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CHILD MALNUTRITION AND MORTALITY IN SWAZILAND: SITUATION ANALYSIS OF THE IMMEDIATE, UNDERLYING AND BASIC CAUSES

Masuku-Maseko SKS[1]* and EE Owaga[2]

Sakhile Masuku-Maseko

*Corresponding author e-mail: sakhilek@yahoo.co.uk

[1]Department of Community Health Nursing Science, Faculty of Health Sciences, University of Swaziland, P.O. Box 369, Mbabane, Swaziland.

[2]Department of Food Science and Technology, Kimathi University College of Technology, P.O. Box 657-10100, Nyeri, Kenya.

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ABSTRACT

Malnutrition is a major confounding factor for child morbidity and mortality in developing countries. In Swaziland, about 31% of the under-five children are stunted in growth, where-as 1% and 6% are wasted and underweight, respectively. Hhohho region has the highest prevalence of underweight children (8.2%) relative to other regions such as Shiselweni (7.3%), Lubombo (6.7%) and Manzini (6.4%). The prevalence of infant and under-five children mortality rate (per 1,000 live births) are 85 and 102 deaths, respectively. Lubombo region has the highest cases of under-five mortality rate (deaths per 1,000 live births) of 115 when compared to rates in other regions, namely; Manzini (112), Shiselweni (100) and Hhohho (96). Despite the several child healthcare programmes, the problem of high child malnutrition places a significant hindrance towards the attainment of the Millennium Development Goals (MDG) 4 on reduction of child mortality. Potential determinants of childhood malnutrition and mortality in Swaziland can be categorized into three levels, namely: (a) immediate causes (inadequate dietary intake of protein, energy and micronutrients; diseases such as pneumonia, diarrhoeal diseases and HIV/AIDS, (b) underlying causes (inadequate access to food due to poverty and decline in food production; inadequate care of children and women, insufficient health services and unhealthy environment), and (c) basic causes (inadequate mother's education and nutrition knowledge, insufficient human resources in child health care; inadequate policies on child nutrition and health care; inequitable distribution of household and national socioeconomic resources). This paper presents an in-depth analysis of the causal factors of childhood malnutrition and mortality in Swaziland, and further explores opportunities that could be adopted to address the malnutrition and mortality problem. It also aims to reinforce that in order to ensure effectiveness and sustainability of intervention programmes, there is need for multi-dimensional strategies and collaboration between all the stakeholders concerned with child nutrition, health and socio-economic development. However, the interventions must recognize the existing socio-economic differentials between the rural and urban areas, and the administrative regions.

Key words: child, malnutrition, mortality, causes, Swaziland

Child malnutrition and mortality status in Swaziland

Malnutrition is an important risk factor for high burden of diseases and mortality in children [1]. The long-term detrimental consequences of malnutrition include impaired physical growth and cognitive development. In Swaziland, 31 % and 1% of the under-five children are stunted and wasted, respectively, whereas 6% are underweight [2]. The national prevalence of under-five children mortality rate (102 deaths per 1,000 live births) is much higher than the MDG 4 target of 32 by 2015 [3]. Lubombo region has the highest under-five mortality rate (deaths per 1,000 live births) of 115 when compared to rates in other regions, namely; Manzini (112), Shiselweni (100) and Hhohho (96) [3]. The high levels of the afore-mentioned child health indices suggest that MDG 4 is unlikely to be achieved, if new strategic approaches are not adopted [4]. However, as a pre-requisite for appropriate child nutrition and health care interventions, there is need for an in-depth understanding of the complex interplay between the various determinants of child malnutrition and mortality in Swaziland.

Conceptual framework for causes of child malnutrition and mortality in Swaziland

As outlined in the UNICEF strategy for improved nutrition of children [5], the conceptual framework on potential direct and indirect causes of child malnutrition and mortality in Swaziland recognizes three levels of causes corresponding to immediate, underlying, and basic factors (Figure 1).

