

The Etiology of Malnutrition among Preschool Children in Rural Costa Rica*

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Introduction

The major purpose of this research was to define the risk factors for malnutrition in a rural community, utilizing a holistic anthropological approach. The functional reason for seeking to define risk factors for malnutrition or any other disease is pragmatic. Once the major factors which are associated with the disease are identified, it is then possible to identify that portion of the population which is at greatest risk for contracting the disease. With a determination of the population which is at risk, planners may design intervention programs which are targeted specifically at this group. Scarce resources, of both material and manpower, may be conserved through directed involvement in programs which will provide the greatest return on invested labor.

In the specific case of malnutrition, the definition of risk factors serves to identify, on a predictive basis, those children who probably are, or will be, malnourished. Paraprofessional personnel may then concentrate their efforts on the families of children determined to be at risk. As the definition of risk factors also properly includes an explanatory aspect, the intervention team thus receives some guidance concerning appropriate avenues for intervention. Appropriate diet adjustments may be recommended in the light of local deficiencies and available resources; counseling on health care problems, which affect the child's nutritional status, may be conducted where determined to be appropriate, and preventive educational programs may be conducted with those mothers whose children are determined to be at risk for future nutritional distress.

The identification of risk factors in a country may be conducted at any one of several levels; national, regional or local. It is the basic contention of this approach that the local definition of risk factors may be conducted on a community basis, and then, with proper adjustments, extrapolated to apply to a wider area. In this case, the information from the subject community provides an analysis in depth of the

sources of nutritional problems, and their range of variation in the community.

The research project was an integral part of the pilot program of community medicine in San Ramón, an innovative program which pioneered the involvement of paraprofessional personnel in rural public health programs in Costa Rica. The program maintains health posts in each of the rural districts of three cantons: San Ramón, Zarcero, and Naranjo with a total population of over 60,000. These are staffed by auxiliary nurses daily and are visited weekly by pediatric residents and general practice doctors; prenatal and family planning clinics are held monthly. The direct services are supported by an active health education program, and the overall program coordinates with other governmental ministries, semi-autonomous agencies and volunteer groups to provide an integrated program of health services and general community development.

The research was conducted in Concepción de San Ramón, one of the rural districts in the program's area, selected to be as representative as possible in terms of land use, land tenure, and access to services within the range of variation present on the Central Plateau, where most of Costa Rica's population is located. The community had a population of 849 in March 1974, 250 of which were children below six years of age. The research took the form of a general ethnographic survey which covered a full agricultural year and which focused on agricultural production, food consumption, domestic economics, child-rearing, and the cultural components of diet and nutrition.

Material and Methods

All preschool children in the community were weighed and measured in their homes every three months and compared with INCAP standards. Utilizing the 24-hour recall method, diet surveys were carried out on a sample of 20 children. These were done in January and September, to control for seasonal variations. A detailed morbidity survey was conducted during six months of the research period controlling for seasonal variation. Two coproparasitological surveys of the children were conducted in January and July 1974.

Risk factors related with malnutrition were

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identified on the basis of their relationship with the nutritional status of specific children based on weight for age data, and on their relationship with households considered to be either "normal" or "deficient". Households classified as normal had all children, or all but one child in normal weight category. Deficient households contained children and II and III degree of malnutrition, all below normal, or more than one child below normal. Statistical correlations were calculated for a range of elements hypothetically related to nutritional deficiencies. Statistical relationships were also confirmed through directed interviewing and participant observation, at the same time establishing the path of relationship through intervening variables.

Results and discussion

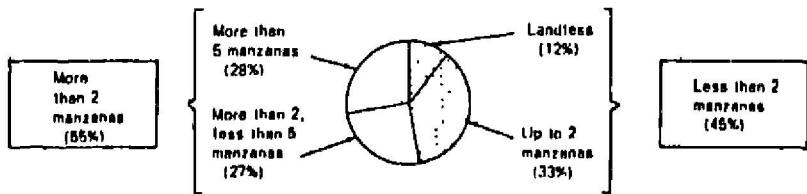
A. Description of the Study Community

The community, composed of descendants of European settlers, is distributed in 157 households, located on or near the unpaved roads which follow the ridgelines running through the district. Almost all households are composed of complete nuclear families, although many of these are clustered in regional concentrations of extended family units. Near the middle of the district, the major community services are grouped on either side of the road: these include the church, a health post, and two general store/bars (*pulperías*), one of which has a dance salon. Two schools, providing classes through the sixth grade, are located at opposite ends of the main road through the district.

