Comparison of mothers’ understanding of two child growth charts in Lesotho

M.T. Ruel,1 D.L. Pelletier,1 J.-P. Habicht,1 J.B. Mason,2 C.S. Chobokoane,3 & A.P. Maruping4

Reported are the results of a study that compared mothers’ understanding of two growth monitoring charts in Lesotho, which was carried out to assist the government in selecting a national growth chart. The study was conducted over 4 months in nine primary health care (PHC) clinics, where 1221 mothers were enrolled. Mothers were assigned to one of the following chart groups: “road-to-health” (RTH), “growth surveillance” (GS), or no chart (controls). Mothers in the first two groups received instruction on their respective chart during monthly growth monitoring sessions and were tested on their knowledge of this chart before and after the follow-up period. The mothers in the control group were tested on the RTH and GS charts at the beginning and at the end of the study. The results indicated that mothers who received training on either chart markedly improved their understanding compared with the control group and that the RTH group understood their chart better than the GS group did theirs.

Introduction

One of the purposes of growth monitoring is to educate mothers about the growth of their child and motivate them to take appropriate action to maintain or improve it. It has been postulated that growth charts could be used as an educational tool to make malnutrition apparent to both health workers and mothers (1–5); however, in order to fulfill this objective, mothers must understand the charts. Although most studies report some degree of understanding of such charts, even by illiterate mothers (6, 7–13), others have documented a lack of success in teaching mothers how to interpret them (14, 15).

In Lesotho two very different growth charts are widely used. The Ministry of Health uses the WHO version of the “road-to-health” (RTH) chart (see Fig. 1) (16), while the Catholic Relief Services, which administer approximately two-thirds of the primary health care (PHC) clinics in the country, use the growth surveillance (GS) system (17). The latter system consists of a “master chart” (see Fig. 2a), which is retained at the clinic, and a “growth surveillance” (GS) chart (see Fig. 2b), which is taken home by the mother.

Although both the RTH and the GS charts are widely used throughout Africa, to the best of our knowledge no study has compared the ability of mothers to understand them. The results presented in this paper specifically address this question by comparing maternal knowledge of the charts before and after 3 months’ participation in a growth monitoring programme.

Materials and methods

Study sample

A total of 1221 mothers from nine PHC clinics situated in the lowland and foothills of Mafeteng and Mohale’s Hoek districts of Lesotho were enrolled in the study from December 1985 to April 1986. Clinics were chosen principally on the basis of the frequency of mothers’ attendance, the schedule offered for under-5-year-olds, and the possibility of new enrolments. With the exception of one clinic that used the RTH chart, all the others employed the GS chart. Mothers were selected for inclusion in the study if their child was under 2 years of age and their level of exposure to clinic activities was low.

Growth charts

With the RTH chart (Fig. 1) the weight of the child is plotted against its age (⁠,⁠,⁠), while on the GS chart

---

1 Cornell Food and Nutrition Policy Program (CFNPP), Division of Nutritional Sciences, Cornell University, Sage Hall, Ithaca, NY 14853, USA. Requests for reprints should be sent to Dr. Ruel at this address.
2 Technical Secretary, Administrative Committee on Coordination/Sub-committee on Nutrition, World Health Organization, Geneva, Switzerland.
3 Formerly Director, Food and Nutrition Coordinating Office, Masera, Lesotho.
4 WHO Medical Officer, Mother and Child Health/Family Planning Program, Harare, Harare, Zimbabwe.

Reprint No. 5100

(Fig. 2b) the percentage of median weight-for-age (calculated from the master chart (Fig. 2a)) is plotted against age (t7). Of the two curves on the RTH chart, the upper represents the 50th percentile of the NCHS standard for boys and the lower the corresponding 3rd percentile for girls. The area delimited by these two lines is usually referred to as the "road-to-health". On the GS chart, the area of "adequate growth" is delimited by a horizontal green band (shaded in Fig. 2b), referred to as the "green band", which corresponds approximately to the road-to-health in the RTH chart.

