AFRICA NUTRITION

Nutrition and Health Status of Young Children and Their Mothers in Mali

Findings from the 1995/96 Mali Demographic and Health Survey

U.S. Agency for International Development

Macro International Inc.

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EXECUTIVE SUMMARY

Malnutrition is one of the most important health and welfare problems among infants and young children in Mali, resulting in serious health and economic consequences for both the individual and nation. Thirty percent of Malian children 0 to 35 months of age are stunted, 23 percent are wasted, and 40 percent of children are underweight. Of the children who are stunted, almost half are severely stunted. Likewise, over one quarter of the wasted children are severely wasted.

It is noteworthy that in Mali, the nutritional situation has been troubling for over a decade. In addition to the results of the 1995/96 Mali Demographic and Health Survey (MDHS) discussed in this report, other available studies in Mali confirm high malnutrition rates (EBC 1989, EMCES 1994, EIM 1996)[1]. The 1988/89 Enquête Buget Consummation (EBC) reported that approximately 25 percent of children under 3 years of age were stunted, and nearly 18 percent were wasted.

There is a clear age-specific pattern of stunting and wasting. The proportion of children stunted rises gradually from 0 to 21 months of age, at which time it peaks at about 55 percent, and remains at over 50 percent through much of the third year. Wasting follows a different pattern: the proportion of children wasted rises rapidly from about 3 to 14 months of age when it peaks at about 40 percent of children, after which it declines to 20 percent wasted in the third year of life. The proportion of children underweight increases rapidly from 3 to 14 months of age, peaking at about 55 percent and remaining at essentially this high level through the second and third years of life. All three indicators suggest that infants and toddlers in the first two years of life are the most vulnerable to malnutrition.

The key feeding behaviors that the data suggest contribute to these high levels of malnutrition are late initiation of breastfeeding and delayed introduction of complementary foods. While almost all infants are breastfed, one third of newborn infants are not put to the breast until the second day of life or later. Two thirds of infants 6 to 9 months of age do not receive complementary foods. Late initiation of breastfeeding prevents the infant from receiving the benefits of colostrum and raises the likelihood that other liquids will be given, thus exposing the newborn to pathogens. Delaying the introduction of complementary foods puts infants at risk of malnutrition because beyond about 6 months, breast milk alone is inadequate to meet energy, protein, and micronutrient needs.

In Mali, 123 infants out of every 1,000 born die before their first birthday. Among all children under 5 years, 238 of every 1,000 will die before reaching their fifth birthday. Malnutrition is an important factor in the deaths of young children. Indeed, an estimated 57 percent of all deaths among children under the age of five years are related to malnutrition. Because of its high prevalence, moderate rather than severe malnutrition contributes the majority of these deaths. This suggests that nutrition programs to prevent and treat moderate malnutrition, as well as severe malnutrition, will have an important impact on child mortality.

Among the children studied, one-quarter had diarrhoea in the two weeks preceding the survey. The prevalence of diarrhoea climbs precipitously during infancy peaking at about 35 percent at 14 months of age. Not surprisingly, the age-specific pattern of diarrhoea is similar to that for underweight, illustrating the direct relationship between diarrhoea and malnutrition. Among children with diarrhoea, only 16 percent were given some form of oral rehydration therapy (ORT). About 39 percent of children were given increased fluids during a diarrhoeal episode, and 42 percent were given the same amount.

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[1] EBC: Enquête Budget Consummation 1988-1989 (Budget and Consumption Survey); EMCES: Enquête Malienne de Conjoncture Économique et Sociale, 1994 (Survey on the Economic and Social Outlook in Mali); EIM: Enquête à Indicateurs Multiples, 1996 (Multiple Indicators Survey)

Women's nutritional status prior to conception and during pregnancy is important both as an indicator of overall women's health and as a predictor of pregnancy outcome for both the mother and infant. In Mali, about 16 percent of nonpregnant women meet the criteria for chronic energy deficiency, which is indicative of poor maternal nutritional status and can put women and their current and future pregnancies at risk. At the other end of the spectrum, close to 9 percent of nonpregnant women are overweight, which may put them at risk for diabetes and cardiovascular disease.

Analyses of the factors related to both child and maternal nutrition point to poverty as the main underlying factor associated with poor nutritional status of children and their mothers in Mali. However, because the immediate causes are inadequate food intake and illness, both short- and long-term strategies are needed. The most important strategies recommended, therefore, are the following:

- Create a multisectoral structure at the level of the Department of Health for reflection and follow-up on the nutritional situation in Mali.

- Reinforce the prevention and treatment of malnutrition within the integrated management of childhood illnesses (IMCI) approach in health sector programs, and reinforce programs which emphasize nutrition surveillance of infants and children and nutrition education of mothers.

- Encourage the increase and diversification of women's incomes by elaborating and financing (or supporting the search for financing) of projects for market gardening, transformation of agricultural products, small commerce, production of foods for children, etc.

- Expand women's and adolescent girls' access to health services by emphasizing nutrition and birth spacing as part of the minimum package of activities (PMA) program.

- Support development and financing of qualitative research on:

  - distribution problems of agricultural products in Mali (national level, markets, villages and families)
  - income distribution and accessibility of households to food products
  - the beliefs, motivations and constraints related to breastfeeding and infant feeding practices of mothers and child caretakers.

- Promote the diversification of agricultural production and ensure food security throughout all regions of Mali by bringing about improvements (small dams, large diameter wells, rural roads, etc.) with the goal of a regular supply of diversified agricultural products from the populations.

ADMINISTRATIVE MAP OF MALI

CHAPTER 1

INTRODUCTION

1.1 Physical Environment, Economy and Population in Mali

Physical Environment

A land-locked country, Mali covers a surface area of 1,241,238 km^2 and shares borders along a length of 7,000 km with Algeria, Burkina Faso, Côte d'Ivoire, Guinea, Senegal and Mauritania.

Mali can be divided into four climate zones:

- Saharan zone: This area covers 56 percent of the total surface area of the country and is characterized by less than 200 mm of annual rainfall.

- Sahel zone: The Sahel area covers 19 percent of the land mass. The annual rainfall is between 150 et 550 mm. This zone covers most of the interior delta of the Niger, with many areas flooded during part of the year and areas of wetland agriculture.

- Sudan zone: This area receives great rainfall (550 to 1,100 mm of rain per year). It is covered by significant vegetation (Sudan savanna).

- Guinean zone: This is the sub-moist area with more than 1,100 mm of annual rainfall. It has wooded savannas and forests and covers 11 percent of the land.

Mali also has three climate seasons:

- a cold season from October to January;
- a hot season from February to May/June;
- and a rainy season from June/July to September.

Mali also has significant water resources: the Senegal and Niger rivers with their tributaries and junctions which are the two largest West African rivers.

Economy

Mali is a developing country, and with a gross national income per inhabitant estimated in 1996 at about 150,000 F.CFA, it is among the least advanced countries in the world. It is in a difficult economic situation as shown by certain 1996 indicators for human development:

Life expectancy at birth of 58.5 years;
Health coverage estimated at 40 percent within a radius of 15 km;
Access to potable water for 46 percent of the population;
Crude education rate of 39.1 percent in 1995-96.

Mali is essentially a rural country with nearly 80 percent of the total population, or about 6,750,000 inhabitants en 1996, dependent upon agriculture which contributes 42 percent of the Gross Domestic Product (Commissariat for the Plan, 1997).

The economy has undergone several constraints which have marked its evolution during the last three decades and which have had decisive consequences for its performance and economic policy orientation:

- great droughts in the years 1973-1974 and 1982-1984;
- strong demographic growth with inadequacy of economic growth;
- very unfavorable world economic environment.

Population

Mali is characterized by a very high natural growth rate (3.7 percent). Accordng to the Commissariat of the Plan, it has increased in a spectacular fashion between 1987 and 1996. Demographic projections estimate the total population of the country in 1995 at 9,013,300 inhabitants and in 1996 at 9.2 million comprised of 49 percent men and 51 percent women.

In general, the structure of the Malian population is very young. Nearly 49 percent of the population was less than 15 years old in 1995. Moreover considerable differences exist between regions as indicated in the table below.

Table 1.1 Distribution of the population by region

Region	Population (RGPH 1987)	Population (1995 estimate)
Mali	7,696,000	9,013,000
Kayes	1,067,000	1,262,000
Koulikoro	1,198,000	1,415,000
Sikasso	1,311,000	1,569,000
Ségou	1,340,000	1,592,000
Mopti	1,283,000	1,453,000
Timbuktu	459,000	506,000
Gao/Kidal	381,000	423,000
District of Bamako	658,000	794,000

Source : DNSI, 1996b

1.2 Agricultural, Nutritional and Food Situation

Agriculture

Agricultural production and food availability in Mali are characterized by certain constraints such as:

- dependence on seasonal rhythms of rain and therefore, on climate hazards;
- use of traditional agricultural tools
- difficulties linked to storage, conservation and transport of products;
- illiteracy of the population.

At the national level, agricultural production in Mali is sufficient, during years with a good harvest, to cover quantitatively the energy needs of the population.

Actions undertaken to promote food diversification seem to have contributed to the growth not only of the production of fruits and vegetables but also to the promotion of their consumption.

However, inequality in the distribution of production among regions and families in a single locality must be noted. To that must be added the population's lack of knowledge of local nutritional and food potentialities. In certain years, due to various transportation problems, and also to food customs, a certain complementarity of production among various regions cannot be achieved.

Herding

Herding is extensive, traditional and diversified. Drought in the 1970s decimated Malian livestock by nearly 50 percent. This catastrophe led authorities to institute a policy for reconstitution of the country's livestock.

Food

Results from the 1995-1996 Demographic and Health Survey have revealed that Mali had chronic and acute malnutrition rates, respectively 11 and 15 times greater than those expected in a healthy and well nourished population. If acute malnutrition reflects the level of socio-sanitary development of the country, chronic malnutrition is an indicator of poverty which denotes weakness in the economic system. In addition to economic stagnation, Mali is one of the countries of the world which is most affected by deficiencies in micronutrients.

