Article

UTILIZATION OF COMMUNITY BASED GROWTH MONITORING SERVICES BY ELIGIBLE CHILDREN IN RURAL RWANDA.

JDD NGIRABEGA[1], W. LEONARD[2], C. MUNYANSHONGORE[3], M. DRAMAIX- WILMET[4]

[1]Ruli Hospital, Ministry of Health Rwanda
[2]The Ihangane Project, Aptos, CA USA
[3]National University of Rwanda/ School of Public Health
[4]Free University of Brussels/ School of Public Health

ABSTRACT

Background: In Rwanda, the initiation of community-based growth monitoring services improves access to malnutrition assessment and treatment for high risk children in rural communities. Although community services have improved access for these children, the consistent attendance of this program remains weak. We present the pattern in which children utilized the community services between 2004 and 2009 in the catchment area of a rural hospital in Rwanda.
Methods: Data on the utilization of community nutrition services were analyzed for the period between January 2004 and June 2009 and for a cohort of children born between January and June 2004. The monthly average utilization rate and the adequate utilization rate were calculated.
Results: The average monthly utilization rate varied between 53% in 2004 and 79.7% in 2008. It gradually increased each year until it plateaued in 2008. The adequate utilization rate of services by the cohort of children who attended the services from the time of birth was 11.7%. The average utilization rate varied by age group, with the highest rate being amongst the 0-6 month age group and the lowest rate being 27.8% amongst 55-60 month age group. On average, the children of the cohort received 45 visits for the duration of evaluation period. The median of visits ranged from 6 visits in the 0-6 month age group and 4 visits for the 49-60 month age group.
Conclusion: This paper shows that the average monthly utilization rate of the community-based growth monitoring services remained flat between 75% and 79% during the last three years of the evaluation period. The adequate utilization rate was very low and decreased with age. We propose home visits for children and that education is strengthened to encourage children at risk of malnutrition to utilize community services appropriately.

Key words: District hospital. Rwanda. Community based growth monitoring. Service utilization.

RESUME

Position du problème : Au Rwanda, l'initiation des services communautaires du suivi de la croissance a amélioré la couverture des enfants cibles. Cependant si les services communautaires sont mieux fréquentés, leur utilisation adéquate reste faible. Cette étude présente les données sur l'utilisation des services communautaires dans la zone de rayonnement d'un hôpital rural au Rwanda.
Méthodes : Les données d'utilisation ont été analysées pour la période entre janvier 2004 et juin 2009. La couverture adéquate a été évaluée pour une cohorte d'enfants nés entre janvier et juin 2004. Les taux d'utilisation mensuel moyen de chaque année et le taux d'utilisation adéquate par les enfants nés entre janvier et juin 2004 ont été calculés.
Résultats : Le taux d'utilisation mensuel moyen variait de 53% en 2004 à 79,7 % en 2008. Il a augmenté progressivement chaque année jusqu'en 2008. Le taux d'utilisation adéquate des services par la cohorte d'enfants qui ont fréquenté les services depuis leur naissance était de 11,7%. Il variait de 51,8 % pour la tranche d'âge de 0-6 mois à 27,8 % pour celle de 55-60 mois. Depuis leur naissance, les enfants de la cohorte avaient réalisé 45 visites en moyenne. La médiane de visites se situait entre 6 visites dans la tranche d'âge de 0-6 mois et 4 visites dans celle de 49-60 mois.
Conclusion : Le taux d'utilisation mensuel moyen des services communautaires a stagné ces trois dernières années. Le taux d'utilisation adéquate des services par les enfants était très bas et diminuait avec l'âge. L'utilisation adéquate diminuait à partir de 6 mois alors que c'est à cet âge que le risque de malnutrition commence. Nous proposons les visites à domicile des enfants et le renforcement de la sensibilisation pour que les enfants à risque de malnutrition utilisent correctement les services communautaires.

Mots clés : Hôpital Ruli. Rwanda. Suivi de la croissance à base communautaire. Utilisation.