**Study design**

In the study a pre–post-intervention design with a control group was used. In each participating clinic, mothers were assigned sequentially to one of the following groups:

- GS group: mothers who received a GS chart (n = 367);
- RTH group: mothers who received an RTH chart (n = 389); and
- control group: mothers who received no growth monitoring chart (n = 465).

**The intervention and interview schedules**

Immediately after being screened, all enrolled mothers were interviewed by project staff in order to collect information about their previous attendance at the clinics and to test their knowledge about both charts. All the mothers selected were expected to participate in the project for three consecutive months. At each visit, all children were weighed and, for the GS and RTH groups, the weights were plotted on the assigned growth charts. Mothers from these two groups were taught how to interpret their respective growth chart, which was then used to provide them with information about their child's growth. During the instruction about the charts, emphasis was placed on the broad direction of growth rather
Comparison of mothers' understanding of two child growth charts in Lesotho

Fig 2a. The "growth surveillance" (GS) system. (a) The master chart.

A total of 335 (27.4%) of the 1221 mothers did not complete four visits to the clinics. Of these drop-outs, 82 were visited at home and administered the final questionnaire to assess their comparability with the rest of the sample.

**Testing and analytical methodology**

The mothers' understanding of the charts was evaluated before and after three visits to the clinic using tests devised by a steering committee involved in decisions about the objectives, design, implementation and supervision of the various steps of the study. The pre-test assessment contained questions

---

82 were visited at home and administered the final questionnaire to assess their comparability with the rest of the sample.

**Testing and analytical methodology**

The mothers' understanding of the charts was evaluated before and after three visits to the clinic using tests devised by a steering committee involved in decisions about the objectives, design, implementation and supervision of the various steps of the study. The pre-test assessment contained questions

---

6 Representations from the following institutions served on the steering committee: Bureau of Statistics of Lesotho (BOS), Catholic Relief Services (CRS), Food and Nutrition Coordinating Office (FNCO); Joint Programme in Nutritional Surveillance of the UNICEF (Eastern and Southern Africa Regional Office) and the Cornell Nutritional Surveillance Programme (CNSP), Cornell University; Ministry of Agriculture of Lesotho (MOA); Ministry of Health of Lesotho (MOH), Private Health Association of Lesotho (PHAL), Red Cross; UNICEF, Lesotho Country programme, and WHO.
on each chart (see Fig. 3, case study II of the RTH and the GS tests): the maximum score attainable was 6 points per chart. The post-test assessment evaluated mothers' knowledge of the chart that they had been instructed on during the study; the maximum score was also 6 points. Fig. 3 illustrates the three case studies used to test mothers on the RTH chart and on the GS chart. For mothers in the control group, who had received no instruction on any chart, the post-test assessment used was similar to that used for the pre-test and contained questions on both charts.

The mothers were shown the growth patterns, which were plotted on real charts, and asked to interpret them as good or bad and to justify their answers. One point was awarded for a correct answer and zero for an incorrect or uncertain answer.

An "improvement" score (ranging from -6 to +6) was calculated. For the GS and RTH groups, this score was obtained by taking the difference between the post-test and pre-test results for their assigned chart, while for the control group the mean difference between their results for the post-test and pre-test on both charts was used.

The analysis was carried out using means, standard deviations, and 95% confidence limits, while the statistical significance of the results ($P < 0.05$) was tested using Student's $t$-tests, $F$-tests, one-way analysis of variance and covariance, or $\chi^2$ tests, as appropriate. Multivariate analysis of variance was also used to control for possible confounding factors, to test interactions, and to obtain adjusted means. The data were coded, entered and analysed in Lesotho, using the microcomputer facilities at the Lesotho Food and Nutrition Coordinating Office.
**Results**

**Baseline, post-test and improvement scores**

The three study groups were compared with respect to their socioeconomic and demographic characteristics and, as expected, no systematic difference was found.

