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Training Local Health Assistants for a Community Health Survey in a Developing Country:
―Longitudinal Monitoring of the Growth and Nutrition of Children in Zambia―

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Abstract ― The nutritional status, growth, and health of children are useful indicators for assessing the ability of a population to adapt to the environment and the extent of this adaptation. These indicators can be used to measure and evaluate the overall nutritional status and health of young children. In Zambia, in southern Africa, drought and unpredictable erratic rainfall are major factors affecting the health and nutrition of the inhabitants, particularly small children. A recent national survey conducted in Zambia indicated that the nutritional status of children was poor because 50% of children between 3 and 59 months of age had stunted growth (extremely short for their age), 20% were underweight (low weight for their age), and 6% showed growth wasting (low weight for their height). By contrast, between 1991 and 2004, data from six cross-sectional national surveys did not show any evidence of effects of drought. Therefore, an intensive, village-level, longitudinal monitoring survey is required to assess the effects of drought on the growth and nutrition of children. We briefly summarize the growth and nutrition of Zambian children using data from the report of the Living Conditions Monitoring Survey (LCMS) 2004, with special focus on the southern and eastern provinces of Zambia. In addition, we propose a methodology for conducting a longitudinal survey to monitor child growth and nutrition in rural villages in the eastern and southern provinces of Zambia and report a 1-week intensive program to train local health assistants to make anthropometric measurements.

(Revised on 1 April, 2008)

1. Introduction

The nutritional status and growth and health status of children are useful indicators to assess the ability of a population to adapt to the environment and the extent of this adaptation. These indicators enable measurement and evaluation of the overall nutritional and health status of young children. Additionally, they enable identification of subgroups of the child population that are at increased risk of impaired growth, mental development, disease and death.

There are several factors that influence the nutritional status of children, including the economic status of mothers, diet and environmental conditions of the household. These factors can impair growth in children and result in decreased body weight or height. Moreover,

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in addition to the cross-sectional survey, a long-term survey monitoring child growth enables assessment of the impact of poverty and environmental destruction, as well as the resilience of the population and that of the community residing in it.

This paper presents a brief summary of the growth and nutritional status in Zambian children; the data provided is based on the report of the Living Conditions Monitoring Survey (LCMS) 2004, with special focus on southern and eastern provinces of Zambia. In addition, we propose a methodology for conducting a longitudinal survey that monitors child growth and nutritional status in rural villages in the eastern and southern provinces of Zambia and report a 1-week intensive program to train local health assistants to make anthropometric measurements.

2. Overview of the child growth and nutritional status in Zambia

Currently, two datasets on the nutritional status of Zambian children are available. They are derived from national surveys: the Zambia Demographic and Health Survey (ZDHS) and the Living Condition Monitoring Survey (LCMS). The latest report of an individual survey published by ZDHS (ZDHS 2001–2002, Central Statistical Office 2003) was in 2003 and that by LCMS (LCMS 2004, Central Statistical Office 2005) was in 2005. In this article, more recent data (LCMS 2004) has been adopted to review the growth and nutritional status of Zambian children.

The LCMS-2004 survey included anthropometric measurements of children under the age of five for assessment of their nutritional status. Table 1 shows the variations in the malnutrition indices of children (aged 3 –59 months) in urban and rural areas and in individual provinces. While similar variations were observed in underweight and growth stunting among provinces, there were no variations in wasting. Overall, 50% of the children aged between 3 and 59 months showed growth stunting, 20% were underweight, and 6% showed growth wasting.

At the provincial level, there were considerable variations in the nutritional status of children. With regard to “stunting,” there was 40% stunting in the southern province, which was identical to that observed in Lusaka and was the least among the 9 provinces. In contrast, the stunting rate in the eastern province was 59%, which was the second highest among all the provinces. A similar tendency was observed with regard to the “underweight” status: the southern province had the lowest rate, while that in the eastern province had an intermediate rate. In other words, at the provincial level, children in the southern provinces were relatively taller and heavier than the average height and weight, whereas those living in

Table 1. Incidence of stunting, underweight and wasting of children aged 3-59 months by province, Zambia, 2004

