

Article

Children's nutritional status and community management in a school community in Africa

Pedro Melo ¹, Maria Isabel Sousa ², Matilde Mabui Dimande³, Sónia Taboada⁴, Maria Assunção Nogueira⁵, Carlos Pinto⁶, Maria Henriqueta Figueiredo⁷, Tam Nguyen⁸ and José Martín-Riera⁹

- ¹ Universidade Católica Portuguesa, Institute of Health Sciences/Centre for Interdisciplinary Research in Health; Center for health technology and services research, Portugal; pmelo@porto.ucp.pt
- ² Universidade Católica Portuguesa, Institute of Health Sciences, Portugal; isabel75ocua@gmail.com
- ³ Maputo Central Hospital, Mozambique; matimabui@yahoo.com.br
- ⁴ Sonae Capital, SC Fitness, Portugal; sonia.taboada@scfitness.pt
- ⁵ Cooperativa de Ensino Superior Politécnico e Universitário (CESPU), Instituto de Investigação e Formação Avançada em Ciências e Tecnologias da Saúde (IINFACTS) ; assuncaoog@gmail.com
- ⁶ North Region Health Administration, Portugal; carlospintorda@gmail.com
- ⁷ Escola Superior de Enfermagem do Porto; Center for health technology and services research, Portugal; henriqueta@esenf.pt
- ⁸ Connell School of Nursing, Boston College, Massachusetts, USA; tam.nguyen@bc.edu
- ⁹ Universidad de Alicante, Spain; jr.martinez@ua.es
- * Correspondence: pmelo@porto.ucp.pt ; Tel.: (+351916725122)

Abstract: Objectives: to identify the nutritional status of children in a school community and to identify the nursing diagnosis in the community management focus for the promotion of child health and healthy eating in that community. Method: a cross-sectional, quantitative study was conducted to assess the nutritional status of children using anthropometric data, including brachial perimeter and the tricipital skinfold, in a sample of 227 children, from which the brachial mass area and brachial fat area, and the respective Z Scores were calculated. To assess community management we surveyed 176 parents and 49 education professionals, using a questionnaire based on the MAIEC clinical decision matrix as a reference. Results: we identified severe malnutrition in most children (51.3%) and a community management committed to the promotion of child health and healthy eating in more than 70% of the community members (parents and education professionals). Conclusion: Children's nutritional status and diagnosis in community management were identified. The need to intervene in a multidisciplinary approach has become objective, with the school community as the unit of care, in a systemic perspective, regarding to the application of the Nursing process.

Keywords: Nutritional Surveillance; Public Health; Community Health Nursing; Public Health Nursing; Children's health; Community Participation

1. Introduction

Framing the community as a care unit and promoting community empowerment as both process and outcomes, are forming principles of the Community Assessment, Intervention and Empowerment Model (MAIEC) [1-3]. This nursing model has a clinical decision matrix that guides nurses' decision-making in relation to the community as the nuclear nursing client. The central focus of nursing attention, according to the International Classification for Nursing Practice – ICNP [4], proposed by MAIEC is community management. This focus has three dimensions of diagnosis, also foci of ICNP: community leadership (related to the community's knowledge, beliefs, behaviors and volition in the context of the problem addressed), community participation (related to

communication, partnerships and the existence of organizational structures) and the community process (related to community coping or experiences with the problem addressed).

Aligned with the strategic plan for the health sector in Mozambique (2014-2019), which supports the search for better solutions for health, with the involvement of communities, this research was developed in MAIEC project, integrated in the Nursing Research Platform of the Centre for Interdisciplinary Research in Health at the Universidade Católica Portuguesa. This project promotes community empowerment and applies the clinical decision matrix of MAIEC [1-3], in a context that fosters responses to a local health problem.

In the neighborhood of Mavalane, there is an institution, created by the Missionaries of Good News, whose objective is to support families and children in difficult and vulnerable situations. Despite the contribution of some economic development, indicated by the Republic of Mozambique (5), Mozambique remains one of the poorest countries in the world, with 46% of Mozambicans living below the poverty line [6].

