International Journal of Epidemiology

Vol. 21, No. 1
Printed in Great Britain

INCAP Publication PCI/017

Impact of a Clinic-Based Growth Monitoring Programme on Maternal Nutrition Knowledge in Lesotho

MARIE T RUEL*, JEAN-PIERRE HABICHT† AND CHRISTINE OLSON†

Ruel M T (INCAP, Carretera Roosevelt, Z 11, Aptdo 1188, Guatemala, Guatemala), Habicht J-P and Olson C. Impact of a clinic based growth monitoring program on maternal nutrition knowledge in Lesotho. *International Journal of Epidemiology* 1992; 21: 59–65.

An evaluation of the impact of a nationwide clinic-based growth monitoring (GM) programme was done in Lesotho to determine if clinic attendance was associated with improved maternal knowledge of weaning practices and diarrhoea. A total of 907 mothers from eight clinics were included in the study. Our results showed that mothers who had attended the clinics knew more about the appropriate timing for introducing animal protein-rich foods in the child's diet and about the use of oral rehydration salts for diarrhoea, than those who had not. The difference in knowledge between previous clinic attendants and new attendants was particularly marked among mothers with less than secondary schooling and mothers with young babies (<6 months). From observation in the clinics, we believe that group nutrition education, although it was not integrated with growth monitoring, was probably responsible for the positive association between clinic attendance and maternal knowledge. Prior clinic attendance was not specifically associated with improved knowledge about feeding during diarrhoea or the need to stop breastfeeding gradually. These need to be better incorporated into present clinic nutrition education. Whether improvements in growth monitoring would further significantly improve nutrition education remains to be seen.

Growth monitoring (GM), first proposed by Morley[1] as the 'Road to Health' strategy, is now the accepted method for ensuring the health and nutrition of preschool children, as evidenced by position papers of the World Health Organization[2] and UNICEF,[3] the two international agencies most concerned with child health. GM is thought to affect the health and nutrition of children mainly by fostering regular contacts between health workers and mothers and by educating mothers about their child's growth through the use of growth charts.[4] Individual counselling of mothers is supposed to be an integrated component of GM and is expected to motivate mothers to improve their health and feeding practices when their child's growth is faltering.

Considering the well-documented difficulties associated with the proper implementation of GM in clinics,[5,6] its usefulness for educational purposes has recently been challenged.[7–10] The most common concerns raised about the potential of GM to fulfil its educational role include: the inappropriate use of the technology involved (scales, growth charts), the poor training and supervision of the clinic staff, their lack of interest, skills and motivation for preventive and educational activities and the resulting scarcity and poor quality of both the individual counselling of mothers and the group education.[8]

In Lesotho, Catholic Relief Services (CRS) administered a Food and Nutrition Program in more than 100 clinics, when our study took place in 1985–1986.[11,12] The programme included growth monitoring with nutrition education, immunization and food distribution.[13] Training and supervision of the programme personnel mainly emphasized the efficient distribution of food to its beneficiaries, as opposed to focusing on the quality of growth monitoring and nutrition education. High and regular attendance rates were achieved by eliminating mothers from the food distribution programme if they failed to attend for more than 2 months. In spite of the relatively high coverage of the CRS clinics, most of the criticisms and concerns related to the educational potential of clinic-based GM applied to this programme. Individual counselling and teaching of growth charts were scarce and often absent. Not surprisingly, maternal knowledge of growth charts was poor and was not associated with previous clinic attendance.[11] Group nutrition education was done as a separate activity and was of variable duration and

* Institute of Nutrition of Central America and Panama (INCAP), Carretera Roosevelt, Z 11, Aptdo. 1188, Guatemala, Guatemala, Central America.
† Division of Nutritional Sciences, Cornell University, Savage Hall, Ithaca, NY 14853, USA.

quality, depending on the skills, interest and enthusiasm of the clinic nurse in charge.