Introduction

Access to primary health care in developing countries continues to be a serious challenge in rural areas, where the utilization rates of health services remain low compared to those of urban areas [1-6]. Low utilization cannot be explained simply by noting the differences in terms of financial incomes between the urban and rural areas. If this were the case, preventive services, which are generally free in these countries, would be better attended. Over the past few years, the initiation of community based services has contributed to an increase in the coverage of services for this target population [7-14]. These achievements illustrate the influence that other factors, such as geographical and sociocultural barriers, have in the low utilization of the services [15-21].

To achieve a higher utilization rate of keys high impact intervention, Rwanda initiated community based health programs (CBNP) in 1997. These programs have been implemented jointly by the health centers and the Community Health Workers (CHWs). One of the activities that has been implemented at the community level is a growth-monitoring program for children under five years of age.

*Correspondence to:
    JDD NGIRABEGA, MD, PhD,
    RULI Hospital, PO Box 1285 KIGALI.
    e-mail: moonhuro@yahoo.fr
    Tel GSM : +250788650824

The CBNP was established in the Ruli hospital catchment area in 2004. It was implemented by Community Nutrition Workers (CNWs) who work as volunteers and are part of the community village team. In each village, 3 CNWs collaborate with politico-administrative authorities to conduct the program activities. The CNWs are generally of primary studies level, and receive a 3-5 day training on all components of CBNP. The program consists of growth monitoring and communication of nutrition information, as well as monitoring and evaluation of overall program activities. The CNWs receive continuous support from the health centers, including monthly supervision and retraining as needed.

Growth monitoring sessions for children less than five years of age are performed once a month in each village. They consist of monthly weight assessments, classification of each child in accordance with his nutritional status and counselling adapted to the nutritional status of each child. Completion of a growth monitoring chart (NCHS/OMS/2000) that illustrates the weight of each child related to his age enables the CNWs to identify children with good nutritional status (area hatched in green), moderately underweight (area hatched in yellow) and severely underweight (area hatched in red).

In health districts where it is implemented, community-based growth-monitoring has clearly improved the utilization rate by the target children. This is illustrated by the increase in utilization rates from 35% in 2000 to 70% in 2007 [22-23]. Although most children attend community-based growth-monitoring services, routine use of services remains below the standards and goals initially set by the Ministry of Health. Moreover, even though the literature provides sufficient information on overall utilization of community based growth monitoring services, there continues to be a scarcity of information related to the appropriate utilization of these services [7, 24-27]. This paper describes the way in which the community based growth monitoring services were utilized by the target children in the catchment area of Ruli district hospital in Rwanda since the beginning of the program in 2004, and proposes options to improve the adequate coverage of the target children in rural communities.

Methodology

Area of the study.

The study was conducted in the catchment area (CA) of Ruli District Hospital in Rwanda. The hospital is a faith based hospital belonging to Kigali Archdiocese. It is located 35 km from Kigali City in Gakenke District, Northern Province
The hospital serves the southern part of the district and covers the surface area of 294 km2. There is an estimated population of 117,327 habitants in 2009 distributed in 6 sectors, 36 cells and 201 villages. Seven health centres and two community health posts serve the catchment area.
The area is entirely rural, and the terrain is dominated by mountains and extensive erosion during rainy season. The utilization rate of ambulatory services has oscillated around 0.6 new cases per annum per capita for at least five years [28].

Community based Nutrition Program (CBNP)

The CBNP began in Rwanda in 1997, and the program was established in the Ruli hospital catchment area in 2004. It was implemented by Community Nutrition Workers (CNWs) who work as volunteers. In each village, 3 CNWs collaborate with politico-administrative authorities to assure the program implementation. The CNWs are generally of primary studies level, and receive a 3-5 day training on all components of CBNP. The program consists of growth monitoring and communication of nutrition information, as well as monitoring and evaluation of overall program activities. The CNWs receive continuous support from the health centers, including monthly supervisions and retraining as needed.
The sessions of growth monitoring for children less than five years of age are performed once a month in each village. Children less than five years of age are the target population for the community based growth monitoring services. Each child under five years of age in the village must present each month for growth monitoring services. Appropriate attendance of community growth monitoring services is defined as a 59 month old child who has completed 59 visits.

