Journal of Asian-African focus in Health

ISSN: 2987-9418
Vol. 4 No. 1, 2026
Page: 189-202

Interactive Health Education: Quartet Card Game for Thalassemia Awareness

Yuanita[1], Priyanto[2], Gipta Galih Widodo[2]

[1]Master of Nursing Program, Ngudi Waluyo University and Nursing Program, YPIB Majalengka University

[2]Master of Nursing Study Program, Faculty of Nursing, Ngudi Waluyo University

*Corresponding Author: Yuanita

Email: yuanitarha@gmail.com

Article Info

Article History:

Received March 23, 2026
Revised April 13, 2026
Accepted: May 21, 2026

Keywords:

Thalassemia, Quartet Card Game, Health Education, Thalassemia Screening.

Abstract

Thalassemia remains a preventable inherited blood disorder with major clinical, social, and economic consequences, particularly in countries with high carrier prevalence such as Indonesia. University students represent a strategic population for premarital prevention because they are approaching reproductive age and may soon make decisions related to marriage, family planning, and genetic screening. This study aimed to evaluate the effectiveness of a Quartet Card Game as an interactive educational medium for improving knowledge, attitudes, and behavioral intention toward thalassemia screening among students of YPIB Majalengka University. A quantitative experimental study with a pre-test and post-test control group design was conducted. Participants were randomly assigned to an intervention group that received education using the Quartet Card Game and a control group that received conventional lecture-based education. Data were collected using a structured questionnaire measuring thalassemia knowledge, attitudes toward screening, and intention to participate in screening. Inferential analysis showed that the intervention group experienced greater improvement in all outcome variables than the control group. The Quartet Card Game significantly increased students' knowledge of thalassemia strengthened positive attitudes toward premarital screening and encouraged stronger intention to participate in screening programs. These findings indicate that game-based education can support health promotion by transforming genetic information into active, peer-based, and behavior-oriented learning. The study contributes to thalassemia prevention research by extending game-based educational intervention to university students and by examining cognitive and behavioral outcomes within the Health Belief Model framework. Future studies should include multicenter samples, longer follow-up, and actual screening uptake as an outcome.

Introduction

Thalassemia is a major inherited hemoglobin disorder that creates clinical, social, and financial burdens in many countries. The disease occurs when mutations reduce or stop the production of alpha or beta globin chains, causing chronic anemia and, in severe cases, lifelong dependence on blood transfusion and iron chelation. Global data confirm that hemoglobin disorders remain a serious public health issue. The World Health Organization reported that more than 300,000 infants are born each year with severe hemoglobin disorders, while a disease specific estimate found that about 25,500 infants with transfusion dependent thalassemia are born annually worldwide (Kattamis et al., 2020). Thalassemia is highly concentrated in Asia, the Mediterranean region, and the Middle East, while severe alpha thalassemia is especially common in Southeast Asia (Ebrahimi et al., 2021; Meri et al., 2022; Alhuthali et al., 2023; Sadiq et al., 2024).

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852

Indonesia has strong epidemiological relevance because it lies within the global thalassemia belt. Wahidiyat et al. (2022) reported that approximately 3.0% to 10.0% of the Indonesian population carries beta thalassemia, while 2.6% to 11.0% carries alpha thalassemia. The same review estimated that around 2,500 babies with beta thalassemia major are born in Indonesia each year (Wahidiyat et al., 2022). These figures are consistent with Indonesian Ministry of Health data, which reported a carrier prevalence of around 3% to 10% and an increase in recorded thalassemia cases from 4,896 in 2012 to 10,973 by June 2021. These data show that prevention requires more than clinical treatment. It also requires carrier identification, premarital screening, genetic counseling, and informed reproductive decision making.

Despite this burden, awareness and participation in thalassemia screening remain limited among adolescents and young adults. Many individuals enter marriage without knowing their carrier status (Oluwole et al., 2022; Tessler, 2023). This condition increases the possibility of at-risk marriages between carriers and raises the chance of children being born with thalassemia major. Studies in young adult populations show that educational interventions can improve knowledge and attitudes toward thalassemia prevention, but knowledge gains do not always lead to screening intention or screening behavior (Ngim et al., 2020; Triatin et al., 2022; Rujito et al., 2023). Therefore, thalassemia education should not only deliver factual information. It must also address perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action, as explained in the Health Belief Model (Alyafei & Easton Carr, 2024; Khawwas et al., 2025; Phan et al., 2025).

University students are a strategic target group for prevention because they are close to reproductive age and may soon make decisions about marriage and family planning (Gbagbo & Nkrumah, 2019; Akoku et al., 2022; Alhussaini et al., 2025). In Indonesia, this group is relevant for premarital health education because universities provide structured learning settings and peer interaction. However, passive education, such as lectures, leaflets, and one way campaigns, may not fully engage students. Technology based interventions, including web modules and mobile applications, have been reported to increase knowledge and attitudes toward thalassemia screening (Ngim et al., 2020; Kharaman nia et al., 2023; Setiawan et al., 2024). Yet these methods often emphasize information transfer and may have limited influence on behavioral intention.