	N	Stunting (%)	Under-weight (%)	Wasting (%)
All Zambia	1,229,519	50	20	6
Province				
Central	125,563	48	22	7
Copperbelt	159,141	44	16	4
Eastern	193,176	59	20	5
Luapula	121,740	64	26	4
Lusaka	132,731	40	18	8
Northern	172,851	55	25	6
North Western	77,470	49	19	10
Southern	162,858	40	16	6
Western	83,989	45	21	6

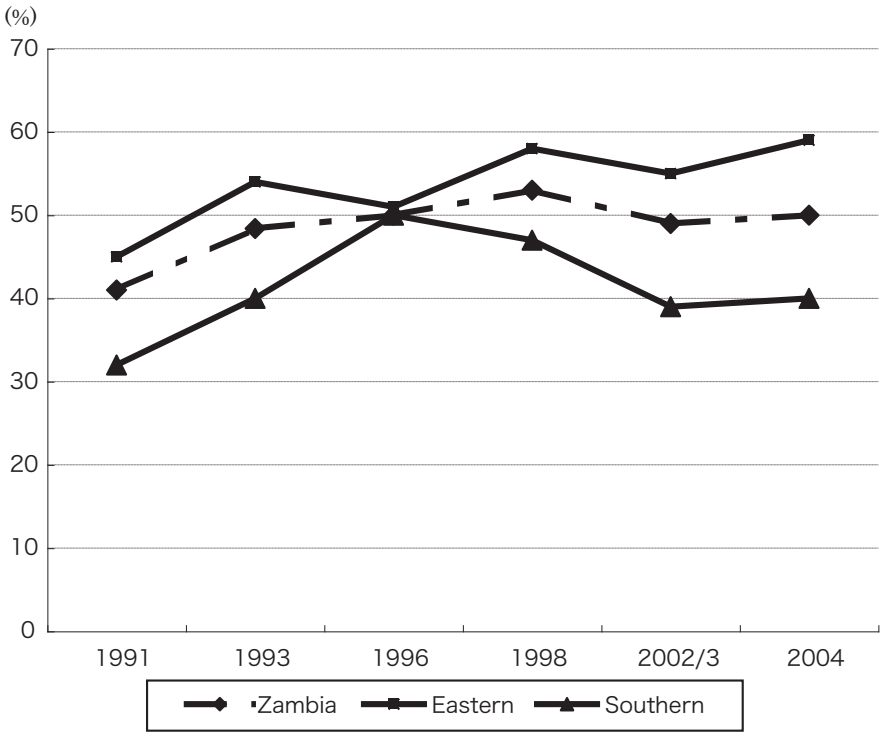

Fig. 1. National and provincial trends in distribution of child malnutrition (Stunting)

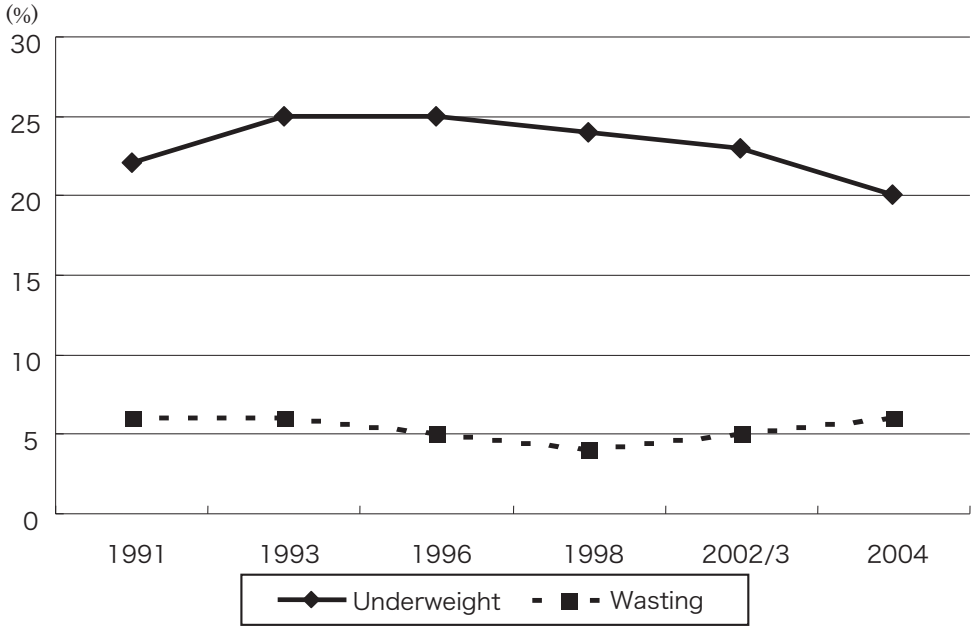

Fig. 2. National trends in distribution of child malnutrition (Underweight and Wasting)

the eastern provinces were shorter and lighter.