Period and population of the study

Data on the utilization of community services was analyzed for the period between January 2004 and June 2009. Adequate coverage was evaluated for the period between January and June of 2009 for the first cohort of children born between January and June of 2004. These children all reached five years of age during the evaluation period.

Data-collection

The data was collected from community registers and CNWs' monthly reports. These documents record the target population of the villages and the number of children being presented for measurements. The data on adequate use was collected on growth-monitoring cards of the children and should total 59 visits during the period between January and June 2009. Each child using the community services of growth monitoring has two cards that are completed at each measurement session. One card is held by the parents, and the other is held at the health center. When it is appropriately completed, the card shows all visits that the child made each month since birth. For children who were in the Community registers but whose growth-monitoring

card was not at found the health centers, we requested the parental card for documentation. The children whose card could not be found were excluded from the study.

Indicators.

The monthly utilization rate of the community services is defined as the proportion of children who presented themselves to the community services during the month compared with the total number of children less than five years of age. The total number of children under five years of age is defined as 16.5% of the population [29]. The monthly utilization rate is calculated each month for each village, for all the villages of the catchment area of the health centre and for all the villages of the catchment area of the hospital. The average monthly rate of utilization during the year was calculated by using the monthly average of the children who attended the services during the year as the numerator and the target population of the children during the year as the denominator. It was calculated for each year of the period 2004-2009. Adequate utilization was studied for a cohort of children born between January and June 2004 and who utilized the services at least once during the period of evaluation. The adequate utilization rate is the proportion of children who had 59 visits during the five years compared with the total number of children in the cohort. Age groups were stratified in increments

of six months. The adequate utilization rate per age group is defined as the proportion of children who made 6 visits while in each age group compared to all the children of the cohort. The mean and the median were calculated for both the number of visits per child for the five year period and for each age group.

Statistical analyses

The 95% confidence intervals (95%CI) of the proportions were calculated and those were compared using the chi square test of Pearson. The median number of visits was compared by using the test of Friedman.

Results

The use of community services by the target children.

Table 1 presents the evolution of the monthly average utilization rate of the community-based growth-monitoring services between 2004 and 2009. This utilization rate varies between 53% at the beginning of the program in 2004 and 79.7% in 2008. It gradually increased each year between 2004 and 2008. It begins to plateau in year 2008.

Adequate utilization of the Community services

Tabl. 1: Monthly average utilization rate of community based growth monitoring services between 2004 and 2009, Ruli Hospital - Rwanda.

Year	Total population	CBNP Population targets	Monthly average # of children utilizing services	Average monthly utilization rate in % (95%CI)
2004	132000	21780	11587	53.2 (52.5-53.9)
2005	135200	22308	14433	64.7 (64.1-65.3)
2006	112000	18480	13380	72.4 (70.8-72.1)
2007	113445	18718	14267	76.2 (75.6-76.8)
2008	115882	19121	15237	79.7 (79.1-80.2)
2009*	117327	19359	15177	78.4 (77.8-79.0)

Table 2 presents the rate of adequate utilization of services by the first cohort of children who attended community-based growth-monitoring services from birth. The global rate of adequate utilization of services from the time of birth is 11.7%. Among 1987 children in the cohort, 224 children had been able to carry out 59 expected visits. When evaluated by age group, this rate varies between 51.8% for the age group 0-6 months and 27.8% for the age group 55-60 months. From the highest rate of 51.8% in the 0-6 month age group, these numbers decrease to 45.6% in the age bracket 7-12 months and remain stable between 41% and 45% in subsequent age groups. It decreases further to 29.6% in the 49-54 month age group, and drops to 27.8% in the 55-60 month age group.

