

RESEARCH STUDY

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The Effectiveness of Digital Pocketbook for the Transformation of the Knowledge and Attitude of Adolescent Girls about the Prevention of Anemia

Efektifitas Buku Saku Digital untuk Transformasi Pengetahuan dan Sikap Remaja Putri tentang Pencegahan Anemia

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ABSTRACT

Background: Anemia is a significant health issues among adolescent girls, negatively impacting their life cycle. Bogor City has an anemia prevalence of 28%. The Indonesian Ministry of Health has introduced a digital pocketbook "Prevention of Anemia for Pregnant Women and Adolescent Girls", an educational tool.

Objectives: This study aimed to assess the effectiveness of the digital pocketbook in improving the knowledge and attitudes of adolescent girls about preventing anemia.

Methods: This quasi-experiment study used Pretest-Posttest with Control Group design. Samples were purposively chosen from female students in four junior high schools in Bogor (40 students per group per school). Group 1 received Digital Pocket Book with Presentatio, Group 2 received Digital Pocket Book only, and Group 3 served as Control. Changes in knowledge and attitude scores before and after the intervention were analyzed using Wilcoxon test, while the difference among the three groups were tested using Kruskal-Wallis tests with post-hoc analysis (p-value<0.05).

Results: Before the intervention, knowledge and attitudes score was relatively homogeneous (p-value=0.068 and 0.695). After the intervention, Group 1 and 2 showed significant improvements compared to the control. Group 1's knowledge increased significantly (3.01 ± 3.613), followed by Group 2 (1.78 ± 2.947). Attitude improvement was also highest in Group 1 (5.10 ± 7.947), followed by Group 2 (2.65 ± 7.118). Additionally, 95% of respondents rated the digital pocketbook as excellent.

Conclusions: The digital pocketbook iss considered effective and informative in improving the knowledge and attitudes of adolescent girls about preventing anemia, regardless of additional explanation.

INTRODUCTION

One of the Sustainable Development Goals (SDGs) objectives is to achieve Good Health and Well-Being, which aims to ensure a healthy life and well-being for individuals across all age groups. A key focus of SDG Goal 3 is providing adequate nutrition for society, one of which is through the Healthy Living Society Movement (GERMAS) strategy¹. A crucial nutrition-related health issue among adolescents is anemia in adolescent girls, which falls under the category of Women of Reproductive Age/WRA. The World Health Assembly (WHA) has committed to reducing anemia prevalence among WRA by 50% by 2025. In 2021, the global prevalence of anemia among women of reproductive age reached 29.9%, while in Southeast Asia, 233,980 out of 539,000 women of reproductive age were affected by anemia². In Indonesia,

the prevalence of anemia among adolescent girls aged 15-24 years, based on data from the Basic Health Research (Riskesdas) of the Indonesian Ministry of Health, showed a high figure, increasing from 18.4% (in 2013) to 32% (in 2018), or approximately 14.7 million individuals, meaning that 3 out of 10 adolescent girls experience anemia³.

The impact of anemia on adolescent girls includes health disorders, reduced quality of life, and developmental and learning impairments, which may ultimately lead to economic and productivity disruptions in society⁴. Anemia in adolescent girls can have further consequences, as when they later become pregnant while suffering from anemia, they are at risk of giving birth to babies with Low Birth Weight/LBW and stunting³. Adolescent girls are at high risk of experiencing iron

deficiency anemia due to the rapid increase in iron requirements, insufficient dietary iron intake, high infection rates, early marriage, teenage pregnancy, and significant blood loss during menstruation^{5,6}. According to Chaparro (2019)⁷ and Hess (2023)⁸, in addition to these direct causes, there are underlying risk factors, including low health education, health behaviors, and health policies.

From a health policy perspective regarding anemia prevention, the Government of Indonesia, through the Ministry of Health (Kemenkes RI), has issued Minister of Health Regulation No. 88 of 2014 on the Standards for Iron Supplement Tablets (*tablet tambah darah*/TTD) for WRA and Pregnant Women⁹ and Circular Letter No. HK.03.03/V/0595/2016 on the Provision of Iron Supplement Tablets for Adolescent Girls and WRA¹⁰. Through various derivative programs stemming from these policies, Indonesia has significantly reduced stunting rates, from 27.7% in 2019 to 24.4% in 2021. By 2024, the government aims to reduce the stunting prevalence to 14%. Special attention for achieving the target is given to five provinces with the highest number of stunted children: West Java, East Java, Central Java, North Sumatra, and Banten¹¹.