Among the principal causes of malnutrition are noted:

- food insecurity;
- inadequate diet for young children;
- infectious diseases;
- poverty of the population;
- insufficient heath coverage;
- lack of objective data which hinders preventive surveillance.

The progressive desertification of the country has a definite effect on the nutritional status of its population.

Food Consumption

The 1988-1989 Budget-Consumption Survey has delineated the diet in Mali. It is based on cereals which account for 75 percent of the energy share in the diet and 70 percent of the proteins.

In terms of the quality of dietary intake, the significant role of glucides which constitute two thirds of the total calories consumed and lipids which represent 18 percent should be noted.

The contribution of animal proteins constitutes barely a quarter of the total protein share.

Vitamin A deficiency among the population in certain areas of the country has been known for some time.

A survey undertaken in 1988 by the National Directorate of Planning and Social and Health Training reported that two out of three women were anemic.

In Mali, troubles due to iodine deficiency are a public health problem. The population in 5 administrative regions situated in the southern part of the country are the areas of highest prevalence for problems due to iodine deficiency.

Access of the population to socio-health services still remains very limited. Surveillance of healthy children covers less than 7 percent of children in the interior of the country and 32 percent in the district of Bamako.

In the fight against malnutrition, a certain number of priorities must be adhered to:

- the struggle against food insecurity (production, distribution, storage, availability and self sufficiency);
- the IEC in charge of all social levels;
- the diet of young children;
- the organization of the health system;
- the development of human resources (professional and non professional in health).

Food Availability in Mali

Due to the improvement in climatic conditions in recent years but also, and especially due to the liberalization intervention in the agricultural sector, Mali is on the path to becoming self sufficient with regard to food.

Moreover, since 1982, the government has launched, with the aid of development partners, a series of stabilization and adjustment programs. In the agricultural sector, reforms have been numerous. Among others can be cited:

- restructuring of the grain market and the Office of Agricultural Products of Mali (OPAM);
- restructuring of the cotton industry;
- restructuring of the Office of Niger;
- liberalization of prices for agricultural products;
- restructuring of the Services of the Department of Rural Development, etc.

The basic strategic options are:

- withdrawal of the state from production and commercialization activities;
- promotion of the cooperative and association sector;
- decentralization of development decisions and actions with an increased participation from the population;
- giving greater responsibility to village groups, etc.

Despite the magnitude of the Saharan and Sahel zones (2/3 of the land), Mali possesses significant agricultural and pastoral potential. In these two zones, the availability of land is about 45.9 million hectares (Traoré, 1996). The potential in irrigable land destined for agricultural production is estimated at 2.2 million hectares. Dryland agriculture occupies some 2.75 million hectares. The principal crops are: millet, sorghum, corn, rice, fonio, cotton, niébé and peanuts.

The surface area devoted to truck farming and fruit orchards are estimated at, approximately, 8,000 hectares. Herding is mainly practiced in an extensive and very diversified manner. In Mali cattle, sheep, goats and camels are herded; donkeys, horses and pigs are also raised as well as poultry.

In 1995, the numbers of livestock in Mali (CPS/DIAPER III, 1996) rose to:

5,708,000 head of cattle,
5,431,000 head of sheep,
7,748,000 head of goats,
112,000 horses,
292,000 head of camels,
63,000 head of pigs,
22,000 head of poultry.

Given the importance of waterways and the extent of the flood planes that they feed, the potential in fishery resources is considerable. According to estimates, the mean level of national production should be between 80,000 and 100,000 tons (Traoré, 1996). It is with the goal of better exploiting this potential that a plan of action has been elaborated and installed by the Department of Rural Development. This plan is articulated around six priority objectives:

- withdrawal of the state and the giving of responsibility to promoters/activists for development;
- restructuring of the MDRE;
- management of natural resources and durable development;
- development of industries;
- promotion of rural credit;
- support to vulnerable groups.

The exploitation of all this potentiel by the population has given very varied results, in both time and space.

Food Availability at the National Level

In Mali, food is grain based (millet, sorghum, rice, corn and fonio). This basic food is completed by numerous harvested products (néré, karité nut butter, leaves, etc.), from fruits and vegetables and also from other cultivated produce (onions, root vegetables, etc.).

From 1987 to 1996, the production of the principal grains in Mali can be presented as indicated in the table below:

Table 1.2 Evolution of grain production from 1987/88 to 1995/96 (in tons)

Grains	1987/ 1988	1988/ 1989	1989/ 1990	1990/ 1991	1991/ 1992	1992/ 1993	1993/ 1994	1994/ 1995	1995/ 1996[a]	1986/ 1987[a]
Millet	693,526	999,901	841,793	737,007	889,896	582,296	691,099	897,592	706,666	738,856
Sorghum	513,176	672,429	730,866	531,433	770,043	602,254	694,383	746,218	710,275	540,273
Rice	236,568	287,797	337,749	282,366	454,349	410,018	388,483	469,127	462,702	613,965
Corn	178,609	214,519	225,393	196,579	256,776	269,841	274,753	322,492	264,457	289,761
Fonio	15,589	20,184	18,925	21,768	40,506	20,898	21,496	19,271	22,179	14,992
Wheat	-	-	-	-	-	-	-	-	6,150	3,086
TOTAL	1,637,468	2,194,830	2,154,728	1,769,153	2,411,570	1,885,307	2,070,664	2,454,700	2,172,429	2,200,923

[a] Production in the off-season has not been taken into account (rice: 13 388 tons; corn : 1 679 tons; sorghum : 1 369 tons).
Source : CPS/DIAPER III, 1996.

The mean grain production of the past ten years has risen to 2,095,177 tons: the agricultural campaigns of 1987-1988, 1990-1991, 1992-1993, and that of 1993-1994 each recorded a lower cereal production than the mean.

Dry grains constitute the essential dietary base for the Malian population, and their production remains exclusively dependent on an irregular rain regimen. This production variance between years is coupled with an inter-seasonal variation tied to the dominant rhythms of grain commercialization and supply of deficit areas. This seasonal variation will be all the greater as national production for the year is lower.

Dry cereal production still remains principally destined for autoconsumption. Production surplus, generally irregular, is sold according to the monetary needs of the producers.

An examination of the evolution in the grain balance sheet for the agricultural campaigns of 1987-1988 to 1996-1997 indicates that a certain equilibrium was reached beginning with the 1989-1990 campaign, while taking into account consumption needs evaluated at 202.12 kg / inhabitant/year (DNSI, 1994). The table below presents the evolution of the cereal balance in Mali.

Table 1.3 Evolution of the grain balance in Mali

Campaign	1987/ 1988	1988/ 1989	1989/ 1990	1990/ 1991	1991/ 1992	1992/ 1993	1993/ 1994	1994/ 1995	1995/ 1996	1996 1996
Population (in 1,000)	7,769	7,895	8,032	8,183	8,348	8,526	8, 710	8,892	9,072	9,249
Available production	1,333	1,793	1,747	1,434	1,936	1,433	1,785	1,969	1,751,53	1,744,57
Initial stocks	146	239	612	268	150	442	160	107	241,25	177,27
Import. (in 1,000 t)	54	87	36	192	79	57	28	60	103,49	65
Export. (in 1,000 t)	-	-	-	-	11	9	2	66	9,63	15
Final stocks (in 1,000 t)	239	612	268	150	442	160	107	241	177,27	35
Apparent consumption	167	191	265	213	205	207	214	206	210,37	213

Availability: sum of the available production and initial stocks. Available production is obtained by applying the following coefficients of transformaiton and loss to the gross production:
- rice paddy: 0.62 (to obtain white rice);
- wheat and other grains: 0.85.

Initial stocks: they are made up of peasant stocks and by those detained by private merchants, OPAM and the cooperatives.
Apparent grain availability or apparent consumption per inhabitant per year: It is equal to the sum of the availabilities and impor/export balance reported to the population on April 30th of the year.
Source : CPS/DIAPER III, 1997

Availability of Meat and Milk

The number of livestock in Mali, as indicated above, is very significant. That available to be used in 1995 is 599,340 head of cattle and 3,953,700 head of sheep/goats with respectively 10.5 percent et 30 percent appropriated for slaughter for the two types of livestock.

With a carcass weight of 120 kg per cow and 12.5 kg per sheep/goat (Traoré, 1996), the potential production in beef, lamb, and goat is estimated at 121,342 tons where 48 percent (or 58,244 tons) (Traoré, 1996) are destined for domestic consumption. This potential meat production allows the country to be self sufficient with an availability of 13.4 kg of meat per person per year. It authorizes the export on foot of livestock. This ratio of potential meat consumption per person is well above the mean consumption of 7.68 kg of meat per person per annum of the 1988-1989 Budget-Consumption Survey of the DNSI. However, as with cereals, the situation is very heterogeneous among regions, villages and families in the country.

Milk is particularly consumed by nomadic populations. According to Traoré (1996), the milk consumption per person per year is 20 kg and 16 kg, respectively, in Timbuktu and Gao. Elsewhere in Mali there is scant consumption with the exception of urban centers where households have somewhat substantial incomes as well as in the Mopti region among the population of herders. This consumption is far from attaining an adequate nutritional norm. The milk production available for food, despite existing potential, is relatively slight compared with need, therefore leading to massive importation of milk products.

The 1995-96 agricultural campaign is considered overall by the National Directorate of Statistics and Programming (DNSI) as well as by the National Directorate of Agriculture as an agricultural campaign of surplus as concerns food. Nevertheless, at the regional level distribution of this production is not at all uniform.

