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Full Length Research Paper

Household factors are strong indicators of children's nutritional status in children with access to primary health care in the greater Gaborone area

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Access to primary health care can improve the nutritional status and survival of preschool children. The effect of the universal provision of primary health care in Botswana on the prevalence, types, and determinants of malnutrition in preschool children is unclear. 522 children 0 - 5 years old from 12 clinics in the greater Gaborone area were studied to address this gap. Children's weights and heights were measured. Birth weights, age, sex, household's socio-economic factors, children's illness status and services sought at the clinics were obtained through care giver interviews and confirmed by the data in the health cards. 11.3 and 13.7% of children were stunted and wasted, respectively. Stunting and wasting ranged from 9.1 and 3.6% in middle-high income neighborhoods to 18.2 and 20.8% in low income neighborhoods, respectively. Households' socio-economic factors were significantly associated with households' location. Consequently, households' location was a strong determinant of nutritional status. Children in higher income neighborhoods had better growth indicators than children in lower income neighborhoods. This was true regardless of the illness status of children and the services sought from the clinics. Therefore, where large socio-economic disparities exist, access to primary healthcare may not equitably support households in improving the nutritional status of children.

Key words: Primary health care, stunting, wasting, nutritional status, Botswana.

INTRODUCTION

Primary health care, inclusive of medical care, immunizations, vitamin A supplementation, routine growth monitoring and age-appropriate supplementary foods, have been shown to improve the survival of children (Gelband and Standsfield, 2001). These programs support households by providing timely management of childhood illnesses, nutrition education and supplementary foods. For children with access to primary healthcare, the services provided to support health and dietary intake, are the two immediate determinants of child survival as conceptualized by the UNICEF conceptual framework of child survival (UNICEF, 1996).

Consequently, the prevalence of malnutrition in preschool children in countries which promote universal access to primary health care for children, such as Botswana, is expected to be low. This expectation follows logically from the interactions of care, health and diet on the survival of children (UNICEF, 1996) and is supported by observations from other studies.

Access to primary health care services in Botswana has improved greatly over the years. In 1995 83 and 98% of people residing in the rural and urban areas were estimated to live within 15 km of a health facility, respectively (Central Statistics Office, 2001). Within the same period, 81 and 94% of the rural and urban population was estimated to live within 8 km of a health facility. With more health facilities constructed as per the National Development Plan 9, access to health facilities has continued to improve (Ministry of Finance and Development Planning, 2003). In addition to the shrinking distance between health facilities and the users, access to primary healthcare services in Botswana is also enhanced by the provision of services at no cost to women and children. However, the impact of increased access to primary healthcare on the nutritional status of preschool children has not been documented. Previous studies have examined the nutritional status and feeding practices of preschool children in general irrespective of

the level of access to health care (Central Statistics Office, 2001; Aplogan et al., 1996, Gobotswang, 1998; Tharakan and Suchindran, 1999). While such studies provide insights into nutritional status, the benefits of access to primary health care are not clear or accounted for.

In addition, the monitoring of the nutritional status of preschool children by the Botswana National Nutrition Surveillance System (BNNSS) only captures weight-for-age and gender, but not other indicators of undernutrition in children. The prevalence, types and determinants of undernutrition such as socio-economic factors can provide useful health education and policy information. This study was conducted to address these gaps especially as they pertain to preschool children, who have access to health care. The study sites were conveniently restricted to Gaborone and the nearby villages because of the higher density of health facilities in the area compared to other areas in Botswana.

METHODS

Study sites and sampling

A cross sectional survey design was used to study the nutritional status of children with access to primary health care. To be eligible for inclusion, children had to be 0 - 5 years of age and have access to health facilities in the greater Gaborone area. Children were considered to have access to health facilities if they had received services from any primary health care facility in the greater Gaborone area within a 30 day period prior to data collection.

Study children were selected systematically from health care facilities in Gaborone City and villages within 15 km of the city (Mogoditshane, Mmopane, Metsimotlhabe and Gabane). The clinics in the village of Tlokweng were not included because the Main clinic in Tlokweng was under renovation. Regular clients of the Main clinic received care at Village Clinic in Gaborone. The study team, consisting of the author and 4 trained research assistants visited each clinic for 2 consecutive days to recruit subjects and collect data. All the clinics within Gaborone city and the neighboring villages were visited in no particular order, but all clinics in Gaborone were visited before clinics outside the city. During each visit the study team recruited every fifth child 0 - 5 years of age who was queuing for service.