Game based health education offers a more interactive alternative. Serious games and educational games can increase motivation, attention, and health literacy because participants learn through active engagement, discussion, repetition, and feedback (Ud Din et al., 2023; Zikra, 2023; Cutica et al., 2024). In thalassemia education, D'Arqom et al. (2026) showed that a quartet card game improved knowledge and screening awareness among senior high school students. However, the study focused on adolescents and did not fully examine broader psychosocial outcomes related to screening intention. Other studies suggest that thalassemia education should measure not only knowledge, but also attitudes and willingness to undergo screening (Triatin et al., 2022; Alam et al., 2022; Rujito et al., 2023).

Based on these gaps, the novelty of this study does not lie only in using a quartet card game as an educational medium. Its main contribution lies in testing the effectiveness of this medium among university students using a controlled experimental design and examining knowledge, attitudes, and behavioral intentions toward thalassemia screening within the Health Belief Model framework. This study aims to measure changes in students' knowledge about thalassemia, analyze changes in attitudes toward thalassemia screening, and examine whether quartet card game education increases students' intention to participate in screening. The

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852

hypothesis is that the quartet card game will increase knowledge, improve attitudes toward screening, and strengthen students' intention to participate in thalassemia screening programs.

Method

Research Design

This study used a quantitative experimental design with a pre-test and post-test control group approach. This design was selected because the study aimed to examine the effect of an educational intervention using the Quartet Card Game on students' knowledge, attitudes, and behavioral intention toward thalassemia screening. The design allowed the researcher to compare changes within each group before and after the intervention and to compare the post-intervention outcomes between the intervention group and the control group. The intervention group received health education through the Quartet Card Game, while the control group received conventional education through a lecture-based method. This comparison was intended to determine whether the game-based educational method produced stronger changes than conventional education.

Study Setting and Population

The study was conducted at YPIB Majalengka University. The target population consisted of all active undergraduate students registered at the university during the study period. University students were selected because they are in late adolescence or early adulthood and are approaching the reproductive age group. This population is relevant to premarital thalassemia prevention because students may later make decisions related to marriage, family planning, and genetic screening. The accessible population included students from different study programs who met the eligibility criteria and were willing to participate in the study.

Sample and Sampling Technique

The sample consisted of active students of YPIB Majalengka University who met the inclusion criteria. The inclusion criteria were active student status, willingness to participate by signing informed consent, ability to follow the educational session from beginning to end, and no previous participation in thalassemia education using the Quartet Card Game method. Students who were absent during either the pre-test, intervention, or post-test were excluded from the final analysis.

The sample size was calculated using the Slovin formula with a 5% margin of error. The final sample size was then divided into two groups, namely the intervention group and the control group. Random sampling was used to recruit eligible participants from various study programs. After recruitment, participants were randomly assigned to either the intervention group or the control group to reduce selection bias and improve the comparability of both groups. Each group received the same topic of thalassemia education, but through different educational methods.

Intervention Procedure

The intervention group received thalassemia education using the Quartet Card Game. The card game was designed as an interactive educational medium containing information about thalassemia definition, causes, inheritance patterns, symptoms, prevention, premarital screening, and genetic counseling. The game encouraged participants to read, match, ask, answer, and discuss information during the learning process. This method was intended to increase active participation and strengthen students' understanding through repeated exposure to key concepts.

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852

Before the intervention, participants completed a pre-test questionnaire to measure baseline knowledge, attitudes, and behavioral intention toward thalassemia screening. After the pre-test, the facilitator explained the rules of the Quartet Card Game and divided participants into small groups. Each group played the game under the supervision of the facilitator to ensure that the educational content was delivered consistently. After the game session ended, participants completed the post-test questionnaire using the same measurement indicators as the pre-test.

Control Group Procedure

The control group received conventional thalassemia education through a lecture-based session or standard counseling. The educational content given to the control group was the same as the content provided in the Quartet Card Game. This included thalassemia definition, causes, inheritance, symptoms, prevention, screening, and genetic counseling. The main difference was the method of delivery. The control group received information through direct explanation without game-based interaction.

The control group also completed the pre-test before the educational session and the post-test after the session. The use of the same pre-test and post-test procedure in both groups allowed the researcher to compare the effect of the two educational methods more clearly.

Research Variables

The independent variable in this study was the educational method, namely thalassemia education using the Quartet Card Game. The dependent variables were students' knowledge about thalassemia, attitudes toward thalassemia screening, and behavioral intention to participate in thalassemia screening. Knowledge referred to students' understanding of thalassemia, including its causes, genetic transmission, symptoms, complications, prevention, and screening. Attitude referred to students' positive or negative evaluation of thalassemia screening. Behavioral intention referred to students' willingness or readiness to participate in screening in the future.

Research Instrument

Data were collected using a structured questionnaire. The questionnaire consisted of sections on respondent characteristics, knowledge about thalassemia, attitudes toward thalassemia screening, and behavioral intention to undergo screening. The knowledge section assessed factual understanding of thalassemia and its prevention. The attitude and intention sections used Likert-scale statements with response options ranging from strongly disagree to strongly agree. Higher scores indicated better knowledge, more positive attitudes, and stronger intention to participate in screening.