Food Availability at the Regional Level (1995/96 Campaign)

According to all appearances, it is possible to affirm that since the 1989-90 campaign, Mali finds itself at a certain level of food self sufficiency. However, if at the national level the food balance situation can be a reality, it is quite otherwise at the regional and local levels, where this situation can cover up disparities from one region to another and from one production unit to another.

During the 1995-96 campaign, contributions from different regions toward the national cereal production are very variable. Therefore, with 31 percent of the quantity of grains produced in the country, the Ségou region is first in cereal production in Mali. It is followed by the region of Sikasso (about 25 percent of the national production) then by the regions of Koulikoro (17 percent approximately) and Mopti (14 percent). The portion from the regions of Kayes, Timbuktu and Gao in the total national grain production are respectively 10 percent, 2 percent, and 0.3 percent. Data from the table below delineate these regional disparities in the country's cereal production.

Table 1.4 Cereal production (in tons) by region (1995-1996 agricultural campaign)

Region	Millet	Sorghum	Rice	Corn	Fonio	Wheat	Total
Kayes	22,594	163,561	3,846	30,099	1,493	-	221,593
Koulikoro	106,531	199,150	19,991	44,186	1,791	-	371,648
Sikasso	77,456	209,873	65,855	180,299	8,011	-	541,493
Ségou	256,799	122,199	276,631	8,888	8,219	-	672,736
Mopti	223,089	14,020	66,670	985	2,665	-	50,290
Timbuktu	18,713	1,164	24,263	-	-	6,150	50,290
Gao	1,485[a]	309	5,446	-	-	-	7,240
Total	706,666	710.275	462 702	264 457	22,179	6,150	2,172,429

[a] Estimated data
Source : DNSI, 1996a

Furthermore, analysis of the apparent cereal consumption per person, per annum reveals significant regional disparities. If the regions of Ségou, Sikasso and Koulikoro have apparent consumptions far above the national average, by contrast, those of Mopti, Kayes and Timbuktu are rather far from this mean. It goes without saying that in these regions, the food situation can be problematic. Even if grain production at the national level is sufficient, the country is often confronted with a problem of distribution. In fact, these deficit regions are also those which are very isolated and which, in addition, had security problems in 1995 (principally Timbuktu, Gao and Kidal). These difficulties may make the supplying of food products to the population in these regions troublesome.

Moreover, since the food situation at the national level is precarious, it will be aggravated by the consequences of the devaluation of the CFA Franc, interposed in January 1994. These consequences will be harder on the population in those "deficient" regions as well as on urban consumers because of the generalized price increase in grains over the entire area.

Table 1.5 Distribution by region of the apparent consumption of cereals (kg/inhabitant/year)

	Estimated population in 1995	Gross production in 1995/96[a]	Available production	Apparant consumption
Kayes	1,262,000	221,593	187,469	148
Koulikoro	1,415,000	371,648	311,302	220
Sikasso	1,569,000	541,493	445,122	284
Ségou	1,592,000	672,736	508,200	319
Mopti	1,453,000	307,429	245,980	169
Timbuktu	506,000	50,290	37,166	73
Gao	423,000	7,240	4,901	12
Total	8,220,000	2,172,429	1,740,140	212
Mali overall	9,013,000	2,188,870[b]	-	210,37

Note: The available production which figures in Table 5 is the gross production (not including the off season production), to which were attributed the transformation and loss coefficients. The apparent grain consumption per inhabitant per year is equivalent to the quotient of the available production by estimated population by region.
[a] Off season production not included
b Includes data from the off season
Source : CPS/ DIAPER III, 1996

Table 1.6 Grain self sufficiency by region

Region	Estimated population in 1995	Grain needs (tons)	Available[a] (tons)	Balance (available) - deficit (t)
Kayes	1,262,000	255,075	187,469	- 67,606
Koulikoro	1,415,000	286,000	311,302	25,302
Sikasso	1,569,000	317,126	445,122	127,996
Ségou	1,592,000	321,775	508,200	186,425
Mopti	1,453,000	293,680	245,980	-47,700
Timbuktu	506,000	102,273	37,166	-65,107
Gao/Kidal	423,000	85,497	4,901	- 80,596
Bamako District	794,000	160,483	-[b]	-160,596
Mali overall	9,013,000	1,821,707	1,992,710[b]	171,003

[a] At the regional level availability does not include initial stocks
[b] Available production + initial stocks

According to the results of these calculations (purely indicative), only three regions have a surplus cereal production: Koulikoro, Sikasso and Ségou. The production from other regions are insufficient to cover the grain needs of the population. However, at the national level, cereal availability is in excess. Thus a distribution problem is created in order to fulfill the needs of deficit regions.

Evolution of Grain Prices

According to analyses from the agro-pastoral campaign of 1995-96, undertaken by the Planning and Statistics Unit (CPS) of the Ministry for Rural Development and the Environment (November 1996), a sustained increase in grain prices is noted since the devaluation of the CFA Franc interposed in 1994.

This augmentation was very evident during the 1995-1996 campaign; in fact, such levels have never before been recorded: dry cereals (millet, sorghum, corn and fonio) extended beyond (and sometimes very greatly) the 100 F.CFA per kilogram at consumption mark (see Table 1.7). In certain consumption markets in the north and in the Kayes region, the grain price broke the 200 F.CFA per kilogram mark.

Table 1.7 Evolution of mean prices of cereals at consumption (in F.CFA)

Year	Millet	Sorghum	Corn	Rice
1992	72,95	67,10	69,58	165,68
1993	77,89	75,38	73,76	162,10
1994	76,67	71,39	70,40	199,11
1995	99,68	100,27	107,35	248,17
1996	151,31	149,20	140,51	261,37

Source : MDRE, 1997

This rise in prices benefited the producers (source SIM; special report Nº 7, February 1996). In fact, the increase in mean prices at consumption of cereals was accompanied by a very notable augmentation in prices to producers, thus improving income in rural areas. According to the SIM, the portion of price to the producer in the price at consumption went, for example for millet, from 48 percent in November 1993 to 57 percent for the same period in 1995 and to 72 percent in April 1996.

On the other hand, this rise was very severely felt by low income consumers from deficit zones and by those from cities.

Since the devaluation of the F.CFA, rice prices have also experienced a general rising trend. This trend was more marked in 1995-1996, a year during which, in certain localities of the north and west, the price of a kilogram of rice broke the 300 F.CFA mark.

According to the Market Information System (SIM, special report Nº 8, April 1996), because of the improvement in returns and their implication in transformation (use of small huskers) and in commercialization, producers have also been beneficiaries. They have, furthermore, benefited from the gain in competitiveness of Malian rice in the sub-region after the devaluation of the F.CFA and the suppression of the Equalization and Stabilization Funds in Côte d'Ivoire, Burkina Faso and Senegal. This translated unfortunately into unevaluated exports. Thus, the price of rice to the producer varied between 178 F.CFA per kilogram in December 1995 and 241 F.CFA per kilogram in August 1996. Moreover, prices to the consumer broke the 300 F.CFA per kilogram mark in certain markets.

This rise in grain prices at consumption has greatly affected low income consumers. It pushed the government to authorize the importation of rice at reduced tax.

The causes of this rise in cereal prices may be multiple. Among others are cited:

- insufficient production in certain localities of the country;
- devaluation of the CFA franc;
- pressure of foreign demand (Senegal, Mauritania, Guinea, Côte d'Ivoire, etc.).

Moreover, the consequences of such a situation may be numerous. Among others are noted:

- scarcity of agricultural products in certain zones;
- insufficient diet for some low income families;
- reduction in the food ration in certain households due to the high cost of agricultural products (a single meal instead of three per day);
- selling of family grain stocks (lure of monetary gains) through certain agricultural cultivations.

The continual price increase for agricultural products in a country where a majority of the population lives below the poverty threshold is not a factor which favors a correct diet for that population.

Income per Inhabitant

The study of incomes in developing countries is not easy. It is even less so in a country like Mali where the population is between 80 and 90 percent illiterate and where statistical data are difficult to collect. In general, information on income is only approximate in Mali. Authors of "A diagnostic balance sheet of lasting human development in Mali" explain these difficulties as:

- the high rate of illiteracy of the population;
- the reticence to spontaneously declare everything which touches upon income and wealth of individuals;
- the high level of self-consumption, especially in rural areas;
- the diversity of informal activites in urban areas;
- the difficulty of assigning an objective value to production, etc.

Inequalities exist among regions as is shown in Table 1.8, drawn up by the authors of "A diagnostic balance sheet of lasting human development in Mali." This table is an indicative table.

The interest in Table 1.9 lies in the comparison between income per person and the mean sum exceeded in food per person per region in 1988/89.

This table illustrates the difficulties of households with regard to food even in zones where production is sufficient. In the regions of Kayes, Koulikoro, Sikasso, Ségou and Mopti, monetary income is insufficient to cover the food expense of the population. The food needs of these people are possibly fulfilled by the consumption of products which are self produced.

The situation in the regions of Timbuktu and Gao/Kidal where monetary income per inhabitant per annum largely covers food expenses can be partially explained by the following points:

- the importance of self-consumption in those zones where production is essentially self-consumed, which reduces the purchase of agricultural products;
- the importance of actions of urgent aid in these zones, thus reducing food expenses;
- the food habits of people who consume less grain than other regions of Mali, etc.

Table 1.8 Income per inhabitant and corrected income per inhabitant (in F.CFA)

Region	Income/inhabitant in 1994	Corrected income in 1994[a]
Mali	60,447	120,874
Urban area	137,312	274,624
Rural area	46,661	85,322
Kayes	61,379	122,758
Koulikoro	40,019	80,038
Sikasso	41,900	83,800
Ségou	64,257	128,514
Mopti	28,330	56,672
Timbuktu	57,985	115,970
Gao/Kidal	53,618	107,236
Bamako District	160,653	321,300

[a] Corrected income: monetary income + self-consumption and gifts of value
Source : DNSI, 1996b

Table 1.9 Comparison between monetary income and food expense per person per year

Region	Monetary income per person in 1994	Food expense per person in 1988-89	Balance
Kayes	61,379	82,877	-21,498
Koulikoro	40,019	97,309	-57,290
Sikasso	41,900	77,225	-35,325
Ségou	64,257	76,600	-12,343
Mopti	28,330	58,362	-30,032
Timbuktu	57,985	25,348	32,637
Gao\Kidal	53,618	23,079	30,539
Bamako	160,653	59,675	100,978

In Bamako, food expenses per inhabitant are in strong competition with other types of expense (pleasure and education, health, clothing, housing and energy).