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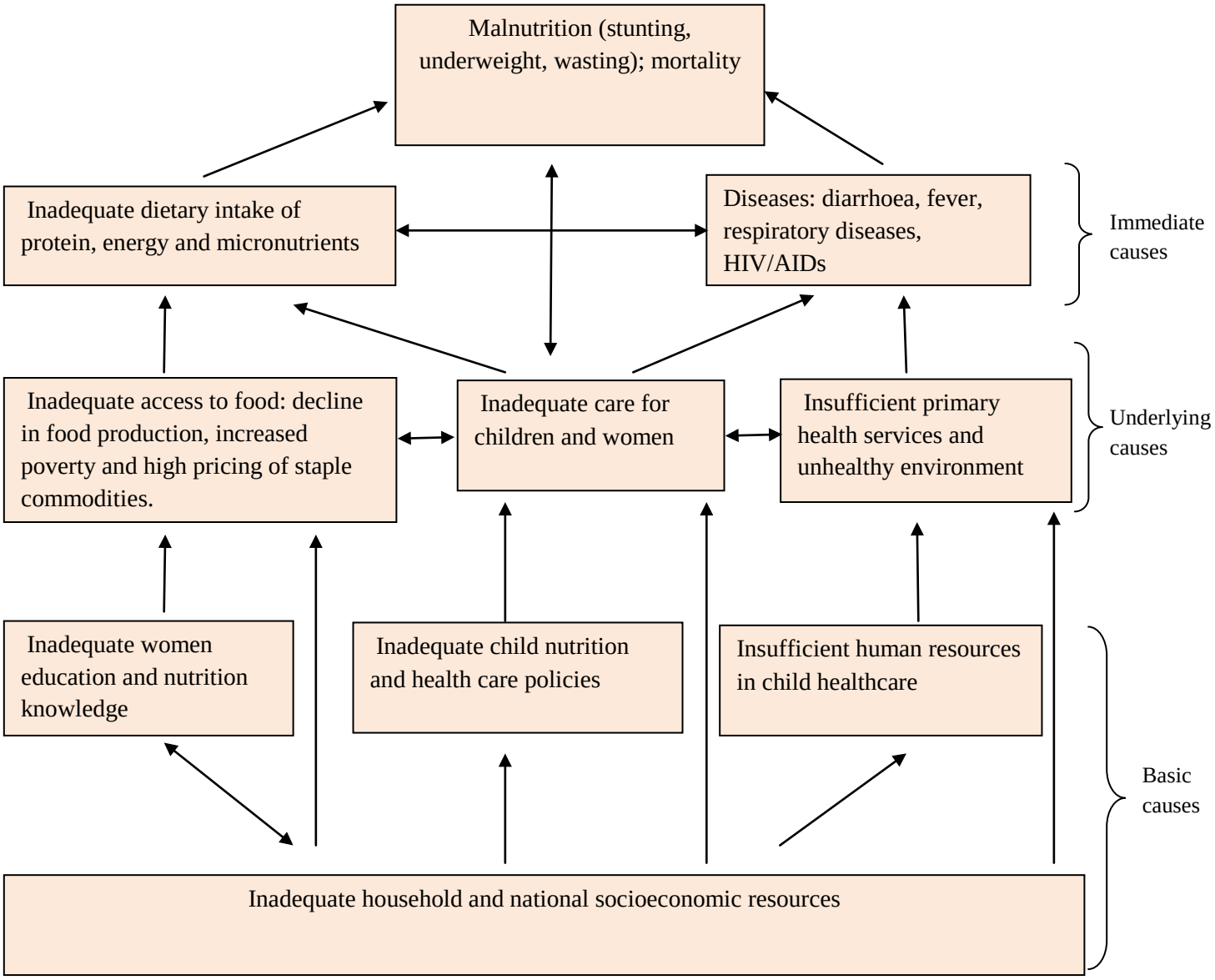