Almost all male residents of the district are farmers, involved in a combination of subsistence and commercial production. The major categories of land use are coffee, sugar cane, cattle, and basic staples. Very few farmers are dedicated exclusively to one form of use or the other, but rather attempt to have diversified holdings within the limits of available land.

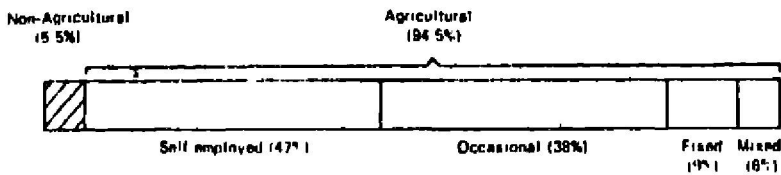
As shown in Figure 1, land holdings are small, with 45% of the farmers having access to less than 2 manzanas of land (1 manzana = .7 hectares).

Figure 1
Land Access by Household,
Concepción de San Ramón, 1974



Almost all household heads are agriculturalists. Of these, less than half have enough land and other resources to be completely self-sufficient, and the others must seek income through agricultural labor either on a part time or full-time basis. Figure 2 presents the occupational activities of household heads.

Figure 2
Occupation of Household Heads in
Concepción de San Ramón, 1974



Labor opportunities are rare, with seasonal variations, and wages are low. Only 19 men in the district have year-round fixed employment, and the others who seek employment are able to obtain it only occasionally. Women contribute to the household economy through participation in the coffee harvest or by making and selling small hand-rolled cigars (*puros*).

B. Nutritional Status of Children

The anthropometric data indicate that the nutritional deficiencies of the children are moderate, but chronic. The children of the community showed the following distribution according to Gomez's classification.

Table 1
Nutritional Status of Pre-school Children Using Gomez
Weight-for-age-categories
in Concepción de San Ramón, 1974

	Status			
	Normal	First Degree	Second and Third Degrees	Total
Number of Cases	62	79	16	157
Percent	40%	50%	10%	100%

Only two children were in the III° category, and 10% of them appear below 75% of standard weight. However, almost half of the children are mildly deficient in weight for age.

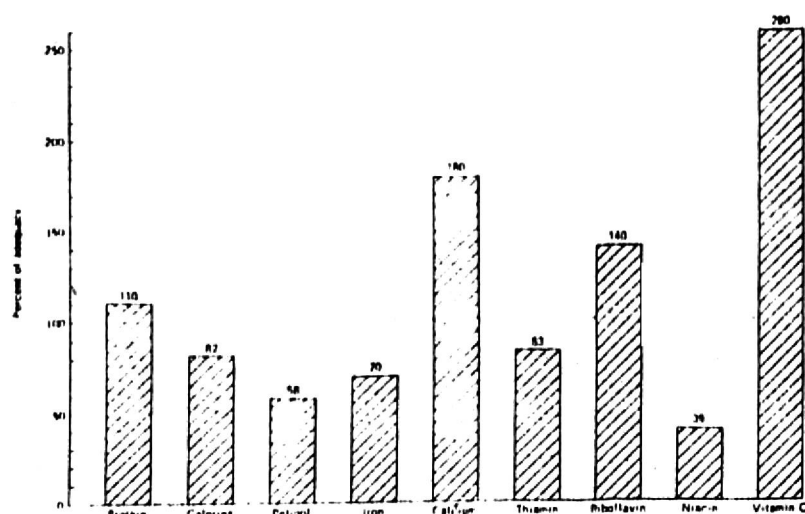
Weight deficiencies show a secular tendency to increase with age. Most of the children in II° and III° are in their fourth or fifth year of life, and the deficiency is mild but cumulative. Most of these children, viewed in terms of weight for height, have normal proportions, with both anthropometric parameters reduced equally. This stunting is not considered to be susceptible to clinical intervention in the later preschool years.

A detailed analysis of the anthropometric data from a sample of children in the rural areas and the urban center of San Ramón confirms the indications from the subject community, with the added perception that rural children are measurably more nutritionally deficient than their urban peers (Valverde and Rawson, 1975). These data indicate that while the nutritional deficiencies of rural Costa Rican children are moderate, they fulfil far less of their physiological potential than do urban children.

