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Evaluating the effect of implementing the Responses to Illness Severity Quantification (RISQ) system on mortality in acutely malnourished children treated in Chad: the CRIMSON cluster-randomised trial

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Introduction

In resource-limited settings, there is significant child mortality in malnutrition treatment programmes. The Responses to Illness Severity Quantification (RISQ) system is an evidence-based clinical decision-support tool based on assessment, scoring, and interpretation of clinical parameters commonly available in the outpatient setting: heart rate, respiratory rate, respiratory effort, oxygen saturation, temperature, level of consciousness, and, for the inpatient setting, inclusion of oxygen use. We evaluated the effect of RISQ on in-programme mortality in an outpatient malnutrition treatment programme.

Methods

In this cluster-randomised trial (CRIMSON), 34 eligible clusters (community health centres) enrolled participants into an acute malnutrition programme located in the Lake Region in Chad. Clusters were randomised (1:1) to either usual care plus RISQ or usual care alone. Eligible participants were aged 6–59 months with mid-upper arm circumference (MUAC) of less than 125 mm and/or oedema. During a 2-month run-in period, pulse oximeters were provided to all 34 health centres, and RISQ training was provided to staff in health centres in the intervention group. The primary outcome was mortality occurring during the period of treatment for up to 60 days after programme admission. Secondary outcomes included processes of care and implementation fidelity. The posterior probability that mortality was reduced, the relative risk, and its 95% credible interval (CrI) were estimated in a Bayesian model. The primary analysis was adjusted for cluster-specific mortality over a 12-month baseline period of usual care. A 95% probability of reduction in mortality was judged as sufficient to conclude benefit of use of RISQ. The trial protocol has been published and is registered with ClinicalTrials.gov (NCT06123390).

Ethics

This study was approved by the Comité National Bioéthique du Tchad (Ref. 032/PT/PMT/MESRI/SE/SG/CNBT/SG/2023), and by SickKids Research Ethics Board, Toronto, ON, Canada (REB #1000080735).

Results

There were 14,673 programme admissions of 10,846 individual participants enrolled from 11 September 2023 to 10 September 2024. Primary outcome measures were available from 14,665 admissions (43·4% males, 56.6% females). During the programme, 59 (0.82%) of 7,171 admissions in usual care centres died, compared with 35 (0.47%) of 7,494 admissions in RISQ centres. The primary analysis estimated a 96.1% probability of lower mortality in the RISQ versus usual care centres, with relative mortality risk of 0.58 (95% CrI 0.3–1.06). Hospitalisation occurred in 430 (6.0%) of 7,171 admissions from usual care sites and 293 (3.9%) of 7,494 admissions from RISQ sites. There was a 95.7% probability of less frequent hospitalisation in RISQ centres with a relative risk of 0·66 (95% CrI 0·39–1.07).

Conclusion

In this cluster-randomised trial, integration of the RISQ System into usual care in an outpatient malnutrition treatment programme had a probability greater than 95% for reduced in-programme mortality and hospitalisation.

Conflicts of interest

CSP has shares in a decision-support company in part owned by the SickKids and is a named inventor of the Bedside Paediatric Early Warning System for which the patent is owned by SickKids. The other authors declare no competing interests.