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by

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THE INFLUENCE OF NUTRITIONAL STATUS ON AGE MISTATEMENT FOR YOUNG CHILDREN IN RURAL BANGLADESH

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ABSTRACT

This paper reports on age misstatement of 679 children aged 22 to 59 months in Companyganj, a rural area in Bangladesh. Over-reporting and random error in age data are found, with the interviewer and nutritional status of children appearring as significant determinants of these errors. The child's nutritional status has a significant interaction with the effects of both the interviewer and the mother's literacy on age reporting. Age error and its interaction with nutritional status makes the understanding of child malnutrition and its related problems in Companyganj difficult.

INTRODUCTION

Age is an important variable for demographic studies as well as for social and economic planning, but there are well-known problems of age misreporting in developing countries. Although numerous studies have reported on the measurement and adjustment of errors in census age data, age reporting for children, particularly content error, has not received much attention. Several reasons might have produced this omission of studies of childhood age misstatement. First, absolute error is often not large enough in this age group to draw the attention of investigators; second, digital preference is usually not a major problem; third, only net age error affects such fertility measures as the child-woman ratio, and its effects on other demographic measures have not been widely explored; fourth the typical small absolute error of this age group normally does not greatly affect any demographic projections; and finally, one needs to know the actual age of the children to measure true error, and that is not usually available in developing countries.

Of course, the level and pattern of age misstatement of young children have been investigated in some studies (Caldwell, 1966; Gibril, 1979; Pison, 1979; Becker and Mahmud, 1981; Bairagi et al., 1982), but social and economic variations in age misstatement have not usually been reported. There is therefore a need for studies on the factors related to age error, the effects of this error on demographic and other important biostatistical measures, and the adjustment of this error. It should be noted, however, that empirical studies of age misstatement in

developing nations are particularly difficult because of the usual absence of birth records. Without being able to establish the individual's true age, it is only possible to examine the reliability of the age reporting, which unfortunately neglects the important topic of bias in age reporting.

The quality of age data depends on the joint influences of the interviewer, questionnaire, and interviewee. If a factor affects either or both the interviewer and interviewee, then that factor should be identified for improvement. It might be hypothesized, for example, that a malnourished child's age would be underestimated and a well-nourished child's age would be overestimated. Because one child is lighter and shorter and another one is heavier and taller, relative to their age, they might differentially influence the reporting of their ages. If this is true, it has special consequences for the usefulness of such age-dependent nutritional indicators as weight-for-age.[1] If a malnourished child's age is underestimated, he might be incorrectly classified as well-nourished; and if a well-nourished child's age is overestimated, he may be wrongly classified as malnourished. This would diminish the validity of weight-for-age and of similar age dependent indices for screening malnutrition. An investigation of this specific point, whether nutritional status and age mistatement of children is related, thus seems to be important. Toward this goal, this paper reports age misstatement of young children--its level, pattern, and determinants--with an emphasis on the influence of childhood nutritional status on age error in Companyganj, a rural area of Bangladesh.

DATA AND METHODS

Data for this study were collected in Companyganj, a rural area of Bangladesh, located about 160 kilometers southeast of Dhaka, the capital of Bangladesh and formerly spelled "Dacca" (see Ashraf, et al., 1980 and Bairgi, 1980 for a more detailed description of the study area). The Christian Commission for Development in Bangladesh started the Companyganj Health Project in 1974, which covered an area of 128 square kilometers and which had a population of 118,000 in 1975. To evaluate the demographic impact of the Companyganj Health Project, birth, death, and migration data were recorded from a prospective systematic random sample of 10 percent of households that were followed from January 1975 through March 1980.

Eighty-eight percent of the people in Companyganj are Muslims and the local populace are religious in observant and somewhat traditional in comparison with other areas of Bangladesh. For example, women usually do not leave their households during daytime and when they go out they cover themselves with a "burqua" (umbrella) or their saree as the usual practice for observing purdah.

Population density exceeds 900 people per square kilometer in the Companyganj Health Project study area. The average family size is about 5 to 6 persons, usually living in a one or two room hut. Almost all the women breastfeed their children for 2 years or more, or until they have another pregnancy. The project area is economically average for Bangladesh with a per capita income of U.S. $120. Educational level is

more than the Bangladesh average: 66 percent of the fathers and 27 percent of the mothers of the study children read simple sentences in Bengali.