Figure 1: Potential causes of child malnutrition and mortality in Swaziland

Immediate causes of child malnutrition and mortality

Inadequate dietary intake

Infancy and childhood are stages of rapid growth and development, thus if the nutritional requirements are not sustained, this population group is highly susceptible to malnutrition [6]. In Swaziland, 44% of under-five children are exclusively breastfed for six months [2]. Coincidentally, protein-energy malnutrition usually manifests in breastfed infants between 3 – 6 months of life partly due to the complementary foods, which are deficient in nutrients required for the growth and development [7]. About 13% of the children consume less than the minimum level of dietary energy requirement (2100 KCal) and the highest prevalence has been observed in Lubombo region (18.7%) followed by Shiselweni (15.4%), whereas Manzini and Hhohho are at 6.1% and 7.9%, respectively [3]. There is need to educate the mothers on home-based techniques for the preparation and preservation of the locally available food resources.

Micronutrients such as vitamin A, iodine, zinc and iron are needed in greater amounts for child growth and development. Vitamin A (β-carotene) promotes growth and repair of body tissues, reducing susceptibility to infections and aids in bone and teeth formation. Thus, even mild forms of vitamin A deficiency (VAD) are associated with increased child mortality. About 44.6% of the Swaziland pre-school age children experience vitamin A deficiency [8]. However, about 32% of children aged 6 - 59 months receive vitamin A supplementation [8]. Zinc promotes immunity, resistance to infection, and the growth and development of the nervous system. Zinc deficiency at a younger age can lead to retardation of growth resulting in dwarfism or stunted growth. About 21% of the Swaziland population is at risk of insufficient intake of zinc [8]. Iron is essential in the production of haemoglobin, the oxygen-carrying component of red blood cells, which carry oxygen to the muscles and brain. Therefore, iron is critical for motor and cognitive development in childhood [8]. The proportion of pre-school age children with anemia is 46.7% [8]. Therefore, anaemia interventions need to focus on food diversification, supplementation and fortification. Iodine is necessary for the synthesis of the thyroxine hormones, which are vital in brain development, growth and maintenance of body temperature. The proportion of school-age children with iodine deficiency is 34.5% [8]. About 14% of the table salts in Swaziland households are not fully iodized, and Lubombo is the region with highest incidence (33%), when compared with Manzini (16%), Hhohho (8%), and Shiselweni (6%) [9]. There is need for subclinical and clinical assessment of the iodine deficiency disease amongst the children and public education on appropriate storage, transportation and display methods at retail outlets in order to minimize losses of iodine in the iodized salts [10].

Diseases

Poor nutrition is strongly related to ill health because a child with poor nutrition is highly vulnerable to diseases due to low body immunity [11]. Likewise, a sick child can easily become malnourished because of appetite loss and increased nutritional requirements. The leading causes of death amongst under-five children in Swaziland are; pneumonia (17%), diarrhoeal diseases (13%) and prematurity (10%) [12].

Malnutrition and HIV/AIDS are the main confounding factors for childhood mortality [6]. There is need to effectively implement the current programme on Prevention of Mother-to-Child Transmission (PMTCT) [13] so that the child HIV infection rates can be lowered.

The prevalence of respiratory diseases such as tuberculosis (TB) in children has increased mainly due to the HIV/AIDS pandemic [9]. The main setback in TB control is poor treatment completion rates due to low level of knowledge among the patients [14]. Therefore, more effort is needed to implement a community-based strategy for control of TB. In contrast to other countries, malaria cases have been substantially reduced in Swaziland, mainly due to the Lubombo Spatial Development Initiative [15]. However, the emergence of drug resistant malaria poses a major challenge to control of malaria [16]. The malaria situation needs to be improved further through preventive approaches such as environmental control measures and insecticide treated nets. Incidences of diarrhoea in Swaziland are highest among children aged 3 – 35 months, mainly due to the inadequate hygiene practices during weaning period [17]. There is need to undertake strategic advocacy and communication efforts through media and health systems, in order to effectively to promote safe water consumption; treatment of diarrhoeal diseases, and appropriate feeding during episodes of diarrhoea [18].

