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ORIGINAL ARTICLE

EFFECTIVENESS OF HEALTHY LIFESTYLE EDUCATION THROUGH CARD GAMES FOR THE EARLY DETECTION AND PREVENTION OF CANCER IN WOMEN: A QUASI-EXPERIMENTAL STUDY

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ABSTRACT

Cancer prevention and early detection efforts in Indonesia remain suboptimal, primarily due to limited public awareness. Therefore, this study evaluated the effectiveness of a card game–based educational intervention in improving women's knowledge of early cancer detection and healthy lifestyle practices. The researchers employed a quasi-experimental design involving 70 women in Depok and Jakarta, with 40 assigned to the intervention group and 30 to the control group. Eligible participants completed a validated questionnaire before and after the intervention. The intervention group received an interactive education session using card games, while the control group received a standard informational brochure. The ANCOVA analysis revealed a significant increase in post-test knowledge scores in both the intervention and control groups (mean square = 190.301, $p < 0.05$). However, a significant difference in knowledge score improvement was observed in the intervention group (mean square = 23.618, $p < 0.05$). These findings suggest that card game–based educational interventions have the potential to improve public understanding of cancer prevention and early detection. It is recommended that larger randomized controlled trials integrate this card game into community health activities (such as school-based programs) to ensure broader engagement and the sustainability of cancer awareness initiatives.

Keywords: *Cancer early detection; card game; healthy lifestyle*

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BACKGROUND

Cancer remains a major public health challenge in Indonesia, particularly among low- and middle-income populations. Among all cancer types, breast cancer remains the most prevalent case in Indonesia and is one of the leading causes of cancer deaths (Widyawati, 2022). According to Globocan data for 2022, the number of new breast cancer cases reached 66,217 (16.2%), with the total prevalence for the past five years being 209,748 cases in Indonesia. Meanwhile, the number of deaths reached more than 22,598 cases (International Agency for Research on Cancer, 2023). Alarmingly, between 68% and 73% of patients in 2022 sought treatment only at advanced stages (III or IV), an increase from the 60%–70% reported three decades earlier (Gautama, 2022; Botteri et al., 2018). This situation highlights the urgent need for improved prevention and early detection strategies. The delay in cancer diagnosis can be attributed to several interrelated factors. Limited health literacy, fear of diagnosis, poor access to screening services, and persistent socioeconomic disparities play major roles (Bakhai et al., 2024; Margaretha et al., 2022). In addition, stigma associated with breast cancer continues to discourage women, especially those from underserved communities, from seeking early detection and engaging in preventive behaviors (Tisnasari, Nuraini, & Afiyanti, 2022). These challenges collectively create a significant barrier to effective cancer control in Indonesia.

Another important issue is the strong link between cancer incidence and lifestyle. Evidence indicates that modifiable risk factors such as maintaining a balanced diet, engaging in regular physical activity, avoiding tobacco use, and managing stress can significantly reduce cancer risk and mortality (Zhang et al., 2020; Usher-Smith et al., 2019). However, awareness of this connection remains low, as many individuals do not associate daily lifestyle choices with cancer prevention (Usher-Smith et al., 2017). Therefore, this knowledge gap underscores the importance of accessible and effective health education interventions.

Additionally, innovative and culturally appropriate educational methods are urgently needed to bridge this gap. Interactive tools such as card games have shown potential to improve engagement, promote peer-to-peer learning, and increase retention of health information (Tani et al., 2016; Mufida & Yunitasari, 2021). In Indonesia, where interactive educational methods are still emerging, card games represent a cost-effective, inclusive, and adaptable medium for disseminating critical information about cancer prevention (Rizany, Christabella, Natasha, & Sulijaya, 2023).

In response to these challenges, this study examines the effectiveness of card game-based education in increasing knowledge of early breast cancer detection and healthy lifestyle practices. By employing a community-based approach, this research aims to generate evidence applicable in resource-limited settings. The findings are also expected to contribute to the design of innovative nursing interventions and scalable public health programs that promote behavioral change and reduce cancer-related morbidity.