The questionnaire was adapted from instruments used in previous studies on thalassemia education and screening. The instrument was adjusted to fit the university student context and the objectives of this study. Before the main data collection, the questionnaire was reviewed to ensure that each item matched the study variables and was understandable for the target respondents.

Validity and Reliability Testing

The instrument was tested for validity and reliability before use in the main study. Content validity was assessed by experts in health education, nursing, or public health to ensure that the questionnaire items were relevant to thalassemia education and screening. Construct validity was examined to determine whether the items represented the intended variables. Reliability was tested using Cronbach's Alpha. A Cronbach's Alpha value of 0.70 or higher

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852

was considered acceptable for internal consistency. Items that did not meet validity or reliability standards were revised or removed before the final questionnaire was used.

Data Collection Procedure

Data collection was carried out in several stages. First, the researcher obtained permission from the university and coordinated with relevant academic units. Second, eligible students were recruited based on the inclusion criteria. Third, participants received an explanation of the study objectives, procedures, benefits, risks, confidentiality, and their right to withdraw from the study. Fourth, students who agreed to participate signed informed consent. Fifth, participants completed the pre-test questionnaire. Sixth, the intervention group received Quartet Card Game education, while the control group received conventional education. Finally, both groups completed the post-test questionnaire after the educational session.

Data Analysis

Data were analyzed using SPSS software. Descriptive statistics were used to summarize respondent characteristics and variable scores. Categorical data were presented as frequencies and percentages, while numerical data were presented as means and standard deviations or medians and ranges, depending on data distribution.

The Shapiro-Wilk test was used to assess the normality of the data. If the data were normally distributed, the paired t-test was used to analyze differences between pre-test and post-test scores within each group. If the data were not normally distributed, the Wilcoxon Signed-Rank Test was used. To compare differences between the intervention and control groups, the independent t-test was used for normally distributed data, while the Mann-Whitney U Test was used for non-normal data. Regression analysis was used to examine the effect of the Quartet Card Game intervention on knowledge, attitudes, and behavioral intention toward thalassemia screening. The level of statistical significance was set at 0.05.

Result and Discussion

The baseline characteristics of respondents, the normality test results, and the statistical comparisons between the intervention and control groups. The analysis was conducted to determine whether education using the Quartet Card Game was more effective than conventional lecture-based education in improving students' knowledge, attitudes, and behavioral intention toward thalassemia screening. The results are presented systematically through baseline comparison, within-group changes, between-group differences, correlation analysis, and regression analysis to provide a comprehensive understanding of the intervention effect.

Table 1. Baseline Comparison Between Intervention and Control Groups

Variable	Intervention Group (n = 50)	Control Group (n = 50)	Test Value	p-value
Age, mean ± SD	20.48 ± 1.32	20.36 ± 1.41	t = 0.44	0.662
Female, n (%)	32 (64.0)	31 (62.0)	χ^2 = 0.04	0.837
Previous thalassemia information, n (%)	18 (36.0)	16 (32.0)	χ^2 = 0.18	0.673
Family history of thalassemia, n (%)	2 (4.0)	3 (6.0)	χ^2 = 0.21	0.646
Pre-test knowledge, mean ± SD	62.50 ± 5.20	62.10 ± 5.40	t = 0.38	0.707

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852

Pre-test attitude, mean ± SD	3.20 ± 0.60	3.12 ± 0.58	t = 0.68	0.500
Pre-test screening intention, mean ± SD	3.40 ± 0.70	3.36 ± 0.68	t = 0.29	0.772

Table 1 shows that there were no statistically significant differences between the intervention and control groups at baseline because all p-values were greater than 0.05. This indicates that both groups were comparable before the intervention. Therefore, differences found after the intervention can be more confidently attributed to the educational method. This strengthens the internal validity of the study.

Table 2. Shapiro-Wilk Normality Test

Variable	**Group**	**Pre-test p-value**	**Post-test p-value**	**Decision**
Knowledge	Intervention	0.118	0.094	Normally distributed
Knowledge	Control	0.132	0.156	Normally distributed
Attitude toward screening	Intervention	0.087	0.102	Normally distributed
Attitude toward screening	Control	0.141	0.119	Normally distributed
Screening intention	Intervention	0.096	0.128	Normally distributed
Screening intention	Control	0.165	0.137	Normally distributed

Table 2 confirms that the pre-test and post-test data were normally distributed. Since all Shapiro-Wilk p-values exceeded 0.05, parametric tests were appropriate. The paired t-test was used to analyze within-group changes, while the independent t-test was used to compare changes between the intervention and control groups.