C. Children's Diets

The results indicate that the major dietary deficiency is caloric, with other nutrients deficient as well:

Figure 3
Percent of Adequacy of Diet Nutrients in Children 0-6
Years
Concepción de San Ramón, August 1974



The adequacy of children's diets in protein intake is due primarily to general access to local sources of fresh cow's milk, eggs, and vegetable protein (beans/rice, beans/corn mixes). The source of caloric inadequacy appears in many cases to be a quantitative deficiency in the diets, or an over-dependence upon milk as a dietary staple among younger children (1-4 years). The comparative study cited above (Valverde and Rawson, 1975) also indicates a contrast in diet adequacy between rural and urban children, with urban children generally receiving adequate amounts of both proteins and calories.

D. Morbidity

The morbidity information indicates that upper respiratory and gastrointestinal infections are very common among children in this area. The average child reported 47 sick-days of upper respiratory infections and 40 days of gastrointestinal illnesses per year.

In January 1974, 83% of the children were infected with some sort of intestinal parasite, and in July the rate was 72%. This is despite the presence of running water and latrines in all households in the district. The most common parasites encountered were *Ascaris* and *Tricocephalus*, followed by *Giardia Lamblia*. Three children had hookworm.

E. Factors Associated with Malnutrition

Forty households and forty-one were classified as normal and deficient respectively. Nutritional status was associated with land tenure, number of siblings 0-6 years of age, occupation and education of parents, level of living code, ownership of house and house plot, type of family unit, intergestational period, age at weaning, sex of child, and salary income. Certain of these showed a positive association and others showed none. A summary is presented in Table 2.

As noted in Figure 1, almost half of the households have access to less than 2 manzanas of land. This extension is frequently cited by residents as being the

minimum required to guarantee self-sufficiency (*para defenderse*), but probably not sufficient to fulfil

Table II

Factors Statistically Related to Nutritional Status in
Concepción de San Ramón

Factors Associated with Nutritional Status	X ²	Significant at less than:
Access to land (0-1.9 manzanas/2 or more manzanas)	5.20	.025
Number of Siblings 0-6 years (0-1/2-4)	20.89	.005
Occupation — Father (self-employed/other)	17.88	.005
Occupation — Mother (in home/out)	7.82	.005
House Code (to 2.5/2.6 or higher)	6.09	.025
Type of Stove (good/poor)	19.38	.005
Ownership of House (owned/not)	15.59	.005
Access to Fresh Milk (yes/no)	19.97	.005
Factors Found Not to be Associated with Nutritional Status		Significant at:
Education — Mother (0-3/4 or more years)		.10
Education — Father (0-3/4 or more years)		.10
House Ownership (owned/not)		NS
Type of Family Unit (unclear/other)		NS
Sex of Child (male/female)		NS
Intergestational Period (less than 18 mo./18 mo. or more)		NS
Age at Weaning (less than 6 mo./6 mo. or more)		.10
Salary Income		NS

suggested adequate living conditions of living (Schatan, 1974). This narrative information is supported by statistical analysis; children in households with less than 2 manzanas of land have a greater tendency to be below normal in weight for age ($P < .025$). A direct causal chain probably does not exist between land tenure and nutritional status. However, the former affects intervening variables which in turn affect the nutritional status of children.

1. Intervening Variables

(a) Labor — Father

A household head with access to less than 2 manzanas has insufficient resources with which to support his family; he must work as a day laborer outside the household. In this area, permanent labor opportunities are rare (9% of household heads are so employed). Labor opportunities are also irregular, and must be confirmed weekly or daily. The salaries are low, approximately \$200 colones per month (\$23 dollars). This income barely supports a family of five, the mean family size in the community. From a study

on income and cost of minimum-cost diets in Costa Rica (Valverde, 1975) it is estimated that a family income of Q372 per month (\$43 dollars) at 1972 prices is necessary to fulfil only food needs for a family of five. It does not take into account other expenses such as housing, clothing etc.