The children's care givers were interviewed to gather data on the children's and households' demographic characteristics, dietary and feeding behaviors, whether the child was ill or not, and the purpose for the clinic visit. The interview was guided by a structured and pretested questionnaire. To be eligible for the interview adults accompanying the child had to live with the child in the same household and be the primary care giver for the child. Children who were brought to the clinic by non-primary care givers were excluded. Care giver responses about the children's birth weights, age, and age of mother were verified by the information in the children's clinic cards. In addition, children's weights and heights were measured to determine their nutritional status. Overall, data were obtained from 522 children from 12 health facilities in the greater Gaborone area.

Assessment of nutritional status

Weight-for-age, height-for-age and weight-for-height z-scores of children were calculated using the Epi. Info 2002 (Centers for Disease Control and Prevention, 2002). Children were considered to have adequate growth when their weight-for-age and height-for-age were greater than -2 z-scores of the WHO reference standards for each growth index. Children with weight-for-age and height-for-age at or below -2 z scores were considered to be underweight or stunted respectively.

Data analysis

For further analysis, the z-score file was imported into SPSS. Both bi-variate and multivariate analyses were conducted to determine the correlates of nutritional status. Chi-Square tests were used to compare the prevalence of malnutrition by clinic location and various categorical household factors. Binary unconditional logistic regression models were built to predict the likelihood of adequate weight-for-age and height-for-age z scores (WAZ and HAZ) respectively). Variables that were significantly associated with the weight-for-age and height- for-age z-scores at the bi-variate level were used to generate a binary logistic regression model predicting the adequacy of nutritional status (greater than -2 standard deviations of the mean HAZ and WAZ. These logistic regression models were run using the backward stepwise (LR) procedure which was set to drop the predictor variables if their Wald statistic had a corresponding alpha of greater than 10%.

RESULTS

Sample characteristics

A total of 522 children were enrolled from 12 clinics in Gaborone and the surrounding villages. Forty-six percent of the children were male. Of the 522 children in the study, 73.8% (n =385) children attended the Child Welfare Clinic for preventive care. Services provided at the Child Welfare Clinic included growth monitoring, immunizations and provision of supplementary feeding rations. About 25% (n = 125) of the children were seeking consultations for various childhood illnesses, while 2.3% (n = 12) children were on follow-up care visits. Seventy-five percent of the children were accompanied by their mothers while the rest were accompanied by other adult relatives. The majority (59.8%) of the children were born to mothers between 20 - 30 years. Thirty- two (6.2%) and 37 (7.1%) children were born to teenage mothers and mothers over 41 years of age, respectively. A low-birth weight prevalence of 13.4% was observed in this study. Most households (47.5%) were male headed. However, grandmothers were also heads of the households for a large percentage (37.4%) of study children. This differed based on household location. A larger percent-tage of households (45.6%) in poorer neighborhoods were headed by grandmothers compared to those in middle (29.1%) to upper income neighborhoods. Other observed differences in households' characteristics were associated with clinic location and are displayed in Table 1. These included maternal age, employment, education and marital status and access to water (indoor plumbing).

Characteristics of households by location

Given the significant association between the prevalence

Table 1. Characteristics of households by the location.

Variables	Adjacent villages (20 km) N (%)	Adjacent to low income neighborhoods N (%)	In middle to [1]upper income neighborhoods N (%)	In neighborhoods with mixed income households N (%)	In neighborhoods with low income households N (%)
Household head* **					
Father	64 (42.7)	76 (59.4)	29 (52.7)	38 (35.2)	40 (50.6)
Mother	17 (12.0)	8 (6.3)	10 (18.2)	20 (18.5)	3 (3.8)
Grandparent	68 (45.3)	44 (34.4)	16 (29.1)	50 (46.30)	36 (45.6)
Marital status* **					
Married	27 (18.2)	34 (36.8)	19 (35.8)	14 (13.2)	3 (3.8)
Cohabiting	47 (31.8)	45 (35.4)	13 (39.6)	28 (26.4)	46 (58.2)
Single	74 (50.0)	48 (37.8)	21 (24.5)	64 (60.4)	30 (38)
Maternal age*					
Under 21	24 (16.0)	19 (14.7)	6 (10.9)	16 (15.2)	17 (21.5)
22-30	81 (54.0)	57 (44.2)	23 (41.8)	51 (48.6)	48 (41.8)
31 and older	45 (30.0)	53 (41.1)	26 (47.3)	38 (36.2)	14 (17.7)
Maternal education* **					
Under primary	20 (13.3)	8 (13.3)	3 (5.4)	11 (10.4)	6 (7.6)
Primary	25 (16.7)	26 (20.2)	9 (16.1)	16 (15.1)	22 (27.8)
Secondary	95 (63.3)	82 (63.6)	26 (46.4)	64 (60.4)	48 (60.8)
Tertiary	10 (6.7)	13 (10.1)	18 (32.1)	15 (14.2)	3 (3.8)
Maternal employment * **					
Employed	55 (37.4)	65 (50.8)	35 (63.2)	57 (52.4)	18 (22.8)
Not employed	92 (62.6)	63 (49.2)	20 (36.4)	51 (47.2)	61 (77.2)
Water source* **					
Indoor plumbing	16 (10.7)	44 (34.4)	37 (66.1)	39 (36.4)	4 (5.1)
Private stand pipe	68 (45.5)	69 (53.9)	19 (33.9)[2]	54 (50.5)	9 (11.4)
Communal stand pipe	66 (44.0)	15 (11.7)	0 (0.0)	14 (13.1)	66 (83.5)[3]