Table 3. Within-Group Comparison of Pre-test and Post-test Scores

Variable	**Group**	**Pre-test Mean ± SD**	**Post-test Mean ± SD**	**Mean Difference**	**t-value**	**p-value**	**Cohen's d**
Knowledge	Intervention	62.50 ± 5.20	82.30 ± 4.80	19.80	15.45	< 0.001	2.18
Knowledge	Control	62.10 ± 5.40	65.10 ± 5.00	3.00	5.05	< 0.001	0.71
Attitude toward screening	Intervention	3.20 ± 0.60	4.10 ± 0.50	0.90	12.38	< 0.001	1.75
Attitude toward screening	Control	3.12 ± 0.58	3.32 ± 0.56	0.20	3.54	0.001	0.50
Screening intention	Intervention	3.40 ± 0.70	4.30 ± 0.60	0.90	13.52	< 0.001	1.91

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852

Screening intention	Control	3.36 ± 0.68	3.46 ± 0.62	0.10	1.77	0.083	0.25

Table 3 shows that students in the intervention group experienced significant increases in knowledge, attitude, and screening intention after receiving education through the Quartet Card Game. The largest improvement occurred in knowledge, with a mean increase of 19.80 points. The effect sizes for the intervention group were large across all outcomes, indicating that the Quartet Card Game had a strong practical effect, not only a statistically significant effect. This result is consistent with previous evidence that game-based educational media can improve health knowledge and engagement through active learning and repeated exposure to key messages (Fazrin et al., 2023; D'Arqom et al., 2026). The control group also showed a small improvement in knowledge and attitude, but the magnitude of change was lower than that of the intervention group. Screening intention did not improve significantly in the control group. This suggests that conventional education may improve factual understanding, but it may be less effective in strengthening students' intention to participate in screening.

Table 4. Between-Group Comparison of Mean Change Scores

Variable	**Intervention Group Mean Change ± SD**	**Control Group Mean Change ± SD**	**Mean Difference**	**t-value**	**p-value**	**Cohen's d**
Knowledge	19.80 ± 9.06	3.00 ± 4.20	16.80	11.86	< 0.001	2.37
Attitude toward screening	0.90 ± 0.51	0.20 ± 0.40	0.70	7.64	< 0.001	1.53
Screening intention	0.90 ± 0.47	0.10 ± 0.40	0.80	9.16	< 0.001	1.83

Table 4 shows that the mean change scores were significantly higher in the intervention group than in the control group for all outcomes. This means that the Quartet Card Game was more effective than conventional education in improving students' knowledge, attitude, and screening intention. The large effect sizes indicate that the differences were not only statistically significant but also practically meaningful. These findings support the use of interactive educational media for thalassemia prevention among university students.

Table 5. Post-Test Comparison Between Intervention and Control Groups

Variable	**Intervention Group Mean ± SD**	**Control Group Mean ± SD**	**Mean Difference**	**t-value**	**p-value**	**Cohen's d**
Knowledge	82.30 ± 4.80	65.10 ± 5.00	17.20	17.55	< 0.001	3.51
Attitude toward screening	4.10 ± 0.50	3.32 ± 0.56	0.78	7.35	< 0.001	1.47
Screening intention	4.30 ± 0.60	3.46 ± 0.62	0.84	6.89	< 0.001	1.38

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852

Table 5 shows that post-test scores in the intervention group were significantly higher than those in the control group. This confirms that students who received education through the Quartet Card Game had better knowledge, more positive attitudes, and stronger screening intention than students who received conventional education. The finding supports the Health Belief Model because students who better understood thalassemia risk and the benefits of screening showed stronger readiness to consider preventive action (Alyafei & Easton Carr, 2024).

Table 6. Correlation Between Knowledge, Attitude, and Screening Intention

Relationship Between Variables	**r-value**	**p-value**	**Interpretation**
Knowledge and attitude toward screening	0.63	< 0.001	Moderate positive correlation
Knowledge and screening intention	0.58	< 0.001	Moderate positive correlation
Attitude toward screening and screening intention	0.70	< 0.001	Strong positive correlation

Table 6 shows that knowledge, attitude, and screening intention were positively correlated. Students with higher knowledge scores tended to have more positive attitudes toward screening and stronger intention to participate in screening. The strongest relationship was found between attitude and screening intention. This indicates that attitude may play an important role in translating knowledge into preventive intention. This result is consistent with studies showing that increased knowledge does not always directly lead to screening behavior unless it is supported by positive attitudes and reduced perceived barriers (Handian et al., 2025; Triatin et al., 2022).

Table 7. Multiple Linear Regression Predicting Post-Test Screening Intention

Predictor	**B**	**SE**	**β**	**t-value**	**p-value**	**95% CI**
Constant	0.82	0.34		2.41	0.018	0.15 to 1.49
Group assignment	0.42	0.10	0.28	4.20	< 0.001	0.22 to 0.62
Post-test knowledge	0.018	0.005	0.31	3.60	0.001	0.008 to 0.028
Post-test attitude	0.47	0.09	0.46	5.22	< 0.001	0.29 to 0.65
Baseline screening intention	0.21	0.07	0.20	3.00	0.003	0.07 to 0.35

Model summary: $R^2 = 0.62$; Adjusted $R^2 = 0.60$; $F(4, 95) = 38.65$; $p < 0.001$.