(b) Labor — mother

Most mothers in households with less than two manzanas must work outside the home also. Most commonly, this means picking coffee (42% of the mothers who work do this), or rolling cigars. Pay for picking coffee is good, and despite the long hours, is not unusually physically demanding. However, the local coffee season lasts only four months. Major purchases are put off until coffee season, and thus few families are able to save from that period to insure cash resources in other seasons. In the rainy season, many mothers and other family members roll cigars. The pay for this is low (\$1.50 — \$2.00 per week), but the work may be done at home, and combined with other domestic activities. A relationship is shown between mother's labor and the nutritional status of her children, as well as with land access. In a household with access to less than two manzanas, the mother is more apt to seek labor opportunities outside the home such as picking coffee, and mothers who do so tend to have children with below-normal weights.

(c) Ownership of House Plot

Out of all the houses in the district, 35% of them are placed on land which is borrowed or rented. Most of these houses are of simple frame construction, and may be taken down and moved. As the house owner does not have the title to the lot, the insecurity of his tenure discourages investment in maintenance and improvements. Such houses also tend to have dirt floors and other elements which qualify the residence as being substandard. A level of living code, developed to evaluate the quality of housing in terms of construction and maintenance, indicates a lower rating for houses which are on borrowed or rented land than for houses which are on land which is owned by the resident.

2. Subsequent Effects of Intervening Variables

(a) A father who works as a day laborer does not have either the time or the resources to maintain a source of subsistence foods (the major requirements being land, labor time and fertilizers and sprays). As a result, his family subsists on a cash economy, purchasing foodstuffs with scarce economic resources.

(b) Mothers who work outside the home must leave their preschool children in the care of an older sibling. During coffee season, for instance, children in such households receive suboptimal care from their mother surrogates who lack proper training or motivation to fulfil their role, for as long as four months. The problem of stimulus deficiency, both aural or visual, which is general in this area, is heightened in these households, contributing another negative element to

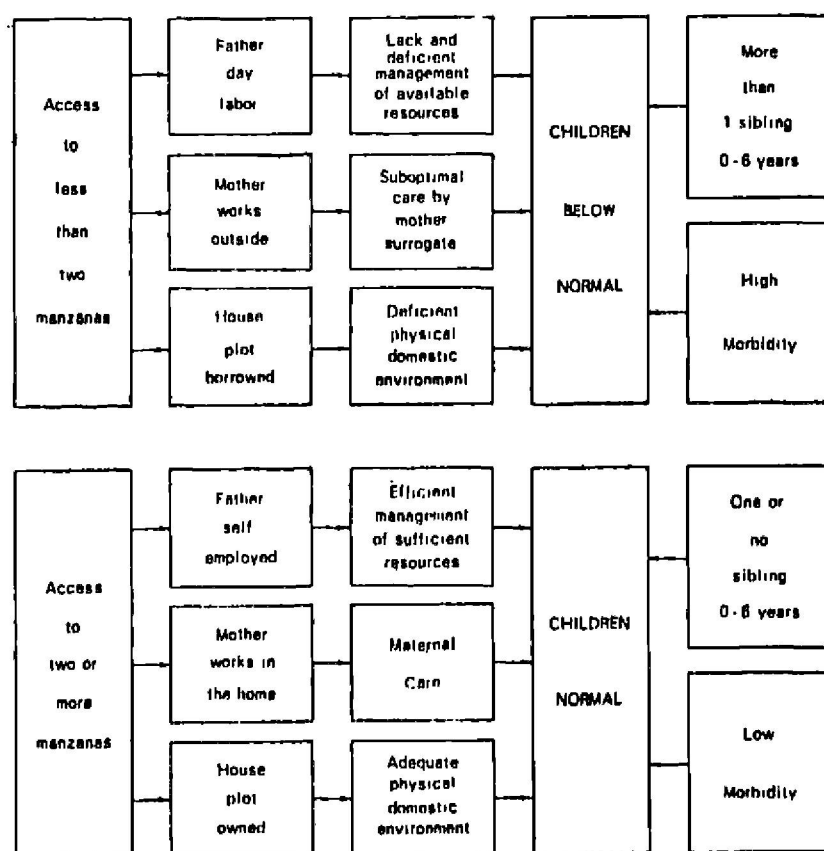
the microenvironment of growth and development of the children.