Table 1 shows the baseline, post-test, and improvement scores for all three comparison groups. The mean baseline scores for the RTH test were higher than those for the GS test with all groups of mothers. The post-test scores for the RTH group were also higher than those for the GS group. Improvements in scores were similar for both groups (1.72 points for the GS group and 1.77 for the RTH group), and were
Table 1: Mean baseline, post-test and improvement scores for Basotho mothers in the study, stratified by chart group

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Baseline score</th>
<th>Post-test score*</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>GS</td>
<td>RTH</td>
<td>GS</td>
</tr>
<tr>
<td>GS</td>
<td>294</td>
<td>1.11 (0.12)*</td>
<td>1.64 (0.14)</td>
<td>2.82 (0.10)</td>
</tr>
<tr>
<td>RTH</td>
<td>318</td>
<td>1.18 (0.12)</td>
<td>1.82 (0.14)</td>
<td>3.07 (0.10)</td>
</tr>
<tr>
<td>Control</td>
<td>266</td>
<td>0.75 (0.09)</td>
<td>1.38 (0.12)</td>
<td>1.83 (0.10)</td>
</tr>
<tr>
<td>Whole sample</td>
<td>968</td>
<td>1.00 (0.07)</td>
<td>1.62 (0.08)</td>
<td></td>
</tr>
</tbody>
</table>

* Mothers were tested on their knowledge of both charts at baseline. The two groups that had been given instruction on a given chart (GS or RTH) were tested only on that chart in the post-test assessment, while mothers in the control group were tested on both charts again.

* Adjusted for baseline scores.

* Figures in parentheses are standard errors

significantly higher than that of the control group.

Because of differences in the extent of baseline knowledge about the charts, analysis of covariance was used to calculate the mean improvement scores, adjusted for baseline scores. The results indicate that there was a significantly greater improvement for the group of mothers who received instruction on the RTH chart (2.28) compared with those who were instructed on the GS chart (1.54). Relative to the results for the control mothers, the mean adjusted improvement score was several times higher for mothers who had been given instruction on the charts, while that for the controls was similar to the unadjusted improvement score. These results were not due to any extreme variations in individual clinics, as indicated by the analysis of variance.

The drop-out rates were similar in all the groups: RTH (27%), GS (27%), and control (28%). A 25% sample of mothers who dropped out were followed up at home and administered the post-test and socioeconomic questionnaires. These mothers were very similar socioeconomically and demographically to the rest of the sample, and the results were not affected by including or excluding them from the analysis.

Comparison of the components of the post-test results

An analysis of the strengths and weaknesses of each growth chart revealed that the basic concept of the direction of growth was generally much better understood when the RTH chart was used for teaching rather than the GS chart (Table 2). Only 56% of the mothers recognized the poor growth of a child who had lost weight when the data were plotted on a GS chart, compared with 75% of the mothers when the RTH chart was used (case study 1). The results of case study II showed that with the GS chart only 19% of the mothers recognized a gain in weight to be a sign of good growth if the child's weight was below the 18th percentile of the reference standards, compared with 54% of mothers when the RTH chart was used. Finally, in case study III with the GS chart half of the mothers correctly identified the position of the weight of their child as inside the green band, while only 7% of the mothers correctly mentioned weight gain as a sign of their child's adequate growth. With the RTH chart, the constant weight pattern that resulted from lack of growth was only evaluated correctly by 33% of the mothers, while the same proportion referred to the position of the dots within the standard lines as an indication of good growth. These results suggest that the concept of "constant weight" was poorly understood by the mothers.

Discussion

The results of this study are consistent with those of others previously carried out in Lesotho in showing that Basotho mothers can learn to distinguish adequate from poor growth using the RTH chart. Our findings also documented that mothers could learn to interpret the growth surveillance chart if they were given instruction on three consecutive visits to the clinic.