Table 3 represents, for the first cohort of children who utilized the community-based growth-monitoring services

since birth, the mean and median number of visits for the 59 visits expected since birth and the 6 visits expected in each 6 month age group. Since birth, the children of the first cohort had achieved an average of 45.3 visits. The median number of visits during the 5 year period was 48. Amongst different age groups, the mean was between 4.9 visits for the 0-6 month age group and 4 visits for the 55-60 month age group. The median number of visits was between 6 visits in the age bracket of 0-6 month and 4 visits in the age group 37-42 month and 49-60 month. It was 5 visits amongst the other age groups.

Table 2. Evolution by age group of the adequate utilization rate of the community-based growth monitoring services by the children of the first cohort, Hospital Ruli- Rwanda

Year	Total population	CBNP Population targets	Monthly average # of children utilizing services	Average monthly utilization rate in % (95%CI)
2004	132000	21780	11587	53.2 (52.5-53.9)
2005	135200	22308	14433	64.7 (64.1-65.3)
2006	112000	18480	13380	72.4 (70.8-72.1)
2007	113445	18718	14267	76.2 (75.6-76.8)
2008	115882	19121	15237	79.7 (79.1-80.2)
2009*	117327	19359	15177	78.4 (77.8-79.0)

Table 3. Mean and median number of visits achieved by the children of the first cohort of the community-based growth monitoring. Hospital Ruli- Rwanda

Age group in months (n=1984)	Mean (DS)	Median [Q1 - Q3]	*P*
0-6	4.87 (1.46)	6.00 [4.00-6.00]	<0.001
7-12	4.69 (1.49)	5.00 [4.00-6.00]	
13-18	4.70 (1.48)	5.00 [4.00-6.00]	
19-24	4.74 (1.45)	5.00 [4.00-6.00]	
25-30	4.72 (1.48)	5.00 [4.00-6.00]	
31-36	4.54 (1.47)	5.00 [4.00-6.00]	
37-42	4.37 (1.58)	4.00 [3.00-6.00]	
43-48	4.74 (1.44)	5.00 [4.00-6.00]	
49-54	4.32 (1.41)	4.00 [3.00-6.00]	
55-60	3.59 (1.13)	4.00 [3.00-5.00]	

Discussion

Target populations

Estimating the number of people in a given target population can be extremely challenging. The data sources are either based on adjusted data of the latest national census of the population or based on local census numbers determined by community health teams. Generally, these two sources produce different numbers and the population figures generated by community health workers are often lower than those of the census. In this study, we use the estimates derived from the national census, although the monitoring of routine indicators uses the community source. The utilization rates calculated based on the data from the national census are slightly under estimated. Nevertheless, we have chosen to use the latest census data because the data is regarded as more reliable. In addition, it should be noticed that multiple changes occurred during the decentralization of administrative services in 2006. For this reason, the population of the catchment area of the hospital changed several times during the study period.

Utilization of the services

The utilization rates reported by districts that have the community-based growth monitoring program are always above 90% [30-32]. These rates are calculated by determining the proportion of children who have used the services at least once during the period of evaluation. This period is generally 6 months. We prefer to consider the average monthly utilization rate because it reflects a more realistic assessment of service use. For example, if all target children present themselves during the first month of the evaluation period and do not return during the remainder of the period, the utilization rate for the period would be 100% when based on traditional reporting methods. On the other hand, the monthly average utilization rate would reflect the reality that this child only presented one time. For this reason, it is difficult to compare the monthly average utilization rates of our study with those usually found in the literature because of the variability calculation methods. The utilization rate of the services of community-based growth-monitoring found in the literature varies between 70% and 90% [7,13,18,25,26]. In our study, the average monthly utilization rate increases from 53% in 2004 to 72% in 2006 and currently plateaus at between 76 and 78%. We hypothesize that the introduction of performance based financing in hospital's health centers' catchment areas in 2005 must have contributed to the rapid