The objective of the present study was to test if attendance at a 'typical' nationwide clinic-based GM programme was associated with improved maternal knowledge of weaning practices and diarrhoea management. The question asked was whether or not mothers had greater nutrition knowledge if they had attended the clinics previously, in spite of the apparent poor quality of GM and nutrition education in clinics and in spite of the lack of use of growth charts for educational purposes. The association between clinic attendance and maternal knowledge was tested, controlling for maternal schooling, working status, experience in childcare and clinic visited. The importance of the interaction between clinic attendance and maternal characteristics was also tested to determine if some subgroups of mothers benefitted more than others from attending the clinics. Finally, the specific areas of knowledge that seemed to be improved and those not improved by clinic attendance were identified so as to provide recommendations for the strengthening of educational activities in clinics of Lesotho.

METHODS

Study Sample

Data were collected on 907 mothers in eight clinics supervised by CRS in Lesotho, from December 1985 to November 1986. All clinics were located in the lowlands and foothills of Mohale's Hoek and Mafeteng districts and offered GM sessions at least three times a week. CRS clinics with the highest attendance rates in these two districts were chosen. All mothers with a child younger than 2 years and who had attended the clinics for less than 2 years were included in the study.

Data Collection and Testing Instrument

All mothers were interviewed to collect information on their socioeconomic and demographic characteristics. Their nutrition knowledge was assessed using questions on some of the themes that are expected to be taught along with GM, namely the timing and abruptness of weaning, the introduction of solid foods in the child's diet, the use of oral rehydration salts and food withholding behaviour during diarrhoea.[14] The questionnaire was developed and pretested by representatives of various institutions involved in GM in Lesotho.[15] All interviews were conducted in Lesotho by specially trained local interviewers. The translation of the questionnaires from English to Lesotho was done by the interviewers themselves, along with the project director (MR) to ensure a standard understanding and interpretation of the questions.

Analytical Methodology

The analysis involved four steps. First, a total knowledge score was computed by adding up the scores to each individual question (maximum score = 50 points). Secondly this total score was used in analysis of variance (ANOVA), to test the main effects ($P<0.05$) and two-way interactions ($P<0.10$) involving clinic attendance.[16] The results of this analysis were then used in the third step to focus on the subgroups of mothers that were shown to benefit more or less from attending the clinics (significant two-way interactions between clinic attendance and maternal characteristics). The maternal characteristics examined included: experience in child care (proxied by age of the child and parity), working status and schooling. Finally, the scores to each individual question (0/1) were used to compare the frequency of correct answers given by different subgroups of mothers. In this last analysis, the statistical significance of differences between groups was tested by χ^2 test or logistic regression, where appropriate. SPSS-PC+, Version 3.1 for microcomputer was used for all analyses.

RESULTS

Table 1 presents the frequency distribution of the sample by the various characteristics of interest. More than a third of the sample had completed primary school and 15% had a higher level of education. A large proportion were primiparous (42%) and 30% had a child younger than 6 months of age. Only 16% of the sample were new attendants (coming to the clinic for less than 3 months), and the remainder 84% had been coming for periods varying between 3 months and 2 years. The comparison (not shown) of previous clinic attendants with new attendants revealed

TABLE 1 *Characteristics of the 907 mothers sampled in eight primary health care clinics in Lesotho*

Maternal/child characteristics		Proportion of the sample (N. = 907) %
Schooling	⩽primary	84.9
	>primary	15.1
Parity	1st child	41.7
	2nd or more	58.3
Working mother	No	46.6
	Yes	53.4
Previous clinic attendance	No	15.6
	Yes	84.4
Age of the child	<6 months	29.5
	⩾6 months	70.5

that they differed only in maternal schooling and demographics (parity, age of the mother and family composition), but not as regards child's age and maternal working status. As expected given the high clinic coverage, new clinic attendants were younger and a larger proportion were primiparous. A larger proportion of new attendants also had higher schooling, which reflects a positive secular trend in schooling.

The importance of the association between clinic attendance and maternal nutrition knowledge was tested by ANOVA, controlling for maternal schooling, working status, experience in child care (proxied by age of the child and parity), and clinic differences. Parity and maternal working status were not statistically significant either as main effects or as effect modifiers of maternal knowledge. Thus, they were excluded from the final model (Table 2).