The results we obtained showed that, after similar training, mothers understood the RTH chart better than the GS: when the scores had been adjusted for initial knowledge, the RTH group gained higher scores on their post-test assessment and learned more about their chart (as indicated by their higher improvement score) than the group trained on the GS chart. The improvement in scores over the study period was several times greater for mothers who received instruction compared with the control

See footnote a, p. 482.
Comparison of mothers' understanding of two child growth charts in Lesotho

Table 2: Distribution of answers given by Basotho mothers to the different components of the post-test questionnaires on the GS and RTH charts

<table>
<thead>
<tr>
<th></th>
<th>% of mothers in:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RTH group</td>
</tr>
<tr>
<td>Case study I: child losing weight within NCHS standards</td>
<td></td>
</tr>
<tr>
<td>Incorrect answer</td>
<td></td>
</tr>
<tr>
<td>Growing well because within standards</td>
<td>1</td>
</tr>
<tr>
<td>Correct answer</td>
<td></td>
</tr>
<tr>
<td>Not growing well because losing weight</td>
<td>75</td>
</tr>
<tr>
<td>No answer or other incorrect reply</td>
<td>24</td>
</tr>
<tr>
<td>Case study II: child’s growth curve is parallel to percentiles, outside the NCHS standards</td>
<td></td>
</tr>
<tr>
<td>Incorrect answer</td>
<td></td>
</tr>
<tr>
<td>Not growing well because outside the standards</td>
<td>26</td>
</tr>
<tr>
<td>Correct answer</td>
<td></td>
</tr>
<tr>
<td>Growing well because adequate rate of weight gain</td>
<td>54</td>
</tr>
<tr>
<td>No answer or other incorrect reply</td>
<td>20</td>
</tr>
<tr>
<td>Case study III (RTH group only): constant weight, within the standards</td>
<td></td>
</tr>
<tr>
<td>Incorrect answer</td>
<td></td>
</tr>
<tr>
<td>Growing well because within standards</td>
<td>33</td>
</tr>
<tr>
<td>Correct answer</td>
<td></td>
</tr>
<tr>
<td>Not growing well because constant weight (or no weight gain for 3 months)</td>
<td>33</td>
</tr>
<tr>
<td>No answer or other incorrect reply</td>
<td>33</td>
</tr>
<tr>
<td>Case study III (GS group only): child gaining weight within standards</td>
<td></td>
</tr>
<tr>
<td>Mothers who referred only to the position of the dot inside the green band</td>
<td>—</td>
</tr>
<tr>
<td>Mothers who referred to the weight gain of the child</td>
<td>—</td>
</tr>
<tr>
<td>No answer or incorrect answer reply</td>
<td>—</td>
</tr>
</tbody>
</table>

group, which indicates that the results were actually due to the intervention.

At the onset of the study mothers understood the RTH chart better than the GS. This was unexpected, since eight of the nine clinics in the sample were currently using the GS chart. Although the GS chart was used in the clinics by health workers for screening purposes, and by the mothers as a “ticket” for participation in the food distribution programme, it was not generally used to teach mothers about the relationship between feeding practices and child growth. Moreover, the usual procedure used by health workers and mothers to interpret the GS chart was to examine the position of the plotted dots relative to the green band, rather than to examine the overall direction of growth. This has arisen largely because decisions about enrolling children in the food supplementation programme in Lesotho are usually made on the basis of this criterion, i.e., they are eligible if their weight-for-age is below the green band.

One of the arguments put forward by Capone in designing the GS chart was that the plot on the RTH chart was difficult for illiterate mothers to understand and that a straight line representing adequate growth would be preferable (18). In our study, mothers seemed to be confused by the straight line plot of the GS chart and did not interpret it as a sign of good growth. On the other hand, their understanding of the direction of growth represented on the RTH chart was very good.

For Lesotho, one implication of these findings, if the GS is to be adopted instead of the RTH chart, is that considerably more effort needs to be put on teaching the concept of direction of growth. With the RTH chart the only difficulty observed was the detection of stationary weight, a problem that has also been encountered in India (19). The importance of the early detection of malnutrition and the risks associated with “constant weight” should therefore be given greater emphasis in teaching the RTH chart.