increase in the average monthly utilization rate from 50% to 72% [33]. Since the beginning of 2008, community activities meetings have been coordinated between the health centers and the hospital. Initiation of these meetings follows the evolution of some indicators of the monthly utilization rate. These efforts, however, has not produced any increase in the average monthly utilization rate beyond 83%. One likely explanation for this plateau is the over-estimation of the target population used in monitoring. Indeed, the utilization rate increases when one uses the census figures reported by the community health teams. However, the reliability of the community figures remains questionable. At times, data has been unmatched in various services even when they were provided by the same teams. In addition, we know that some community members believe that their children do not have problems. These children do not regularly utilize community services. We must educate these families so that they will use the community services, and also serve as positive role models for their peers. The global adequate utilization rate and the adequate utilization rate per age group were calculated for each child by considering that a child is adequately covered during the five years if he achieved 59 visits and during the age group of six months if he achieved 6 visits. Our results show that these rates are very low and contrast with those usually reported by the health centers. The adequate use of the services for a cohort of children in this study was found to be 11.7%. Reports from many health districts in Rwanda show high values of adequate use of the services [30-31]. This can be explained by the fact that they evaluate the adequate utilization on the basis of all the children being presented during the period of evaluation and for this 6 months period only. It is important to consider whether or not children who are 5 years old have completed the program, or whether a child in a particular age group presented at any point in the 6 month age group time period. It is only with this strategy, that it is possible to evaluate the adequate utilization for children who finished the program. If not we do not know how the children evaluated for one 6 months period behaved before this period nor how they will behave afterwards. Calculating the number of visits per age group enabled us to determine the mean and the median number of visits in each age group. The mean and the median of the adequate utilization rate decreases with the age of the child. It is noted that following the mean or the median number of visits per age group could reveal improvements more quickly than following the adequate utilization rate alone. For example, if the adequate utilization rate is 51.8% in the age group of 0-6 months, the median number of visits is at 6 visits. The monitoring of this indicator in addition to the adequate utilization rate could show improvements quickly and thus motivate the community health teams to continue their efforts to increase the adequate utilization. In our study, the adequate utilization decreases with the age. The fact that the 0-6 month age group has the best adequate utilization rate could be explained by immunization services which accounts for 3 visits during this period. The adequate utilization rate further decreases at 6 months of age, and continues to fall until 5 years of age. The highest risk of malnutrition begins at 6 months when weaning starts, and reaches a maximum between 12 and 36 months of age [34-36]. For this reason, it is crucial to improve adequate utilization rates during this critical period. We feel that efforts should be deployed to increase the adequate utilization of the most at risk children who are between the age of 6 and 36 months. The sensitization of community services' utilization must be based on this data to underscore the problem. Health districts, together with community opinion leaders, can then develop ways and means to increase adequate utilization. Our study did show that the growth monitoring cards were not being appropriately managed. Ruli District Hospital has since instituted a rule is that states that each child must have documentation on two growth-monitoring cards each month. This includes one that is kept by the parents and another that is kept at the health centre. The health center must review both cards each month to assess both accurate documentation and adequate utilization of services. This examination should identify the children with inconsistent access to services so that a home visit can be performed. Home visits by the community health teams and the health center staff should include an assessment of possible barriers to receiving services. To make home visits operational, the health centers must support the use of social workers as a component of community based growth monitoring. A second agent should be in charge of the supervision of this aspect of the community activities.

Limits of the study

This study has mainly focused on utilization of community based growth monitoring activities, one of the determinants of the coverage of services. It is also important to study the quality of services delivered by community nutrition workers. Concerning the community based growth monitoring in the catchment area of Ruli district hospital, it was proved that anthropometric measurements provided by the CNWs were reliable [37] .Further studies should focus on the effective coverage of targeted children and consider the quality of services delivered.