This tendency was observed to be consistent during the 6 surveys that were conducted between 1991 and 2004 (Fig. 1). Except for 1996, the rate of "stunting" in the whole of Zambia has been lower than the (average) rate in the eastern province while it has been higher than the rate in the southern province. The rate of "stunting" increased from 1991 to 2004, whereas the rate of the "underweight" status tended to decline and that of "wasting" remained stable in this period (Fig. 2).

In summary, 50% of the children aged between 3 and 59 months showed growth stunting (extremely short for their age), 20% were underweight (low weight for their age) and 6% showed growth wasting (low weight for their height). The stunting level in the eastern province was greater than the national average, while it was low in the southern province. Overall, the nutritional status of Zambian children was considered poor because only 2.5% of the children fell below –2 SD for each of the three indices, including "stunting," "wasting," and "underweight," in the reference population (WHO 1983, 1995). From 1991 to 2004, the data from six cross-sectional surveys did not show any evidence of the impact of drought. A village-level intensive longitudinal monitoring survey is required to assess the impact of drought on the growth and nutritional status of children.

3. Longitudinal monitoring of growth and nutrition

This survey aimed to monitor the nutritional status of local villagers (especially children) by measuring their physical dimensions (e.g., height, weight, and so on) on a regular basis and in a longitudinal manner in order to investigate the food shortage that occurs due to drought and its impact on the health and security of residents living in villages in the eastern and southern provinces of Zambia.

The study would involve all residents ranging from the infants to the elderly from two or three rural areas in the eastern and southern provinces. One of the reasons is that including not only children but all villagers would be better to obtain cooperation in our survey. All participants will be provided with detailed information regarding the procedures involved and the purpose of conducting the survey, and informed consent will be obtained from all the participants. The sample size in each province (comprising few villages) is expected to range from several hundred to a thousand.

3.1 Baseline survey

Japanese experts simultaneously conduct anthropometric measurements in the field annually (Yamauchi 2007). Ideally, the measurements are performed on the same date or at least in the same month.
Measurements:
1) Infants (aged 0–2 years, unable to stand-up independently): body length (in the lying position), weight, and upper arm circumference (UAC).
2) Children (aged 2–18 years): height, weight, UAC, waist and hip circumferences, and skinfold thickness (in the triceps and subscaplar regions).
3) Adults (aged >18 years): height, weight, UAC, waist and hip circumferences, and skinfold thickness (in the triceps and subscaplar regions).

3.2 Growth monitoring survey

Well-trained local health assistants conduct anthropometric examinations according to the standard protocol (Weiner and Lourie 1981) on a weekly or biweekly basis.

Measurements:

1) Infants (aged 0–2 years, unable to stand-up independently): body length (in the lying position), weight, and upper arm circumference (UAC).
2) Children (aged 2–18 years): height, weight, and UAC.
3) Adults (aged >18 years): weight and UAC (The height of the adults is assumed to be stable).

3.3 Indicators and analyses

The three standard indices of physical growth that describe the nutritional status of children are defined as follows:

1. Height-for-age (chronic malnutrition)—Stunting
2. Weight-for-height (current malnutrition)—Wasting
3. Weight-for-age (chronic and current malnutrition)—Underweight

Stunting (height-for-age) is a condition reflecting the cumulative effect of chronic malnutrition. Wasting (weight-for-height) is defined as failure to gain weight in relation to height. This can occur as a result of

recent illness that causes a sudden loss of appetite and subsequent loss of muscle and fat in a child. In fact, this is a short-term effect. Underweight (weight-for-age) is defined as low weight in relation to age. It is a composite index for weight-for-height and height-for-age; thus, it does not distinguish between acute malnutrition (wasting) and chronic malnutrition (stunting). A child may be regarded as underweight for his/her age because he/she shows growth stunting, growth wasting, or both. Therefore, weight-for-age is a good overall indicator of the nutritional status of a population.