In conclusion, it may be said that the income per inhabitant per year does not ensure, by itelf, a correct diet for the population.

These low incomes are not used exclusively for food. They are used for the acquisition of other goods and services which compete with food expenses. The devaluation provoked a nearly continuous rise in the price of products with incomes increasing only very slowly. This situation does not always favor a quality diet for the population of Mali.

1.3 Data Source and Type of Information Collected

Data presented in this report are based on the results of the second Demographic and Health Survey in Mali (EDSM-II), undertaken from November 1995 to May 1996 by the Planning and Statistics Unit of the Minstry of Health, Solidarity and Older People (CPS/MSSPA) and by the National Directorate of Statistics and Programming (DNSI), with the technical assistance of Macro International Inc. (Calverton, Maryland, USA). Furthermore, it is part of a large Malian development program with multi-donor financing, the Project for Health, Population and Rural Hydraulics (PSPHR). The EDSM-II has benefited from financing from the U.S. Agency for International Development (USAID) mission in Mali,

The sample for the 1995-96 EDSM-II is based on the General Census of the Population and Housing of 1987 and on the 8,928 Enumeration Sections (ES) defined by the Central Bureau of the Census (BCR). The EDSM-II covered seven areas of the country—Bamako city, the cities of Timbuktu and Gao, and the urban and rural areas of the regions of Kayes, Koulikoro, Sikasso, Ségou and Mopti—thus forming 13 strata. The EDSM-II sample is stratified and weighted in such a way as to be representative at the national level. The sample selection was done in two phases. First, 300 Primary Sampling Units (PSU) were selected and, during a second phase, a household sample was selected from a complete enumeration of households established in each PSU. The detailed sampling plan for the EDSM-II is found in Appendix A. A sample of 9,704 women from 15-49 years, belonging to 8,716 households and 2,474 men from 15-59 years, belonging to 2,869 households were interviewed.

The 1995-96 EDSM-II collected information at the level of the individual, the household , and the community. At the individual level different questionnaires were used for women and men. The individual questionnaire allowed for the collection of information on fertility, nuptiality, fertility preferences, family planning, infant and child mortality, maternal mortality, maternal and child health, breastfeeding, nutritional status of mothers and young children under 3 years of age, practice and attitudes toward excision, and knowledge and attitudes of men and women toward sexually transmitted diseases and, in particular, Acquired Immune Deficiency Syndrome (AIDS). Data collected at the household level concern characteristics of all household members, housing characteristics and the possession of certain specific durable goods. At the community level, data were collected on the availability of health and family planning services for each community. Household characteristics and the socio-demographic characteristics of women are presented in Appendix B.

Data on vaccination and health were collected for all children of interviewed women born since January 1992 (age 0-35 months at the time of the survey), and information on mortality was collected for all children of interviewed mothers. Questions on recent morbidity, nutrition and health care were asked for all surviving children age 0-35 months: these questions include breastfeeding, nutritional practices, and the onset and treatment of diarrhoea, fever and cough during the two weeks preceding the survey. This report is based on a sub-sample of 4,678 surviving children age 0-35 months for whom anthropometric data are available.

CHAPTER 2

NUTRITIONAL STATUS OF INFANTS AND CHILDREN

Malnutrition is one of the most important health and welfare problems among infants and young children in Mali, resulting in serious health and economic consequences for both the individual and nation. The prevalence and severity of malnutrition among Malian infants and children from birth to three years of age, regional differences in malnutrition, and the age-specific nature of the patterns of malnutrition, are described in this chapter. Comparisons are also made with the 1987 Mali DHS and with Demographic and Health Surveys in other African countries.

2.1 Effects of Malnutrition

Malnutrition results in increased risk of illness and death.[1] In addition, malnutrition can result in a lower level of cognitive development, which results in lower educational attainment (Brozek and Schurch, 1984). In adulthood, the accumulated effect of malnutrition may be a reduction in worker productivity and increased absenteeism in the workplace, both of which may reduce individual and national lifetime earning potential (World Bank, 1993). Malnutrition also has intergenerational effects; infants born to women who themselves were malnourished during early childhood are smaller than infants born to better nourished women (Villar and Rivera, 1988). Infants born with low birth weight (defined as birth weight less or equal to 2.5 kg) are at greater risk of illness and death compared with normal weight infants (IOM, 1985).

Malnutrition is a direct result of both inadequate intake of food and infectious disease. Inadequate food intake, which leads directly to malnutrition, is a consequence of insufficient food at the household level and improper feeding practices. Infectious diseases, particularly diarrhoea, acute respiratory illness, malaria and measles, result from inadequate health care, insufficient water supply, and poor environmental sanitation, which put infants and young children at risk of increased incidence and duration of illness (Haggerty et al., 1994a; Clemens and Stanton, 1987). Diarrhoeal disease, in turn, compromises nutritional status through reduced dietary intake, poor absorption, and increased nutrient loss (Brown et al., 1990; Rosenberg et al., 1977; Rahaman and Wahed, 1983). In addition, in environments where infectious diseases are common, children typically suffer recurrent infections and are unable to recover fully from each bout of illness. The result is weakened immunity and increased susceptibility to malnutrition.

This interaction between inadequate food intake and infectious disease, of which diarrhoea is particularly significant, is important in understanding the direct causes of child malnutrition (Lutter et al., 1989). Several studies have pointed to the fact that child nutritional status depends on both the prevalence of diarrhoea and food intake. The relationship between inadequate food intake and diarrhoea is thus interactive, or synergistic, and affects nutritional status in a manner far greater than the simple additive effects of diarrhoea or inadequate intake alone would predict. In other words, when both malnutrition and infection are present the result is an interaction that is biologically more detrimental than the combined effect of the two working independently (Scrimshaw et al., 1968). These interactive effects are of particular importance in Mali, where the delayed introduction of complementary foods (resulting in inadequate nutrient intake) and the high prevalence of diarrhoeal disease between 3 and 14 months of age result in dramatic increases in the prevalence of malnutrition.

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[1] Although the association between malnutrition and death has been recognized for many years, recently a method has been developed to estimate the contribution of malnutrition to under five mortality (Pelletier et al., 1993).

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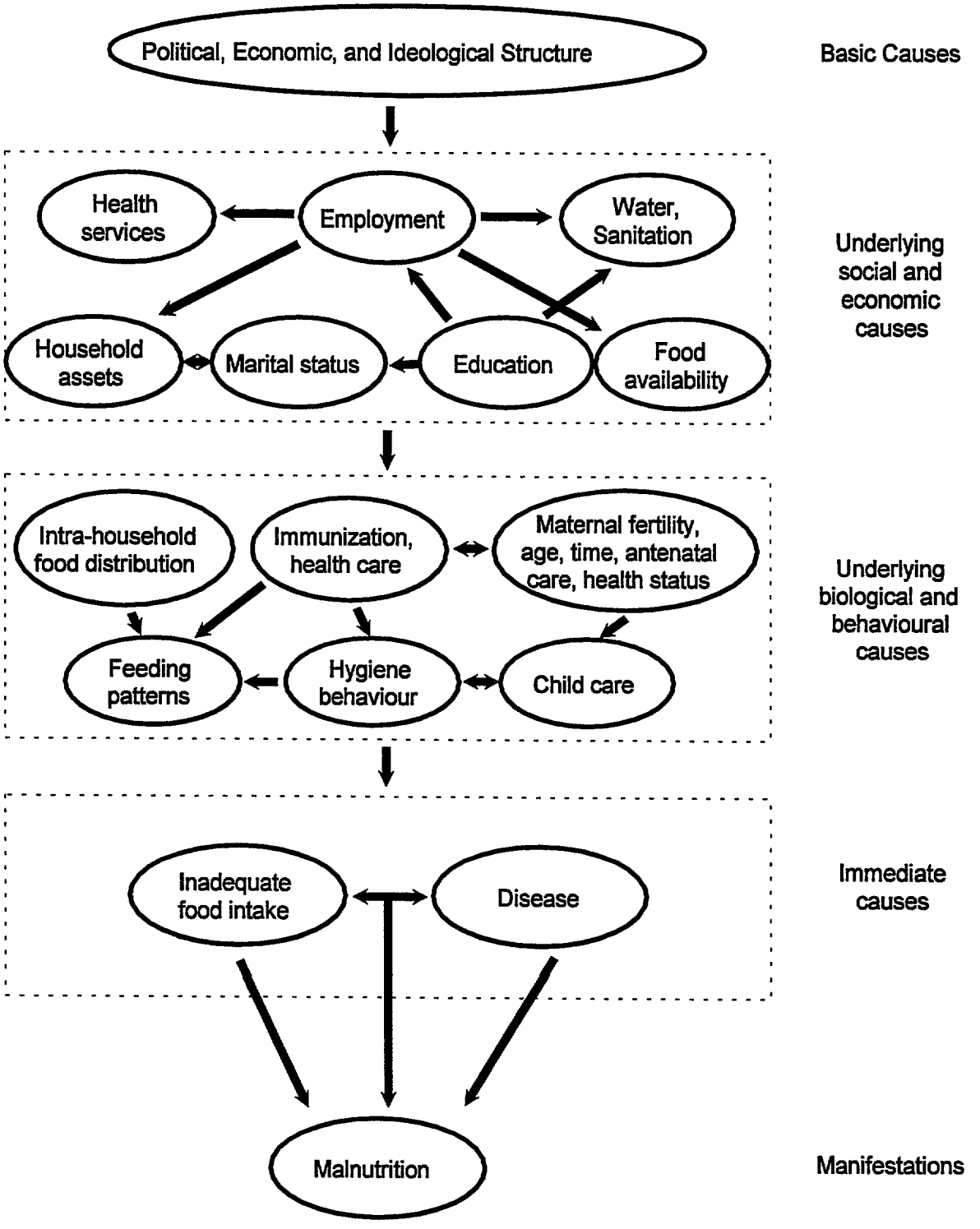
Figure 2.1
Causes of Malnutrition