According to the strategic health plan [5], one in six children dies before reaching 5 years of age. The infant and youth mortality rate is 178 per thousand inhabitants and malnutrition is responsible for approximately 20% of deaths. Mortality levels are exacerbated mainly by poverty, low literacy of mothers and the precarious supply of drinking water and basic sanitation. Nutritional indicators report that 43% of children under 5 years old suffer from moderate chronic malnutrition and 20% suffer from severe chronic malnutrition [7]. Recent studies demonstrate the importance of articulating community and educational policies, as well as health and education professionals in promoting healthy eating in children [8].

For these reasons, we wanted, in parallel with the diagnosis of Nursing in the community management focus [1,3], to assess the nutritional status of children who attend schools at the partner institution of the project, in the district of Mavalane, in Mozambique.

2. Materials and Methods

To assess the nutritional status of children, we developed a cross-sectional, quantitative study, using anthropometric data, including brachial perimeter (BP) and the tricipital skinfold (TS). From this data, we calculated the brachial mass area (BMA) and brachial fat area (BFA), and the respective Z. Scores and Composite Z-Scores (9-14). The collection of these data, not being invasive and having a low cost, were considered ideal for the context of the study, whose resources are scarce. To the Z scores, we added the evaluation of the Standard Deviation in the Weight-Height ratio in children under the age of 5 years and the Standard Deviation in the Body Mass Index (BMI) for children over the age of 5, according to reference values for Mozambique (15-16). Of the 566 children who attended the schools in the project's partner institution in Mavalane, considered the inclusion criteria, anthropometric data was collected from 227 children.

For the evaluation of the community management focus for the promotion of healthy eating in children, a survey was created based on the MAIEC clinical decision matrix and administered to the leaders and members of the affected community.

The survey included two parts. The first part focused on participants' sociodemographic characterization, which included the realization of a genogram and the adapted Graffar scale proposed by Figueiredo (17) applied to parents. The second part of the survey had questions related to the diagnostic dimensions of community management, including:

- a) Community Leadership (knowledge, beliefs and behaviors associated with children's health and nutrition – associated with the parental role in parents and the professional role in the education and health professionals involved);
- b) Community Participation (perception of the existence of organizational structures and partnerships to promote healthy eating for children);
- c) the Community Process (previous experiences with health and food promotion projects).

A pre-test was carried out on members of a school community with characteristics similar to the population under study (9 education professionals and 20 parents), to assess for clarity and relevance. Based on the pre-test, no revisions to the original version were proposed.

The survey was administered to 176 out of 227 (77%) parents of the evaluated children and 49 out of 52 (94%) education professionals of the evaluated schools. The data were analyzed with Microsoft Excel 2007. To the statistical analyses was considering the measure of proportion of responses in relation to the diagnostic dimensions proposed by the clinical decision matrix of the MAIEC, described above.

The study was submitted to the ethics committee of the Institute of Health Sciences of the Portuguese Catholic University, which gave a favorable opinion – CE.C. (10) 2018. Informed consent was obtained from all parents and children, with communication adapted to children's age. The study ran from September 2018 to January 2019.

3. Results

We now present the results related to nutritional status and community management, starting by the first one:

Nutritional status according to age and sex:

The ages of the 227 children evaluated had a minimum of 23 months (approximately 2 years) and a maximum of 69 months (5 years and 9 months, almost 6 years). The average age is 51.24 months (approximately 4 years). 47% (107) of the children are male and 53% (120) are female.

Table 1 shows the results of the Z scores for the different parameters assessed individually, as well as the evaluation of the Z scores for the set of parameters (composite Z-scores), related to nutritional status.

Table 1. Distribution of Z-Scores from BMA, BFA, BP and TS and Composite Z-Scores.