Conclusion

This study shows that the monthly average utilization rate of community-based growth-monitoring services in the catchment area of Ruli hospital reached a plateau of between 75 and 79% during the last three years of the study period despite the implementation of efforts to improve this rate. It is lower than the periodic utilization rate calculated every 6 months which takes into account the proportion of children who have attended community services at any time in the 6 month evaluation period. We prefer to follow the monthly average utilization rate, however, because it more

realistically expresses how community services are being utilized during the entire six month period. Our study shows that the adequate utilization of services is very low and that it decreases with the age. This rate further decreases after 6 months of age, whereas it is at this age that the risk of malnutrition increases. We propose that sensitization to the importance of community nutritional services be strengthened so that children under 36 months of age use the community services correctly. The duplicate growth monitoring cards kept by the health centers should allow for appropriate documentation to assess whether the child is adequately utilizing services. In addition to the monthly coordination meetings for community activities, regular supervision of the community teams by the health centers should include assistance in identifying children who are not receiving adequate services. A community supervisor at each health center may be essential to improving communication and the coordination of care. Home visits by the community supervisor of the health center that target children who do not utilize services consistently can improve the adequate use of the services.

REFERENCES

1. World Health Organization. World health statistics 2009. Health inequities coverage. http://www.who.int . Accessed 11/20/2009.

2. Oyekale AS., Eluwa CG. Utilization and Health Insurance among rural households in Irewole local government, Osun state, Nigeria. International Journal of Tropical Medicine 2009; 4 (2):70-75.

3. Jutting JP. Do community-based health insurance schemes improve poor people's access to health care? Evidence from rural Sénégal. World Dev.2004 ; 32 :273-288

4. Yared M, Asnaketch M. Ethiopian Health and Nutrition. Utilization of maternal Health Care Services in Ethiopia Addis Ababa, Ethiopia. ORC Macro. Calverton, Maryland, USA. 2002

5. Organisation Mondiale de la Santé. Rapport sur la Santé dans le monde 2008. Les Soins de Santé Primaires : maintenant plus que jamais. http://www.who.int. Consulté le 20/11/2009

6. B.Melville, T.Fidler, D.Mehan, E.Bernard, J.Mullings . Growth monitoring: the role of community health volunteers. .Public Health;1995 Volume 109, Issue 2, P 111-116

7. Schellenberg, J. A., et al. Inequities Among the Very Poor: Health care for children in rural southern Tanzania. The Lancet2003;, vol. 361, no. 9357, February 2003, p. 561-566.

8. Faber,M., Oelofse A., Benade A.S. A model for community-based growth monitoring system. African journal of health sciences 1998:Volume 5 ,p 72-8

9. The World Bank. Repositioning nutrition as central to development. A strategy for large-scale action. The World Bank, Washington, DC 2006

10. Schoeman E, Dhansay Y M, Fincham J E, Kunneke E, Benade A. J. A community-based growth monitoring model to complement facility-based nutrition and health practices in a semi-urban community in South Africa. South African Journal of Clinical Nutrition 2003; vol. 16, no4, pp. 126-132

11. Faber M., Phungura M.A.S., Kvalsvig J.D., Benadé A.J.S. Acceptability of community-based growth monitoring in a rural village in South Africa. Food and Nutrition bulletin 2003; 24,350-359

12. Agueh V, Makoutoundé M, Dramaix M, Dujardin B, Hennart P. Effets de la participation à un programme de nutrition communautaire sur l'état nutritionnel des enfants. Revue d'épidémiologie et de santé publique, 2004 Oct;52(5):415-22.

13. Muyeti R.S, Miller del Rosso J .Uganda Community Based Growth promotion, Program review. 2007.

14. Krishnaswamy S; Subramaniam K; Low WY; Aziz JA; Indran T ; Ramachandran P & all. Factors contributing to utilization of health care services in Malaysia: a population-based study. Asia-Pacific journal of public health 2009; vol 21 (issue 4) : p 442-50

15. Enis Baris, Stella Sanchez, Mauricio de Vasconcellos, and Moises Balassiano. Determinants of utilization of health care services. Chapter 8. A Population-based Survey in Three Cities of Latin America. International Development Research, 2000. Centre. http://www.idrc.ca/en/ev-35735-201-1-DO_TOPIC.html. Accessed 11/22/2009

16. J.van der Meer, J.van den Bos, J.Mackenbach. Socioeconomic differences in the utilization of health services in a Dutch population: the contribution of health status Health Policy 1996; Volume 37, Issue 1, p1-18

17. Alix-Dancer P. Access to health care in developing countries. In: Developing countries, society and technology. Stockholm: Royal Institute of Technology (KTH). 2003

18. Babar T. Shaikh and Juanita Hatcher. Health seeking behavior and health service utilization in Pakistan: challenging the policy makers. Journal of Public Health (Oxford):2004, 27(1): 49-54

19. Katung PY. Socio-economic factors responsible for poor utilization of PHC services in rural community in Nigeria. Niger J Med 2001;10: 28–29.