METHOD

Study design

This study employed a quasi-experimental design with a non-equivalent control group method to assess the efficacy of a card game-based educational intervention in improving women's knowledge of early breast cancer diagnosis and healthy lifestyle practices. The participants were selected via convenience sampling from community organizations in Depok, West Java. The inclusion criteria consisted of women aged 20 years or older who had not previously undergone systematic breast cancer education. The exclusion criteria comprised a current cancer diagnosis or a professional background in healthcare. A total of 70 participants were enrolled in the study, with 40 assigned to the intervention group and 30, to the control group to replicate applying the intervention in a real-world community setting.

Sample

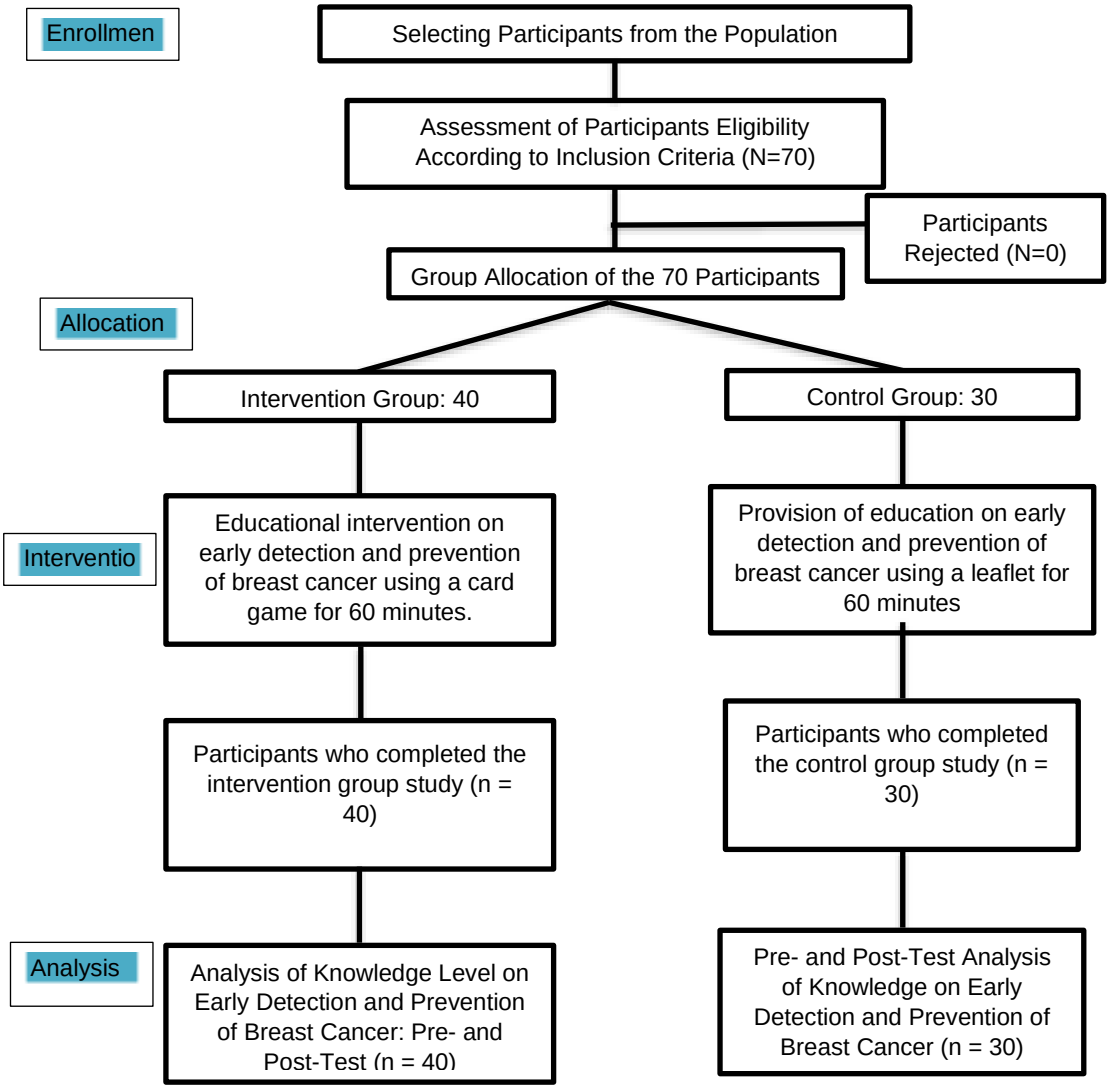

Figure 1. The Consort Diagram

This study was conducted in two urban locations in Indonesia: Depok City, West Java, and Jakarta. A total of 70 female participants aged 20 or older were recruited via convenience sampling. The intervention group consisted of 40 participants from Depok City, who participated in the study during October and November 2024. The control group included 30 participants from Jakarta, and data collection took place in December 2024.