During the second week of September 1981, a team of six students and three faculty members of the Institute of Statistical Research and Training, University of Dhaka went to Companyganj for preliminary arrangement of the data collection. The questionnaire had been previously tested in the area of Savar Ganosastha Kendra, which is located 30 kilometers northwest of Dhaka. Becker and Mahmud (1981) observed in prior work that the age of the children is reported better if the Bengali month of birth is collected along with the reported age in years (Edmonston and Bairagi, 1981 describe the Bengali calendar in the context of age reporting). During field testing this point was verified and found correct. This field work also disclosed that reference to local events (past festivals and historical topics) did not aid in the collection of age data. Few respondents were able to relate births to past events, and many mothers merely became confused by this type of interview.

After preliminary testing of the questionnaire, recruitment and training of the supervisors and the workers began during the third week of October 1981. The purpose of the study was discussed, the complete set of equipment displayed, and the anthopometric measurements were demonstrated. The workers were given extensive training for the collection of age data and in the use of the various measuring instruments.

Identification of all children born between January 1975 and March 1980 (names, sex, sub-sector, name of the "bari" or household, family number, individual number, father's name, and mother's name) was collected from the vital registration records of the Companyganj Health Project. Some names of the children, as recorded in the birth registration, were found to have been changed during the time of the study; however, these were updated before actual data collection began. After the collection of the reported age from the field, the actual date of birth was noted from the center's vital registration record by a supervisor in the office.

Four teams of field workers collected the data. Each team comprised two trained field workers (one male and one female), a porter to carry the anthropometric equipment, and a local "dai" or midwife. These workers visited each of the sample households and collected data on the anthropometry (height, weight, and arm circumference) and reported age of the child, some socio-economic data on the child's family, and also some data on beliefs, attitudes and practices of child nutrition from the mothers and other members of the households.

Four spring Salter weighing scales were provided by the Companyganj Health Project. These scales were standardized from time to time against several known weights. The scales were calibrated once a week in the Companyganj Health Project office to ensure accurate measurements. Weights were taken to the nearest 100 grams, and height and arm circumference to the nearest 0.1 centimeter.

Data on 679 children, ranging from 22 to 59 months of age, were collected in the field study. These age limits were used because, first, in developing countries under 5 years children are thought to be nutritionally most vulnerable and, second, the actual age of the children below 22 months of age was not available.

Age error, defined as actual age minus reported age, was calculated in the office by a supervisor. Weight-for-age and height-for-age (see Waterlow et al., 1977 for definitions) as a percentage of the National Center for Health Statistics (NCHS) standard were calculated for actual age and for reported age as well. The Polish standard (Jelliffe, 1966: 220-226) was used to calculate arm-circumference-for-age. All the information including socioeconomic data for each child were coded, checked and processed at the Bangladesh University of Engineering and Technology computer center in Dhaka.

RESULTS

Table 1 presents age error by actual age for the Companyganj children (the table omits age error for 37 children who were 22 or 23 months of age). Age was over-reported for each of the completed age groups in Companyganj. Male-female differences were also examined (not shown in Table 1), but displayed no significant differences. This over-reporting tendency for these age groups is common in other populations, although related work in Matlab, Bangladesh shows underreporting of age for children in the 4 year-old age group (Bairagi, et al., 1982).

Random error is apparent from the standard deviation of the age error. This error increases with age as expected. Table 1 also shows that the standard error increases with age, primarily due to greater random error. Both systematic error (absolute) and random error in these Companyganj data are significantly ($p < 0.05$) higher than in comparable Matlab data (Bairagi, et al., 1982).

Several independent variables were included in the data collection in order to examine their relationship with age error. Table 2 presents the distribution of age error classified by three independent variables. As appears in the last column of this table, the association between age error and nutritional status is almost linear. The age of each category of nutritional status of children is overstated: but for well-nourished childrens the overstatement is greater. The trend of the age error with nutritional status is statistically significant ($p < 0.05$).

Table 2 also shows that, although the mean difference between literate and illiterate mother is only 0.55 month in age error, there is a significant association between age error and education of the mother ($p < 0.05$).

It is also obvious from Table 2 that the performance of all the interviewers was not equally accurate. Interviewer number 2 reported much greater age overstatement, while interviewer number 3 reported relatively accurate--on average--age statements.