Underlying causes of child malnutrition and mortality

Inadequate access to food

In Swaziland, the national average of households with poor food consumption index is 2.58%, and Lubombo region has the highest index of hunger vulnerability (4.6%) in comparison to Manzini (1.7%) and Hhohho (0.4%) [3]. The low food consumption index is attributed to high levels of poverty and increased pricing of staple food commodities [19]. Although the maize production for the 2009/2010 season was 6% higher than the previous season, the levels were lower than the national requirement [9]. The continued uncertainty over the food production levels has partly contributed to food aid dependence syndrome in Swaziland. Due to the inability of the World Food Programme (WFP) to provide food aid to all vulnerable people, more children and women are predisposed to severe impact of food insecurity. There is need to develop effective food production strategies that target household units. The public should be educated on sustainable techniques for home gardening, crop harvesting, preservation and processing methods in order to limit post-harvest losses and retain the vital nutrients in the foods consumed.

Inadequate care for children and women

About 83% of children aged 12 – 23 months in Swaziland are fully immunized with Bacillus Calmette-Guérin (BCG), diphtheria, pertussis and tetanus (DPT), hepatitis B (HEPB), polio, and measles vaccines [2]. However, this coverage is lower than the MDG 4 target of 100% by 2015 [19]. Therefore, there is need for more public education on the importance of child immunization particularly at the primary health care level [20]. The HIV/AIDS pandemic has been associated with increased death rates and morbidity, which has resulted in increased dependency ratios across all the

regions and increased number of orphaned and vulnerable children (OVC) to at least 15% of the population [9]. The highest number of OVC are found in Lubombo (35.9%), followed by Shiselweni (35.5%), Manzini (33.2%), and Hhohho (21.6%). Consequently, a large number of the households are child-headed, which predispose the OVC to food insecurity [21]. In addition to accessing universal education, more OVC need to be included in the school feeding programmes and Neighborhood Care Points (NCPs). In partnership with World Food Program (WFP), various non-government organizations (NGO) deliver food commodities to pre- and primary schools and NCPs located in the areas that are highly affected by drought and HIV/AIDS pandemic, in order to support vulnerable children [22].

Despite the low incidence of malaria, there is need for continued effort in its control. About 6.1% of the households in Swaziland have at least one insecticide-treated net (ITNs) [23], thus there is need for continued distribution of ITNs particularly to children and pregnant women. The indoor residual spraying with dichloro-diphenyl-dichloroethylene (DDT) has been successful in combating malaria-carrying mosquitoes, but concerns have been raised on the environmental safety [24]. Infestation by parasites such as roundworms and schistosomiasis could also cause malnutrition amongst the Swaziland school age children particularly among those living in the peri-urban areas [25, 26]. Although about 53.2% of the children receive deworming treatments [3], the deworming programmes tend to target the school-aged children (6 - 12 years) more than pre-school children who could also be a potential source of transmission [25]. Therefore, a more intensive programme on deworming of children of all ages is necessary especially those living within the peri-urban areas.

The HIV prevalence among pregnant women attending antenatal care (ANC) services in Swaziland is 41.1% [27] Therefore, without any preventive measures, a large proportion of mother-to-child-transmission of HIV (ranging 25 – 45%) could occur through breast milk transmission [28, 29]. The nutritional guidelines for HIV infected persons have been developed in Swaziland, but the infant feeding options for mothers who are HIV positive and are receiving antiretroviral prophylaxis are not clear. The World Health Organization recommends the use of acceptable, feasible, affordable, sustainable and safe (AFASS) criteria to determine whether a mother is able to adopt replacement feeding [30]. However, due to limited knowledge and high poverty levels amongst the mothers, the effectiveness of implementation of AFASS criteria is uncertain. There is need to enhance the counselling activities on appropriate infant feeding guidelines for exposed babies and HIV positive infants, especially within the context of risk of HIV transmission and risk of malnutrition.