The sample size was determined using G-Power software. Based on previous research by Altuntuğ, Koçak, and Ege (2021), which reported an effect size with an r value of 0.76 and R^2 of 0.58, the minimum required sample size was calculated to be 34 participants. To ensure robustness and account for potential dropouts, 40 participants were assigned to the intervention group and 30 to the control group.

Inclusion Criteria: 1) Female residents of Depok or Jakarta, 2) Aged above 20 years, 3) Willing to participate and provide informed consent. Exclusion Criteria: Individuals with visual or vestibular impairments that could hinder participation in the card game-based intervention.

All participants completed a pre-test to assess their baseline knowledge regarding cancer prevention, early detection, and healthy lifestyle practices.

The intervention group participated in an interactive **60**-minute card game. The participants were divided into small groups of 5 to 10 members, with a minimum of two groups per session. The card game covered topics such as cancer risk factors, early signs and symptoms (especially of breast cancer), early detection methods (e.g., SADARI, SADARNIS, Pap smear, ABCDE for skin cancer), and healthy lifestyle behaviors.

The facilitator initiated each session by shuffling the cards and placing them face down in the center of the table. Questions related to cancer awareness were posed, and teams competed by selecting the most appropriate card to answer each question. Every correct response earned 100 points, while incorrect answers incurred a 10-point deduction. After each round, the facilitator briefly explained the correct answer and its relevance. The session concluded with the announcement of the winning team based on the total points accumulated.

Meanwhile, the control group received the identical educational content. However, it was in the form of a printed booklet without the interactive game component.

Instrument

The participants' knowledge was assessed using a modified version of the Indonesian Version of the Breast Cancer Awareness Scale (BCAS - I) developed by Solikhah et al. (2017), which demonstrated acceptable internal consistency with a Cronbach's alpha of 0.79 and an adjusted goodness of fit index of 0.97. The instrument also underwent content and face validity reviews by subject-matter experts to ensure its relevance and clarity for the target population.

The researchers administered the questionnaire to both the intervention and the control groups before and immediately after the educational session. The instrument used in this study was designed to assess participants' knowledge of early cancer detection and healthy lifestyle practices. It consisted of 30 true/false items covering key domains, including cancer risk factors, early warning signs and symptoms, recommended screening methods, and preventive health behaviors. To evaluate changes in knowledge, the same questionnaire was administered before and after the intervention, allowing for a direct comparison of pre- and post-education outcomes.

Intervention (Game Design)

This innovative card game-based intervention was designed to improve public knowledge of cancer prevention, with a particular focus on breast cancer. The goal of the activity is to equip participants with the knowledge and motivation to engage in early detection practices, such as breast self-examinations, and to adopt healthy lifestyle behaviors that reduce cancer risk.

Each session is structured to last approximately **60** minutes, though the duration may vary depending on the number of participants and the pace of the game. Sessions are facilitated by a trained health educator or nurse who guides participants through the gameplay, offers clarifications, and reinforces key learning points. The participants are divided into small groups of 5 to 10 individuals. Each group is randomly assigned a set of cards containing health-related information and visual cues related to cancer awareness and prevention.

The game begins with the facilitator posing a question related to cancer risk, early detection, or healthy living. The participants would then collaborate within their groups to select and arrange the appropriate cards that best answer the question. For every correct card placed, the group earns 100 points. However, each incorrect card results in a 10-point deduction. After each round, the facilitator reveals the correct response, provides explanations using visual aids such as posters, anatomical models, and illustrated flashcards, and encourages discussion. The game concludes by tallying scores, and the group with the highest cumulative score is declared the winner, adding a competitive and motivational element to the learning experience.

The game content covers a comprehensive range of cancer-related topics, including identification of modifiable and non-modifiable risk factors; early warning signs and symptoms of breast, cervical, testicular, and skin cancer; guidelines for early screening practices (e.g., breast self-examination using the SADARI method, Pap smears, and testicular self-examinations); the ABCDE method for identifying abnormal moles or skin lesions suggestive of skin cancer; and dietary and lifestyle choices that contribute to cancer prevention.

