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Letter to the Editor

Re: Impact of self-efficacy–based health education programs on behavior modification for *Opisthorchis viverrini* and cholangiocarcinoma prevention in Thailand: A systematic review and meta-analysis

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To the Editor,

We read with great interest the recent systematic review and meta-analysis by Busabong et al. [1], which examined the impact of self-efficacy–based health education programs on behavior change for the prevention of *Opisthorchis viverrini* infection and cholangiocarcinoma in Thailand. This comprehensive synthesis addresses a critical public health challenge in endemic areas, highlighting the importance of theory-driven interventions in promoting sustainable behavioral change.

The authors' use of Bandura's self-efficacy framework offers a strong theoretical basis for understanding how health education can impact knowledge, self-efficacy, and behavior outcomes [2,3]. We appreciate the thorough methodology, including the meta-analytic approach, which strengthens the evidence supporting the effectiveness of the intervention. To enhance the usefulness and relevance of such reviews, we suggest considering the following points. The substantial heterogeneity observed across outcomes—knowledge (I^2=76%), self-efficacy (I^2=77%), and behavior (I^2=93%)—could be better understood through subgroup analyses based on sociodemographic factors, cultural contexts, and delivery methods. Prior research emphasizes that culturally ingrained practices, such as the consumption of raw fish, vary by region and significantly impact the adoption of interventions [4,5].

Second, it is crucial to tackle potential publication bias. Incorporating gray literature and registered but unpublished trials could broaden the evidence base, mitigate the "file drawer problem" and enhance the robustness of future meta-analyses [6,7].

Third, considering the importance of self-efficacy theory, a more detailed evaluation of implementation fidelity in the included studies would be helpful. Identifying which components—mastery experience, vicarious learning, and social persuasion—are most effectively implemented could elucidate the mechanisms underlying behavioral change and inform improvements in interventions [8,9].

Additionally, although the authors propose applying these educational strategies to other parasitic infections, caution is advised. Different epidemiological, cognitive, and contextual factors require health promotion interventions to be tailored specifically for each disease [10].

Finally, embedding individual self-efficacy interventions within broader multisectoral strategies—encompassing policy support, community engagement, and socioeconomic progress—will likely be crucial for lasting effects, particularly in resource-constrained environments [11-13].

Author contributions
Conceptualization: Rattanapitoon NK, Rattanapitoon SK
Data curation: Rattanapitoon NK, Thanchonnang C, Rattanapitoon SK
Formal analysis: Rattanapitoon NK, Rattanapitoon SK
Methodology: Rattanapitoon NK
Validation: Thanchonnang C
Writing – original draft: Rattanapitoon NK, Rattanapitoon SK
Writing – review & editing: Rattanapitoon NK, Thanchonnang C, Rattanapitoon SK

Conflict of interest
The authors declare no conflict of interest related to this study.

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In summary, Busabong et al.'s work [1] makes an important contribution to parasitology and public health literature. Future studies addressing the points above could strengthen educational strategies and accelerate efforts to reduce the burden *O. viverrini* infection and cholangiocarcinoma in endemic populations.

Reply from Dr. Nopparat Songser (corresponding author: nopparat.s@ubru.ac.th)

We sincerely thank Dr. Rattanapitoon and colleagues for their insightful and constructive comments on our recent article. We are glad to respond to each of the points they raised.

Regarding outcome heterogeneity, we fully agree with the suggestion to use subgroup analyses to address it. As noted on pages 7–9 of our article, there was significant heterogeneity in outcomes for knowledge (I^2=76%), self-efficacy (I^2=77%), and behavior change (I^2=93%). While we acknowledged this and used random-effects models to analyze it, future meta-analyses could benefit from more specific subgroup analyses based on region, age, education, and cultural factors, especially considering traditional dietary habits, such as raw fish consumption, that influence *O. viverrini* transmission. This approach aligns with our discussion of potential variability (p. 10).

Regarding publication bias, we appreciate the advice to include gray literature to reduce this bias. Our current search encompassed peer-reviewed sources, including PubMed, Google Scholar, ThaiJo, and ThaiLis, as detailed in the Methods section (p. 3). The funnel plot asymmetry (Figs. 3, 4) suggests the possibility of publication bias. Incorporating gray literature—such as dissertations, government reports, and trial registries—in future reviews could enhance the robustness of the evidence.

On the topic of theoretical fidelity, we value the suggestion to assess how well the implementation of self-efficacy frameworks aligns with their core principles. Although our study confirmed the positive effects of programs based on self-efficacy, few included studies clearly reported on the operationalization of Bandura's core constructs, such as mastery experiences, modeling, and verbal persuasion [14]. This limitation is acknowledged in our discussion (p. 10), and we support future analyses that examine the fidelity of these theoretical applications to better understand the mechanisms underlying behavioral change.

Regarding the broader application to other parasitic infections, we agree that each disease has its own unique behavioral and contextual characteristics. Our conclusion on page 10 briefly suggests that self-efficacy principles might be applicable to other prevention efforts, but this should be approached with caution. Effective strategies must be tailored to specific epidemiological and cultural contexts.

Finally, in terms of incorporating individual-level interventions into multisectoral strategies, we strongly endorse this approach. As discussed, while changing individual behaviors is essential, systemic approaches are necessary for sustained success. Embedding self-efficacy-based interventions within comprehensive frameworks—encompassing public health, education, media, local governance, and socioeconomic development—will promote sustainability and tangible impact, especially in resource-limited endemic areas.

We once again sincerely thank Dr. Rattanapitoon and colleagues for their participation. Such scholarly exchanges are vital for advancing public health strategies, especially in behavior change interventions.

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