The data obtained were examined for the following sources of bias that could potentially have affected the internal validity of the study: characteristics of the drop-out mothers; allocation of mothers to the different chart groups; and clinic variations. None of these affected the results obtained in any way.

In Lesotho the long history of food aid and the well-organized system of clinics have ensured a high coverage of under-5-year-olds, especially in the lowland and foothill areas. Our findings are therefore typical of what would be expected for most of the Basotho population living in these two topographical zones; still to be investigated, however, is whether the minority of Basotho mothers who are not reached by clinic programmes can also learn to understand the growth charts easily.

Compared with most other sub-Saharan African countries, the rate of women's literacy in Lesotho is high; also, the survey staff had received a higher level of education than the individuals who usually conduct growth monitoring surveys. It therefore remains to be seen whether our findings can be replicated in other countries where illiterate mothers or less educated voluntary health workers are often responsible for growth monitoring activities.
Acknowledgements

The study was conducted under the auspices of the Joint Programme between UNICEF and Cornell Nutritional Surveillance Program (CNSP) and the cooperative agreement AID DSAN CA-0240 between USAID and Cornell University. Additional funding was provided by UNICEF.

We thank Mrs. V.J. Quinn for her crucial work in initiating and implementing this research, Mr. J. Haaga for writing the first research proposal; and Mr. M. Mogwanja, for his remarkable efficiency and continued support throughout the field work and at all stages of the study. We also thank the research assistants and drivers who took part in the field work, the nurses and health personnel from the clinics, and especially the participating mothers and their children.

Résumé

Comparaison de deux fiches utilisées au Lesotho pour surveiller la croissance des enfants.

Au Lesotho, deux types de fiches sont couramment utilisés pour surveiller la croissance des enfants: la fiche dite “chemin de la santé” (road-to-health ou RTH) choisie par le Ministère de la Santé, et le système adopté par les Catholic Relief Services, qui consiste en une fiche de référence et une fiche d’enregistrement des données (growth surveillance ou GS). Depuis longtemps, on pensait que la co-existence de ces deux types de fiches était une source de confusion, tant pour les agents de santé que pour les mères des enfants. Afin d’aider le gouvernement à choisir une fiche nationale unique, nous avons entrepris une étude destinée à établir lequel des deux modèles actuellement utilisés était le mieux compris par les mères de famille.

L’étude a été menée dans neuf dispensaires de soins de santé primaires du Lesotho, avec la participation de 1221 mères qui ont été réparties en trois groupes et suivies pendant 4 mois. À chacune des mères du premier et du deuxième groupe on a remis respectivement une fiche RTH et une fiche GS, tandis que le troisième groupe (groupe témoin) ne recevait aucune fiche. Les mères des deux premiers groupes ont reçu une fois par mois, lors des visites de contrôle de la croissance de leur enfant, des instructions sur l’interprétation de la fiche qui leur avait été remise. Leur connaissance de cette fiche a été vérifiée avant et après la période de suivi. Les mères appartenant au groupe témoins ont également été interrogées sur les fiches RTH et GS au début et à la fin de l’étude.

Les résultats montrent que les mères auxquelles on avait enseigné à interpréter l’une ou l’autre des deux fiches connaissaient beaucoup mieux celle-ci à la fin de la période d’étude que les mères du groupe témoin; cependant, pour un effort d’information analogue, le progrès a été plus net pour les mères qui avaient reçu une fiche RTH que pour celles qui avaient reçu une fiche GS. D’autre part, au début de l’étude, l’ensemble des mères connaissaient mieux la fiche RTH que la fiche GS, en dépit du fait que huit des neuf dispensaires participants utilisaient alors la fiche GS.

Ces résultats semblent donc plaider en faveur du choix de la fiche RTH pour la surveillance de la croissance des enfants au Lesotho, étant donné qu’elle est plus facile à comprendre que la fiche GS. Des études analogues devraient toutefois être entreprises dans d’autres pays d’Afrique pour vérifier si la fiche RTH est supérieure à la fiche GS dans des contextes différents.

References