Table 7 shows that group assignment, post-test knowledge, post-test attitude, and baseline screening intention significantly predicted post-test screening intention. The model explained 62% of the variance in screening intention. Group assignment remained significant after controlling for knowledge, attitude, and baseline intention. This indicates that students who received the Quartet Card Game intervention had stronger screening intention than those who received conventional education. Among all predictors, attitude had the strongest standardized coefficient. This suggests that improving students' attitudes toward screening is central to increasing their intention to participate in thalassemia screening programs. This finding supports the Health Belief Model because perceived benefit, perceived severity, and positive evaluation of screening can influence preventive intention (Alyafei & Easton Carr, 2024; Zareban et al., 2024).

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852

Thalassemia Prevention as a Behavioral and Educational Challenge

This study should be understood as more than an evaluation of an educational tool. It addresses a broader public health issue, namely how thalassemia prevention can be moved from clinical information into the personal decision-making space of young adults before marriage and reproduction. Thalassemia control depends not only on treatment, but also on early carrier identification, genetic counseling, and informed reproductive choices. However, many prevention programs still rely on education as simple information delivery. This approach is limited because factual knowledge alone does not automatically lead to screening behavior.

In Indonesia, thalassemia remains an important public health concern because carrier frequency is epidemiologically meaningful and long-term treatment places a heavy burden on families and health systems. Therefore, prevention must address knowledge, attitude, perceived risk, and intention simultaneously (Kattamis et al., 2020; Wahidiyat et al., 2022; Siswati et al., 2022; Alfaqeeh et al., 2025; Santoso et al., 2025). University students are a strategic population because they are approaching reproductive age and may soon make decisions about marriage, family planning, and premarital screening.

The findings of this study indicate that thalassemia education should not rely only on conventional didactic methods such as lectures, leaflets, or one-way counseling. These methods can deliver information about symptoms, inheritance patterns, and screening procedures, but they may fail to make genetic risk personally meaningful. Previous studies also show that knowledge may increase after education, but willingness to participate in screening does not always improve in the same way (Ngim et al., 2020; Triatin et al., 2022; Rujito et al., 2023). This gap between knowing and intending is one of the main weaknesses of many prevention programs.

By placing thalassemia content into a structured, peer-based, game-based activity, the Quartet Card Game creates opportunities for repeated exposure, social interaction, active recall, and immediate clarification. These mechanisms are stronger than passive learning, especially for genetic health topics that students may perceive as abstract or emotionally distant (Fazrin et al., 2023; Cutica et al., 2024; D'Arqom et al., 2026). Therefore, the value of this intervention lies in its ability to connect cognitive understanding with affective appraisal and preventive intention.

Theoretical and Practical Implications of the Quartet Card Game

The results of this study strengthen the argument that thalassemia prevention requires a behavioral theory, not only a biomedical explanation. The Health Belief Model is relevant because screening is not an automatic response to information. Students need to perceive thalassemia as serious, recognize that carrier status may be personally relevant, believe that screening has clear benefits, and feel that barriers such as fear, stigma, cost, and access can be managed (Hita et al., 2023; Alyafei & Easton Carr, 2024). In this framework, knowledge is necessary, but it is not sufficient.

The Quartet Card Game supports this process because it organizes information into smaller, repeated, and socially negotiated learning units. Students do not only receive information; they ask, answer, compare, correct, and remember. This active learning process can help transform genetic information into perceived susceptibility, perceived benefit, and screening readiness. Compared with conventional lectures, game-based learning has greater potential to make students personally engaged with the issue of thalassemia prevention.

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852

This study also contributes to the literature on thalassemia education by focusing on university students. Previous school-based interventions are useful for introducing genetic literacy early, but senior high school students may still be relatively distant from marriage and reproductive decisions. University students occupy a more decision-relevant position because partner selection, reproductive planning, and future family decisions are more immediate. Thus, this study extends earlier work on adolescent thalassemia education by applying the intervention to a population that is closer to premarital decision making (Triatin et al., 2022; Anwar et al., 2025; D'Arqom et al., 2026).

From a practical perspective, thalassemia screening education should be integrated into campus health promotion, reproductive health programs, premarital counseling preparation, and student orientation activities. Universities may not be clinical institutions, but they are important prevention settings because they gather young adults before many of them enter marriage and family life. Campus-based education can also reduce stigma by presenting carrier screening as a normal part of responsible health planning, not as a sign of illness or personal defect.

The content of the Quartet Card Game should also be designed around the decision pathway toward screening. It should not only explain the definition, symptoms, and causes of thalassemia, but also include inheritance patterns, carrier meaning, risk of affected offspring when both partners are carriers, benefits of premarital screening, genetic counseling, myths about carrier status, and practical access to screening services. In this way, game-based education can become a bridge between awareness and service linkage, not merely a classroom activity.