To address the problem of anemia, World Health Organization (WHO) classifies interventions into specific and sensitive approaches. The specific approach includes strategies for improving dietary patterns, micronutrient supplementation, and behavioral and social changes. Meanwhile, the sensitive approach focuses on combating parasitic infections, improving hygiene and sanitation, ensuring access to clean water, enhancing reproductive health, and implementing cross-sectoral actions¹². The specific approach oriented toward healthy behavior involves three key components: knowledge (cognitive), attitude (affective), and action (psychomotor). One of the solutions to support efforts in improving health education is through providing information media, including digital information media such as the digital pocketbook titled "*Prevention of Anemia for Pregnant Women and Adolescent Girls*," published by the Indonesian Ministry of Health¹³.

Previous studies related to improving health education on anemia among adolescent girls have shown that health counseling has a significant impact on increasing adolescents' knowledge about anemia (p-value=0.016)¹⁴. Another study in 2023 on the use of digital pocketbooks found a significant increase in knowledge among adolescent girls after the intervention, particularly regarding nutrition and anemia knowledge. Another study in 2023 on digital pocketbook media found a significant increase in knowledge after the intervention, particularly in nutrition and anemia knowledge among adolescent girls¹⁵. A similar study conducted in 2023 on reproductive health and healthy eating involving female students in Islamic boarding schools (*pesantren*) found a significant relationship between the digital pocketbook intervention and the anemia status of female students in the pesantren. The provided education led to a significant

increase in students' knowledge (p-value<0.001), as evidenced by the higher percentage of students with good knowledge after the intervention¹⁶.

Although several previous studies have evaluated the use of digital educational media in increasing knowledge about anemia, no research has examined the effectiveness of the digital pocketbook developed by the Indonesian Ministry of Health or how the information within the digital pocketbook is utilized. Additionally, while the digital pocketbook has been introduced as an educational tool, evaluations of its acceptance and effectiveness in the Indonesian context, particularly among adolescent girls, remain limited. This study is essential to address this gap by providing more apparent evidence on how adolescent girls can accept and implement the digital pocketbook as an effective measure for anemia prevention.

This study was conducted in West Java Province, which has a high anemia prevalence (41.9% in 2018), particularly in Bogor City, where anemia prevalence falls within the moderate category¹⁷. This study was conducted in areas with the highest and lowest prevalence of anemia among adolescent girls, specifically in the service area of Puskesmas Kayu Manis in Bogor City, which is among the three areas with the highest anemia prevalence among adolescent girls (49%)¹⁸, as well as one of the areas with the lowest anemia prevalence, Puskesmas Warung Jambu (7%), to provide a comprehensive picture of the knowledge and attitudes of adolescent girls regarding anemia prevention. This study aims to examine the level of knowledge and attitudes of adolescent girls regarding anemia prevention and evaluate significant differences in their knowledge and attitudes after receiving an educational intervention through the "Digital Pocketbook for Anemia Prevention in Pregnant Women and Adolescent Girls". Additionally, this study seeks to understand how adolescent girls assess the quality of the information in the digital pocketbook, including aspects such as ease of understanding, image and color arrangement, layout appropriateness, and whether the conveyed messages effectively encourage the desired actions.

METHODS

This quantitative study used a quasi-experimental approach with a Pretest-Posttest Design with a Control Group to determine whether the digital pocketbook on anemia prevention improves the knowledge and attitudes of adolescent girls before and after the intervention. The participants were selected from public and private junior high school students in Bogor City who had provided written consent to participate in this study. This study received ethical approval from the Health Research Ethics Committee of Ibn Khaldun University, Bogor, on 15 August 2024, with Approval Letter Number 012/K.11/KEPK/FIKES-UIKA/2024. Table 1 below presents the intervention group design based on the variables studied:

Table 1. Intervention group design based on variables

Variables	Groups	Pre-test	Intervention	Post-test
Knowledge	Intervention Group 1	A1	x ₁	A2
	Intervention Group 2	B1	x ₂	B2
	Control Group 3	C1	o	C2
Attitude	Intervention Group 1	D1	x ₁	D2
	Intervention Group 2	E1	x ₂	E2
	Control Group 3	F1	o	F2

Notes:

x₁ : Intervention using the digital pocketbook on anemia prevention along with face-to-face discussion.

x₂ : Intervention using the digital pocketbook on anemia prevention only.

o : No intervention.