The card game employs principles of active learning, peer interaction, and experiential education to foster critical thinking and knowledge retention. The gamified structure also improves engagement and creates a psychologically safe space for participants to learn, ask questions, and reinforce healthy behaviors. By transforming complex medical information into accessible, interactive content, this method serves as a valuable tool for community-based health education, particularly in low-resource settings.

Data collection

The researchers collected the data in Depok and Jakarta from October to December 2024. A research assistant contributed in collecting data. Data collection involved participants completing a series of true/false items, with facilitators present to provide guidance and ensure participants understood the material.

Data analysis
All data were examined utilizing computer software. The ANCOVA tests assessed pre- and post-intervention improvements within each group. The results were used to compare the knowledge scores between the intervention and control groups. A p-value below 0.05 was deemed statistically significant.

The research procedure included a systematic data management strategy. After data collection, questionnaire responses were assessed for completeness, coded, and input into a digital database. Data cleansing and statistical analysis were performed using computer software.

Univariate and bivariate analyses were performed. An ANCOVA test was employed to assess variations in knowledge scores within each group before and after the intervention and examine the differences in pre- and post-intervention knowledge between the intervention and control groups. A p-value below 0.05 was deemed statistically significant.

Ethical considerations
The study obtained ethical clearance from the Ethics Committee of the Faculty of Nursing, Universitas Indonesia, under approval number KET-255/UN2.F12.D1.2.1/PPM.00.02/2024. All participants furnished written informed consent prior to the commencement of data collection.

RESULT

This study, conducted between October and December 2024, involved 70 participants and assessed the effectiveness of a card game-based educational intervention on cancer prevention knowledge. A homogeneity test was first performed to evaluate the equivalence of potential confounding variables between the intervention and control groups.

Table 1 shows the frequency distribution of the respondents' characteristics. Most respondents were adults, highly educated, unemployed, unmarried, and had moderate incomes.

Table 1. Frequency distribution of respondents' characteristics

Characteristic	Intervention (n = 40) n (%)	Control (n = 30) n (%)
Age		
Adult	25 (62.5)	28 (93)
Older adult	15 (37.5)	2 (7)
Level of education		
Primary school	21 (52.5)	4 (13.3)
High school	19 (47.5)	26 (86.6)
Job status		
Working	33 (82.5)	26 (86.7)
Not working	7 (17.5)	4 (13.3)
Marital status		
Married	2 (5)	3 (10)
Not married	38 (95)	27 (90)
Income		
< minimum regional wage (IDR 5 million)	23 (57.5)	8 (26.7)
> minimum regional wage (IDR 5 million)	17 (42.5)	22 (73.3)

Table 2 shows that no significant differences were found in the groups' (intervention and control) occupation, marital status, level of education, income, and age ($p > 0.05$).

Table 2. Homogeneity test according to the categorical data of the respondents' characteristics

Characteristic	Type III Sum of Squares	df	Mean Squares	F	Sig
Corrected model	282.967	18	15.720	1.21	0.289
Intercept	0.000	0			
Group * Marital status	0.814	1	0.814	0.063	0.803
Group * Job status	18.657	1	18.657	1.436	0.236
Group * Level of education	7.509	2	3.754	0.289	0.750
Group * Income	0.922	1	0.922	0.071	0.791
Group * Age	2.343	1	2.343	0.180	0.673

R Squared = 299 (adjusted R Squared = 0.052)

Table 3 illustrates that the pre-test mean ± SD knowledge score in the intervention group was lower than that of the control group, 16.6 ± 4.18 vs. 18.7 ± 2.6. After the intervention, both groups showed improvements in knowledge scores. However, the intervention group displayed a greater improvement. The intervention group had a post-test mean score of 21.88 ± 3.61, which was higher than the control group's mean score of 19.37 ± 2.48.

Table 3. Changes in knowledge scores before and after education card game

Variable	Group	Mean	SD	Mean difference (95% CI)
Knowledge score (0-30)	**Intervention**			
	Before	16.6	4.18	-5.775 (-6.04 to -4.51)
	After	21.87	3.61	
	Control			
	Before	18.07	2.56	-0.7 (-1.22 to -0.18)
	After	19.37	2.48	

Table 4 indicates that the intervention group experienced an average increase in knowledge score of 5.28 ± 2.4 points, whereas the control group exhibited only a slight improvement of 0.7 ± 1.4 points. The disparity in knowledge score improvement between the two groups was statistically significant ($p < 0.05$), indicating the efficacy of the card game-based educational intervention.

