

External validation of the DHAKA score and comparison with the current IMCI algorithm for the assessment of dehydration in children with diarrhoea: a prospective cohort study



Adam C Levine, Justin Glavis-Bloom, Payal Modi, Sabiha Nasrin, Bitu Atika, Soham Rege, Sarah Robertson, Christopher H Schmid, Nur H Alam



Summary

Background Dehydration due to diarrhoea is a leading cause of child death worldwide, yet no clinical tools for assessing dehydration have been validated in resource-limited settings. The Dehydration: Assessing Kids Accurately (DHAKA) score was derived for assessing dehydration in children with diarrhoea in a low-income country setting. In this study, we aimed to externally validate the DHAKA score in a new population of children and compare its accuracy and reliability to the current Integrated Management of Childhood Illness (IMCI) algorithm.

Methods DHAKA was a prospective cohort study done in children younger than 60 months presenting to the International Centre for Diarrhoeal Disease Research, Bangladesh, with acute diarrhoea (defined by WHO as three or more loose stools per day for less than 14 days). Local nurses assessed children and classified their dehydration status using both the DHAKA score and the IMCI algorithm. Serial weights were obtained and dehydration status was established by percentage weight change with rehydration. We did regression analyses to validate the DHAKA score and compared the accuracy and reliability of the DHAKA score and IMCI algorithm with receiver operator characteristic (ROC) curves and the weighted κ statistic. This study was registered with ClinicalTrials.gov, number NCT02007733.

Findings Between March 22, 2015, and May 15, 2015, 496 patients were included in our primary analyses. On the basis of our criterion standard, 242 (49%) of 496 children had no dehydration, 184 (37%) of 496 had some dehydration, and 70 (14%) of 496 had severe dehydration. In multivariable regression analyses, each 1-point increase in the DHAKA score predicted an increase of 0.6% in the percentage dehydration of the child and increased the odds of both some and severe dehydration by a factor of 1.4. Both the accuracy and reliability of the DHAKA score were significantly greater than those of the IMCI algorithm.

Interpretation The DHAKA score is the first clinical tool for assessing dehydration in children with acute diarrhoea to be externally validated in a low-income country. Further validation studies in a diverse range of settings and paediatric populations are warranted.

Funding National Institutes of Health Fogarty International Center.

Copyright © The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY license.

Introduction

Despite tremendous progress over the past several decades, diarrhoeal disease remains a leading cause of death in children worldwide. Annually, children younger than 60 months have an estimated 1.7 billion diarrhoeal episodes, leading to 124 million outpatient visits, 9 million hospital admissions, and 520 000 deaths.¹⁻⁴ Accurate and rapid assessment of dehydration status is crucial to prevent morbidity and mortality in children with diarrhoeal disease. Global health authorities recommend classifying such children into one of three categories on the basis of their initial presentation: severe dehydration, some dehydration, or no dehydration.⁵⁻⁸ For children with some dehydration, oral rehydration therapy is highly cost-effective and associated with shorter hospital stays and fewer adverse events than treatment with intravenous fluid, particularly in resource-limited settings.^{7,9,10}

However, the tools available to assess dehydration status in children with diarrhoeal disease are inadequate. Neither clinician gestalt nor any individual clinical sign, symptom, laboratory, or imaging test has been found to have adequate sensitivity, specificity, and reliability for detecting dehydration in children.¹¹⁻¹³ The WHO Integrated Management of Childhood Illness (IMCI) guidelines recommend using a combination of clinical signs to classify children as having no, some, or severe dehydration (figure 1).¹⁴ However, the IMCI algorithm was developed based largely on expert opinion, and studies¹⁵⁻¹⁷ have not found it to be an accurate predictor of dehydration in children. Other dehydration scales have been derived in high-resource settings for use by physician providers but have not been validated for use by nurses and other non-physician providers in resource-limited settings.¹⁸⁻²¹

Lancet Glob Health 2016;

4: e744-51

Published Online

August 22, 2016

[http://dx.doi.org/10.1016/S2214-109X\(16\)30150-4](http://dx.doi.org/10.1016/S2214-109X(16)30150-4)

See [Comment](#) page e674

Warren Alpert Medical School

of Brown University,

Providence, RI, USA

(A C Levine MD,

J Glavis-Bloom MD, S Rege BS);

Department of Biostatistics,

Brown University School of

Public Health, Providence, RI,

USA (S Robertson MS,

C H Schmid PhD); University of

Massachusetts Medical School,

Worcester, MA, USA

(P Modi MD); and International

Centre for Diarrhoeal Disease

Research, Bangladesh, Dhaka,

Bangladesh (S Nasrin MBBS,

B Atika MBBS, N H Alam MD)