A1/A2 : Pre-test/Post-test knowledge scores of adolescent girls in Intervention Group 1.

B1/B2 : Pre-test/Post-test knowledge scores of adolescent girls in Intervention Group 2.

C1/C2 : Pre-test/Post-test knowledge scores of adolescent girls in the Control Group 3.

D1/D2 : Pre-test/Post-test attitude scores of adolescent girls in Intervention Group 1

E1/E2 : Pre-test/Post-test attitude scores of adolescent girls in Intervention Group 2.

F1/F2 : Pre-test/Post-test attitude scores of adolescent girls in the Control Group 3.

The intervention in this study utilized the digital pocketbook, as seen in Images 1, "Prevention of Anemia for Pregnant Women and Adolescent Girls." This book comprises five content chapters and one concluding chapter, totaling 50 pages. The complete digital

pocketbook on anemia prevention from the Indonesian Ministry of Health can be downloaded at <https://perpustakaan.kemkes.go.id/books/buku-saku-pencegahan-anemia-pada-ibu-hamil-dan-remaja-putri/>.



Figure 1. Cover of the Digital Pocketbook "Prevention of Anemia for Pregnant Women and Adolescent Girls"

Population and Sample

The target population were adolescent girls aged 12-15 years (early adolescence), while the accessible population includes adolescent girls aged 12-15 years from four junior high schools (SMP) in Bogor City, West Java, selected purposively based on the schools' willingness to participate in the study. SMPN 16 and MTS Yatashi (private school) are located in the Kayumanis area (anemia prevalence 49%), while SMPN 08 and SMPN 15 are in the Warung Jambu area (anemia prevalence 7%). The inclusion criteria for the sample are willingness to participate as respondents by signing the informed consent form; willingness to complete the pre-test and post-test questions in full using *Google Forms* or paper; and not referring to any other sources during the study except for the digital pocketbook used in the intervention.

The sample distribution from the four schools (one private and three public junior high schools) is as follows: each school selected 120 students through purposive sampling from 7th and 8th-grade classes. Each school was divided into three research groups:

Intervention Group 1 (digital pocketbook and presentation), Intervention Group 2 (digital pocketbook only), and Control Group 3. Each research group consisted of 40 students per school. The total sample size in this study was 120 students per school totaling to 480 adolescent girls.

Data Analysis

Univariate analysis was used to describe the variables of age, school, and anemia prevention behavior, as well as the assessment toward the digital pocketbook by the respondents. For bivariate analysis, a normality test was conducted on the knowledge and attitude variables prior to analysis¹⁹. The Kolmogorov-Smirnov normality test was used to determine whether the data distribution was normal. If the p-value <0.05, the data is considered non-normally distributed²⁰.

The study tested the hypothesis of whether there was a significant difference in the mean knowledge and attitude scores of adolescent girls before and after receiving the digital pocketbook educational intervention across all groups. The difference in mean od knowledge

and attitude score in each group was tested using Wilcoxon test, while differences among the three groups was tested using Kruskal-Wallis test with post hoc analysis. The study examined whether there was a significant difference in the increase in adolescent girls' mean knowledge and attitude scores before and after the intervention among the three groups (two intervention groups and one control group).

Instrument

Instruments for the study was developed following a standardized procedure²¹. Instrument was tested for validity and reliability before its use in data collection. The questionnaire items were confirmed as reliable with Cronbach- α of 0.768 for the knowledge questionnaire and 0.808 for the attitude questionnaire. The instrument was available in printed (paper-based) and online formats (Google Form). The research instrument for measuring the knowledge and attitudes of adolescent girls about anemia was developed in alignment with the content of the digital pocketbook used in the study. The questionnaire instrument was a closed-ended online survey consisting of variables of age, school origin, anemia prevention behavior, knowledge, and attitude. The knowledge variable included 20 multiple-choice questions (single correct answer). The attitude variable comprised 25 questions with a Likert scale response format, ranging from strongly agree, agree, neutral, disagree, to disagree strongly. Data was collected by distributing the Google Form questionnaire through the WhatsApp Group (WAG) of students at each school, with access provided via a QR code.