The mother's nutritional status is a confounding predictor for the health status of her children. About 50% of the Swazi women aged 15 - 49 years are overweight, whereas 2% are underweight [9]. The high levels of overweight and obesity amongst women pose diet related health risks such as metabolic syndrome. There is need to ensure that women are educated on management of overweight, which should incorporate diet management and increased physical activity. In order to further improve the nutritional status of the mothers, the interventions should focus on the more critical stages of pregnancy and breastfeeding. Most women who attend ANC in Swaziland

are provided with iron and folic acid supplements whereas vitamin A supplements are provided to post-partum women [9].

The national antenatal care (ANC) coverage is estimated at 97%, which is slightly lower than the MDG target of 100% by 2015 [23]. However, only 26% of the women attend ANC during the first trimester, while most women prefer attending ANC during the third trimester [23], which could predispose the mother and new-born baby to complications during birth. About 82% of mothers deliver with assistance from skilled health providers [2]. Despite the impressive indicators of high health facility births and skilled birth attendance of 76% and 82%, respectively in Swaziland [2], the question still remains on the high trend of maternal mortality rate (589 deaths per 100,000 live births) [9]. Amongst the leading causes of maternal deaths are puerperal sepsis, haemorrhage, abortions, eclampsia, HIV/AIDS, tuberculosis and malaria [23]. There is need to promote ANC attendance during the first trimester and facility delivery as opposed to traditional birth attendants (TBAs) whose procedures could be potentially harmful [31]. There is also need to promote post-natal visits in order to achieve improved care of mothers and their babies [32].

Insufficient essential health-care services and unhealthy environment

The access to essential health-care services by Swaziland children is influenced by household socio-economic conditions. The prevalence of poverty in the rural areas (76%) is higher than levels in the urban areas (50%) whereas the distribution of better health facilities and skilled health staff is also skewed towards urban areas (Hhohho, Manzini) [23]. This disparity could be partly reflected in the health facility birth attendance data, which shows 78.3% and 79% of women in Hhohho and Manzini, respectively, were attended to by skilled staff when compared to those at Lubombo (69.5%) and Shiselweni (65.9%) [23]. Therefore, effective interventions on child nutrition and health-care must consider the existing socio-economic differentials between the rural and urban areas within the four regions.

Diarrhoea, one of the leading causes of child mortality in Swaziland, is caused by unsafe water supply and poor sanitation [33]. The national proportion of persons with access to improved drinking water sources and improved sanitation is 67% and 54%, respectively [2]. Lubombo region has the lowest toilet coverage (48%) when compared to Hhohho (55%), Manzini (52%), and Shiselweni (59%) [2]. The high prevalence of *Schistosoma haematobium* amongst the under-five children (15.3%) in the Lubombo area has been attributed to lack of sanitation and safe water supply [25]. The most significant determinant for improved sanitation is the socio-economic status whereby 71% and 32%, of the richest and poorest households, respectively, have access to improved sanitation [2]. Therefore, there is need to enhance educational programmes on clean environment, safe water, and personal hygiene targeting those of a lower socio-economic status. A recent concern has been the disposal of environmental hazards close to the water sources, which pose high risk of infectious diseases amongst children. Hhohho has the highest proportion of water sources (68%) with incidence of solid waste [9]. There is need to ensure that the food provided to children are protected from biological and chemical contaminants through effective environment sanitation programmes.

