Anthropometry and Childhood Mortality in Northwest and Southwest Uganda

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ABSTRACT

Two longitudinal studies were carried out in northwest and southwest Uganda to examine the relationship between anthropometry and childhood mortality. Although the prevalence of malnutrition was significantly different between the two geographic areas, the relative risk for mortality associated with low levels of anthropometry was similar. When the anthropometric parameters were compared among each other, mid-upper arm circumference was found to be the most powerful predictor of mortality. The findings of this study confirm that mid-upper arm circumference is the indicator of choice to identify children at higher risk of death. (*Am J Public Health*. 1993; 83:1616–1618)

Introduction

The strength of the relationship between malnutrition and mortality differs according to the country, the type of anthropometric parameter used, and the cutoff point selected.

Sommers and Lowenstein[1] showed a relative risk of 3.4 for children below the 10th percentile of arm circumference for height compared with those above the 50th percentile. Kielmann and McCord[2] found that among Indian children, mortality decreased exponentially with each 10% rise in median weight for age. In a study carried out in Bangladesh, Chen et al.[3] found a relative risk of around 3 among children who were below 60% in weight for age, with mid-upper arm circumference and weight for age being the most sensitive predictors of mortality. Briend et al.[4] confirmed in Bangladesh that mid-upper arm circumference had the highest sensitivity compared with weight for age, weight for height, and height for age.

However, other studies conducted in Guinea Bissau[5] and Zaire[6] showed a poor predictive power of anthropometry. Therefore, mortality associated with anthropometry varies between countries, and what has been found in Asia may not be applicable to Africa. This could be owing, in part, to the lower prevalence of wasting in Africa associated with a lower variability within the socioeconomic structure.[7]

This study sought to determine whether anthropometry can be used in an African country to identify children at higher risk of death.

Methods

In 1987 and 1988, 5498 children under 5 years of age were selected from 61 villages in two districts in northwest and southwest Uganda. The villages were selected with cluster sampling, with probability proportional to size. All the children residing in the villages were measured for weight, height (for children above 2 years of age), and length (for children below 2 years of age), and, in the southwest villages, for mid-upper arm circumference as well. A salter spring scale was used to measure weight within the nearest 100 g, and locally constructed boards were used to measure length and height to the nearest millimeter. Measurement techniques conformed to the United Nations manual, *How to Weigh and Measure Children.*[8]

Follow-up visits to all families 12 months later were used to assess mortality of the study children. The data were entered, cleaned, and analyzed using the Statistical Package for the Social Sciences (SPSS).[9] We transformed measurements into standard deviation scores of the median reference of the National Center for Health Statistics[10] using the Centers for Disease Control and Prevention package.[11]

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This paper was accepted March 25, 1993.

The views expressed in this article are the authors' and do not necessarily reflect those of the Uganda Ministry of Health, UNICEF, or CUAMM.

Results

Malnutrition was significantly higher in the northwest than in the southwest, but the mortality rates associated with low levels of anthropometry were similar in the two areas (Tables 1 and 2).

When levels of anthropometric parameters were compared, mid-upper arm circumference was associated with a relative risk for mortality that was significantly higher than that associated with other parameters (Tables 3 and 4). The relative risk for mortality associated with less than 11.5 cm of mid-upper arm circumference was more than 2 when compared with a standard deviation of less than −3 for weight for age, and less than −2 for weight for height and it was more than 4 when compared with a standard deviation of less than −3 for height for age. Low levels of weight for age and weight for height had almost the same relative risk, which was higher than that associated with low levels of height for age.

TABLE 1—Prevalence of Childhood Malnutrition and Mortality below Defined Anthropometric Cutoff Points, Northwest (NW) and Southwest (SW) Uganda

Cutoff	Geographic Area	Prevalence n	Prevalence %	Mortality below Cutoff n	Mortality below Cutoff %	Sensitivity	Specificity
<−3 SD W/A	NW	75/1066	7.0*	8/75	10.7	23	93
	SW	132/3768	3.5	12/132	9.1	12	97
<−3 SD H/A	NW	192/1066	18.0*	6/192	3.1	18	82
	SW	502/3768	13.3	23/502	4.6	24	87
<−2 SD W/H	NW	32/1066	3.0	4/32	12.5	12	97
	SW	142/3768	3.8	12/142	8.5	12	96
<11.5 cm MUAC	SW	96/3748	2.6	18/96	18.8	19	98

Note. SD = standard deviation; W/A = weight for age; H/A = height for age; W/H = weight for height; MUAC = mid-upper arm circumference.
*Prevalences between SW and NW are significantly different ($P < .0001$).