Intervention Stages

The research was conducted through intervention implementation stages, beginning with the intervention preparation stage, which included determining the schools and classes, grouping students, preparing instruments using Google Forms along with media links, pre-test and post-test links, QR codes, and hard copies, as well as PowerPoint (PPT) presentation materials based on the content of the digital pocketbook. The intervention implementation stage included pre-test

data collection for all groups, providing interventions for Groups 1 and 2, and post-test data collection for all groups. The duration of the pre-test and post-test data collection was 15 minutes. The intervention duration for Group 1 was 30 minutes for reading the digital pocketbook and 15 minutes for listening to the presentation, while Group 2 was given 30 minutes to read the digital pocketbook only. Group 3 only completed the pre-test and post-test without any intervention.

RESULTS AND DISCUSSIONS

Images 2 presents the results of students' assessments of the digital pocketbook used in the intervention. The assessment was conducted by adolescent girls in intervention Groups 1 and 2, evaluating ten aspects related to design and functionality. The data show that, on average, students rated various aspects of the pocketbook used in the intervention as very good, including ease of understanding the content (95%), the attractiveness of images and colors (99%), layout appropriateness (97%), and the ability of the pocketbook to encourage actions aligned with the conveyed messages (96%). These findings indicate that the pocketbook is effective in delivering information, visually appealing, and easy to understand for adolescent girls, which is crucial in motivating them to apply the knowledge gained.

The results suggest that the digital pocketbook used in this study successfully met the applied standards in terms of design and functionality. The highly positive assessments from students suggest that visual elements, such as images, colors, and layout, play a crucial role in enhancing comprehension and the material's appeal. Additionally, the pocketbook's ability to encourage actions aligned with the conveyed messages demonstrates its potential to improve knowledge and motivate behavioral changes among adolescent girls in anemia prevention. These findings also support the notion that educational media that present information in an engaging and easily accessible manner are more effective in capturing attention and promoting healthy behaviors than less interactive educational materials.