Table 4. Differences in mean knowledge scores after the educational card game between the intervention and control groups

Variable	Group	Mean	SD	Mean difference (95% CI)
Knowledge score (0-30)	**After**			
	Intervention	21.88	3.01	2.51 (1.05 to 3.96)
	Control	19.37	2.48	
	Difference			
	Intervention	5.28	2.4	4.56 (3.66 to 5.49)
	Control	0.7	1.4	

Tables 5 and 6 show a significant difference ($p < 0.05$) in post-test scores and in score improvements between the intervention and the control groups, after controlling for confounding variables (age, marital status, occupation, education, income).

Table 5. ANCOVA tests of between-subjects effects

Dependent variable: post test

Variable	Type III Sum of Square	Df	Mean Square	F	Sig
Corrected model	235.315	6	39.219	4.413	0.001
Intercept	591.601	1	591.601	66.569	.000
Age	26.869	1	26.869	3.023	.087
Level of education	.855	1	.855	.096	.757
Job status	.480	1	.480	.054	.817
Marital status	7.872	1	7.872	.886	.350
Income	31.582	1	31.582	3.554	.064
Group: intervention and control	190.301	1	190.301	21.413	.000

a. R Squared = .296 (Adjusted R Squared = .229)

Table 6. ANCOVA tests of between-subjects effects

Dependent variable: difference (post-test - pre-test)

Variable	Type III Sum of Square	Df	Mean Square	F	Sig
Corrected model	51.856a	6	6.643	3.131	0.009
Intercept	57.527	1	57.527	20.839	.000
Age	8.627	1	8.627	3.125	.082
Level of education	5.299	1	5.299	1.920	.171
Job status	2.822	1	2.822	1.022	.316
Marital status	1.589	1	1.589	.576	.451
Income	1.760	1	1.760	.638	.428
Group: intervention and control	23.618	1	23.618	8.556	.005

a. R Squared = .230 (Adjusted R Squared = .156)

In summary, participants in the intervention group were generally older, had lower levels of education, and reported lower household incomes than those in the control group. These socio-demographic factors were associated with significantly lower baseline knowledge scores regarding cancer awareness and healthy living. However, following the implementation of the card game-based educational intervention, the intervention group demonstrated a substantial, statistically significant improvement in knowledge, surpassing the control group that received conventional printed materials.

This outcome underscores the effectiveness and adaptability of interactive, gamified learning tools, particularly in reaching and empowering underserved or low-literacy populations. The findings highlight the potential of culturally relevant, engaging educational strategies to promote health literacy and support early detection initiatives among at-risk communities.

DISCUSSION

This study demonstrates that card game-based education significantly improves public knowledge, motivation, and health-related behaviors, particularly regarding early cancer detection and the adoption of healthy lifestyle practices. The findings align with the existing literature, which emphasizes the effectiveness of interactive and participatory health education approaches over traditional methods. This study supports previous studies that explained the importance of building support for patients with chronic diseases by implementing a health education approach model in the learning process (Muliyadi, 2024).

Participants in the intervention group, who played a structured card game focused on cancer awareness and prevention, exhibited notably higher post-intervention knowledge scores than those in the control group who received standard printed materials. This finding supports prior research showing that interactive learning strategies foster greater cognitive engagement, emotional involvement, and improved information retention (Rosário et al., 2024; Davaris et al., 2021; Palumbo et al., 2021).

The success of the card game can be attributed to its gamified elements, which promote active peer interaction and create a more stimulating and enjoyable learning environment. Game-based learning has been shown to maintain participant interest and facilitate deeper understanding, which may lead to sustained behavioral changes (Mufida & Yunitasari, 2021; Davaris et al., 2022).

This approach is especially relevant in the Indonesian context, where limited health literacy and persistent social stigma around cancer often hinder early detection efforts (Hout et al., 2020). This study's results underscore the

importance of designing culturally appropriate, community-based health education interventions. By incorporating familiar, interactive tools such as card games, this study successfully empowered women with the knowledge and confidence needed to recognize cancer risk factors and engage in preventive health behaviors (Badua et al., 2022; Joseph et al., 2023).