20. World Health Organization. World Health report 2000. Health systems: improving performance. www.who.int/whr/2000/en/whr00_en.pdf   Accessed 11/20/2009

21. McGuire, James. Democracy, Basic Service Utilization, and Under-Five Mortality: A Cross-National Study of Developing Countries." Paper presented at the annual meeting of the American Political Science Association, Marriott Wardman Park, Omni Shoreham, Washington Hilton, Washington, DC, Sep 01, 2005 http://www.allacademic.com/meta/p40288_index.html Accessed 11/20/2009

22. Ministère de la Santé (Rwanda). Rapport annuel 2000. Kigali 2001

23. Ministry of Health (Rwanda). Annual report 2007. Kigali 2008. http://www.moh.gov.rw/ Accessed 01/10/2010

24. Save the Children U.K. Thin on the Ground: Questioning the Evidence behind World Bank Funded Community Nutrition Projects in Bangladesh, Ethiopia, and Uganda. London: Save the Children U.K. 2003 http://www.savethechildren.org.uk/temp/scuk/cache/cmsattach/ Accessed 11/25/2009

25. Fagbule, D.O., Olaosebikan, A. and Parakoyi, D.B. Community awareness and utilization of growth chart in a semi-urban Nigerian community. East. Afr. Med. J; 1990. 67, 69-74.

26. Shekar, M. "The Tamil Nadu Integrated Nutrition Programme: A Review of the Project with Special Emphasis on the Monitoring and Information System." Paper prepared for the Rockefeller Foundation and the Food and Nutrition Policy Programme, Cornell University,Ithaca, NY. 1998

27. Gillespie, S.R., Measham A. Implementation Completion Report of the Second Tamil Nadu Integrated Nutrition Project. Washington D.C.: The World Bank. 1998

28. District de Gakenke (Rwanda). Hôpital de Ruli. Plan stratégique 2009-2010. 2008

29. Ministry of Finance and Planning (Rwanda). Third census of population and housing of Rwanda. 2002

30. District de Nyanza (Rwanda). Hôpital de Nyanza. Rapport annuel du programme de nutrition à base communautaire. 2008

31. District de Ngororero (Rwanda). Hôpital de Muhororo. Rapport annuel du programme de nutrition à base communautaire. 2008

32. District de Gakenke (Rwanda). Hôpital de Nemba . Rapport annuel du programme de nutrition à base communautaire. 2008

33. Rusa L, Ngirabega JDD, Janssen W, Van Bastelaere S, Porignon D, Vandenbulcke V. Performance-based financing for better quality of services in Rwandan health centres: 3-year experience. Tropical Medicine and International Health; 2009 Volume 14 no 7 p 830–837.

34. Mahgoub Sarah EO, Nnyepi M, Bandeke T. Factors affecting prevalence of malnutrition among children under three years old of age in Botswana. African journal of food agriculture nutrition and developpement 2006; .Vol.6 No.1.

35. Kikafunda JK, Walker A, Collett D, Tumwine JK. Risk Factors for Early Childhood Malnutrition in Uganda. Pediatrics; 1998. Vol. 102 No. 4, p.45.

36. Morrisson C, Linskens C. Les facteurs explicatifs de la malnutrition en Afrique subsaharienne, Centre de développement de l'OCDE. 2000

37. Ngirabega, Wendy, Munyanshongore, Donnen, Dramaix-Wilmet. Fiabilité des mesures anthropométriques dans le suivi de la croissance à base communautaire des enfants en milieu rural au Rwanda. Revue d'Épidémiologie et de Santé Publique. Volume 58, Issue 6, December 2010, Pages 409-414