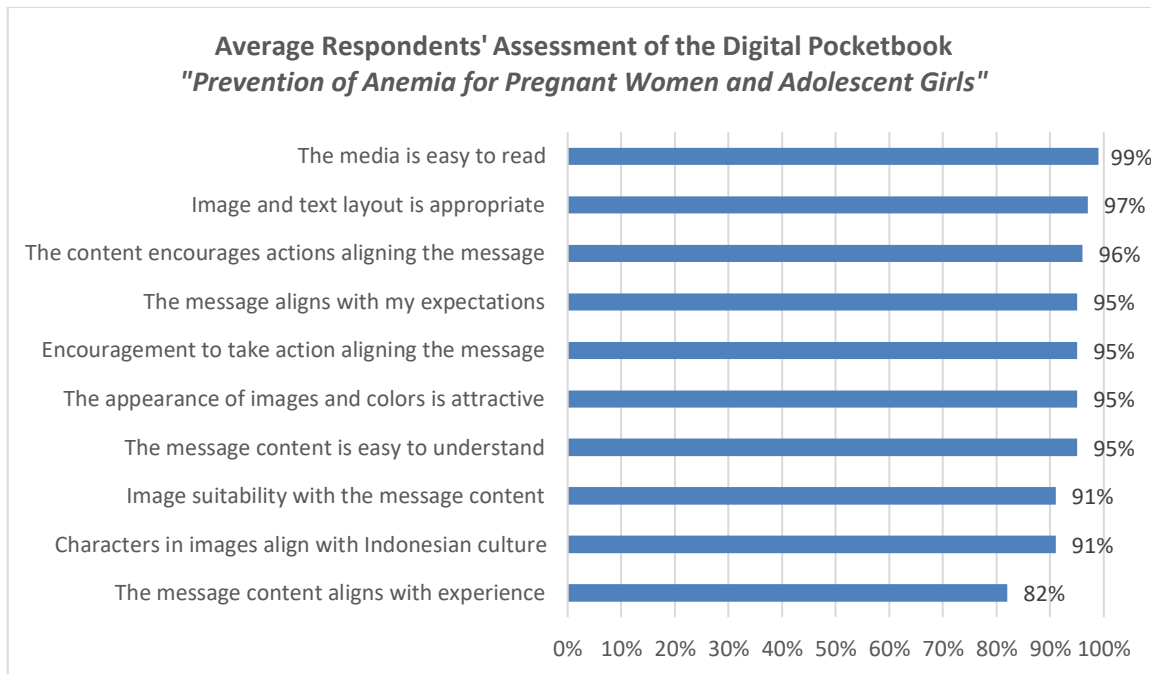


Figure 2. Students' assessment of the Digital Pocketbook

Table 2 presents the distribution of age, school origin, and anemia prevention behavior before the intervention across the three groups: the control group, the group that received the digital pocketbook, and the group that received the digital pocketbook, along with a presentation. In general, there were no significant differences in demographic characteristics and anemia prevention behavior among the three groups before the intervention. The average age of the students was approximately 13.2 years, with a similar distribution across groups. A total of 25% of the students were from private junior high schools, while 75% were from public schools. The majority of students (60%-70%) in each

group overall exhibited poor anemia prevention behavior (prevention behavior score ≤ 50).

This indicates that factors such as age and school origin did not contribute to differences in anemia prevention behavior at the initial data collection stage, suggesting that the intervention rather than external factors primarily influenced the observed effects in this study. The data also confirm that, despite demographic variations within the sample, the majority of adolescent girls exhibited inadequate anemia prevention behavior, highlighting the importance of behavioral change interventions.

Table 2. Age, school, and anemia prevention behavior by intervention group

Variables	Groups											
	3 Control				2 Pocketbook				1 Pocketbook and Presentation			
	n	%	Mean \pm SD	Min-Max	n	%	Mean \pm SD	Min-Max	n	%	Mean \pm SD	Min-Max
Age	160	33.3	13.19 \pm 0.810	12-15	160	33.3	13.18 \pm 0.765	12-15	160	33.3	13.18 \pm 0.723	12-15
School												
Private	40	8.3			40	8.3			40	8.3		
State	120	25.0			120	25.0			120	25.0		
Anemia Prevention Behavior												
Good	48	10.0			59	12.3			64	13.3		
Inadequate	112	23.2			101	21.0			96	20.0		

Table 3 shows the knowledge and attitude scores changes among adolescent girls in each intervention group (Pocketbook & Presentation, Digital Pocketbook Only, and Control). The group that received the pocketbook along with a presentation demonstrated a significant increase in knowledge (3.01 points) and attitude (5.10 points), with a p-value < 0.001 for both. The group that received only the pocketbook also showed a

significant increase in knowledge (1.78 points) and attitude (2.65 points). However, the increase was lower than the group receiving the pocketbook and presentation. Meanwhile, the control group, which did not receive any intervention, showed a very slight increase in knowledge (0.46 points) and no significant change in attitude. The Kruskal-Wallis test and further post-hoc analysis confirmed significant knowledge and

attitude improvement differences among the three groups (p-value <0.001).

Table 3. Distribution of knowledge and attitude scores among adolescent girls before and after the intervention, along with analysis results

Groups#	Variables							
	Knowledge (mean/med ± sd)			p-value	Attitude (mean/med ± sd)			p-value
	Pre	Post	Pre-Post		Pre	Post	Pre-Post	
1	10.95±3.246	13.96±3.707	3.01 ±3.613	<0.001*	88.37±7.501	93.11±8.997	5.10±7.947	<0.001*
2	10.15±3.408	11.93±3.689	1.78 ±2.947	<0.001*	87.61±7.199	90.86±8.622	2.65±7.118	<0.001*
3	10.47±34.87	10.93±3.545	0.46 ±2.659	0.028*	87.72±7.232	87.33±7.513	0.31±6.226	0.428**
Comparison across groups				<0.001***				<0.001***

#Group 1: Pocketbook and Presentation; Group 2: Pocketbook Only; Group 3: Control

*Wilcoxon test, significant if p-value <0,05

**Paired T-test, significant if p-value <0.05

***Kruskal-Wallis test, significant if p-value <0.05

These results confirm that the intervention involving the digital pocketbook, along with face-to-face explanations, was more effective in improving adolescent girls' knowledge and attitudes than using only the digital pocketbook. Interactive explanations allowed students to gain a deeper understanding of the material, ask questions directly to the presenter, and receive clarifications on topics that might be difficult to grasp solely through reading. This supports the theory that educational approaches engaging multiple senses and interactive elements are more effective in transforming knowledge and attitudes²⁴. Conversely, the control group, which did not receive any intervention, showed minimal changes, reinforcing the importance of intervention in raising awareness and understanding of anemia prevention.

