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Nutritional evaluation of undocumented children: a neglected health issue affecting the most fragile people

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The precise knowledge of age is necessary for assessing a child's nutritional status. We show the magnitude and the effects of age error in real and hypothetical situations, and discuss possible compensative strategies. Using data collected in different years, we found that 79.8% of 1056 Ugandan children had some age knowledge, but there was a mean shift of 7.5 (±8.8) months between ages obtained from different sources. Using a free software for calculating the effect of bias and random error, we showed the variation in malnutrition prevalence in hypothetical cases.

Introduction

The precise knowledge of age is necessary for assessing a child's nutritional status, in particular for calculating the most common indicators of undernutrition: stunting and underweight.[1] However, in low- and middle-income countries, especially in sub-Saharan Africa and South-East Asia, where undernutrition is a public health issue, information on age is frequently imprecise or absent, mainly due to the low practice of registering children at birth.[2] The unknown or unreliable age is also a common condition among the huge number of migrants and refugees who are coming to Europe. Such people include minors, who have experienced stress and trauma during their long journeys and need adequate health care.

The 'scandal of invisibility',[3] which affects more than 230 million of children under five worldwide,[2] has been widely debated in relation to social, political, ethical, and also epidemiological implications, but rarely in relation to nutritional status. However, the consequences of insufficient or imprecise age data on stunting and underweight estimates are substantial. In a recent article, we have calculated that a 6-month bias can produce an error up to 28% in the stunting prevalence of children below 5 years of age from Swaziland.[4] The random error (equal probability of over- or underestimating age), even without affecting mean age because deviations compensate each other, can have an effect on undernutrition prevalence.[4]

This short article highlights the magnitude of age error in some real contexts, the effects of such errors on nutritional status estimates in a broad range of hypothetical situations, and discusses possible compensative strategies that could be used in public health.

Methods

Magnitude of age errors in real contexts

In a recent nutritional study on 1056 Ugandan children (508 males; 548 females; 3–16 years), two of us collected age data in different years (2012, 2014, 2015) and from various sources (parents, teachers, nurses, school or social workers registers).

Effects of age error on malnutrition prevalence

We have calculated the effect of age bias and random error on stunting and underweight prevalence, and showed an overview of different scenarios of age error (figure 1). Calculations of z-scores are based on WHO reference height and weight data (http://www.who.int/childgrowth/). As an example, we have considered a hypothetical population of male children aged between 5 and 10 years, with height-for-age Z-scores = − 2 and a population mean z-score = − 0.5 (figure 1). For different nutritional indicators and samples characteristics, in males and females, the effect of age bias on undernutrition prevalence can be calculated using the free software (https://stefano-cabras.shinyapps.io/ageimperrapp/).

Results

Magnitude of age errors in real contexts

Information on age was available only for 843 children (79.8%). In 514 cases (61%) the complete date of birth (day, month, year) was known, while in 329 cases (39%) only the year of birth or the child's age in years was given. In these latter cases, more frequent in schools from poor settings and orphanages, we assigned the date of birth as 1 July (middle of the year).

For the 843 children with some information on age, we had two (202 children, 24.0%), three (24 children, 2.8%) or more data replicates (9 children, 1.1%). Within these 235 cases, the percentage of children with the same and complete date of birth in different sources was equal to 6.0% (14 children), indicating that uncertainty can also affect children with apparently reliable information on age. The gap between ages from two different sources was lower or equal to 6 months in 66 children (28.3%). The mean range of age was 7.5 8.8) months, and the maximum was 3 years and 3 months.

Effects of age error on malnutrition prevalence

Both bias and random error can produce a variation in the prevalence of malnutrition. Such effect decreases with child's age. Age bias produces a noticeable variation, in both cases of systematic over-age (right areas in figure 1) or systematic under-age (left areas in figure 1). A random shift of age (plus and less, i.e. equally probable over and underestimate of age) causes a lower change in malnutrition prevalence, perceivable in figure 1 as the difference between left and right areas. For example, a bias of 10 months in excess produces an overestimate of stunting prevalence ranging from 12% (within 10 years children) to 22% (6 years), while a random error produces an overestimate of stunting ranging between 6% (10 years) and 14% (6 years).

