that incorporating behavior change theories into a digital framework, tailored to adolescents' interests and habits, can significantly influence compliance in hypertension prevention. It offers a scalable, cost-effective solution adaptable for school-based health promotion efforts in low-resource settings.

CONCLUSION

The GEMOY Interactive Model effectively enhances adolescent compliance with hypertension prevention measures by leveraging digital health tools that are engaging, personalized, and behaviorally grounded. The significant improvements in knowledge, behavior, and compliance scores suggest that such models are both practical and impactful in rural settings where access to traditional health education may be limited. Recommendations:

1. Integration of the GEMOY model into school-based health programs to maximize reach and sustainability.
2. Training for school nurses and health educators on using digital tools to promote adolescent health.
3. Expansion of the GEMOY model to other districts within Riau Province to test scalability.
4. Long-term follow-up assessments at 3-month and 6-month intervals to evaluate retention of behavioral change.

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