Correspondence to:

Adam C Levine, Warren Alpert

Medical School of Brown

University, Providence,

RI 02903, USA

adam_levine@brown.edu

Research in context

Evidence before this study

We systematically reviewed the scientific literature to identify studies published up to Feb 1, 2016, addressing the assessment of dehydration in children with diarrhoea. We searched PubMed, Cochrane Libraries, and Google Scholar to identify all published and unpublished trials in English using combinations of the following search terms: dehydration, dehydration scale, dehydration assessment, diarrhoea, gastroenteritis, child, pediatric. Additional studies were identified by hand searching references from included studies. Our literature search identified four previous clinical prediction models for dehydration that have been derived using data from prospective cohorts of children against a valid criterion standard. All four studies were done in high-income or middle-income countries, and none of these previous studies were based on cohorts of children large enough to develop a stable clinical prediction model. Only three previous studies have validated the Integrated Management of Childhood Illness (IMCI) algorithm against a physiological criterion standard, and all three studies found it to be a poor predictor of dehydration in children.

Added value of this study

The Dehydration: Assessing Kids Accurately (DHAKA) score is the first clinical diagnostic model for dehydration in children with diarrhoea derived in a low-income country using local nurses to perform all exams. In this study, we externally validated the DHAKA score in a new population of children and compared it with the IMCI algorithm. The DHAKA score was shown to be significantly more reliable and accurate than the IMCI algorithm ($p < 0.0001$).

Implications of all the available evidence

The DHAKA score is the first dehydration assessment tool empirically derived and externally validated for use in a low-income country. Further validation studies of the DHAKA score in different regions of the world and with different populations of children and providers should be prioritised to establish its generalisability to children with acute diarrhoea worldwide.

In response, the Dehydration: Assessing Kids Accurately (DHAKA) study²² empirically derived and internally validated a new clinical score for assessing dehydration in children with acute diarrhoea in a low-income country (figure 2). In this study, we sought to externally validate the DHAKA score and compare its accuracy and reliability to the IMCI algorithm.

Methods

Study design and participants

The DHAKA validation study was a prospective cohort study that included all eligible children presenting to the International Centre for Diarrhoeal Disease Research, Bangladesh. Enrolment took place in the International Centre for Diarrhoeal Disease Research, Bangladesh, rehydration (short stay) unit. The International Centre for Diarrhoeal Disease Research, Bangladesh, provides free clinical services to the population of Dhaka, Bangladesh, and the surrounding rural and suburban districts, with a catchment area of more than 17 million people.²³

All children younger than 60 months presenting to the rehydration unit with acute diarrhoea, defined by WHO as three or more loose stools per day for less than 14 days, were eligible for enrolment.⁵ Research staff randomly selected children younger than 60 months for screening 24 h a day and established whether each child met any of the four predefined exclusion criteria, which were fewer than three loose stools per day, diarrhoea for more than 14 days, a diagnosis other than gastroenteritis as established by the treating physician, and previous enrolment in the DHAKA validation study. Random selection was accomplished by pulling coloured marbles

from a black pouch. A blue marble was for inclusion, a white marble for exclusion.

For children who did not meet any exclusion criteria, research staff explained the risks and benefits of the study and obtained informed consent from the parent or guardian of the child in the local language, Bengali. Ethical approval was obtained from the International Centre for Diarrhoeal Disease Research, Bangladesh, the Ethical Review Committee, and the Lifespan Institutional Review Board.

Procedures

Local general practice nurses with 4–6 years of clinical experience collected all data for this study. Beforehand, they received 5 days of training in all study procedures. This included didactic, video, and practical instruction in how to appropriately apply both the DHAKA score and the IMCI algorithm in children (appendix).

After obtaining informed consent, children were immediately undressed and weighed to the nearest tenth of a kilogram with an electronic scale. Study staff recorded the volume of fluid received before baseline weight measurement. Participants were then assessed clinically by a study nurse, who classified their dehydration status first with the DHAKA score and second with the IMCI algorithm. Participants were also assessed clinically by a second study nurse when available, masked to the exam done by the first nurse. Study nurses collected baseline historical and demographic data for each child from their parent or guardian including age, sex, home district, days of diarrhoea, diarrhoeal episodes in the past 24 h, and type of diarrhoea (bloody, watery, rice water). Nutritional

See Online for appendix

Download English Version:

<https://daneshyari.com/en/article/3408694>

Download Persian Version:

<https://daneshyari.com/article/3408694>

[Daneshyari.com](https://daneshyari.com)