Z score ranges	ZBMA		ZBFA		ZBP		ZTS		Composite Z-scores	
	Fi	Fri	Fi	Fi	Fi	Fi	Fi	Fri	Fi	Fri
-3,00 a -2,00	1	0,4	1	0.4	2	0.8	3	1.3	0	0
-2,00 a -1,00	35	15,2	27	11.7	35	15.2	27	11.7	23	10.7
-,99 a -0,01	84	37,9	100	45.1	72	31.7	95	42.4	92	40.6
= 0,00	0	0	0	0	0	0	0	0	3	1.3
0,00 a 1,00	68	29,7	71	31.2	83	36.4	77	33.9	88	38.7
1,00 a 2,00	31	13,5	22	9.2	29	12.7	17	7.3	18	7.5
2,00 a 3,00	8	3,3	4	1.6	5	2.1	5	2.1	2	0.8
>3,00	0	0	2	0.8	1	0.4	3	1.3	1	0.4
Total	227	100,0	27	100,0	272	100,0	27	100,0	227	100,0

Considering the statistical analysis related to the percentage distribution of the Z scores and also the composite Z scores identified for the different anthropometric measures (which allows an integrated analysis of the Nutritional Status from all the analyzed parameters) we found that 51.3% (n = 119) of children have a very low Nutritional Status (composite Z score between -2 and 0). Ten point seven percent of children suffer from moderate malnutrition.

In relation to children above average weight parameters, we identified only one child (0.4%) with a composite Z score above 3 and two children (0.8%) with a composite Z score between 2 and 3.

To these data we added the analysis of the percentage distribution related to the weight/height ratio for children under 5 years old and the Body Mass Index for children older than 5 years.

One hundred and sixty five children under 5 years old were evaluated, which corresponds to 72.7% of the total children evaluated. Table 3 shows the data relating to the Standard Deviation for the Weight-Height ratio, according to the reference values for Mozambique:

Table 1. Percentage distribution of children under 5 years of age, in relation to the Standard Deviation in the Weight-Height ratio

Standard Deviation Weight-Height Ratio	Frequency	Percentage
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-3,00 a -2,00	13	7,8
-1,99 e -0,01	22	13,3
0	84	50,9
0,01 a 1,99	28	17
2,00 a 3,00	18	10,9
Total	165	100

In children under 5 years of age, it appears that 7.8% have values of Standard Deviation in the Weight-Height ratio (SD W-H) below "-2" and therefore with a state of malnutrition present in a very high degree. However, 10.9% have values for SD W-H above two, indicating over nutrition.

In children over 5 years old, we analyzed the standard deviation for the BMI (SD BMI/age), according to the reference values for Mozambique. Sixty-two children older than 5 years were evaluated, representing 27.3% of the total children evaluated.

Regarding the BMI/age SD, the values found are shown in Table 4:

Table 3. Percentage distribution of children older than 5 years evaluated, in relation to the SD BMI/age.

SD BMI/age	Frequency	Percentage
-3,00 a -2,00	6	9,6
-1,00 a -0,01	10	16,1
0,00	34	54,8
1,00	11	17,7
2,00	1	1,6
Total	62	100,0

From the analysis of the data presented in table 4, it is identified that 9.6% of children over 5 years of age present a state of malnutrition present in a very high degree (SD BMI \leq -2) and 1.6% have over-nutrition (SD BMI = 2).

Assessment of Community management:

In the context of the community management focus, 49 education professionals were surveyed, of which 98% (48) were female and the majority (44.9%, n = 22) were in the 30-39 age group.

Regarding educational qualifications, 44.9% (n= 22) have between the 11th and 12th year and 64.2% (n=27) have schooling from the eighth to the twelfth year. Fifty-nine percent of education professionals have the category of child educator, which requires specific training in the area of early childhood education.

Relating to parents, from the 176 assessed, 45% (n= 79) were between 20 and 29 years old, followed by 35% (n= 62) between 30 and 39 years old, and 20% (n = 35) below 20 years old. From the analysis of genograms and Graffar scales, it was found that 61% of the sample of parents refers to extended families with a predominance of lower middle class (52%, n = 91) and low class (19% - n = 33).