[1]Households with the least prevalence of stunting and underweight. [2]All households with standpipes were from the service area of Main clinic in Tlokweng. This clinic was closed for renovations at the time of data collection. [3]Household with the highest prevalence of underweight and stunting. ***P<0.001; **P<0.01; *P<0.05.

of malnutrition and the location of households, further analysis were done to establish distinguishing factors between households in locations associated with higher prevalence of undernutrition and those in locations with low undernutrition rates. The results, as shown in Table 1, show that households in locations with the highest prevalence of under nutrition fared worse in maternal employment, tertiary education and access to indoor plumbing. Mothers in these locations also tended to be younger compared to those in other locations. Further, a higher percentage of mothers in the lower income households were in non-marital co-habiting relationships compared to mothers in other locations. For example, the proportion of mothers under 21 years of age is twice as high in low income neighborhoods compared to those from middle to upper income neighborhoods. The households in the nearby villages and those adjacent to low-income neighborhoods in the city were the second and third worse off households with respect to the proportion of younger mothers. With regard to the employment status, 77.2% of mothers in households in low income neighborhoods were unemployed compared to 36.4% in middle to upper income households. Similarly to the disproportionately large number of young mothers, households in the nearby villages and those adjacent to low-income neighborhoods in the city had the second and third worst rate of unemployment in mothers respectively. With a few exceptions households in low income neighborhoods fared worse in variables associated with child undernutrition followed by those in villages and those in the city that are located next to low income neighborhoods. These results suggest that the household location can be used as a composite proxy indicator of factors associated with undernutrition in children with access to primary healthcare.

Prevalence of undernutrition

Table 2 depicts the percent of stunting, underweight and

Table 3. The prevalence of malnutrition in children 0 -5 years by the clinic location.

Clinic Location[1]	All Children N	Percent Stunted	% Underweight
Villages Adjacent to the city (15 kms) (Gabane, Mogoditshane, Mmopane, Metsimotlhabe clinics)	120	16.7	12.4
Adjacent to low income households (Broadhurst, 1, 2,and 3 clinics)	127	14.2	11.8
Clinics in predominately middle to upper income households (Village clinic)	55	9.1	3.6
Neighborhoods with households of varying income levels (Bontleng, Extension 14 and Block 9 Clinics)	107	14.2	6.5
Neighborhoods with predominately low income households (Old Naledi Clinic)	77	18.2	20.8
All clinics	522	(70) 13.7	(58) 11.3

[1]Since children were enrolled at the clinics, the location of the clinic was used as the location of the household. While households members are not restricted to use clinics outside their residential location, most households use clinics in their neighborhoods.

Table 2. Prevalence of undernutrition in children by different age groups.

Undernutrition	Prevalence of malnutrition by age (months)			
	0-12	13-36	37-60	0-60
Stunted*	11.6	11.3	22.2	13.7
Underweight**	4.7	13.1	19.3	11.3
Wasted	2.6	4.2	5.5	3.9

*P<0.05; **P<0.001.

wasting by age. An estimated 11.3 and 13.7% of children 0 - 5 years old had weight-for-age and height-for- age z scores below -2 standard deviations of the mean of the reference population and were therefore classified as underweight and stunted respectively. The prevalence of both stunting and underweight increased with age. The prevalence of stunting ranged from 11.6% in children 0 - 12 months of age to 22.2% for those 37- 60 months. The prevalence of underweight ranged from 4.7% in children 0 - 12 months to 19.3% in children 37 - 60 months. A similar trend was observed with regard to wasting, with 2.6% of children 0 - 12 months and 5.5% of children 57 - 60 months wasted. In all the growth indices, children 37 - 60 fared worst compared to others.