TABLE 2—Relative Risks (95% Confidence Intervals) for Childhood Mortality Associated with Different Anthropometric Cutoff Points in Northwest (NW) and Southwest (SW) Uganda

	Cutoffs in Standard Deviations (SD)		
	<−3 SD	−3 to −2 SD	>−2 SD
Weight for age			
NW	3.5** (1.6, 7.6)	0.8 (0.3, 2.3)	1
SW	4.7† (2.6, 8.6)	2.3*** (1.5, 3.7)	1
Height for age			
NW	0.7 (0.3, 1.8)	0.5 (0.2, 1.3)	1
SW	2.0** (1.3, 3.3)	1.1 (0.6, 1.8)	1
Weight for height			
NW	... ...	3.9* (1.4, 10.0)	1
SW	5.0** (1.9, 13)	3.2** (1.5, 6.4)	1
	Cutoffs for Mid-Upper Arm Circumference		
	<11.5 cm	11.5–12.4 cm	> 12.4 cm
SW	9.4† (5.9, 15.2)	2.6* (1.2, 5.5)	1

*$P < .05$; **$P < .01$; ***$P < .001$; †$P < .0001$.

TABLE 3—Comparison of Relative Risks for Mortality Associated with Different Parameters (95% Confidence Intervals) in Northwest Uganda

	Weight for Height < −2 Standard Deviation	Height for Age <−3 Standard Deviation
Weight for age: <−3 standard deviations	0.8 (0.3, 2.6)	3.4* (1.2, 9.5)
Weight for height: <−2 standard deviations	...	3.9* (1.5, 10.0)

*$P < .05$.

Discussion

Previous studies found that mid-upper arm circumference and weight for age were the most sensitive predictors of mortality in Asia[2-4]; however, these results were not confirmed in Guinea Bissau[5] and Zaire.[6] This suggests that anthropometry might play a relatively minor role in Africa in identifying children at higher risk of death. The data from this study confirm that, in Uganda, low levels of anthropometry are significantly related to mortality, with mid-upper arm circumference being the best predictor of mortality.

Although it is not possible to generalize the results outside the two areas surveyed, we can expect the results to be valid for this part of Africa. From a previous analysis not presented in this paper, the predictive power of mid-upper arm circumference for mortality was independent of age and was not improved by the addition of the other anthropometric parameters.[12] Besides being the most powerful predictor of mortality, mid-upper arm circumference does not need the knowledge of age below 5 years; it is cheap, quick, and easy to use; and it has fewer sources of error than other parameters. With a simple color-coded tape, mid-upper arm circumference could be used by those who are illiterate, with the advantage of identifying children at risk more effectively than other measuring methods.

Beyond these advantages, the effectiveness of mid-upper arm circumference is supported by the fact that, in the southwest, 45% of mortality was concentrated below 13.5 cm of mid-upper arm circumference. Considering that 17% of the examined children were below this measure and that 95% of the deaths below this cutoff point were due to infectious diseases, a reduction in mortality of 43% (95% of 45%) is theoretically possible if resources were prioritized on the 17% of the child population identified by mid-upper arm circumference as being at risk. In conclusion, this study confirms that the best indicator to identify children at risk is mid-upper arm circumference, which could be considered a simple and comprehensive proxy of deprivation to be used for target-

TABLE 4—Comparison of Relative Risks for Mortality Associated with Different Parameters (95% Confidence Intervals) in Southwest Uganda

	Weight for Age <−3 Standard	Weight for Height <−2 SD Standard	Height for Age <−3 Standard
Mid-upper arm circumference: <11.5 cm	2.1* (1.1, 4.1)	2.2* (1.1, 4.4)	4.1** (2.3, 7.3)
Weight for age: <−3 standard deviations	...	1.1 (0.5, 2.3)	2 (1, 3.9)
Weight for height: <−2 standard deviations	...	...	1.8 (0.9, 3.6)

*P < .05; **P < .0001.

ing, monitoring, and evaluating child survival programs. □

Acknowledgments

We thank the Uganda Ministry of Health, UNICEF, and the Collegio Universitario Aspiranti Medici Missionari (CUAMM) for their logistic and financial support.

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The Authorship and Fate of International Health Papers Submitted to the *American Journal of Public Health* in 1989

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ABSTRACT

We reviewed the authorship characteristics, editorial processing, and final fate of 126 papers dealing with data from countries other than the United States and Canada and submitted to the *American Journal of Public Health* in 1989. The acceptance rate of these international health papers was 22%, similar to that of all papers (25%). Authors from developed countries had higher acceptance rates than authors from developing countries, but the highest acceptance rate (36%) was for international health papers with joint authorship from both developed and developing countries. Of 83 rejected papers, 72% were published in other journals. Of these, 45% were published in journals covered by *Index Medicus,* a figure similar to that for all papers rejected by the Journal. (*Am J Public Health.* 1993;83:1618–1620)

Introduction

The *American Journal of Public Health,* the official journal of the American Public Health Association, is widely read throughout the world. Therefore it is understandable that health professionals from other countries submit papers to the Journal in the hope of reaching its broad readership.

In recent years, however, the Journal has noted an increase in the number and proportion of papers received from countries other than the United States and Canada, as well as an increase in the acceptance rate of such papers (Table 1). Stossel and Stossel observed a similar phenomenon in papers published by four prestigious English language journals from 1977 to 1988.[1] We decided to explore this situation in greater depth by describing the authorship, processing, evaluation, and eventual outcome of all international papers received by the Journal in 1989.

Methods

In Table 1, only papers received from countries outside the United States and Canada are defined as international health papers. We have also examined accept-

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This paper was accepted August 17, 1993.