Regarding the nursing diagnosis, we identified the diagnosis of "impaired community management", with the impairment of the following diagnostic dimensions (presented in table 4):

Table 4. Diagnostic dimensions diagnoses and sub-diagnoses identified in the context of the administrative management focus.

Diagnostic dimensions	sub-diagnoses
Diagnoses	<p>Parental Role:</p> <p>Cognitive Dimension</p> <p>Knowledge about healthy eating (food quality) not shown in 98%</p>

Impaired Community Leadership	<p>Knowledge of community resources to seek informational support about food not demonstrated in 85%</p> <p>knowledge about caring for children with gastrointestinal disorders not demonstrated in 77%</p> <p>knowledge about nutritional status assessment of children not demonstrated in 77%</p> <p>Behavioral dimension:</p> <p>Adherence behavior to adequate water intake by children not demonstrated: inadequate amount of daily water in 82%</p> <p>Adherence behavior to the appropriate number of meals not demonstrated in 100%</p> <p>Adherence behavior to food of adequate quality not demonstrated in 85%</p> <p>Adherence behavior to daily soup consumption by children not shown in 94%</p> <p>Adherence behavior to control the consumption of sweets by children is not adequate in 79%</p>
Professional Role (Education Professionals):	
Cognitive dimension:	
<p>Knowledge about assessing children's nutritional status not demonstrated in 92% of educators</p> <p>Knowledge about caring for children with diarrhea not shown in 71% of educators</p> <p>Knowledge about resources for information on food security not shown in 78% of educators</p> <p>Knowledge of suitable fruit portions for children not demonstrated in 94% of educators</p> <p>Knowledge about School Health Program content not shown in 57% of educators.</p>	
Behavioral dimension:	
<p>Adherence behavior to candy consumption control not demonstrated in 70% of educators</p>	
Impaired Community Participation	<p>Inexistence of organizational structures to promote health and healthy eating in children, in the perception of 100% of the evaluated community members;</p> <p>Inexistence of Partnerships related to the promotion of health and healthy eating in children, in the perception of 100% of the evaluated community members</p> <p>Inexistence of a communication mechanism on the issue of child health and nutrition, in the perception of 100% of the evaluated community members</p>
Impaired Community Process	<p>Impaired community coping- no previous experience associated with children's health problems and food perceived by 100% of community members.</p>

4. Discussion

Among the 227 children evaluated, we identified a diagnosis of impaired nutritional status, with malnutrition present in more than half of the children (51.3%, n = 119). The phenomenon of overnutrition is residual, when considering the composite- Z scores of all the parameters evaluated, corresponding to only 0.4% (n = 1) of the children.

However, when analysing the weight parameters proposed by the Ministry of Health of Mozambique for children under the age of 5 and older than 5 years [14, 15], there is a higher

percentage of malnutrition cases in the children over 5 years old (9.6%) and more cases of overnutrition in children under 5 years old (10.9%).

Being a priority in public health in Mozambique with a relevant impact on child morbidity and mortality, these data support the urgent need to intervene on improving the nutritional status of children.

The assessment of community management (together with members and leaders of school communities) to promote healthy eating and skills to assess the problem, revealed a serious impairment in several dimensions. Both in parents and in education professionals, there are very high knowledge deficits about adequate nutrition and children's health surveillance (over 70% in all dimensions evaluated and in some cases over 90% of members and leaders assessed). The behavioral dimension was also identified as being impaired to a very high degree, both in the children's parents and in education professionals, with inadequate eating behaviors and equally inadequate monitoring of eating habits.

The lack of organizational structures and partnerships in the community to promote adequate food in children and child health intensifies the problem. Taken all together, the following nursing diagnosis is identified: impaired community management of child health promotion, specifically with regards to nutritional status, related to impaired community leadership, impaired community participation, and impaired community process.

This study has several limitations. First, it is a cross-sectional and descriptive study. Therefore, the results relate to the sample studied and the period studied, and are reflective of the children who participated in the study and attend the schools covered in the project. Multivariate analysis was not developed. Regarding the survey for the evaluation of the community management focus, even though a pre-test was conducted, the cultural aspects do not guarantee the understanding of all questions in the same way, by all participants in the study.