In the final model (Table 2) clinic attendance was significantly associated with increased knowledge ($P<0.05$) when other maternal characteristics were controlled for. Schooling and clinic were also significant main effects in this model and clinic attendance significantly interacted with schooling, age of the child and clinic ($P<0.10$). The interaction between clinic attendance and clinic suggests that the difference between previous clinic attendants and new attendants varied between clinics, according to initial levels of knowledge and to the effectiveness of clinics in improving maternal knowledge.

Examination of the interactions of clinic attendance with schooling, and with age of the child (Table 3) revealed that previous clinic attendance was associated with greater nutrition knowledge among mothers with lower levels of schooling (primary or lower) and mothers of children younger than 6 months. Clinic attendance made no difference for mothers with secondary or higher levels of schooling and for mothers with children older than 6 months.

TABLE 2 *Analysis of variance (ANOVA) to test the association between clinic attendance and maternal nutrition knowledge of Basotho mothers*

Source of variation	Sum of squares	df	Mean square	F	Significance of F
Main effects	2844.28	10	284.43	6.51	0.000
Schooling	243.52	1	243.52	5.57	0.018
⩽Primary					
>Primary					
Previous clinic attendance (PCA)	374.46	1	374.46	8.57	0.004
No					
Yes					
Child's age	91.54	1	91.54	2.09	0.148
<6 months					
⩾6 months					
Clinic (1-8)	1556.52	7	222.36	5.09	0.000
Two-way interactions	2133.08	24	88.88	2.03	0.002
PCA*schooling	141.77	1	141.77	3.24	0.072
PCA*age	309.11	1	309.11	7.07	0.008
PCA*clinic	719.75	7	102.82	2.35	0.022
Schooling*age	10.12	1	10.12	0.23	0.630
Schooling*clinic	72.95	7	10.42	0.24	0.976
Age*clinic	445.15	7	63.59	1.45	0.180
Explained	4977.36	34	146.39	3.35	0.000
Residual	35660.69	816	43.70		
Total	40638.06	850	47.81		

TABLE 3 *Interaction between previous clinic attendance and maternal schooling and between previous clinic attendance and age of the child.*
Means and standard deviations (SD) to the knowledge test, by previous clinic attendance and maternal schooling

		Previous clinic attendance			
		No		Yes	
		Mean	SD	Mean	SD
Schooling	⩽Primary	(N=105) 34.92	9.74	(N=646) 39.04	6.33
	>Primary	(N=35) 39.17	7.44	(N=105) 39.32	5.36

Means and standard deviations (SD) to the knowledge test, by previous clinic attendance and age of the child

		Previous clinic attendance			
		No		Yes	
		Mean	SD	Mean	SD
Age of the child	<6 months	(N=86) 34.79	10.38	(N=185) 38.92	6.44
	⩾6 months	(N=54) 37.89	7.21	(N=564) 39.11	6.13

Analysis of the frequency of mothers who responded correctly to the various questions revealed that the questions that were mostly responsible for the significant two-way interaction between clinic attendance and schooling in the ANOVA model were related to the timing of introduction of animal protein foods in the child's diet, to the knowledge and use of oral rehydration salts during diarrhoea and to the method of weaning (Table 4). Mothers with less schooling knew more about these issues if they had been coming

TABLE 4 *Percentage of mothers who answered correctly the nutrition knowledge questions, by schooling and previous clinic attendance*

	Schooling					
	≤ Primary school			> Primary school		
Previous clinic attendance	No (N. = 101)	Yes (N. = 638)	Difference[a]	No (N. = 35)	Yes (N. = 99)	Difference[a]
	%	%	%	%	%	%
Introduction of						
Liquids	90.1	97.6	7.5*	97.1	100.0	2.9
Cereals	89.1	97.0	7.9*	91.4	100.0	8.6*
Solids	88.0	95.9	7.9*	94.3	98.0	3.7
Peas/beans	49.5	46.8	−2.7	51.4	48.0	−3.4
Eggs	73.0	91.7	18.7*	94.3	93.9	−0.4
Meat	76.8	92.9	16.1*	91.4	94.8	3.4
Fish	75.0	90.7	15.7*	88.6	89.7	1.1
Breastfeeding						
When to stop	91.0	94.5	3.5	94.3	94.9	0.6
How to stop	40.6	53.4	12.8*	51.4	51.5	0.1
Diarrhoea[b]						
Know oral rehydration solution	75.6	93.1	17.5*	88.9	96.7	7.8
Give oral rehydration solution	82.2	91.2	9.0*	94.4	93.4	−1.0
Continue:						
Breast	82.9	86.8	3.9	100.0	90.0	−10.0
Liquids	83.3	83.6	0.3	100.0	86.0	−14.0
Cereals	69.7	70.0	0.3	88.2	66.0	−22.2
Solids	32.3	20.2	−12.1	47.1	34.8	−12.3

