



## THE LANCET Child & Adolescent Health

### Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

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# Effects of water quality, sanitation, handwashing, and nutritional interventions on child development in rural Kenya (WASH Benefits Kenya): a cluster-randomised controlled trial

**Background** Poor nutrition and infectious diseases can prevent children from reaching their developmental potential. We aimed to assess the effects of improvements in water, sanitation, handwashing, and nutrition on early child development in rural Kenya.

**Methods** In this cluster-randomised controlled trial, we enrolled pregnant women in their second or third trimester from three counties (Kakamega, Bungoma, and Vihiga) in Kenya's western region, with an average of 12 households per cluster. Groups of nine geographically adjacent clusters were block-randomised, using a random number generator, into the six

intervention groups (including monthly visits to promote target behaviours), a passive control group (no visits), or a double-sized active control group (monthly household visits to measure child mid-upper arm circumference). The six intervention groups were: chlorinated drinking water; improved sanitation; handwashing with soap; combined water, sanitation, and handwashing; improved nutrition through counselling and provision of lipid-based nutrient supplements; and combined water, sanitation, handwashing, and nutrition. Here we report on the prespecified secondary child development outcomes: gross motor milestone achievement assessed with the WHO module at year 1, and communication, gross motor, personal social, and combined scores measured by the Extended Ages and Stages Questionnaire (EASQ) at year 2. Masking of participants was not possible, but data assessors were masked. Analyses were by intention to treat. This trial is registered with ClinicalTrials.gov, number NCT01704105.

**Findings** Between Nov 27, 2012, and May 21, 2014, 8246 women residing in 702 clusters were enrolled. No clusters were lost to follow-up, but 2212 households with 2279 children were lost to follow-up by year 2. 5791 (69%) children were measured at year 1 and 6107 (73%) at year 2. At year 1, compared with the active control group, the combined water, sanitation, handwashing, and nutrition group had greater rates of attaining the standing with assistance milestone (hazard ratio 1.23, 95% CI 1.09–1.40) and the walking with assistance milestone (1.32, 1.17–1.50), and the handwashing group had a greater rate of attaining the standing alone milestone (1.15, 1.01–1.31). There were no differences when comparing the other intervention groups with the active control group on any of the motor milestone measures at year 1. At year 2, there were no differences among groups for the communication, gross motor, personal social, or combined EASQ scores.

**Interpretation** The handwashing and combined water, sanitation, handwashing, and nutrition interventions might have improved child motor development after 1 year, although after 2 years there were no other differences between groups. Future research should examine ways to make community health and nutrition programmes more effective at supporting child development.

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