Adapted from UNICEF 1990

Both inadequate intake of food and disease reflect underlying social and economic conditions at the household, community and national level. Figure 2.1 adapted from the UNICEF conceptual framework (UNICEF, 1990; Jonsson, 1995) reflects the relationships among variables and mechanisms that lead to childhood malnutrition. Political, socioeconomic, environmental and cultural factors operating at the national and community levels, and poverty at the household level, ultimately affect the nutritional status of children. For example, employment, by providing a source of income, is an important determinant of household food security; female employment, in particular, which offers women opportunities for resource control, has been shown to result in increased food availability, improved child care practices and improved nutritional status (NCC/UNICEF, 1996). Similarly, maternal education, through its association with the biological and behavioural causes of malnutrition, such as inter-household food distribution, child care practices, feeding behaviours and patterns, and food handling procedures, is a powerful predictor of child nutritional status and fertility (Moore, 1990). However, social or cultural norms, or the economic situation in a country may work against greater women's education and employment.

In communities that have little access to health care, children are more vulnerable to malnutrition as a consequence of low immunization rates, poor antenatal care, and inadequate treatment of common childhood diseases. Poor sanitation also puts children at increased risk of infection from the ingestion of contaminated food and water (Esrey et al., 1985; Haggerty et al., 1994).

2.2 Basic Indicators of Nutritional Status

The assessment of nutritional status is based on the concept that in a well-nourished population the distribution of children's height and weight, for a given age, will approximate a normal distribution. This means that about 68 percent of children will have a height or weight within 1 standard deviation of the median for that age. About 14 percent of children will have a height or weight within 1 or 2 standard deviations of the median for that age. Of the remainder, 2 percent will have a height or weight less than 2 standard deviations from the median of that age. Because all populations have similar genetic potential for growth (Habicht et al., 1974), the U.S. National Center for Health Statistics (NCHS) Reference Data are recommended by WHO (1979) to be used in the evaluation of nutritional status.

Three indicators using measures of height and weight in combination with age are commonly used to determine nutritional status in infants and children.

Stunting, defined as height-for-age more than two standard deviations below (-2 SD) the median of the NCHS reference population, is the failure to grow adequately in height in relation to age. It reflects past or chronic malnutrition and results from inadequate food intake over a long period of time and/or repeated episodes of illness, particularly diarrhoea.

Wasting, defined as weight-for-height more than two standard deviations below (-2 SD) the median of the NCHS reference population, is the failure to gain weight adequately in relation to height and reflects recent or acute malnutrition. Wasting results from a recent shortage of adequate nutrition and/or recent or current acute illness, especially diarrhoea.

Underweight, defined as weight-for-age more than two standard deviations below (-2 SD) the median of the NCHS reference population, is a composite indicator that reflects either chronic or acute malnutrition status or both. It does not add additional information beyond that provided by the indicators of stunting and wasting, however, it is often used as a general indicator of a population's health status.

Children who are below -2 SD but not below -3 SD are considered moderately malnourished, whereas children who are below -3 SD are considered severely malnourished.

Although a child may be both stunted and wasted, these two indicators often reflect different aetiologies and consequences, and hence, have some different implications for programmatic action. Appendix C discusses some aspects of the quality of nutrition data from the 1995/96 MDHS.

2.3 Data and Methodology

The 1995/96 Mali DHS includes 6,019 children under the age of 3 years. Of these, 5,237 children were living at the time of the survey and were thus eligible for anthropometric data collection. Complete anthropometric data are available for 4,678 children, 89.3 percent of living children under age 3 years sampled in the MDHS. Data are unavailable for the excluded children for the following reasons: 4 percent of the eligible children were not measured (height and/or weight) either because they were sick, not present or refused, or the mother refused; for 6 percent of eligible children the weight and/or height measurements are biologically improbable (due to reporting errors, or due to measurement errors, particularly for the youngest children whom it is often difficult to measure accurately); for 0.5 percent of eligible children, data on age in months is either missing or incomplete and therefore height-for-age and weight-for-age cannot be calculated (Coulibaly et al., 1996:150).

The tables, figures and analyses in chapters 2 to 5 of this report are based on the 4,678 living children for whom complete anthropometric data are available, unless otherwise noted in the table concerned. All analyses in this report are done using SPSS for Windows, Version 6.1.3, and figures are made using Harvard Graphics, Version 3.0. For bivariate tables, p-values are determined using chi-square tests from cross-tabulations; logistic regression analyses are conducted using a forward step-wise likelihood ratio method (Appendix G describes logistic regression methodology in more detail).

2.4 Gestational Age and Birth Weight

Only one percent of children are reported to have been delivered by caesarean section (Table 2.1). Mothers were able to report birth weights for only 22 percent of children. The mean birth weight for these children is 3.1±0.02 kg, which is slightly lower to the NCHS median of 3.3 kg (WHO, 1979). Among those children weighed at birth, the incidence of low birth weight is 13.6 percent. However, since this incidence is based on less than a quarter of all births, it must be interpreted with caution. Mother's perceptions of their infants size match the low reported incidence of low birth weight: slightly over 14 percent of the infants were perceived by their mothers to be small at birth (Table 2.1). Assuming that a mother's perception of having a small infant may influence her feeding and care behaviours, maternal perceptions of small size, as well as actual size, are both important to consider in examining the factors associated with malnutrition.

Table 2.1 Type of delivery, birth weight and size at birth

Among children under three years, the percentage of children delivered by caesarean section, the percentage weighed at birth, mean birth weight, the percentage of low birth weight (LBW) births and the percentage of births that were of average size or larger, or small, at birth, Mali 1995/96

Characteristic	Percentage	Denominator
Caesarean section[1]	1.0	4,642
Weighed at birth[1]	22.4	4,674
Mean weight (kg) and (SD)[2]	3.1 (.02)	1,049
LBW[2]	13.6	1,049
Size at birth[1]		
Small	14.1	4,629
Average+	85.9	4,629

[1] Denominators vary due to missing cases.
[2] Based on total number of children weighed at birth.
LBW = Low birth weight (less than 2.5 kg).

Significant regional differences in the proportion of newborns who were weighed at birth were reported (Table 2.2). The highest proportion was in Bamako town, the most developed and urban part of the country, where 79 percent of mothers could report birth weights. In contrast, in Segou region and Mopti region only around 11 percent of newborns were weighed at birth. Similarly, close to 60 percent of mothers in urban areas could report weight compared with less than 10 percent of rural mothers. Slightly more male than female children were weighed at birth.

The incidence of low birth weight among those infants weighed at birth did not differ significantly between rural and urban areas or between male and female children. Bamako town had the lowest regional proportion of low birth weight births at 11 percent, and Kayes region, the most remote and poor of the regions, had the highest proportion of low birth weights at 20 percent. However, differences among the regions were not statistically significant. Slightly more rural than urban mothers perceived their infants to be "small" at birth, and a higher proportion of female than male infants were perceived to be small at birth. About half the mothers in the Timbuktu/Gao urban areas perceived their infants to be small at birth, compared with only 8 to 9 percent of mothers in Sikasso region and Bamako town.

Table 2.2 Birth weight and size at birth for children under three years

Among children under three years, the percentage weighed at birth, mean birth weight, the percentage of low birth weight (LBW) births, and the percent distribution of births that were of average size or larger, or small by residence, region, and sex of the child, Mali 1995-1996.

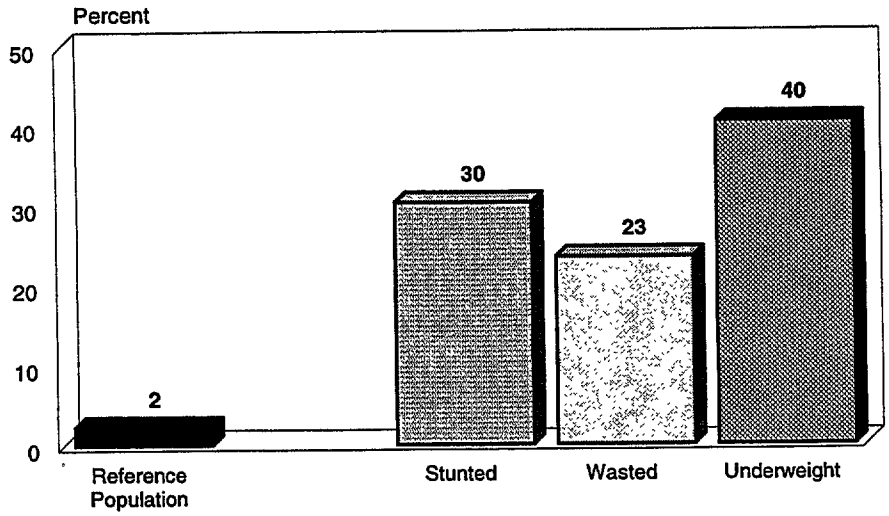
Residence, region and sex	Weighed at birth	Mean weight (kg) and (SD)	LBW[1] births	Size at birth		
				Average+	Small	Total
Residence						
Rural	9.4	3.1 (.04)	14.2	85.7	14.3	100.0
Urban	58.8	3.1 (.03)	13.4	86.4	13.6	100.0
	p<0.0001			p<0.05		
Region						
Kayes	19.7	3.0 (.06)	20.3	82.1	17.9	100.0
Koulikoro	18.7	3.1 (.06)	13.7	86.0	14.0	100.0
Sikasso	18.1	3.1 (.05)	11.7	91.6	8.4	100.0
Segou	11.2	3.1 (.08)	16.3	84.5	15.5	100.0
Mopti	11.4	3.2 (.08)	13.3	83.7	16.3	100.0
Timbuktu/Gao	18.6	3.0 (.18)	16.5	46.9	53.1	100.0
Bamako	79.3	3.2 (.04)	11.5	91.2	8.8	100.0
	p<0.0001			p<0.0001		
Sex						
Female	21.7	3.1 (.03)	14.7	84.5	15.5	100.0
Male	23.3	3.2 (.03)	12.7	87.3	12.7	100.0
	NS			p<0.01		
Total	22.4	3.1 (.02)	13.6	85.9	14.1	100.0
Number[2]	4,674	1,049	1,049	4,629	4,629	