* $P<0.05$, χ^2 test.

[a] Difference between previous clinic attendants and new attendants in the percentage of mothers who answered the question correctly.

[b] Among new clinic attendants, only 45 and 18 children of mothers with ≤primary schooling and >primary schooling, respectively, had ever had diarrhoea and were asked the questions about diarrhoea. Thus, this analysis lacked statistical power.

to the clinics before. On the other hand, previous clinic attendance was not associated with better knowledge of these questions in mothers with higher educational level than primary school. Analysis of each individual question by logistic regression also showed a statistically significant interaction term between previous clinic attendance and schooling ($P<0.10$) for the questions related to the introduction of animal protein-rich foods (eggs, meat and fish).

Comparison of mothers with young babies (<6 months) and mothers of older children on differences in nutrition knowledge between previous clinic attendants and new clinic attendants (not shown), revealed that the same questions were responsible for the interaction found in the ANOVA as those seen in Table 4.

Table 4 also indicates that in general, mothers had a good knowledge and practice of breastfeeding (they reported breastfeeding on average for 2 years) and of when to introduce liquids and cereals in the child's diet (more than 85% correctly answered between 4 and 6 months of age). In spite of this relatively good knowledge, previous clinic attendance was associated with a still greater percentage of mothers who could answer these questions correctly. Knowledge of how to *stop* breastfeeding, however, was poor, even among clinic attendants. Approximately 50% of the sample thought that weaning should be done abruptly (in 1 day), which relates to the tradition of sending the child to the grandmother for weaning.

There were two areas where clinic attendance was negatively associated with maternal knowledge: the introduction of peas and beans in the child's diet and the withholding of solid foods during diarrhoea. The negative association was indicated by the larger percentage of new clinic attendants who answered these questions correctly compared to the previous clinic attendants. With respect to the food withholding questions, the negative association with clinic

attendance was particularly strong among mothers with higher schooling, although it was not statistically significant due to lack of power [because of the reduced sample size for these specific analyses (Table 4)].

DISCUSSION

Overall Results

Previous clinic attendance in Lesotho appeared to be beneficial, particularly for mothers of young babies (<6 months) and mothers with less than secondary schooling. If they had attended the clinics before, the nutrition knowledge of these mothers was as high as that of more educated and more experienced mothers and was significantly higher than that of less schooled new clinic attendants with young babies. Since growth charts were not used for educational purposes and since individual counselling of mothers was rarely done in these clinics, it may be argued that this effect was probably due to the group nutrition education that was however not integrated with the GM activities.

Regularity of attendance also probably played an important role in gaining and retaining such knowledge. However, the incentive to attend CRS clinics in Lesotho was clearly the availability of food as opposed to the weighing and charting, as indicated by marked decreases in attendance rates when food supplies were unavailable for some time. Thus, our results suggest that growth charts and individual counselling of mothers might not be as essential for the information to be assimilated by mothers as some promoters of GM tend to argue,[4,17] and that incentives other than GM might be as effective or more, in motivating mothers to attend. Research in other settings should be done to substantiate these findings and to determine where and under what circumstances growth charts significantly improve the effectiveness of nutrition education.

The fact that clinic attendance benefitted mothers with less than secondary schooling, which represents the large majority of Basotho women (85% of our sample) suggests that the clinic programme can potentially have an impact on most Basotho women if they attend the clinics. Considering the positive association between maternal knowledge and child's growth found in this population,[15] it is justified to continue to motivate mothers to attend CRS clinics in Lesotho. Similarly, the fact that mothers benefitted more from attending the clinics in the first months of their child's life as opposed to later indicates that some strategies should be designed to motivate mothers to attend the clinics in their early post-partum months and to provide them with adequate preventive nutrition and health education. This is possible in Lesotho, since no cultural barriers prevent mothers from leaving their home with their newborn as early as in the first month post-partum.