Basic causes of child malnutrition and mortality

Inadequate formal education and nutrition knowledge

The mother's education and nutrition knowledge level affect her ability to care for a child with regard to management of food choices and eating behaviour. In Swaziland, under-five mortality rate (per 1,000 live births) in children of mothers with no education (151) is much higher than the rate observed in children of mothers who have tertiary education (53) [23]. Therefore, there is need to integrate food and nutrition components in the community nutrition education curricula, which should target the mothers and children. Although primary school enrolment ratio is in favour of girls, about 33% of women give birth by age 18 and before completing formal school [23].There is need for emphasis on reproductive health education so that the girls can bear children after acquiring adequate formal education. Some of the identified determinants of the ability of a mother to practice what she knows about child health and nutrition are; gender inequality, presence of support networks, alternative explanatory models of malnutrition, and poverty [34]. Therefore, any intervention on alleviation of child malnutrition should extend beyond nutrition education and adopt multi-dimensional approaches that include poverty reduction and gender equity amongst Swaziland mothers.

Child nutrition and health policies

Several programmes have been implemented in Swaziland towards improvement of nutritional and health status of children, either directly or indirectly. These include: Primary Health Care Strategy and Programme, Prevention of Mother to Child Transmission, Integrated Management of Childhood Illnesses Strategy, Early Childhood Care and Development; Expanded Programme of Immunization, and Orphaned and Vulnerable Children Fund [9, 19]. However, despite all the substantial efforts, the state of under-five child malnutrition and mortality (stunting 31% and 102 deaths per 1,000 live births, respectively) is still not satisfactory with respect to the MDG target goals [2,19]. The major setback has been lack of a co-ordinated and integrated multi-dimensional approach to solving the various causes of child malnutrition and mortality. Therefore, there is need for a comprehensive policy and strategy that should include the following components: dietary intake, disease prevention, diagnosis and treatment; access to food; care of children and women, health services and healthy environment; mother's education and nutrition knowledge; capacity building of child health care providers, and equitable distribution of socio-economic resources amongst households.

Insufficient human resources in health-care

There has been a decline in Swaziland's Human Development Index score in Swaziland from 0.523 in 1995 to 0.498 in 2010, largely due to the HIV/AIDS pandemic that resulted in diminished labour supply, lowered productivity, and weakened human capital formation process [35]. Implementation of a HIV/AIDS care and treatment programme is a complex undertaking that requires well-trained workforce with the appropriate knowledge, skills and attitudes [36]. In Swaziland, about 9.5% of the persons receiving anti-retroviral treatment are children [9]. Lack of

adherence to antiretroviral medications is the main challenge in paediatric HIV care and treatment [37]. Therefore, health facilities should have the capacity to effectively provide advanced level HIV/AIDS services including paediatric antiretroviral adherence and counselling. Continued training of the nurses and rural health motivators is increasingly being recognized as a vital strategy towards scaling up of antiretroviral treatment (ART) in Swaziland [35].

Socioeconomic resources

The access by children to nutrition and health care services is largely influenced by social and economic conditions at the household level. In Swaziland, about 69% of the population is below the poverty line [9]. Nationally, due to the global and economic financial crisis and the impact of HIV/AIDS pandemic, the Gross Domestic Product (GDP) growth rate has declined to 3.5% [19]. This has resulted in less budgetary allocation towards socio-economic services. There is need for further collaboration with international agencies and development partners towards the funding of the child nutrition and health programmes, particularly at the community level.

CONCLUSION

The child nutrition and health status indices in Swaziland are not satisfactory with regard to the MDG 4 target on reduction in child mortality. Child malnutrition and mortality are caused by a complex interplay of many direct and indirect determinants, which include: (a) immediate causes (inadequate dietary intake; diseases such as pneumonia, diarrhoea, HIV/AIDS), (b) underlying causes (inadequate access to food due to poverty and decline in food production; inadequate care of children and women, insufficient health services and unhealthy environment), and (c) basic causes (inadequate mother's education and nutrition knowledge, insufficient human resources in child health care; inequitable distribution of household and national socioeconomic resources). Therefore, only multi-dimensional interventions that integrate co-operation and co-ordination among various sectors can be effective towards alleviation of the problem. There is need for sustainable collaboration between all the stakeholders concerned with child and maternal health and socio-economic development in the country.