4. Conclusion

The diagnosis of the health status of a population, in this case of children from a school community in Mozambique, using a multidisciplinary approach, allowed the identification of an impaired nutritional status regarding its prevalence in the context of malnutrition and overnutrition. The multidisciplinary data analysis (nursing and nutrition) allowed the identification of the nursing diagnosis: impaired nutritional status, supporting it with the diagnosis of the nutrition area, in a public health perspective.

At the same time, the approach of the School Community as a care unit, in a systemic perspective and shaped by a theoretical nursing model, MAIEC, allowed the identification of the community health nursing diagnosis: impaired community management to the promotion of child health and healthy eating in children.

As contributions to the profession, this study provides a path and foundation for future interventions, based on a clinical decision that considers community as a unit of nurses' care. In addition, partnering with local political and organizational structures, including members and leaders from schools and surrounding organizations from community, increases the chance for future interventions to succeed.

Interdisciplinary synergies were also promoted, based on public health and community health from the perspective of nursing and nutrition, in order to obtain health gains, namely those sensitive to community and public health nursing and nutrition care.

As contributions to society, this community-engaged research study improved citizenry and community participation, thereby strengthening the community's resources to improve nutritional status and children's health, and addressing a local public health priority.

As contributions to the research, the application of a theoretical model of Nursing, MAIEC, was used on a problem where it had never been applied. This facilitated clinical decision making for nurses, in the context of the community as a client, related to the nutritional status and children's health. Other experiences in other contexts have shown the advantage of consider community as target of nursing care [18,19], but this project was innovative in relation to nutritional status and

children's health. In addition, using the MAIEC decision matrix to guide future community-based longitudinal intervention will increase the likelihood of improving community management; a central focus of the attention of the community health nursing specialist.

Future research in this area must ensure that a multidisciplinary approach, between nursing and nutrition sciences, is used to monitor the nutritional status of children. To achieve this, the assessment of nutritional status should be repeated, using the same procedures and in the same sample, after applying the interventions proposed by MAIEC, with an interval of 1 to 2 years after its application to adequately assess the impact of the changes promoted in the community as it relates to the nutritional status of children.

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References

1. Melo, P.; Silva, R.; Figueiredo, M.H. Attention foci in community health nursing and community empowerment: a qualitative study. *Revista de Enfermagem Referência* **2018**, Série IV N^o 19, pp- 81-90. doi: 10.12707/RIV18045
2. Melo, P; Figueiredo, M.H. As intervenções de Enfermagem e o empoderamento comunitário: um estudo com "Focus Group". 10 International Seminar on Nursing Research Proceedings. 2016. Universidade Católica Portuguesa, Instituto de Ciências da Saúde, Porto, Portugal. Available online: <https://repositorio.ucp.pt/handle/10400.14/27214> (accessed on 26 June 2020)
3. Melo, P. *Enfermagem de Saúde Comunitária e de Saúde Pública*, 1rd ed.; Lidel Editora: Lisboa, Portugal, 2020
4. ICNP Browser. Available online: <https://www.icn.ch/what-we-do/projects/ehealth/icnp-browser> (accessed on 26 June 2020)
5. República de Moçambique. *Plano Estratégico do Sector da Saúde 2014-2019*. Ministério da Saúde: Maputo, 2014.. Available online: <http://www.misau.gov.mz/index.php/planos-estrategicos?download=132:plano-estrategico-do-sector-da-sade-2014-2019> (accessed on 26 June 2020)
6. Ministério da Saúde (MISAU). *Moçambique Plano Estratégico 2016-2020*. MISAU :Maputo, 2016.Avalilable online: <http://www.misau.gov.mz/index.php/planos-estrategicos?download=132:plano-estrategico-do-sector-da-sade-2014-2019> (accessed on 26 June 2020)
7. Ministério da Saúde (MISAU), Instituto Nacional de Estatística (INE) & ICF International (ICFI). *Moçambique Inquérito Demográfico e de Saúde 2011*. MISAU, INE e ICFI: Calverton, Maryland, USA, 2011.Avalilable online: : <https://dhsprogram.com/pubs/pdf/FR266/FR266.pdf> (accessed on 26 June 2020)
8. Dias PC; Henriques P; Ferreira DM; Barbosa RMS, Soares DSB, Luquez TMS,Feijão MD & Burlandy L. Desafios da intersectorialidade nas políticas públicas: o dilema entre a suplementação nutricional e a promoção da alimentação saudável em escolas. *Cad. Saúde Pública*, **2019** 34 (12): 1-13. <http://dx.doi.org/10.1590/0102-311x00035218>
9. Mascarenhas MR, Zemel B. Stallings VA. Nutritional Assessment in Pediatrics. *Nutrition*. **1998**, 14:105-15. [https://doi.org/10.1016/S0899-9007\(97\)00226-8](https://doi.org/10.1016/S0899-9007(97)00226-8)
10. Frisancho AR. *Anthropometric Standads for the Assessment of Growth and Nutritional Status*. The University of Michigan Press: Ann Arbor, 1993: 189
11. Frisancho AR. New norms of upper limb fat and muscle areas for assessment of nutritional Status. *Am J Clin Nutr*. **1981** 34(11):2540-5. <https://doi.org/10.1093/ajcn/34.11.2540>
12. Monteiro FPM, Araujo TL, Lopes MMVO, Chaves DBR, Beltrão BA, Costa AGS. Nutritional status of children with congenital heart disease. *Rev. Latino-Am. Enfermagem*. **2012**; 20(6): 1024-1032. <http://dx.doi.org/10.1590/S0104-11692012000600003>