Analysis of the Responses to Individual Questions and Implications for Clinic-Based Nutrition Education in Lesotho

The analysis of the responses given by mothers to each individual question highlighted some important aspects that should be considered if clinic-based nutrition education activities are to be improved in Lesotho. First, the analysis characterized the general nutritional knowledge of rural Basotho women who attend clinics. It showed that these women had an adequate knowledge of the duration of breastfeeding and of the age of introduction of liquids and cereals in the child's diet. Secondly, it provided information about the specific themes that were currently being taught and well assimilated by mothers through clinic attendance. These included the earlier introduction of animal protein-rich foods in the child's diet and the use and preparation of oral rehydration salts for diarrhoea. Finally it helped identify the issues that were either not taught, or were improperly covered by the clinic staff, like the timing for introducing peas and beans in the child's diet and food withholding behaviour during diarrhoea.

The recommendations that can be made, based on these findings, are that clinic nurses should be encouraged to continue to teach the use and preparation of oral rehydration salts and to emphasize the earlier introduction of animal protein-rich foods in the child's diet. Periodical refresher courses should be organized to motivate them and to correct their knowledge about specific questions. For instance, clinic nurses should be informed about the proper timing for introducing peas and beans in the child's diet and they should be updated on the results of recent scientific work demonstrating the advantages of continued feeding during diarrhoea.[18,19] Thus, the most urgent need for Lesotho is to ensure that clinic nurses transmit accurate and useful messages and that they do not waste their time educating mothers on subjects already assimilated.

Methodological Issues

A method for the impact evaluation of an on-going clinic-based GM programme on mothers' knowledge was developed in the present study. Firstly, the subgroups of mothers who benefitted more from attending the clinics were identified. The analysis of variance using the overall knowledge score as outcome and the *a priori* hypothesized maternal characteristics to be

examined were particularly useful for this purpose. Once the subgroups were identified, the analysis of the scores to each individual question permitted the evaluation of the particular aspects of the educational programme that appeared adequate as well as those that could be improved.

Other methodologies like rapid assessment procedures (RAP)[20] or operations research[21,22] have become popular for the evaluation of on-going GM programmes. While these approaches are particularly useful for the diagnosis of problems and the identification of solutions related to the process and delivery of services, our methodology focused on the outcome as a first step. It was felt that the usefulness of the programme needed to be demonstrated first, as a basis for justifying further investment in the improvement of specific aspects of the programme. Our methodology could easily be applied to other programmes that face similar problems of application and whose effectiveness still needs to be demonstrated.

CONCLUSIONS

Our results showed that regular attendance at a clinic-based GM programme, as delivered in the Catholic Relief Services clinics of Lesotho in 1985–1986, was associated with improved maternal nutrition knowledge. From observation in the clinics during the study period, we believe that the group nutrition education conducted separately from the GM activities was probably the main activity responsible for the positive effect of clinic attendance on mother's knowledge. Whether the addition of teaching of growth charts and individual counselling would significantly increase the impact of the programme on maternal knowledge still needs to be investigated. We believe that in the short term however, improved educational messages could have important implications for the growth and health of Basotho children during the weaning period, considering the positive association between maternal knowledge and child's nutritional status shown in this population.[15]

ACKNOWLEDGEMENTS

The authors acknowledge the importance of V Quinn, J Mason and J Haaga in developing the opportunity and supporting the field work in Lesotho. The continuous support of M Mogwanja from UNICEF was also greatly appreciated. The authors also wish to thank P Pinstrup-Andersen, Y Gröhn and K Rasmussen for their valuable advice in the preparation of this paper. The study was conducted under the auspices of the Joint Programme between UNICEF and Cornell Nutritional Surveillance Program and the cooperative agreement AID DSAN CA-0240 between USAID and Cornell University. Additional funding was provided by UNICEF.