REFERENCES

1. **Black RE, Allen LH, Bhutta ZA Caulfield LE, de Onis M, Ezzati M, Mathers C and J Rivera** Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet*, 2008; **371** (**9608**): 243 – 260.

2. **CSO.** Central Statistical Office. Multiple Indicator Cluster Survey**,** Mbabane, Swaziland, 2011.

3. **SNNS.** Swaziland National Nutrition Survey Report. Ministry of Health, Mbabane, Swaziland, 2008.

4. **WHO.** World Health Organization. Infant and young child nutrition: quadrennial report. World Health Organization, Geneva, 2006; Report no. A59/13.

5. **UNICEF.** United Nations Children Fund. Strategy for improved nutrition of children and women in developing countries. UNICEF, New York, USA. 1990; 18 -23.

6. **Muller O and M Krawinkel** Malnutrition and health in developing countries. *Can. Med. Assoc. J.* 2005; **173**(**3**): 279-283.

7. **Faber M, Jooste PL, Mqoqi NP and AJ Benade** Breastfeeding and complementary feeding practices in a Swaziland population. *Afr. J. Health Sci.* 2000; **7(3-4)**: 51-54.

8. **Micronutrient Initiative**. Micronutrient initiates 2009. Investing in the future. A united call to action on vitamin and mineral deficiency, Global report. Canadian International Development Agency (CIDA). 2009; 4-5.

9. **SVAC.** Swaziland Annual Vulnerability Assessment and Analysis Report. Mbabane, Swaziland, 2010.

10. **WHO.** World Health Organization**.** Assessment of iodine intake deficiency disorder and monitoring their elimination. A guide for programme managers, Third edition WHO/ICCID/UNICEF. Geneva, 2001: 31-41.

11. **Rollins N** Food insecurity—a risk factor for HIV infection. *PLoS Med.* 2007; **4(10**): e301.

12. **WHO.** World Health Organization**.** Swaziland: Health profile, http://www.who.int/gho/countries/swz.pdf**.** Accessed 30th December, 2011.

13. **UNAIDS.** United Nations Program on HIV/AIDS. Monitoring the Declaration on the Commitment on HIV and AIDS (UNGASS): Swaziland Country Report, **2010:** 13-14.

14. **Escott S and J Walley** Listening to those on the frontline: Lessons for community-based tuberculosis programmes from a qualitative study in Swaziland. *Soc. Sci. Med.*, 2005; **61**: 1701–1710.

15. **Sharp BL, Kleinschmidt I, Streat E, Maharaj R, Barnes KI, Durrheim DN, Ridl FC, Morris N, Seocharan I, Kunene S, La Grange JJP, Mthembu JD, Maartens F, Martin CL and A Barreto** Seven years of regional Malaria Control Collaboration in Mozambique, South Africa, and Swaziland. *Am. J. Trop. Med. Hyg.* 2007; **76**(**1**): 42–47.

16. **Dlamini SV, Beshir K and CJ Sutherland** Markers of anti-malarial drug resistance in *Plasmodium falciparum* isolates from Swaziland: identification of pfmdr1-86F in natural parasite isolates. *Malar. J.* 2010; **9**: 68.

17. **Ziyane IS** The relationship between infant feeding practices and diarrhoeal infections. *J. Adv. Nurs.* 1999; **29(3)**: 721-726.

18. **Keusch GT, Fontaine O, Bhargava A, Boschi-Pinto C, Bhutta ZA, Gotuzzo E, Rivera J, Chow J, Shahid-Salles SA and R Laxminarayan** Diarrheal Diseases, **In**: Disease Control Priorities in Developing Countries, Second edition. International Bank for Reconstruction and Development. World Bank, Washington (DC), 2006; 371-388.

19. **MEPD.** Ministry of Economic Planning and Development. Swaziland Millennium Development Goals Progress Report. Mbabane, Swaziland, 2010.