Note: Level of significance determined using Chi-square test
NS=Not significant (p<0.1)
[1] Low birth weight (less than 2.5 kg)
[2] Totals vary due to missing cases

2.5 Prevalence of Malnutrition

The prevalence of malnutrition in Mali is high, with 30 percent of children 0 to 35 months of age being stunted, and 23 percent being wasted (Figure 2.2). In other words, almost one-third of Malian children are too short and almost one-quarter are too thin. These are 15 and 11 times, respectively, the levels that would be expected in a healthy, well-nourished population. In addition, 40 percent of children are underweight for their age, 20 times the level expected in a healthy, well-nourished population. Other results from surveys undertaken in various agro-ecological zones confirm these high levels of malnutrition, thus denoting a troubling situation (EBC 1988-1989, EMCES 1994).

Figure 2.2 Malnutrition among Children under Three Years, Mali



Note: *Stunted* reflects chronic malnutrition; *wasted* reflects acute malnutrition; *underweight* reflects chronic or acute malnutrition, or a combination of both.

Source: MDHS 1995/96

Of the children who are stunted, almost half are severely stunted (i.e., below -3 SD from the reference median) (Table 2.3). Thus, severe stunting affects 14.5 percent of all Malian children. Likewise, over one quarter of the wasted children (and 6 percent of all the children) are severely wasted (Table 2.3). In a healthy, well-nourished population only 0.13 percent of children are expected to be severely malnourished. Thus, the level of severe stunting in Mali is 112 times that expected in a healthy, well nourished population and severe wasting is 46 times healthy levels.

2.6 Geographic Variations in Malnutrition

There are noticeable and significant regional differences in the proportion of children suffering from malnutrition; however, these patterns are different for stunting and for wasting (Figure 2.3 and Table 2.3). The highest prevalence of stunting (Figure 2.3) is in the remote enclosed Kayes region (34 percent) and the lowest in Bamako town (17 percent). On the other hand, wasting is higher in Bamako town (28 percent) than in any other region. Certain sections of the population in Bamako town live in very poor economic and environmental conditions, and these groups may contribute to the high levels of wasting in this region. Bamako town has by far the lowest level of severe stunting (5 percent) but the second highest level of severe wasting (7 percent) in the country (Table 2.3).

Urban-rural differences are significant for stunting, though not for wasting (Figure 2.4). Eleven percent fewer urban than rural children are stunted (22 versus 33 percent). However, severe stunting and wasting are both higher in rural than in urban areas (Table 2.3).

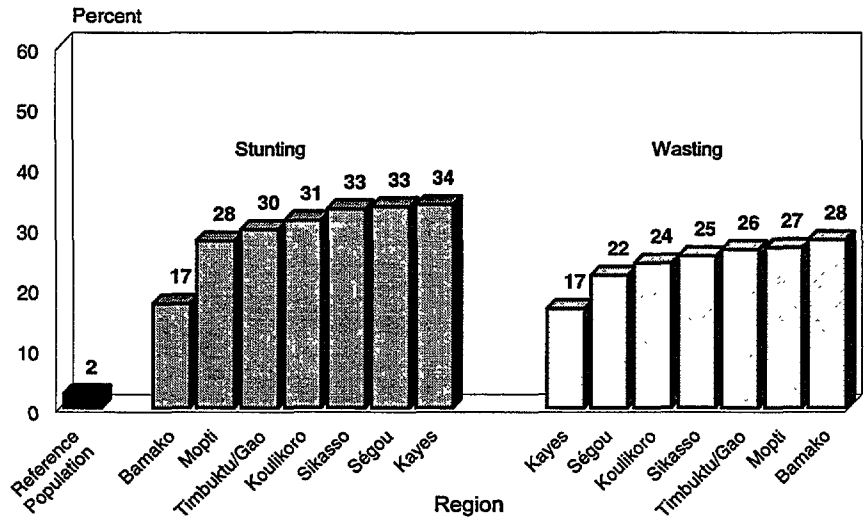
Table 2.3 Moderate and severe stunting and wasting, by residence and region

Among children under three years, the percent moderately undernourished and severely undernourished, by region and residence, Mali 1995/96.

Residence and region	Wasting			Stunting		
	Moderate[1]	Severe[2]	Number	Moderate[1]	Severe[2]	Number
Residence						
Rural	16.5	16.6	3,443	16.8	6.5	3,443
Urban	13.1	8.7	1,235	17.9	5.5	1,235
		p<0.0001				
Region						
Kayes	16.8	16.4	687	13.2	3.2	687
Koulikoro	16.6	14.1	833	17.2	6.3	833
Sikasso	17.1	16.0	1,003	18.6	6.0	1,003
Segou	15.3	17.7	880	15.6	6.1	880
Mopti	13.5	14.1	714	17.3	9.3	714
Timbuktu/Gao	20.2	9.4	79	19.5	6.5	79
Bamako	12.0	5.1	483	21.3	6.7	483
		p<0.0001			p<0.0001	
Total	15.6	14.5	4,678	17.1	6.2	4,678

Note: Level of significance determined using Chi-square test
[1] Between -2 and -3 standard deviations from the median of the NCHS/WHO/CDC reference population
[2] Below -3 standard deviations from the median of the NCHS/WHO/CDC reference population

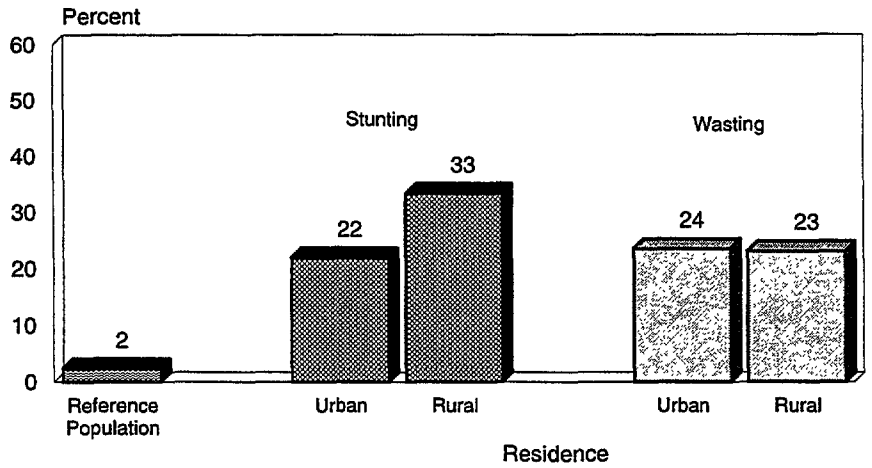
Figure 2.3 Stunting and Wasting among Children under Three Years by Region, Mali



Note: *Stunting* reflects chronic malnutrition.
Wasting reflects acute malnutrition.

Source: MDHS 1995/96

Figure 2.4 Stunting and Wasting among Children under Three Years by Residence, Mali



Note: *Stunting* reflects chronic malnutrition.
Wasting reflects acute malnutrition.

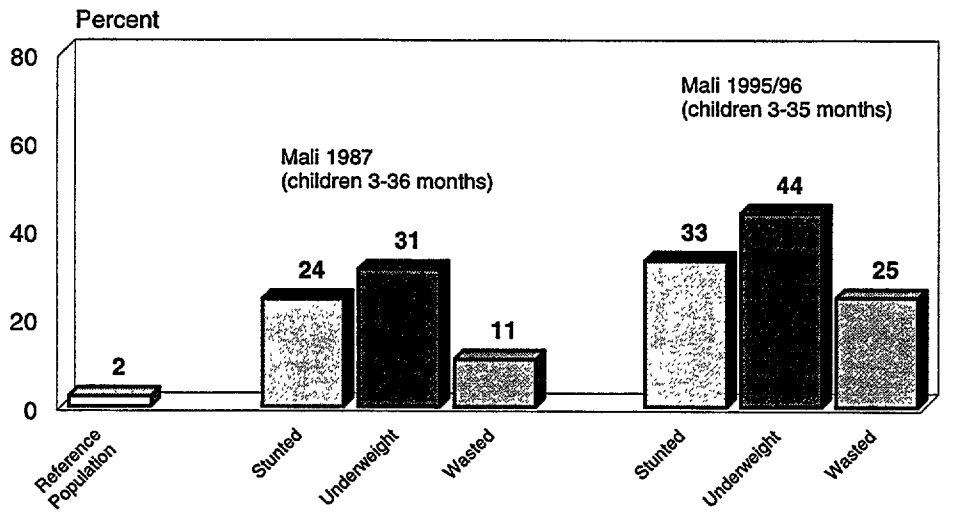
Source: MDHS 1995/96

2.7 Changes in Malnutrition Since 1987

An uncontrolled comparison between the 1987 MDHS and the 1995/96 MDHS suggests that the nutrition situation in Mali has worsened markedly since the 1987 MDHS (Figure 2.5). Between 1987 and 1995/96, among children between 3 to 35 months of age, the proportion stunted appears to have increased by 38 percent, the proportion wasted appears to have doubled, and the proportion underweight may have increased by 42 percent. However, an important consideration in survey data analysis—and in comparing data sets—is the impact of missing data on the results. If the distribution of key characteristics among the missing cases resembles those still in the sample, the loss of these cases may not seriously bias the findings. If, however, the missing cases differ systematically from those that were included in the analysis, cases included in the sample can not be considered representative of the study population. This issue is of particular concern for the child anthropometric data from the 1987 Mali DHS, and hence for comparisons between the 1987 and the 1995/96 Mali DHS surveys.