A number of indicators have been developed to express the various types of malnutrition that affect the growth of children. However, those selected for this survey are the most commonly used indicators. According to the recommendations by the World Health Organization (WHO 1983, 1995), the nutritional status of children will be compared with an international reference population (Kuczmarski et al. 2002) defined by the U.S. National Center for Health Statistics (NCHS) and accepted by the U.S Centers for Disease Control (CDC).

3.4 Expected outcomes

- General nutritional status of children and adults as compared to the international reference population.
- Growth retardation during seasons of drought and periods of food shortage.
- Interhousehold variations in the nutritional status and growth level of children during both normal and drought/food shortage periods.
- Identification of high-risk gender and age groups.
- Associations between the coping strategies/socio-economic status of the household and the nutritional status and growth of the child.
- Development of a national standard growth curve in Zambia.

4. Training of local health assistants

To conduct a longitudinal survey to monitor the growth and nutrition of villagers, candidate local health assistants (enumerators) participated in an intensive 1-week program in September 2007. This program trained the local health assistants to make anthropometric measurements.

4.1 Local health assistant (enumerator) candidates

Initially, six youths with more than secondary school education were selected by a local supervisor, a staff from

Table 2. Training schedule for 17–23 September 2007

Day	Date	Morning	Afternoon
1	17 Sep	Equipment preparation; technical staff meet with local supervisors	
2	18 Sep	Instruction and explanation of the survey and training program, questions and answers	
3	19 Sep	Introduction to anthropometry and explanation of the equipment	Demonstration and practicing of themeasurements; on-the-job training in village A
4	20 Sep	Focus training for important measurements (i.e., height and skinfold thickness)	Demonstration and practicing of the measurements; on-the-job training in village B
5	21 Sep	Examination of measurements; English listening comprehension	Demonstration and practicing of the measurements; on-the-job training in village C
6	22 Sep	Instruction for three new candidates (two young men and one young women)	Demonstration and practicing of the measurements; on-the-job training in village D
7	23 Sep	Off (self-practice at home)	

Table 3. Measurements and equipments

Measurement	Equipment	Accuracy	Remark
Body length	Measuring board built by a local carpenter	0.1 cm	For infants aged 0–2 years, unable to stand unaided
Height	Metal tape measure (wall mounted)	0.1 cm	For children able to stand unaided and adults
Weight	Portable digital scale	0.1 kg	
Circumferences (upper arm, waist, and hip)	Plastic tape	0.1 cm	Left side
Skinfold thickness (triceps and subscapular)	Adipometer (plastic calipers)	0.2 mm	Left side

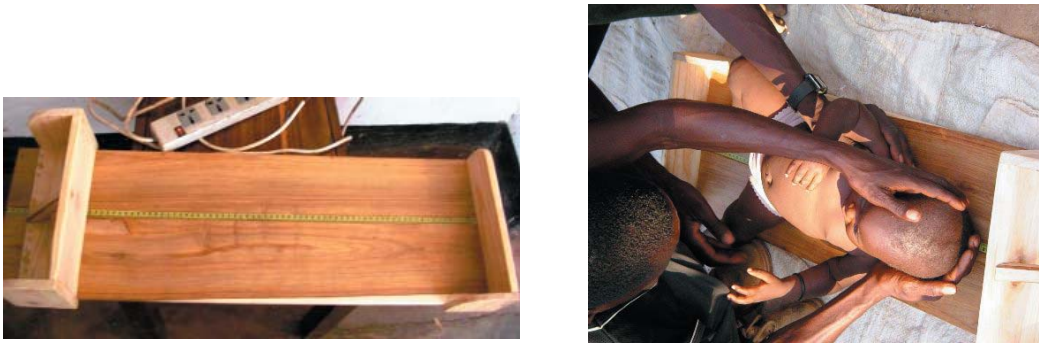

Photo 1. Measuring board for infants

Photo 2. Height

Photo 3. Weight

a nongovernmental organization. The youths were from villages near the subject villages. They were required to have fluency in both the local language (Tonga) and English, the ability to handle numerical data, and basic mathematical and interviewing skills.