The prevalence of underweight was significantly higher ($p<0.01$) in boys (14.5%) compared to girls (8.6%). The prevalence of stunting was also higher in boys (16.5%) than in girls (11.3%) at $p<0.10$. Study observations also showed significant differences in the prevalence of undernutrition by the location of the clinics where the children were enrolled. Since clinics service specific residential areas, clinic locations were equated with household locations. Children from clinics, and by extension, households located in or adjacent to neighborhoods predominantly occupied by low income households exhibited higher prevalence of both stunting and under-weight compared to those from middle to upper income neighborhoods (Table 3). The prevalence of malnutrition was not significantly related to illness status. In Table 4, logistic regression modeling showed that children's sex, age and the location of households were strong predictors of weight-for-age in this population. Controlling for other variables, girls were 1.95 times more likely ($P<0.05$) to have adequate weight-for-age than boys. With respect to age, children under 12 months were 5.09 times more likely ($p<0.001$) to have adequate weight-for-age compared to those over 37 months of age. No significant differences were observed between the likelihood of adequate weight-for-age between children of ages 13-36 months and those over 37 months of age.

Children enrolled in clinics located in low income neighborhoods were the least likely ($p<0.001$) to have adequate weight-for-age compared to neighborhoods with predominately middle to upper income households. Such children were only 13% as likely to have adequate weight-for-age compared to children living in neighborhoods with predominately middle to upper income households. Although only significantly different at $p<0.10$, children enrolled from clinics adjacent to low income neighborhoods and from clinics in villages about 15km from the City (Gaborone) were also less likely to have adequate weight-for-age z-scores.

With respect to height-for-age (Table 5), birth weight, age and perceived adequacy of food for household members were significant predictors. Children with low-birth weight (< 2.5 kg) were only 29% as likely to have height-for-age z-scores greater than -2 ($p<0.001$). Compared to children 37 - 60 months, children 0 - 12 and 13 - 36 months were 2.18 and 2.23 times as likely to have adequate height-for-age z-scores respectively. In the households with perceived sufficient amounts of food for all members of the household at all times children were 3.31 times more likely to have adequate height-of- age z-scores than children in households where food was deemed as sometimes not being enough for all house-hold memb-

Table 4. Determinants of adequate weight-for-age.

Characteristics	Odds	95% CI
Sex ***		
Female	1.95	1.08 –3.52
Child age in months		
0-12	5.09	2.18 – 11.94
13-36	1.29	0.66 – 2.49
Clinic Location[1,2]		
Villages Adjacent to the city	0.25	0.54-1.11
Adjacent to low income neighborhoods **	0.24	0.051-.1.09
In neighborhoods with households of varying income levels *	0.51	0.10-2.59
In low income neighborhoods***	0.13	0.03-0.61

[1]The reference category, neighborhood with predominately middle to upper income households, is represented by Village City Clinic. Despite its name, this clinic is located in Gaborone City.[2]Refer to table 3 for the names of the clinics in each of the identified locations. ***P<0.001; **P<0.01.

Table 5. Determinants of adequate height-for-age.

Characteristics	Odds	95% CI
Adequacy of food		
Always adequate**	3.31	1.44 – 7.62
\Child's age		
0-12 months*	2.18	1.14 - 4.24
13-36 months*	2.23	1.15 - 4.36
Birth weight in kg ***		
Low-birth weight	0.29	0.16 - 0.54

*** p< .001; ** P < .01; *P < .05.

ers.

DISCUSSION

The nutritional status of preschool children with access to primary healthcare in the greater Gaborone area is greatly influenced by household factors. Primary health care factors such as the type of service provided (immunization, growth monitoring, supplementary feeding or consultation and follow up for illnesses) did not emerge as strong predictors of children's nutritional status. Rather, the household location, socio-economic characteristics, the care givers' perceptions about the adequacy of food at household level and the occurrence of a low-birth weight child in a household are some of the factors that strongly predicted adequate height-for-age z-scores.