Of the 1687 children under 4 years who were included in the 1987 MDHS survey, complete weight, height and age data were obtained for only 925 children (55 percent, Table 2.4). Most missing cases lacked information on the child's age. Table 2.4 shows the nonresponse bias in the 1987 Mali children's sample: the included children were younger, had parents who were more highly educated, and were more often urban dwellers than the missing children. Additionally, children included in the analysis resided more often in Mopti, Gao, Timbuktu and Bamako, and less often in Sikasso and Segou, than missing children. Thus, unlike the 1995/96 MDHS sample (see Appendix C), the 1987 MDHS sample is not strictly representative of the population. Taking these results into consideration, it is difficult to compare the results of the 1987 MDHS with those from the 1995/96 MDHS, and any comparisons should be made cautiously. Moreover, if one assumes that parental educational attainment and residence are reliable proxies for socioeconomic status, the distribution of characteristics in Table 2.4 suggests that the rates of malnutrition may have been under estimated in the 1987 MDHS since rural children of less educated parents were under-represented.

Figure 2.5 Changes in Malnutrition Rates among Children 3 Months to 3 Years of Age, Mali 1987 to 1995



Note: *Stunted* reflects chronic malnutrition; *wasted* reflects acute malnutrition; *underweight* reflects chronic or acute malnutrition, or a combination of both.

Source: MDHS 1987 and 1995/96

While a direct comparison of results between the two surveys is problematic, it is probable that the nutrition situation in Mali has deteriorated, although the magnitude of this decline is uncertain. At best, the situation has remained static, but even this would be cause for concern, given the improvements in other social, health and economic indicators over the past decade.

An explanation of the likely decline in children's nutritional status requires close examination of many factors associated with child health and nutrition, some of which are beyond the scope of this report. One factor that can be ruled out is difference in season of data collection: the 1995-96 survey was conducted during months usually considered more food secure (November through April) compared with the 1987 survey (conducted from March through August), indicating that any difference in the season of data collection is not the cause of this increase in malnutrition. In addition, there has been little change in the methodology of anthropometric data collection between the two surveys. A partial explanation may lie in the decrease in under-five mortality from 292 per 1,000 births in 1984 to 238 per 1,000 in 1995/96. In effect, it may be that the additional children surviving as a result of a drop in the death rate are more likely to be malnourished than other children.

However, this probably only explains a small portion of the change in malnutrition levels. More broadly, economic and agricultural long-term factors may be contributing to declines in children's nutritional status and available economic, agricultural and health service utilization data need to be studied in depth in order to better understand the situation and to identify appropriate interventions.

2.8 Malnutrition according to Age

There is a clear age-specific pattern of stunting and wasting (Figure 2.6). The proportion of children stunted rises gradually from 0 to 21 months of age, at which time it peaks at about 55 percent. It then drops

somewhat between 22 and 27 months of age (possibly due to an artifact inherent in the reference standard), then rises again to over 50 percent through the remainder of the third year. Wasting follows a different pattern, illustrating the difference in etiology between stunting and wasting. The proportion of children wasted rises rapidly from about 3 to 14 months of age when it peaks at about 40 percent of children. Thereafter the proportion of children wasted starts to decline, with about a third of children wasted by the time they are 21 months old, and 20 percent wasted in the third year of life. However, in the first month of life, already 15 percent of newborn infants are wasted, suggesting that the rate of low birth weight is high, and that mothers may not be in an optimal state of health during pregnancy. The proportion of children underweight increases rapidly from 3 to 14 months of age, peaking at about 55 percent and remaining at essentially this high level through the second and third years of life.

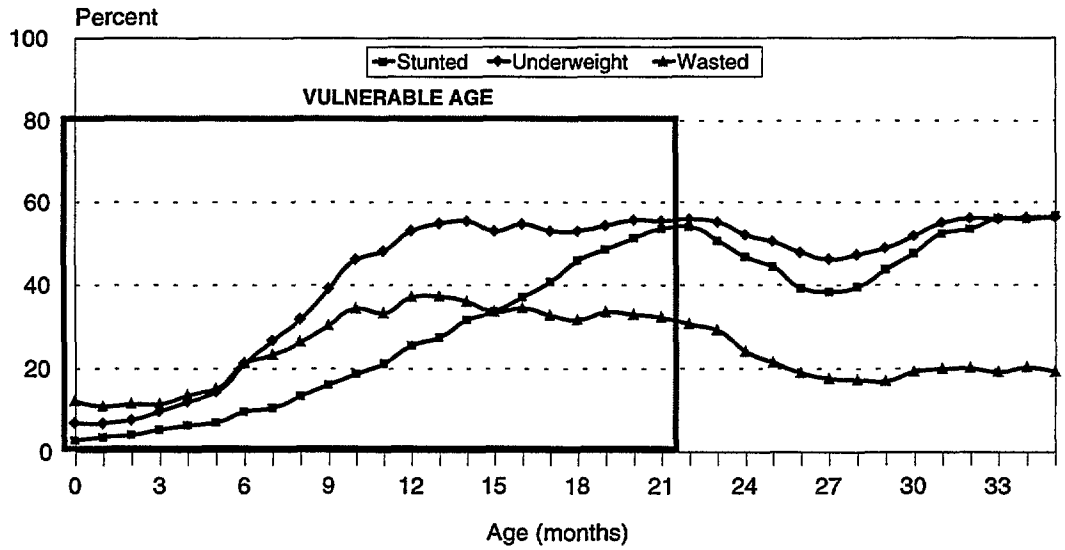
Although chronic malnutrition, as reflected by the prevalence of stunting, affects larger numbers of children in Mali than acute malnutrition, the level of acute malnutrition is alarmingly high. At 23 percent, the level of wasting in Mali represents the highest level of wasting recorded among sub-Saharan countries that have DHS surveys. Among children age 12 to 24 months, one third are wasted; after age 24 months, the proportion wasted is lower. About 30 percent of all children under the age of 3 and 42 percent between 12 to 24 months are stunted, and this proportion is higher for older ages. These data indicate that infants and toddlers in the first two years of life are the most vulnerable to wasting, and highly vulnerable to stunting.

Inadequate dietary intake and illness experienced during infancy and the second year of life clearly results in long-term growth failure, manifested by the sustained high level of stunting in the third and fourth years of life. Because these are cross-sectional data, it cannot be determined if the prevalence of stunting continues to increase or merely reflects the deficits acquired during the first two years of life. Longitudinal data from other studies, however, would suggest that the proportion of children aged 3 and 4 years who are stunted reflects deficits acquired during their first two years (Lutter et al., 1989). Thus, the first 2 years of life are a critical period for interventions to improve nutritional status.

Table 2.4 Percentage distribution of children under 4 years by selected background characteristics, according to sample status in the Mali 1987 DHS Survey

Background characteristic	Sample status in 1987 survey		Percent included
	Included	Missing	
Child's age (months)			
0-5	15.7	8.5	6.9
6-11	26.1	17.3	6.5
12-17	19.4	15.2	61
18-23	15.0	16.0	53
24-29	11.0	17.4	43
30-35	11.0	23.6	36
36-47	1.8	2.0	52
Child's gender			
Male	52.5	50.1	56
Female	47.5	49.9	54
Mother's age (years)			
15-19	10.9	9.1	59
20-24	20.5	19.3	56
25-29	28.2	27.2	56
30-34	21.2	20.6	56
35-49	19.2	23.8	49
Mother's education			
No education	80.6	90.5	52
Primary	18.2	9.2	70
Secondary+	1.2	0.3	80
Husband's education			
No education	75.7	90.8	50
Primary	13.1	3.3	83
Secondary+	5.2	0.5	92
Don't know	6.0	5.0	60
Residence			
Urban	33.6	15.9	72
Rural	66.4	84.1	49
Region			
Kayes, Koulikoro	30.2	32.0	53
Sikasso, Segou	34.4	53.5	44
Mopti, Gao, Timbuktu	24.3	9.0	77
Bamako	11.1	5.5	71
Toilet facilities			
No facilities	25.2	27.7	52
Latrine	69.8	68.9	55
Flush	0.4	0.1	75
Other	4.7	3.3	63
Total	100.0	100.0	54.8
Number of children	925	762	1,687

Figure 2.6 Stunting, Underweight and Wasting by Age, Mali



Note: *Stunted* reflects chronic malnutrition; *wasted* reflects acute malnutrition; *underweight* reflects chronic or acute malnutrition, or a combination of both.