13. Hoffman D, Cacciola T, Barrios P, Simon J. Temporal changes and determinants of childhood nutritional status in Kenya and Zambia. *J Health Popul Nutr.* **2017**; 36: 27. <http://dx.doi.org/10.1186/s41043-017-0095-z>
14. Bechard JL, Duggan C, Touger-Decker R, Parrott JS, Rothpletz-Puglia P, Byham-Gray L, Heyland D & Mehta M N. Nutritional status based on Body Mass Index is associated with morbidity and mortality in mechanically ventilated critically ill children in the PICU. *Crit Care Med.* **2016**, Aug; 44(8): 1530–1537. <http://dx.doi.org/10.1097/CCM.0000000000001713>
15. República de Moçambique. *Curvas de Crescimento para raparigas dos 0 aos 18 anos de idade- Livro de Referência.* Ministério da Saúde, Direção-Geral da Saúde Pública: Maputo; 2018. Available online: : <https://www.fantaproject.org/sites/default/files/resources/Moz-Growth-Charts-GIRLS-Jul2018.pdf> (accessed on 26 June 2020)
16. República de Moçambique. *Curvas de Crescimento para rapazes dos 0 aos 18 anos de idade- Livro de Referência.* Ministério da Saúde, Direção-Geral da Saúde Pública: Maputo, 2018. Available online: <https://www.fantaproject.org/sites/default/files/resources/Moz-Growth-TABLES-BOYS-Mar2018.pdf> (accessed on 26 June 2020)
17. Figueiredo, MH. *Modelo Dinâmico de Avaliação e Intervenção Familiar – uma abordagem colaborativa em enfermagem de família.* Lusodidata: Loures, 2012
18. Pérez-Wilson, P., Álvarez-Dardet, C., Ruiz Cantero, MT, Martínez-Riera, JR y Carrasco-Portiño, M. Desarrollo del sentido de comunidad: una propuesta para las universidades promotoras de la salud. *Promoción mundial de la salud.* **2019.** <https://doi.org/10.1177/1757975919859572>
19. Rubio, AC; Martínez-Riéra. JR; Hígon, EG. Experiencia de cooperación en Turkana (Kenia). Una mirada enfermera. *Cultura de los Cuidados.* **2015.** XIX, pp. 116 - 126. <http://dx.doi.org/10.14198/cuid.2015.43.12>