There is convincing evidence linking intrauterine growth retardation and low-birth weight with poor maternal weight gain during pregnancy and low socioeconomic status (Hirves and Ganatra, 1994; Neel and Alvarez, 1991). Both low-birth-weight and low height-for-age z-scores reflect chronic malnutrition. Therefore, the observed occurrence of low-birth weight and low height-for-age z-scores in this study suggests that chronic exposure to inadequate nutrition is common in preschool children in the greater Gaborone area. This problem exists despite the fact that primary health care in Botswana includes a supplementary feeding component for both pregnant women and preschool children. Further, the findings show a higher prevalence of low height-for-age z-scores (stunting) in children whose households are located in or adjacent to low-income neighborhoods compared to children in middle to upper income households. This difference is expected because the socio-economic disparities across households are likely to exacerbate the problem in poorer households and minimize it in more privileged households.

In predicting adequate weight-for-age z-scores, the child's age, the child's sex and the location of households emerged as key factors. Consistent with previous studies, children under twelve months had a greater likelihood of achieving adequate weight-for-age than older children. Younger children are more likely to be still breastfeeding (Ubomba-Jaswa and Belbase, 1996). Amongst this age group, some children are not on complementary foods as yet and thus tend to have less exposure to contaminated complementary foods that can trigger repeated infections that are common in older children (ACC/SCN, 1997).

Household location strongly predicted adequate weight-for-age z-scores, with children in poorer households' faring worse than children in middle to upper income households. Again, this is consistent with observations reported by others (Gwatkin et al., 1999; Wagstaff, 2004), which show disproportionately higher levels of undernutrition and even mortality in children from poor households.

To a large extent, households' socio-economic factors were associated with clinic locations and children's nutritional status. Households located in or adjacent to poor income neighborhoods had less favorable socio-economic factors compared to those in middle to upper income

households. In particular, care givers in households located in or adjacent to low income neighborhoods had higher unemployment rates, higher percent of care givers with less than primary education, higher proportion of households headed by grandparents, higher percentage of unmarried co-habiting parents and the least percentage of households with indoor plumbing.

In many ways the socio-economic characteristics of households in the catchment areas of clinics located in low income neighborhoods in the city were similar to or worse than the characteristics of households in the neighboring villages. Given the poorer socio-economic factors in households located in low-income neighborhoods, the higher prevalence of undernutrition in children residing in these neighborhoods is not surprising.

The findings suggest that despite the fact that healthcare services were accessible; the disparities in household socio-economic factors overshadowed the influence of the primary health care services on the nutritional status of preschool children. This suggestion is consistent with observations made by other researchers which show that household factors such as maternal education (Cleland and Van Ginneken, 1989; Barret and Browne, 1996; Toyama et al., 2001; Vavia, et al., 2003), employment status (Vavia et al., 2003), family headship (Madzingira, 1995), adequacy of food intake (Pelto et al., 1991), use of pit latrines (Gobotswang, 1998), household location and the overall socio-economic differences between households (Hakeem, 2001; Saito et al., 1997) influence the children's nutritional status. It is important therefore that these additional factors be taken into consideration by health care providers and policymakers when addressing child undernutrition.

Differing positions about the impact of primary healthcare programs on the nutritional status of children are documented in the literature (Sabu et al., 1991; Garner et al., 2000; Panpanich and Garner, 2000). In some studies, the data seemed to suggest that the impact of some primary health care programs (e.g. growth monitoring), was negligible and thus raised questions of the cost effectiveness of these programs (Gerein and Ross, 1991; Sabu et al., 1993). In relation to such issues, the findings from this study suggest that when access to health care is controlled by enrolling only children with comparable access, it is the household level factors that have a critical influence on both the chronic and acute indicators of nutritional status in preschool children. Therefore, efforts for addressing undernutrition in preschool children should not only emphasize access to primary health care but also ascertain the relevance of the service to the household specific needs, which in this study were clearly captured by the location of households. Given these observations, the use of a standard primary healthcare package across all households, though a good start is unlikely to equitably meet the varying needs of all preschool children because of the large variances in household socio-economics characteristics.

In conclusion, the findings of this study show that household characteristics are strong predictors of both acute and chronic indicators of nutritional status in preschool children even if access to primary health care is available. Furthermore, households with less favorable socio-economic characteristics such as those with less access to adequate food for all members, children with low-birth weight or resident in low-income neighborhoods are likely to have poor growth. These children have low height-for-age and/ or weight-for-age z-scores despite access to primary health care services. Although healthcare access is a step in the right direction, solving nutriational problems requires a more comprehensive approach. Based on these observations it is recommended that measures be taken to improve the socio-economic characteristics of households in order that children's nutritional status may be improved. This is critical because of the extent to which poor nutrition status can delay or prevent positive health outcomes. Further-more, while primary health care is often standardized across populations, there may be a need to modify the services to better address the varying needs of households by areas of residence.

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