Knowledge plays a crucial role in shaping an individual's behavior. Without sufficient knowledge, behavior tends to be unsustainable²². The Affective-Cognitive Consistency Theory by Rosenberg (1965) explains that attitude formation involves two components: the cognitive component, which includes knowledge and understanding, and the affective component, which relates to feelings or emotions that can influence attitude changes²³. Therefore, changes in knowledge and attitude can be key factors in modifying behavior or actions. In this context, Edgar Dale's "Theory of the Cone of Experience" explains that the learning process and outcomes are significantly influenced by how individuals acquire material. This theory states that material learned through more interactive experiences, such as viewing images or watching videos, is more easily retained compared to reading alone. Thus, an approach that combines reading, listening, and viewing images or videos is more effective in enhancing memory retention and understanding of the material. From the cone theory, if a person learns from what they read, only 10% of the material can be learned and remembered. In contrast, if people learn from what they hear, their ability to learn and remember increases by 20%. Learning through reading and listening enhances the ability to define, describe, and explain²⁴.

These results are consistent with other studies showing that delivering information accompanied by interactive explanations is more effective in improving knowledge and attitudes than providing written materials alone. In this context, direct explanations allow respondents to understand the information more deeply, clarify difficult concepts, and strengthen their motivation to change attitudes. This study aligns with research conducted by Indriasari, Mansur, Srifitayani, and Tasya in 2022, which found that education through printed media combined with verbal explanations had a significant impact on improving knowledge and attitudes related to adolescent girls' health²⁵. Similar findings were also reported by Angelia, Noor, Herawati, Sanyoto, and Suhartono in 2024, where health education using a pocketbook with explanations was more effective than using a pocketbook alone²⁶. However, the slight difference in the effect on attitude improvement between the group that received only the pocketbook and the group that also received explanations may be due to variations in respondents' learning interests or learning styles, students' cognitive abilities, or the researchers' ability to explain the material. Some students may benefit more from interactive explanations, while others may find written materials sufficient. Respondents may still remember the pre-test questions if the intervention period is too short. Conversely, if the interval is too long, respondents may have been exposed to other sources of information from outside.

This study is in line with previous research conducted by Mularsih²⁷, which found that the majority of respondents (59%) exhibited poor anemia prevention behavior. Another study by Nurmalitasari, Ningsih, and Nugraheni²⁸ reported similar results, with as many as 78.7% of respondents falling into the category of poor or inadequate anemia prevention behavior. Therefore, the findings of this study highlight the importance of improving knowledge and changing attitudes as part of efforts to encourage better anemia prevention behavior among adolescents.

The main strength of this study is its methodology, which employs a controlled experimental

design, allowing for a clear comparison between the intervention and control groups. However, this study also has several limitations. Firstly, the relatively short intervention duration (20-30 minutes) may not be sufficient to observe long-term changes in anemia prevention behavior. Secondly, the study is limited to a specific geographical area and local characteristics, so generalizing the results to a broader population should be done cautiously. Lastly, although the digital pocketbook effectively improved knowledge and attitudes, this study does not provide data on actual behavioral changes, such as increased consumption of iron-rich foods.

CONCLUSIONS

Educational intervention using a digital pocketbook accompanied by face-to-face explanations (presentation and discussion) has been proven to be more effective in improving the knowledge and attitudes of adolescent girls regarding anemia prevention efforts than using the digital pocketbook alone. This study provides evidence that the digital pocketbook is not only considered effective (with or without explanation) but also informative in enhancing the knowledge and attitudes of adolescent girls about anemia prevention. Future research should assess the impact of health education interventions on actual behavioral changes in anemia prevention, such as dietary modifications and the habit of consuming iron supplements.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

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AUTHOR CONTRIBUTIONS

HN: conceptualization, data curation, formal analysis, methodology, administration, resources, validation, visualization, roles/writing-original draft. ER: conceptualization, formal analysis, methodology, supervision, roles/writing-original draft. HK: conceptualization, data curation, formal analysis, methodology, visualization, supervision, roles/writing-original draft. DAM: formal analysis, resources, writing review, and editing. HL: formal analysis, resources, writing review, and editing.

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