Table 3 gives the results of an analysis of variance for age error. In addition to confirming the results of Table 2, Table 3 shows that the interaction of the nutritional status and mother's education and the interaction of the nutritional status and the interviewer on age error are significant ($p < 0.05$). This means that the influence of nutritional status on literate and illiterate mothers in reporting the age of their children differs, and also that the interviewers are not equally influenced by the nutritional status of the children in age reporting. Illiterate mothers understated the age of the severely malnourished children (less than 60 percent weight-for-age) instead of the usual overstatement. Figure 1 displays this relationship graphically.

Table 4 displays the effects of the age error on the analysis of variance of the nutritional status of the children. This table includes a measure of family income in additon to the mother's literacy status and the actual age of the child. Household income is classified into three categories and age of the children is also divided into three categories. From this table it appears that income is a significant determinant of the nutritional status of children (using actual age) but the mother's education is not. But when the weight-for-age on the basis of reported age is used, both income and mother's education appear statistically significant. This change in the level of significance is artificial and is due to the interaction of nutritional status and mother's education on age error that was found in Table 3 and Figure 1.

DISCUSSION

Both systematic and random error in Companyganj are higher than in previously reported Matlab data (Bairagi, et al., 1982). Matlab has had continuous vital registration and different set of health activities for last 18 years, however, and this may have some effect on age reporting. This point cannot be confirmed without experimental work controlling the effect of the interviewers. One of the interviewers of this study (number 3) obtained results similar to Matlab.

Child's sex and mother's education appear as determinants of age error in one Matlab study (Becker & Mahmud, 1981), but the child's sex is not found to be a significant factor in the Companyganj data. The child's sex may have some effect on age error for elderly children, and perhaps age dissimilarities (the Matlab study children were 0 to 14 years old) of the children between the Becker and Mahmud (1981) and this study may contribute to the difference.

Variation in age error among the interviewers was substantial with an average absolute difference of 4.1 months between the "best" and the "worst" interviewer. This indicates that proper selection and training to the workers may greatly reduce age error.

Probably the most interesting and important finding of this study is the association between nutritional status and age mistatement of the children. Although the age of both malnourished and well-nourished children is over-reported, over-reporting for malnourished children is

diminished. Moreover, the nutritional status of children influenced different interviewers, and literate and illiterate mothers report differently the age of the children.

How does nutritional status influence the interviewers and the mothers in reporting the age of the children? First of all, both the interviewers and the mothers have an estimate of the expected growth of a child for different age. In their expectations, they calculate the age of a child from his or her growth and tend to underestimate the malnourished child and overestimate the well-nourished child. An interviewer is likely to be even more influenced than a mother by the nutritional status of the child because the interviewer meets the child for the first time, while the mother knows the growth history of the child as well as having information about the date of the child's birth. Ultimate age reporting thus depends on the interaction of the interviewer, the mother (interviewee), and the questionnaire. The illiterate mother possibly either surrenders more to the opinion of the interviewer or possesses poorer information about the child's date of birth.

From the findings of this study it might be thought that if the interviewers are advised not to be biased by the nutritional status of the children, age reporting may be improved. It might not decrease absolute error (and may even increase it), but it might reduce the correlation between the nutritional status of the children and age error. Absolute error affects the assessment of malnutrition, but the correlation affects nutritional screening greatly.

In this paper only one example (weight-for-age) is cited showing the effects of age error on the interpretation of the relationship between nutritional status of children and mother's education. The incorrect interpretation of the variables determining weight-for-age originated from the interaction between the nutritional status of the children and the mother's education on age error. Systematic error would affect assessment of malnutrition, and random error and the correlation would affect screening of malnutrition. Various age-dependent indicators may be affected by age error differently, but these are issues for further study. The present findings are a caution for the use reported child's age in the analysis of anthropometric and other biostatistical measures.

FOOTNOTES

1. Waterlow et al., 1977 provides a definition of the weight-for-age index. The weight-for-age index is defined as $I = (W_x)/(W_x^*)\ 100$, where x is the actual age of the study child, W_x is his true weight, W^*_x is the weight of a reference child (Harvard or National Center for Health Statistics median- Jelliffe 1966; Waterlow et al. 1977) at age x. An error in x will make I as $I' = (W_x/W^*_x + E) \cdot 100$.