(c) The level of living code indicated that a poorly built and badly maintained house logically provides more sources of infection, which affect the physiological balance of resident children. As a methodological footnote, a useful device emerged from the use of the house code: the type of stove in the house served as a significant predictor of nutritional status, and as an indicator of the house code. A final, statistically firm, relationship is shown between the stove type and nutritional status. Therefore, a short cut may be used in predicting nutritional status of children by evaluating the stove type, obviating the need for the full house survey.

The effects of these variables, and their interrelationships may be seen more clearly in graphic representation in Figure 4.

Figure 4

Identified Risk Factors for Malnutrition and Their Interrelationships in Concepción de San Ramón, 1974



3. Anomalous Cases

Land tenure may be seen to be a primary variable which affects, through other related factors, the nutritional status of children. The statistical association between land tenure and nutritional status ($P < .025$) may be seen to be strengthened when the anomalous situations are analyzed, i.e., the cases seen to be "deficient" in households with more than 2 manzanas, and those termed "normal" with less than 2 manzanas.

(a) "Deficient", with Sufficient Land

There was a total of eleven cases. In five of them, the domestic environment of the children is visibly deficient; the houses are dirty, and the children

themselves are usually unclean and not cared for. In one of these five the house was inherited, and although it is well built, it is poorly maintained, and a worse environment than that of others which are less well constructed. Other factors contribute to a deficient microenvironment in several of these houses. In one the mother is frequently absent, leaving the children to be cared for by an older sister, who is poorly motivated to care for the children. In another, domestic problems generated by a husband who is open about his extra-marital alliances, contribute to deficient care. In a third home, the mother is frank in admitting that caring for four preschool and four school-aged children makes excessive demands on her time and resources.

In two cases, the deficient children are four or five years old, and are in I° weight category; probably the result of a moderate but cumulative nutritional insult. One of the other children is reported in II°, but was in the process of recovering from a low birth weight. At the end of this study the child had attained a normal weight.

It is probable that the problems of the remaining two cases may be traced to maternal care. In one instance, the mother fusses over her late-born son, bringing him often to the health post because he is not eating well. The other child has frank psychological problems, diagnosed by the psychiatric resident at the San Ramón hospital. The mother reports that she suffered a "susto" (she was frightened by a white horse) while pregnant with the child and that the child was born abnormal. The psychiatrist feels that the mother rejected the child in infancy, and he is now withdrawn, spending as much time as possible with his father. He may be rejecting food as an indirect form of revenge against his mother, who prepares it.

(b) "Normal", but with Less Than 2 Manzanas

Of the 19 households in this category, three are represented by three-generation households, in which unmarried mothers live with their parents; they themselves have no land resources, but are supported by their natal households.

Ten of these cases are relatively young couples who are living on land lent to them by the parents of one spouse, usually the husband. They are at a semi-independent stage of the development cycle, in which they have no direct access to land, but probably will inherit at least 2 manzanas. Meanwhile, they are permitted to work land owned by their parents and keep most of the profits from this. These households perhaps might be classified in the category of access to 2 manzanas or more, but their right of access is unclear, as is the extent of land to which they have rights. Three other families are more dependent upon the parents of the husband or wife, living in houses set up in the same *patio*. These share in the labor and production of family lands, either on a wage basis or on the basis of proportion of work contributed. While they have no direct access to land, their indirect access

appears to be sufficient to provide an adequate diet for their children.

Of the other three cases, one owns a pulperia, which provides adequate income for his family's needs. In the other two, the household heads have fixed agricultural employment, guaranteeing a year-round income; the men are well-respected as laborers, and are relatively well-paid.

In eight of the households mentioned above, the wives work during coffee season, picking coffee for others. However, in all but one case, this involves harvesting coffee which belongs either to their parents or to those of their spouse. This, therefore, indicates either wage income, or possibly sharing in the income from harvest production.

4. Other Factors Related to Nutritional Status

(a) If a child has more than one sibling of preschool age, the child has a statistically greater chance of being below normal in weight for age. The same relationship does not exist between nutritional status and intergestational period to the next youngest child. The latter factor is related to nutritional status in other places, notably Haiti, where short intergestational periods are associated with precipitate weaning (Webb, Ballweg & Fougère, 1973). Breast feeding is neither common nor extended in rural Costa Rica, and the availability of fresh milk provides a protective element. A mother with more than two preschool children to care for does not have the time nor the resources to properly care for them all. This may be noted both by observation and through the observation of the mother herself. As a result, either sub-optimal care is general for all children, or one child receives, by maternal preference, deficient care and stimulus. Both of these patterns were noted in the study.