4.2 Training schedule

The candidates took part in a 1-week program for training to make anthropometric measurements. Training occurred at the base camp in the morning (or the whole of Day 2) and on the job at four villages (villages A, B, C, and D) in the afternoon (Table 2). Training was done in English.

4.3 Measurements and equipment

Four measurements were taught (see, "3. Longitudinal monitoring of growth and nutrition"). The measurements, equipment, accuracy, and remarks are summarized in Table 3.

4.4 Precautions and technical problems identified during the training program

(1) All measurements
- Learn to how to prepare and operate each instrument correctly.
- Learn how to read the scale and variables quickly and correctly.

(2) Height (Photos 1 and 2)
- A flat place is needed for the measurement.
- A measuring board is used for infants who cannot stand unaided.
- Ask the subjects to take off their footwear before the measurement.

(3) Weight (Photo 3)
- The scale needs to be put on a hard flat place. The results depend on the type of surface on which the scale is placed, e.g., soil, grass, stone, wood, concrete, etc.
- The subjects should wear light clothing (e.g., T-shirt and trousers/skirt).
- Take off footwear before the measurement.
- Remove heavy items such as keys and coins (purse) from the subject's pockets.
- Help children and the elderly to get on the scale, but do not touch them during the measurement.

(4) Circumferences/girths (Photo 4, left)
- The determination of the measurement points (surface landmarks) is important.
- The midpoint of the arm is taken as the point on the lateral side of the arm midway between the lateral border of the acromion and the olecranon when the arm is flexed at 90 degrees.

Photo 4. Arm circumference (left) and subscaplar skinfold thickness (right)

- The waist is measured as the minimum circumference between the iliac crests and lower ribs.
- Hip circumference should be measured at the level of the greatest protrusion of the buttocks.

(5) Skinfold thickness (Photo 4, right)
- Learn to how to operate the adipometer (a device for measuring subcutaneous fat).
- Measurement points (surface landmarks).
- For women, take care that the back is exposed when measuring the subscapular skinfold thickness.

4.5 Final examination and results (Photo 5)

(1) Measurements: Height, arm circumference, and skinfold thickness (triceps and subscapular).
(2) Reading scales: Arm circumference, height, and subscapular skinfold thickness.
(3) Basic skill test: Listening comprehension both in Tonga and English, arithmetic test, dictation test to measure note-taking skills.

Two men and two women satisfactorily passed the anthropometric and basic skill tests. However, one woman barely passed both tests and the remaining woman clearly failed the measurement test. Three additional candidates (two men and one woman) were recruited to replace the vacant position and to keep the other two as a reserve backup if qualified (Photo 6).

The three newcomers together with the below average performer of the original group were subject to the same anthropometric measurement test. All three new comers satisfactorily passed the test. It is worth noting that the basic arithmetic test revealed that 3 of the 8 candidates had weak mathematic skills. To avoid calculation mistakes, calculators were provided to every enumerator. The listening test also found a candidate with a possible minor degree of hearing impairment. He was instructed to repeat answers to the respondents during field interviews before recording the responses on the questionnaires.

5. Summary

We briefly summarized the growth and nutritional status of Zambian children, focusing on the southern and eastern provinces, and presented a methodology for conducting a longitudinal survey to monitor child growth and nutrition in rural villages. In addition, we presented the structure of a 1-week intensive course to train candidates as local health assistants.

Generally, the nutritional status of Zambian children is poor because 50% of children between 3 and 59 months of age had stunted growth (extremely short for their age), 20% were underweight (low weight for their age), and 6% exhibited growth wasting (low weight for their height). By contrast, data from six cross-sectional national surveys conducted between 1991 and 2004 did not show any evidence of the effects of drought. Thus, there is a need to conduct a village-level longitudinal monitoring survey to assess the effects of drought on the growth and nutrition of village children.

Therefore, we trained local health assistants in the

Photo 5. Final examination

Photo 6. Enumerators

field to make weekly anthropometric measurements of local villagers. After 1 week of intensive training, four of six candidates passed the final examination and three new candidates were enrolled.

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