20. **Daly AD, Nxumalo MP and RJ Biellik** Missed opportunities for vaccination in health facilities in Swaziland**.** *S. Afr. Med. J.* 2003; **93**(**8**): 606-610.

21. **Earnshaw S, Njongwe PZ, English B and Z Worku** The health and living conditions of children in child-headed households in Siteki, Swaziland. *East Afr. J. Public Health*. 2009; **6**(**1**): 95-101.

22. **Save the Children.** Swaziland (2007-2008) Annual Report. 2008; 11-15.

23. **CSO.** Central Statistical Office**.** Swaziland Demographic and Health Survey 2006-2007. Central Statistical Office and Macro International Inc. Mbabane, Swaziland. 2008.

24. **Curtis CF** Should the use of DDT be revived for malaria vector control? *Biomedica*. 2002; **22(04)**: 455-461.

25. **Chu TB, Liao CW, D'Lamini P, Chang PWS, Chiu WT, Du WY and CK Fan** Prevalence of *Schistosoma haematobium* infection among inhabitants of Lowveld, Swaziland, an endemic area for the disease. *Trop. Biomed.* 2010; **27**(**2**): 337–342.

26. **Cheng CY and CK Fan** Seroprevalence of *Toxocara canis* infection among children in Swaziland, southern Africa. *Ann. Trop. Med. Parasitol*. 2010; **104**(**1**): 73-80.

27. **MOH**. Ministry of Health. 12th Round of national HIV sero-surveillance in women attending antenatal care (ANC) services at health facilities in Swaziland. Mbabane, Swaziland. 2010; 21.

28. **Horvath T, Madi BC, Iuppa IM, Kennedy GE, Rutherford G and JS Read** Interventions for preventing late postnatal mother-to-child transmission of HIV. *Cochrane Database Syst. Rev.* 2009; **21**(**1**): CD006734.

29. **Taha TE** Mother-to-child transmission of HIV-1 in sub-Saharan Africa: Past, present and future challenges. *Life Sci.* 2011; **88 (21-22**): 917-921.

30. **WHO**. World Health Organization. Guidelines on HIV and infant feeding. Principles and recommendations for infant feeding in the context of HIV and a summary of evidence. Geneva. 2010; 15-28.

31. **Lech MM and TP Mngadi** Swaziland's Traditional Birth Attendants Survey. *Afr. J. Reprod. Health*. 2005; **9**(**3**): 137-147.

32. **Mazia G, Narayanan I, Warren C, Mahdi M, Chibuye P, Walligo A, Mabuza P, Shongwe R and M Hainsworth** Integrating quality postnatal care into PMTCT in Swaziland. *Glob. Public Health.* 2009; **4**(**3**): 253-270.

33. **Van Derslice J, Popkin B and J Briscoe** Drinking-water quality, sanitation, and breastfeeding: their interactive effects on infant health. *Bull. World Health Org.* 1994; **72** (**4**): 589-601.

34. **Mwangome M, Prentice A, Plugge E and C Nweneka** Determinants of appropriate child health and nutrition practices among women in rural Gambia. *J. Health Popul. Nutr.* 2010; **28**(**2**): 167-172.

35. **Kober K and WV Damme** Public sector nurses: can the down turn be reversed? *Human Resource for Health*, 2006; **4**:13.

36. **Kamiru HN, Ross MW, Bartholomew LK, McCurdy SA and MW Kline** Effectiveness of a training program to increase the capacity of health care providers to provide HIV/AIDS care and treatment in Swaziland. *AIDS Care*. 2009; **21**(**11**): 1463–1470.

37. **Phelps BR, Hathcock SJ, Werdenberg J and GE Schutze** Experiencing antiretroviral adherence: helping healthcare staff better understand adherence to paediatric antiretrovirals. *J. Int. AIDS Soc.* 2010; **13**: 48.