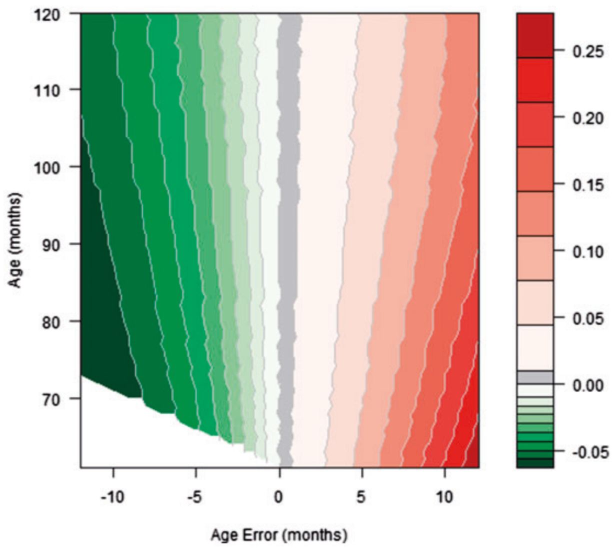

Figure 1 Effect of age bias and random error on stunting prevalence. Right areas correspond to systematic over-age; left areas to systematic under-age; for each hypothetical shift of age (plus and less, i.e. equally probable over and underestimate of age), the difference between the right and left areas corresponds to random error in malnutrition prevalence. The vertical bar on the right indicates the error in stunting prevalence

Discussion

In this study based on the analysis of age data collected from different sources we have showed that errors can be meaningful and can cause significant variations in the malnutrition prevalence.

Data repetitions on age are rarely available in nutritional studies, but in some cases the analysis of age-heaping has been used to estimate age misreporting. Age-heaping has been observed in many sub-Saharan African countries, with a high frequency of adults' ages ending in 0 and 5[5] and of children aged at a complete year and at half a year (e.g. 7 years or 7 years and 6 months),[6] or born on particular days of the month.[7] Evidence of age heaping was also observed in a sample of 353 sub-Saharan African adults and minors seeking asylum in Sardinia (Italy), where 32.9% of subjects were born on the first day of the year (unpublished data).

Interestingly, in our study we have detected a significant imprecision of age, but no age-heaping, suggesting that different sources of error can affect age data.

Methods for assessing nutritional status not requiring information on age, such as the weight-for-height (WHZ) index of wasting, or middle upper arm circumference, are suitable and are informative, but more appropriate to detect severe acute conditions (http://www.who.int/nutrition/topics/severe_malnutrition/en/). Moreover, international standards are only available for children up to 5 years (http://www.who.int/childgrowth/en/). Further, WHZ is unable to recognize stunted children who regained weight and has demonstrated weakness in very tall or very short children.[8]

Regrettably, accurate techniques for assessing age do not exist.[9,10] The use of physical maturation is imperfect and can produce high misclassification rates.[9] Furthermore, skeletal, dental, or other developmental markers are influenced by nutritional status (and in fact used to evaluate it), hence their use for assessing both age and nutritional status lead to a vicious circle.

According to Cole,[9] there is a need for alternative methods using extra information from socio-political approaches in order to establish a multi-disciplinary—'holistic'—process for age assessment, which could be adopted in all cases of unknown or undeclared age. In spite of the already discussed limitations, the analysis of nutritional status could give additive information. For example, wasted children (low WHZ) with normal or high weight-for-age Z scores could have had their age underestimated.

Beyond a shadow of a doubt, the more effective way to overcome age imprecision is to strengthen global and national efforts for improving the efficiency of civil systems and for raising awareness on the importance to register all children immediately after birth. This first step for building a right-based system could contribute to removing socioeconomic and health inequalities—not letting down the most fragile people.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Conflicts of interest: None declared.

Key points

- We have showed that in a real context the knowledge of age data is poor;
- We have showed the effect of age bias and random error on malnutrition prevalence;
- We have provided a free online software for calculating the effect of age error on malnutrition prevalence, that can be used in nutritional studies.

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