(b) Many mothers, particularly those with many demands on their time, prepare bottles of milk for their children. For many children, even up to the ages of three and four years, these bottles of milk provide the major portion of the volume of their diet. In addition to the risk of infection from poor sanitary habits from prolonged contact with the nipple, the use of the bottle is frequently related to a lack of interest on the child's part in solid foods, heightening the protein/calorie imbalance noted earlier.

(c) 37% of the households in the community have at least one cow. Most who do, have only one or two cows, which produce milk for domestic consumption. Some families sell bottles of milk on a contract basis to neighbors or family members. During the dry months, production of milk is reduced, and families with neither a cow nor a contract have no access to fresh milk. Ownership of a cow involves an initial investment and sufficient land for pastures; contract purchases require a year-round cash availability, neither of which is generally available to households with limited access to land.

(d) The acquisition of foodstuffs involves a

combination of production and purchase; all nuclear families purchase at least part of their food, especially prepared foods. Foods may be purchased in the community's general stores where selection is limited and prices are high, or they may be purchased in San Ramón, where the advantages of selection and price are offset by the difficulty of access due to distance (5 kilometres) and limited means of transportation.

Families with limited land resources must purchase more of their food needs than do families who have sufficient land to produce annual food requirements. These families usually also have limited cash availability. The problem of insufficient home-produced food is compounded by the lack of cash for food purchases and the problems, through distance and transportation costs, of access to less expensive food sources. Credit for food purchases is available only at the local general stores, so those who must buy on credit are restricted to those sources with higher prices and limited variety. Thus the quality of food available to land-poor families is restricted directly through limited production of staples, and indirectly through limited labor opportunities, reduced cash income, and problems of food purchasing.

(e) Infection, Disease and Nutrition

The average preschool child reported 47 days of upper respiratory infections and 40 days of gastrointestinal illnesses per year; a feedback loop was identified in the comparison of weight gain or loss and morbidity during specific periods. A high rate of parasitic infection was noted among preschool children.

F. Some Factors Not Associated With Nutritional Status

1. Type of Family

Nutritional status does not seem to be related to the type of family of the subject child; most families are complete nuclear units, and those which are not do not seem to generate nutritional deficiencies. For example, four mothers in the community are unmarried; all live in three-generation households, and all have children who are of normal weight.

2. Parents' Schooling

Even though 75% of the fathers and 60% of the mothers in the community did not go beyond the third grade in school, most are functionally literate. In addition, a high level of awareness of the nutrient qualities of specific foodstuffs is noted among mothers. The educational level of neither parent is significantly related to nutritional status.

3. Age at Weaning

Few mothers breast feed their children for more than two or three weeks. The length of time children receive breast milk is not related to their nutritional status. A weak ($P < .10$) relationship is seen, but this may not be reflecting the direct nutritional benefits of breast milk as much as the level of attention and care given by the mother to the child.

4. Sex of the Child

The sex of the child is not a strong indicator of nutritional status; both boys and girls have an equal opportunity of being either well or poorly nourished. These data provide an interesting contrast to indications in other countries, where cultural preferences result in the generally better nutritional status of male children.

5. Salary Income

Salary income has been related to nutritional status in other etiological studies, specifically in India and Barbados (PAHO 1972; Grewal *et al.*, 1973). In the agricultural regions of Costa Rica, where almost half of the farmers are self-employed, an estimated conversion from agricultural production to salary income is difficult to perform accurately. For those who are employed, salaries are low, and the mere fact that they must work as day laborers is related to both land tenure and to the nutritional status of their children, as noted earlier. Within the salaried group, the range of variation is so limited that a division of the group for analytical purpose is not possible.

Summary

In the present study, access to land appears to be the primary variable affecting nutritional status, although it operates indirectly in this relationship. Households with access to less than two manzanas of land usually have fathers who work as day laborers, working mothers, and an identifiably deficient physical domestic environment. All of these factors affect negatively the nutritional status of children in households, through inadequate resource availability and management, suboptimal domestic care, and a heightened risk for infection and disease. Additionally, children with more than one preschool sibling were found to be at greater risk for nutritional deficiency, although access to land was not related to the number of children 0-6 years of age in the household.

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