Dear *Lancet* Editors,

We are pleased to submit the article entitled "**Effects of water, sanitation, and hygiene interventions on detection of enteropathogens and host-specific faecal markers in the environment: an individual-participant data meta-analysis**" for consideration for publication in *The Lancet* family. This manuscript supports *The Lancet* Commission report on water, sanitation and hygiene (WASH)[1].

Recent robust trials of basic WASH interventions have found little or no effects on child diarrhea and growth[2] and these findings have generated substantial debate about whether basic WASH interventions can effectively reduce child exposure to faecal pathogens and therefore prevent disease. In this study, we pool individual participant data from several trials to assess the effects of basic WASH interventions on specific enteropathogens as well as human- and animal-specific microbial source tracking markers across important environmental compartments for disease transmission, e.g. drinking water and food.

The application of advanced molecular methods to enumerate pathogens and host-specific faecal markers in the domestic environment in low-income countries is relatively recent. Most published evidence to date on whether WASH improvements reduce faecal exposure is based on measurements of faecal indicator bacteria,[3] which are imperfect proxies for pathogen presence and health risk.[4] Directly enumerating pathogens and host-specific faecal markers may offer clearer insight about environmental mechanisms behind intervention failure or success. However, individual studies are typically underpowered to detect intervention effects on these intermediate outcomes because pathogens are infrequently detected in environmental samples. Our individual participant data meta-analysis approach provides increased statistical power to detect effects on these rare outcomes.

We identified and obtained data for nine comparisons, drawn from five trials, that sampled various environmental media (drinking water, soil, hand rinses, flies). Our review identified only eligible sanitation intervention studies that measured enteropathogens and microbial source tracking markers in the environment; no water supply/quality or hygiene interventions measured these targets. In our pooled analysis, we found a small effect of sanitation interventions on pathogen detection in environmental samples and no effect on the detection of human or animal faecal markers. These findings are consistent with the small or null effects of the sanitation interventions on child health outcomes in these trials and lend weight to calls for more radical sanitation solutions that do effectively contain waste and prevent exposure to enteropathogens.

We believe that this article is particularly timely given the *Lancet* Commission on WASH, but also more in the context of slow progress towards the Sustainable Development Goal target of universal access to safely managed WASH services by 2030.[5] Understanding why basic interventions are ineffective is essential for policy reform and critical reflection on current normative standards.

Thank you for your consideration.

Yours faithfully,

Ayse Ercumen, PhD
Department of Forestry and Environmental Resources, North Carolina State University

Andrew Mertens PhD
Division of Epidemiology, School of Public Health, University of California, Berkeley

References

1. Amebelu, A. et al. *The Lancet* Commission on water, sanitation and hygiene, and health. *The Lancet* **398** (10310): 1469-1470 (2022).
2. Pickering, A. J. *et al.* The WASH Benefits and SHINE trials: interpretation of WASH intervention effects on linear growth and diarrhoea. *Lancet Glob. Health* **7**, e1139–e1146 (2019).
3. Sclar, G. D. *et al.* Assessing the impact of sanitation on indicators of fecal exposure along principal transmission pathways: A systematic review. *Int. J. Hyg. Environ. Health* **219**, 709–723 (2016).
4. Wu, J., Long, S. C., Das, D. & Dorner, S. M. Are microbial indicators and pathogens correlated? A statistical analysis of 40 years of research. *J. Water Health* **9**, 265–278 (2011).
5. WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP). *Progress on drinking water, sanitation and hygiene: 2017 update and SDG baselines*. (World Health Organization (WHO) and UNICEF, 2017).