Policy, Measurement, and Future Research Implications

This study has important policy relevance for thalassemia prevention in Indonesia. The burden of thalassemia cannot be addressed only by expanding transfusion services and clinical care. Treatment remains necessary, but prevention is a more sustainable public health strategy. Countries that have successfully reduced severe thalassemia births have relied on carrier screening, genetic counseling, public education, and culturally adapted reproductive health policies (Kattamis et al., 2020). Indonesia therefore needs educational strategies that are scalable, culturally appropriate, and suitable for young adults.

A low-cost educational game such as the Quartet Card Game can serve as a practical entry point for wider screening promotion. However, its scalability depends on standardized content, facilitator training, fidelity monitoring, and referral systems that connect students with real screening services. Universities, health faculties, campus clinics, local health offices, and community health centers should be involved in building this prevention pathway.

The study also suggests that future research should move beyond post-test knowledge as the main outcome. Knowledge is only a proximal indicator. Screening intention is closer to prevention, but it is still incomplete without measuring actual screening behavior. Future studies should assess actual screening uptake, knowledge retention over time, perceived susceptibility, perceived barriers, and whether students discuss screening with partners or family members. Longitudinal and multicenter studies are also needed to examine whether the effect of the intervention remains stable across different regions, cultures, academic disciplines, and levels of health literacy.

There is also a need for stronger measurement instruments. Future studies should measure not only knowledge accuracy, but also misconception correction, perceived seriousness, perceived susceptibility, perceived benefits, perceived barriers, cues to action, self-efficacy, intention,

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852

and actual screening behavior. This would allow researchers to explain how an educational intervention works, not only whether it works. It would also prevent overclaiming based only on improved knowledge scores.

Conclusion

This study demonstrates that the Quartet Card Game is a promising interactive educational medium for strengthening thalassemia prevention among university students by improving knowledge, shaping more positive attitudes, and encouraging stronger intention to participate in premarital thalassemia screening. The findings support the view that effective thalassemia education should move beyond one-way information delivery and should instead use active, theory-informed, and student-centered learning strategies that connect genetic knowledge with personal preventive decision making. By applying a controlled experimental design and examining cognitive and behavioral outcomes within the Health Belief Model framework, this study contributes evidence that game-based education can serve as a practical bridge between awareness and screening readiness. The intervention is relevant for higher education settings because university students are approaching reproductive age and represent a strategic group for early prevention. However, future studies should extend this work through multicenter trials, longer follow-up periods, and measurement of actual screening uptake to confirm whether improved intention can translate into real preventive behavior.

References

Akoku, D. A., Achombwom Vukugah, T., Abena Tihnje, M., & Bigweh Nzubepie, I. (2022). Childbearing intentions, fertility awareness knowledge and contraceptive use among female university students in Cameroon. *Plos one*, *17*(10), e0276270. https://doi.org/10.1371/journal.pone.0276270

Alam, N. E., Islam, M. S., Khabir, M. I. U., Suriea, U., Islam, M. M., Mohiuddin, R. B., ... & Mohiuddin, A. K. M. (2022). The scenario of knowledge, attitude and practice of the Bangladeshi population towards thalassemia prevention: A nationwide study. *PLOS global public health*, *2*(10), e0001177. https://doi.org/10.1371/journal.pgph.0001177

Alfaqeeh, M., Zakiyah, N., Postma, M. J., & Suwantika, A. A. (2025). Setting priorities for healthcare interventions in Indonesia: a comprehensive conceptual framework. *International Journal for Equity in Health*, *24*(1), 327. https://doi.org/10.1186/s12939-025-02668-z

Alhussaini, N. W. Z., Elshaikh, U., Abdulrashid, K., Elashie, S., Hamad, N. A., & Al-Jayyousi, G. F. (2025). Sexual and reproductive health literacy of higher education students: a scoping review of determinants, screening tools, and effective interventions. *Global Health Action*, *18*(1), 2480417. https://doi.org/10.1080/16549716.2025.2480417

Alhuthali, H. M., Ataya, E. F., Alsalmi, A., Elmissbah, T. E., Alsharif, K. F., Alzahrani, H. A., ... & Hassanein, D. E. (2023). Molecular patterns of alpha-thalassemia in the kingdom of Saudi Arabia: identification of prevalent genotypes and regions with high incidence. *Thrombosis Journal*, *21*(1), 115. https://doi.org/10.1186/s12959-023-00560-w

Alyafei, A., & Easton Carr, R. (2024). The health belief model of behavior change. In *StatPearls*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK606120/

Anwar, M. N., Abdullah, N. N., Roslan, D., & Mat Ruzlin, A. N. (2025). Characteristics and effectiveness of premarital thalassaemia educational interventions worldwide: A

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852

scoping review. *Sultan Qaboos University Medical Journal, 25*(1), 773–783. https://doi.org/10.18295/2075-0528.2908

Beber, R. B. C., Meyer, N. D., & Felipetto, G. R. (2024). Digital educational game "O Jardim do Ferro": A tool for the prevention of iron deficiency anemia in childhood. *Games for Health Journal, 13*(1), 20–34. https://doi.org/10.1089/g4h.2023.0006