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Figure 1. Relationship of Age Error, in months, by Child's Nutritional Status and Mother's Literacy

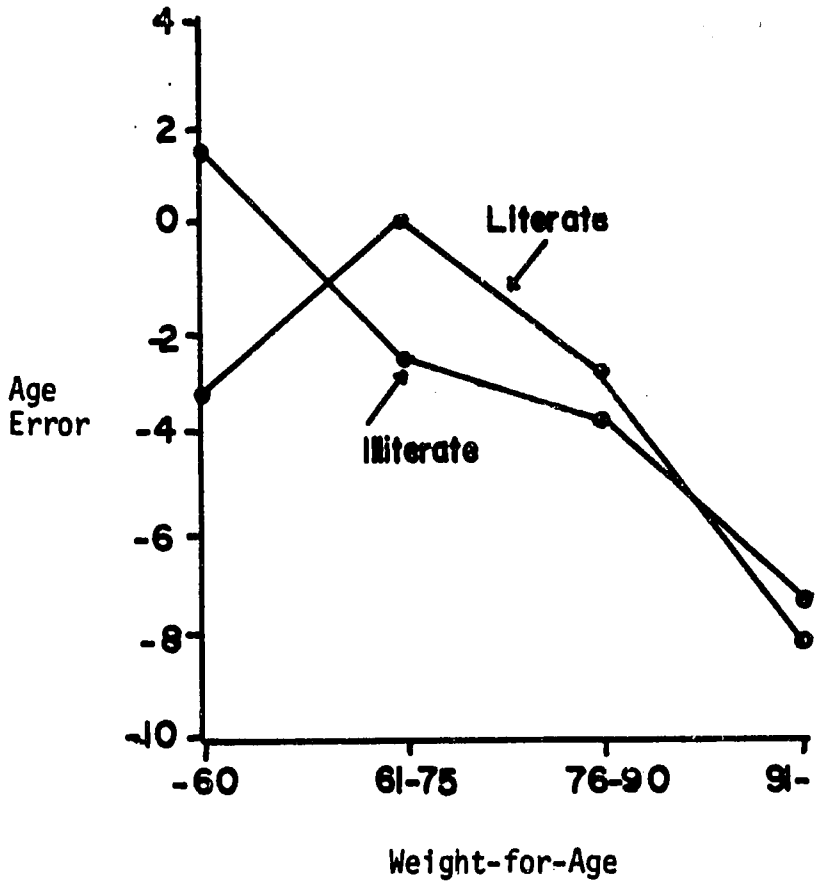

Table 1. Age Error (in months) in Companyganj by Actual Age[a]

Actual Age (in years)	Number	Correctly Reported[b]	Mean	Standard Deviation	Standard Error[c]
2	228	116	-2.43	7.07	7.86
3	214	113	-2.27	9.46	9.73
4	200	107	-3.15	10.36	10.83

[a] age error, in months, is calculated as actual age minus reported age.
[b] correctly reported to the same completed year.
[c] calculated as the square root of the mean square error.

Table 2. Percentage Distribution of Age Error by Nutritional Status, Mother's Education, and Interviewer

Variable	Number	Reported Older	Age Correct[a]	Reported Younger	Mean Error (Months)[b]
Nutritional Status[c]					
-60	100	25	52	23	0.62
61-75	358	31	57	12	-2.27
76-90	192	38	55	7	-3.86
91+	29	48	38	14	-8.10
			$p < 0.05$		
Mother's Education					
Illiterate	483	35	51	14	-2.70
Literate	196	26	50	24	-2.15
			$p < 0.05$		
Interviewer Number					
1	189	24	67	7	-2.11
2	219	42	46	12	-4.42
3	73	16	73	11	-0.34
4	198	37	47	16	-1.70
			$p < 0.05$		

[a] reported age within +2 months of the actual age was considered as correct.
[b] age error is actual age minus reported age.
[c] measured by percent weight-for-age of median NCHS standards.

Table 3. One-Way Analysis of Variance of Age Error in Companyganj

Sources of Variation	Degrees of Freedom	Probability Values
Weight-for-age (WA)	3	0.000
Mother's Education (ME)	1	0.229
Interviewer (I)	3	0.000
Interactions		
WA x ME	3	0.014
WA x I	9	0.000
ME x I	3	0.506
WA x ME x I	9	0.090
Residual	647	
Total	679	

Table 4. Effect of Age Error on One-Way Analysis of Variance of Nutritional Status in Companyganj

Sources of Variation	Degrees of Freedom	Probability Values For Actual Age	Probability Values For Reported Age
Income (I)	2	0.000	0.002
Mother's Education (ME)	1	0.177	0.029
Age (A)	2	0.706	0.647
Interactions			
I x ME	2	0.819	0.445
I x A	4	0.691	0.911
ME x A	2	0.940	0.651
I x ME x A	4	0.301	0.456
Residual	661		
Total	678		

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