REFERENCES

[1] Morley D. Paediatric priorities in the developing world. London: Butterworth, 1973.

[2] Habicht J P. Nutrition: a health sector responsibility. *World Health* 1983; 4: 5–9.

[3] Grant J P. The State of the World's Children 1987. New York: Oxford University Press. UNICEF 1987; pp 64–80.

[4] Griffiths M. Growth monitoring: making it a tool for education. *Indian J Pediatr* 1988; 55: S59–S66.

[5] Gopalan C, Chatterjee M. *Use of Growth Charts for Promoting Child Nutrition. A Review of Global Experience.* New Delhi: Nutrition Foundation of India. Special Publication Series, No. 2, 1985.

[6] Gerein N M. Is growth monitoring worthwhile? *Health Pol Plan* 1989; 3: 181–94.

[7] Nabarro D, Chinnock P. Growth monitoring—Inappropriate promotion of an appropriate technology. *Soc Sci Med* 1988; 26: 941–48.

[8] Ruel M T. Growth monitoring as an educational tool, an integrating strategy and a source of information: a review of experience. In: Pinstrup-Andersen P, Pelletier D, Alderman H (eds). *Beyond child survival. Enhancing child growth and nutrition in developing countries.* Ithaca: Cornell University Press, In Press, 1992.

[9] Reid J. The role of maternal and child health clinics in education and prevention: a case study from Papua New Guinea. *Soc Sci Med* 1984; 19: 291–303.

[10] Gerein N M, Ross D A. Is growth monitoring worthwhile? An evaluation of its use in three child health programmes in Zaire. *Soc Sci Med* 1991; 32: 667–75.

[11] Ruel M T, Pelletier D, Habicht J P *et al.* A comparison of mothers' understanding of two growth charts in Lesotho. *Bull WHO* 1990; 68: 483–91.

[12] Ruel M T, Pelletier D, Habicht J P *et al.* Comparison of growth charts in Lesotho: health workers' ability to understand and use them for action. *Am J Public Health* 1991; 81: 610–16.

[13] Capone C. *Integrating Title II Program with Locally Operated Nutrition, Socio-Economic and Humanitarian Activities.* Field Bulletin No. 27. Nairobi: Catholic Relief Services, 1977.

[14] Pielemeier N R. Mothers' knowledge related to child health and nutrition in Ghana and Lesotho. *J Trop Pediatr* 1985; 31: 131–39.

[15] Ruel M T. The role of maternal nutrition knowledge and formal education as determinants of child's nutritional status in Lesotho. (PhD thesis). Ithaca: Cornell University, 1990.

[16] Cohen J. *Statistical power analysis for the behavioral sciences.* 2nd ed. Hillsdale, New Jersey, Hove and London: Lawrence Erlbaum Associates, 1988.

[17] Rohde J E, Northrup R S. Feeding, feedback and sustenance of Primary Health Care. *Ind J Pediatr* 1988; 55: S110–23.

[18] Brown K H, Gastañaduy A S, Saavedra J M *et al.* Effect of continued oral feeding on clinical and nutritional outcomes of acute diarrhea in children. *J Pediatr* 1988; 112: 91–200.

[19] Organizacion Panamericana de la Salud. *Manual de tratamiento de la diarrhea.* Serie PALTEX para ejecutores de programas de salud. Numero 13. Organization Panamericana de la Salud,

Oficina Sanitaria Panamericana, Oficina Regional de la Organizacion Mundial de la Salud, 1987.

[20] Scrimshaw S C M, Hurtado E. *Rapid assessment procedures for nutrition and primary health care. Anthropological approaches to improving programme effectiveness.* Tokyo: The United Nations University, UCLA Latin American Center Publications, University of California, Los Angeles, 1987.

[21] Blumenfeld S N. *Operations research methods: a general approach in primary health care.* PRICOR Monograph Series: Methods Paper 1. Bethesda: PRICOR, Center for Human Services, 1985.

[22] Teller C H. *Applications of operations research in growth monitoring/promotion.* Paper presented at the Annual Conference of the National Council for International Health, Washington, DC, June 10–13, 1986.

(Revised version received August 1991)