Cutica, I., Cincidda, C., Oliveri, S., Mainetti, R., Borghese, N. A., & Pravettoni, G. (2024). Effectiveness of serious games in improving genetic literacy and genetic risk awareness in the general public: A pilot study. *Games for Health Journal, 13*(2), 85–97. https://doi.org/10.1089/g4h.2022.0041

D'arqom, A., Nasution, M. Z., Indiastuti, D. N., Kostya, K., Savira, N. F., & Yusof, J. (2026). Effectiveness of a quartet based educational game in improving thalassemia knowledge and screening awareness among senior high school students. *Media Publikasi Promosi Kesehatan Indonesia, 9*(2), 253–261. https://doi.org/10.56338/mppki.v9i2.8889

Ebrahimi, M., Mohammadi-Asl, J., & Rahim, F. (2021). The worldwide molecular spectrum and distribution of thalassaemia: a systematic review. *Annals of Human Biology*, *48*(4), 307-312. https://doi.org/10.1080/03014460.2021.1909135

Fazrin, I., Anggraeni, S., Hidajaturrokhmah, N. Y., Siwi, R. P. Y., & Wahyuni, C. (2023). Media education quartet card play on reproductive health learning in adolescents. *Journal of Nursing Practice, 7*(1), 127–132. https://doi.org/10.30994/jnp.v7i1.426

Fetriyah, U. H., Ariani, M., Elasari, Y., & Nito, P. J. B. (2020). Health education and early detection of thalassemia through premarital check up programs for adolescents. *Jurnal Suaka Insan Mengabdi, 3*(2), 308–316. https://doi.org/10.51143/jsim.v3i2.308

Gbagbo, F. Y., & Nkrumah, J. (2019). Family planning among undergraduate university students: a CASE study of a public university in Ghana. *BMC women's health*, *19*(1), 12. https://doi.org/10.1186/s12905-019-0708-3

Hadi, E. N. (2024). Premarital screening: A catalyst for achieving good health and well being. *Jurnal Promkes: The Indonesian Journal of Health Promotion and Health Education, 12*(1), 146–154. https://doi.org/10.20473/jpk.V12.ISI1.2024.146-154

Handian, F. I., Maemunah, N., Kipply, Z., & Aisah, A. (2025). Nursing students' health beliefs and attitudes towards thalassemia screening. *Care: Jurnal Ilmiah Ilmu Kesehatan, 13*(3), 511–518. https://doi.org/10.33366/jc.v13i3.7525

Hita, M. L. R., Grégoire, Y., Lussier, B., Boissonneault, S., Vandenberghe, C., & Sénécal, S. (2023). An extended health belief model for COVID-19: understanding the media-based processes leading to social distancing and panic buying. *Journal of the Academy of Marketing Science*, *51*(1), 132-152. https://doi.org/10.1007/s11747-022-00865-8

Kattamis, A., Kwiatkowski, J. L., & Aydinok, Y. (2022). Thalassaemia. *The lancet*, *399*(10343), 2310-2324.

Kharamannia, F., Rezaei, H., Roustaei, N., & Etemadfar, P. (2023). Comparing the effects of self care education by lecture and smartphone application on self efficacy of patients with thalassemia. *BMC Medical Informatics and Decision Making, 23*, Article 21. https://doi.org/10.1186/s12911-023-02097-4

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852

Khawwas, H. S. M., El-Guindi, F. K., Farahat, N. H., & Mohamed, A. T. (2025). Applying health belief model among mothers of children with thalassemia. *Scientific Reports*, *15*(1), 31219. https://doi.org/10.1038/s41598-025-15584-7

Lotfi, M. (2023). An educational program on improving parents' knowledge, attitude, and performance in thalassemia care. *Medical Science, 27*, e250ms3033. https://doi.org/10.54905/disssi/v27i136/e250ms3033

Meri, M. A., Al-Hakeem, A. H., & Al-Abeadi, R. S. (2022). Overview on thalassemia: a review article. *Medical Science*, *3*(1). https://doi.org/10.46966/msjar.v3i1.36

Ngim, C. F., Ibrahim, H., Abdullah, N., Lai, N. M., Tan, R. K. M., & Ng, C. S. (2020). A web based educational intervention module to improve knowledge and attitudes towards thalassaemia prevention in Malaysian young adults. *Medical Journal of Malaysia, 74*(3), 219–225. https://pubmed.ncbi.nlm.nih.gov/31256177/

Ngim, S. (2020). Intervensi berbasis teknologi dalam skrining thalassemia: Efek pada pengetahuan dan sikap. *Journal of Genetic Counseling*. https://doi.org/10.1002/jgc4.1289

Oluwole, E. O., Okoye, C. D., Ogunyemi, A. O., Olowoselu, O. F., & Oyedeji, O. A. (2022). Knowledge, attitude and premarital screening practices for sickle cell disease among young unmarried adults in an urban community in Lagos, Nigeria. *The Pan African medical journal*, *42*, 8. https://doi.org/10.11604/pamj.2022.42.8.27705

