Methodological considerations in evaluating digital serious games for public health education

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To the Editor:

Huang et al provide a valuable systematic review and Bayesian network meta-analysis regarding the effectiveness of digital serious games on enhancing public health knowledge and attitudes among various groups of people and in different educational contexts. It is fair to say that the authors deserve praise for performing a systematic literature search of 40 randomized control studies and utilizing Bayesian network meta-analytical analysis to compare the outcomes of using several different digital platforms. Nonetheless, there are some important issues that must be mentioned in connection with the paper. There are possible concerns about comparability in the included studies with substantial heterogeneity observed in the pairwise meta-analysis as also presented in the figures. There was large heterogeneity for both knowledge (I^2=89.1%; 95% CI: 0–100) and attitudes (I^2=80.7%; 95% CI: 72.2–88.6). The subgroup and sensitivity analyses found little consistency for the included studies by age groups, health conditions of either participants or controls, intervention intensity, delivery modes and follow-up periods. This variability introduces uncertainty regarding pooled effect estimates making the integrated interpretation of overall intervention efficacy less straightforward. In light of such fundamental differences, network meta-analysis is a better choice for comparing several interventions within one analysis to ascertain the moa effective one than a series of pairwise meta-analyses which would be much more vulnerable to significant statistical heterogeneity.[1] Nonetheless, NMA often struggles to address the high levels of between-study heterogeneity observed in public health interventions that include several overlapping compo-nents.[2]

Secondly, the validity of the network meta-analysis is critically dependent upon the transitivity assumption. For this particular network meta-analysis, indirect comparisons were made among studies conducted in different intervention settings, which were heterogeneous as they involved adolescent versus adult samples, patients versus non-patients, mental illness versus infectious disease education, and single versus multiple session interventions. These may represent potential effect modifiers, thereby posing threats to the transitivity assumption, which requires studies to be comparable for an appropriate indirect comparison.

As a result, uncontrolled confounding related to these factors could lead to biases in effect estima-tion.[3]

Thirdly, the definition of the terms "knowledge" and "attitude" is too broad, which creates issues concerning the construct validity of the review. In this meta-analysis, different tools were employed to measure the effects on outcomes that varied from immediate knowledge recall to behavioral intentions and attitude. Combining such disparate variables into one analysis using standard mean difference may over-look significant differences among cognitive learning, emotional involvement, and behavioral readiness.

Moreover, a cautious consideration should be given to interpreting ranking results as well. While mobile app-based and web-based interventions received high ranking results during Bayesian network analyses, some categories showed rather limited supportive evidence. High ranking results such as SUCRA can be seen as clear even with overlapping credible intervals and lack of head-to-head comparison. Thus, superiority of some games compared to others cannot be considered proven yet. On top of that, the risk of publication bias, which was recognized as a major limitation of network meta-analysis in education and psychology, might cause exaggeration of the re-sults.[4,5]

Other limitations are that serious game interventions were mostly implemented alongside other forms of teaching methods like traditional class teaching, video tutorials, and guided teaching by instructors, making it challenging to ascertain whether the bene-fits recorded were as a result of the games or the complementary educational interventions. Also, the majority of the studies reviewed focused on assessing short-term results, hindering conclusive evidence about knowledge retention and sustainable behavior change, the main objectives of health education interventions. Future research should ensure standardization of outcome measures, use a prolonged follow-up period, and employ stringent methodology for effective evidence synthesis and subsequent formulation of game design principles.[6] Furthermore, the literature review did not emphasize issues of accessibility and digital inequities, considering that people with poor computer skills and inadequate internet connectivity would not fully enjoy technology-driven interventions. Future research should consider widening database search scope and con-ducting extensive searches using various search engines to mitigate publication bias.[7]

Nonetheless, this research is of great significance for digital public health education and forms a useful base for further comparison of effectiveness re-search. Future research needs to have more randomized trials that are sufficiently powered, have comparable outcome measures, longer follow-up periods, and better defined intervention components.

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