This study also highlights the pivotal role of healthcare workers in promoting early detection and preventive health behaviors. As frontline practitioners, health workers are uniquely positioned to bridge knowledge gaps, address emotional barriers, and deliver impactful community-based interventions. Their proactive engagement is a well-established determinant of success in early cancer detection programs globally (Bakhai et al., 2024). For instance, initiatives such as the CHANGE (The Cancer Health Awareness through screeNinG and Education) program in the United States have demonstrated that targeted education on modifiable risk factors, when combined with accessible screening services, can improve health literacy, increase motivation, and improve outcomes among underserved populations (Vernon, Heboyan, & Coughlin, 2024).

The use of interactive educational tools, such as card games, goes beyond knowledge transmission. These tools foster a safe and inclusive learning environment that encourages personal reflection, group discussion, and autonomous decision-making. According to Farhadi and Nikbakht (2022), emotional engagement improves message retention and facilitates deeper behavioral transformation. In the context of Indonesia, where breast cancer remains one of the leading causes of mortality among women, and healthcare access is often limited, such emotionally engaging, community-based interventions are especially critical.

Furthermore, the current findings emphasize that interventions using culturally resonant media can reshape beliefs about cancer, reduce fear and stigma, and improve individuals' readiness to adopt preventive behaviors. As Karujan et al. (2023) note, empowering individuals with interactive tools can significantly influence attitudes toward early screening and healthy living, thereby reducing disease incidence over time.

From a preventive health perspective, lifestyle modification remains a cornerstone in reducing breast cancer risk. Evidence consistently supports the effectiveness of maintaining a healthy weight, engaging in regular physical activity, limiting high-fat intake, and avoiding tobacco and alcohol use as preventive measures (Macleod & Anderson, 2018; Karavasiloglou et al., 2019). Therefore, health education strategies that promote these behaviors, particularly when delivered through engaging, interactive formats, should be integrated into national public health frameworks. Such interventions not only raise awareness but also cultivate lasting behavioral changes, offering a sustainable path to reducing the cancer burden in vulnerable communities.

Nevertheless, this study has several limitations that should be acknowledged. First, the relatively small sample size and limited geographic scope restrict the generalizability of the findings. Future research should be conducted on a larger and more diverse population to validate and extend these results across broader community settings.

Second, the age profile of the participants, primarily middle-aged and older women, may have influenced the outcomes. Although this demographic is crucial in cancer prevention efforts, younger age groups should also be targeted in future studies to encourage earlier adoption of healthy behaviors and timely engagement in cancer screening practices.

Third, although the quasi-experimental design included both intervention and control groups, a baseline imbalance in knowledge levels between the groups was observed. This may have introduced a degree of bias in interpreting the intervention's true effect. However, the intervention group still demonstrated a significantly greater improvement in post-test scores, suggesting that the card game-based education had a meaningful impact beyond initial disparities.

Despite these limitations, the study provides valuable insights into the potential of interactive educational tools in promoting cancer awareness and lifestyle change. Future investigations should consider longitudinal designs to assess the sustainability of behavior changes and expand the use of gamified education in diverse populations.

CONCLUSION AND RECOMMENDATION

This study demonstrates the effectiveness of interactive, community-based education, specifically card games, in enhancing knowledge of early cancer detection and healthy lifestyle practices. The significant improvement observed in the intervention group underscores the potential of gamified learning as a powerful strategy, particularly for populations with low literacy levels.

The role of health workers is pivotal in sustaining the success of such interventions. As trusted agents within the community, they are well- positioned to deliver interactive tools, provide guidance, and foster behavioral change at the grassroots level. Their active involvement can ensure that knowledge gained through educational games translates into meaningful preventive actions.

Based on these findings, it is recommended that interactive, culturally tailored educational tools such as card games be systematically integrated into national health promotion strategies. Health workers should be equipped and trained to apply these tools effectively, with a focus on reaching marginalized communities to improve awareness, encourage early detection, and promote healthier lifestyles.

In addition to national-level strategies, a practical recommendation is to incorporate the card game into existing community health activities, such as *posyandu* (integrated service post) sessions or school-based programs. Embedding this intervention within routine activities can facilitate broader engagement, strengthen health literacy, and support long-term behavioral change across diverse populations. Future research may also be conducted with larger randomized controlled trials.

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