Perrin, J., Meeus, A., & Broseus, J. (2023). A serious game about hematology for health care workers (SUPER HEMO): Development and validation study. *JMIR Serious Games, 11*, e40350. https://games.jmir.org/2023/1/e40350/

Phan, N. Q., Pham, T. T., Dang, T. T. T., Tran, T. A. N., Nguyen, T. T. A., Doan, B. N., ... & Tran, H. (2025). Understanding What Medical Students Know—but Don't Do—about Thalassemia: A Behavioural Perspective on Socioeconomic Influences. *Semarak International Journal of Applied Psychology*, *6*(1), 10-23. https://doi.org/10.37934/sijap.6.1.1023

Rujito, L., Pusparini, I., Lestari, D. W. D., & Mulyanto, J. (2023). Educational intervention to improve knowledge and attitudes about thalassemia premarital screening among Muslim societies: A pilot study in Indonesia. *Jurnal Keperawatan Soedirman, 18*(1), 30–36. https://doi.org/10.20884/1.jks.2023.18.1.6253

Sadiq, I. Z., Abubakar, F. S., Usman, H. S., Abdullahi, A. D., Ibrahim, B., Kastayal, B. S., ... & Hassan, H. A. (2024). Thalassemia: Pathophysiology, diagnosis, and advances in treatment. *Thalassemia Reports*, *14*(4), 81-102. https://doi.org/10.3390/thalassrep14040010

Santoso, A., Citraningtyas, T., Viora, E., Gotera, W., Fujiati, I. I., Lukito, W., ... & Billy, A. (2025). Towards integrated cardiovascular and mental health management in primary health care in Indonesia: a policy outlook. *The Lancet Regional Health-Southeast Asia*, *37*. https://doi.org/10.1016/j.lansea.2025.100605

Sari, T. T., Rahmartani, L. D., Wirahmadi, A., Selene, N. B., Iskandar, S. D., & Wahidiyat, P. A. (2024). Psychological burden among pediatric thalassemia major patients in Indonesia: A review. *Thalassemia Reports, 14*(2), 33–43. https://doi.org/10.3390/thalassrep14020005

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852

Setiawan, H., Rahman, I. A., Hidayat, N., Marliany, H., & Rahayu, Y. (2024). Development of educational leaflet for genetic counseling and premarital screening of thalassemia for prospective couples. *Genius Journal,* *5*(2), 161–167. https://doi.org/10.56359/gj.v5i2.316

Siswati, T., Paramashanti, B. A., Rialihanto, M. P., & Waris, L. (2022). Epidemiological transition in Indonesia and its prevention: A narrative review. *J Complement Altern Med Res*, *18*(1), 50-60. https://doi.org/10.9734/jocamr/2022/v18i130345

Tan, H. Y., Hussein, N., Lee, Y. K., & Abdul Malik, T. F. (2023). Adolescents' experiences and views of the national school based thalassaemia screening programme in Malaysia: A qualitative study. *Journal of Community Genetics, 14*(4), 361–369. https://doi.org/10.1007/s12687-023-00656-w

Tessler, H. (2023). The stability of singlehood: Limitations of the relationship status paradigm and a new theoretical framework for reimagining singlehood. *Journal of Family Theory & Review*, *15*(3), 444-464. https://doi.org/10.1111/jftr.12506

Triatin, R. D., Rakhmilia, L. E., Sribudiani, Y., & Susanah, S. (2022). Knowledge towards thalassemia and willingness to screen among students in Public Senior High School 3 Bandung. *Althea Medical Journal,* *9*(4), 241–247. https://doi.org/10.15850/amj.v9n4.2730

Ud Din, S., Baig, M. Z., & Khan, M. K. (2023). *Serious games: An updated systematic literature review*. arXiv. https://arxiv.org/abs/2306.03098

Wahidiyat, P. A., Sari, T. T., Rahmartani, L. D., Iskandar, S. D., Pratanata, A. M., Yapiy, I., ... Lubis, A. M. (2022). Thalassemia in Indonesia. *Hemoglobin, 46*(1), 39–44. https://doi.org/10.1080/03630269.2021.2023565

World Health Organization. (2022). *Thalassemia*. https://www.who.int/news-room/fact-sheets/detail/thalassemia

Zareban, I., Oudi Akbari, Z., Jadgal, M. S., Ansari, H., & Hosseinzehi Zamani, J. (2024). Effectiveness of the application of an educational program based on the Theory of Planned Behavior in adopting preventive behaviors among mothers who have thalassemia children in Iran: A randomized controlled trial. *Egyptian Journal of Medical Human Genetics, 25*, Article 45. https://doi.org/10.1186/s43042-024-00487-5

Zikra, A. A. (2023). The impact of gamified interventions on youth health literacy: Effectiveness and implementation challenges. *Jurnal Riset Kualitatif dan Promosi Kesehatan, 2*(2), 202–217. https://doi.org/10.61194/jrkpk.v2i2.666

Copyright © 2026, Journal of Asian-african Focus in Health, Under the license CC BY-SA 4.0
DOI: https://doi.org/10.71435/738852