Source: MDHS 1995/96

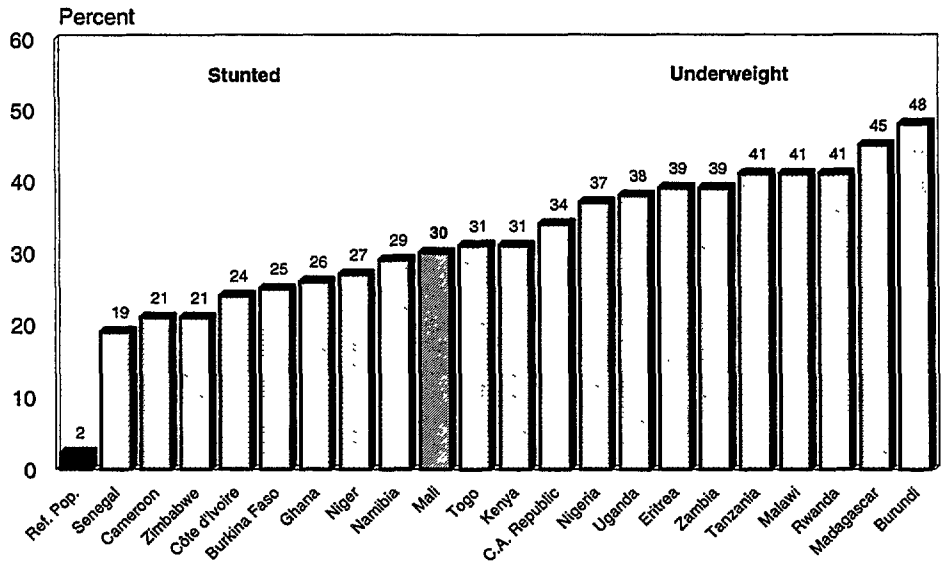
2.9 Malnutrition among Children under Age 3 in Mali Compared with Other Sub-Saharan Countries

Comparison of nutritional status among sub-Saharan countries must be done with caution as the season in which anthropometric data are collected can greatly affect the proportion of children categorized as malnourished. Underweight and wasting would be especially vulnerable to this limitation; stunting would be less affected. Among children under 3 years in the sub-Saharan countries surveyed, the proportion stunted ranges from 19 percent in Senegal to 48 percent in Burundi (Figure 2.7). Mali falls in the middle of this range, with about 30 percent of children stunted. However, Mali has among the highest percentages of underweight children in sub-Saharan Africa, with 44 percent of children under the age of 3 being underweight. Cameroon has the lowest, at 14 percent, while in most other countries the percentage underweight falls between 24 and 32 percent.

2.10 Summary

In Mali, infant and child malnutrition constitutes one of the most significant public health problems. The prevalence of Protein Energy Malnutrition (PEM) is very high. Approximately 23 percent of children 0-35 months are wasted. This level of wasting is the highest ever recorded in the countries of sub-Saharan Africa which have undertaken a DHS survey. The proportion of wasted children is already very high from the first month of age (15 percent). This is accounted for, in part, by very high prevalence of low birth weight (LBW). In fact, in certain regions of the country, 20 percent of newborns exhibit a birth weight of less than 2.5 kg. Moreover, 30 percent of children 0-35 months are stunted. In other words, practically one in three Malian children is too small for his/her age.

Figure 2.7 Malnutrition (stunting) among Children under 3 Years of Age in Mali Compared with Other Sub-Saharan Countries



Note: *Stunting* reflects chronic malnutrition; *underweight* refelcts chronic or acute malnutrition, or a combination of both.

Source: DHS Surveys 1986-1995

Finally, 40 percent of children 0-35 months are underweight, which is 20 times greater than expected in a healthy and well nourished population.

The proportion of children suffering from PEM differs significantly by region, with various trends in wasting and stunting. Thus, the Bamako region manifests the highest wasting prevalence (28 percent) but the lowest stunting prevalence (17 percent). In rural areas, the nutritional status of children is far more deficient than in urban areas, but in all cases the highest stunting prevalence occur among the children of poor low income populations.

2.11 Recommendations

General recommendations for improving the nutritional status of children in Mali are as follows:

- Train trainers in nutrition and increase the number of nutritionists in the services concerned.
- Obtain the cooperation of social and health personnel in promoting international recommendations on breastfeeding and dietary practices for young children.
- Reinforce the nutrition component of the PMA (Minimum Package of Activities).

CHAPTER 3

INFANT AND CHILD FEEDING PRACTICES

3.1 Optimal Infant and Child Feeding Practices

Infant and child feeding practices are important predictors of child nutritional status and hence the prevalence of malnutrition. In this chapter, optimal infant feeding practices are described and compared with infant feeding practices in Mali.

Optimal infant feeding is defined by WHO and UNICEF as follows (WHO/UNICEF, 1990; WHO, 1994):

- Initiation of breastfeeding within about one hour of birth;
- On-demand and frequent feeding (including night feeds);
- Exclusive breastfeeding (defined as breast milk only and no other foods or liquids) until the infant is about 6 months of age;
- Breastfeeding complemented with hygienically prepared appropriate local weaning foods at about 6 months of age;
- Increased breastfeeding during illness and recovery
- Continued breastfeeding well into the second year of life and beyond.

Early initiation of breastfeeding is important in that it fosters mother-infant bonding and takes advantage of the newborn's intense sucking reflex and alertness immediately postpartum, which permits the newborn to benefit within the first hour of life from the nutritional, anti-bacterial, and anti-viral properties of colostrum (Righard and Alade, 1990). Early initiation of breastfeeding also stimulates breast milk production and causes the uterus to retract, which can reduce postpartum blood loss. Delayed initiation of breastfeeding often results in the newborn being provided with another source of nourishment, often liquids and foods, which can introduce infection and delay lactogenesis (milk arrival) (Perez-Escamilla et al., 1996).

Frequent, on-demand breastfeeding, including night feeds, is important to ensure both that an infant receives sufficient breast milk and that the supply of breast milk is maintained. Frequent feedings can also help to prevent the problem of engorgement. On-demand feeding is important to ensure that newborns regain their birth weight (de Carvalho et al., 1983). Infants should be breastfed 8 to 10 times every 24 hours and during the first month of life even more frequently.

Exclusive breastfeeding, defined as breast milk as the only source of infant food or liquid, meets nutritional requirements (Cohen et al., 1994), satisfies fluid needs even in hot and humid climates (Sachdev et al., 1991), and protects against illness (Huffman and Combest, 1990) for about the first six months of life. Exclusively breastfed infants are 14 times less likely to die from diarrhoea compared with formula fed infants and 4 times less likely to die compared with partially breastfed infants (Victora et al., 1987). Thus, exclusive breastfeeding is the infant feeding behaviour most predictive of infant survival.

At about 6 months of age, breast milk alone will no longer satisfy the energy and protein requirements of most infants. Local foods that are rich in energy, protein, and micronutrients, hygienically prepared, and soft to eat need to be provided. During this transitional period when complementary foods are being introduced, on-demand and frequent breastfeeding should continue to ensure that infants receive all the benefits of breastfeeding. Increased diarrhoeal morbidity, which is often associated with the introduction of other foods and liquids, can be prevented with proper hygiene in the preparation and storage of the foods and liquids given to a child.

Increased breastfeeding during illness and recovery is important to reduce the risk of inadequate nutrient intake during illness, to prevent dehydration, and to promote catch-up growth. Dietary intake of all foods, except breast milk, is reduced during illness (Hoyle et al., 1980; Brown et al., 1990; Dickin et al., 1990). Thus, breastfeeding, by providing a continual source of high quality and hygienic food, plays a critical role in the maintenance of infant and child nutritional status in and around periods of illness.

Both WHO and UNICEF recommend that because of its many nutritional and immunological benefits breastfeeding should continue into the second year of life and beyond. Breastfeeding beyond about 6 months of age should be complemented with energy and other nutrient dense weaning foods.

3.2 Initiation of Breastfeeding

In Mali, virtually all women (over 99 percent) initiate breastfeeding (Table 3.1). However, a third of newborns are not put to the breast before the second day of life; 88 percent receive other liquids or even solid food before their fourth month and more than two-thirds of children 6 to 9 months do not receive complementary foods to breast milk. This behaviour is contrary to the WHO recommendations for the feeding of young children and puts their nutritional status and health in danger. Late initial breastfeeding deprives the newborn of the benefits of colostrum; in addition, it encourages administration of other liquids and exposes the infant to pathogens. At about 6 months, mother's milk alone does not cover all the infant's needs for energy, proteins and micronutrients.

No differences in breastfeeding initiation were found by region, residence, mother's occupation, possession score (an indicator of socio-economic status), source of antenatal care or single/twin birth were found. Statistically significant differences were found by maternal age and type of assistance at delivery. Women between 30-34 years of age were slightly less likely to breastfeed than other women; however, there was no other obvious pattern in breastfeeding initiation across maternal age, and more than 99 percent of women had breastfed, regardless of age. Women assisted at delivery by a doctor were at least 3 percent less likely to breastfeed compared to women assisted by a nurse, traditional birth attendant (TBA), relative or no one.

Although virtually all women initiate breastfeeding, the recommended practice of initiating breastfeeding within the first hour after giving birth occurs in less than 10 percent of all births (Table 3.1). More serious is the practice of delaying initiation of breastfeeding for more than 24 hours, which was reported for slightly over one-third of children under the age of 3 years (table 3.1). Regional differences are large: almost three quarters of children under 3 in Kayes region were breastfed only after their first 24 hours of life, compared to Bamako town, where all but 15 percent of children were breastfed within 24 hours. Similarly, almost twice as many rural than urban children were breastfed late (40 percent compared to 22 percent). Children whose mothers worked in agriculture or manual labour, as well as mothers from households with low possession scores are more likely to be breastfed after 24 hours compared to children whose mothers are in professional occupations or come from households with a high possession score. This would suggest that poorer women are more likely to delay breastfeeding initiation compared to better-off women. However, women assisted at delivery by a doctor, or who receive antenatal care from a doctor are more likely to delay breastfeeding beyond 24 hours (50 and 43 percent, respectively) than are women who are assisted at delivery or who receive antenatal care from other sources, particularly a nurse (22 and 32 percent, respectively). This result suggests that women who receive antenatal care or delivery assistance from doctors, and doctors themselves, need to be the target of focused breastfeeding education messages.

Table 3.1 Initial Breastfeeding

Percentage of children under three years who were ever breastfed and the percentage who started breastfeeding within one hour, within 24 hours, and after 24 hours or more, by selected background characteristics, Mali 1995/96

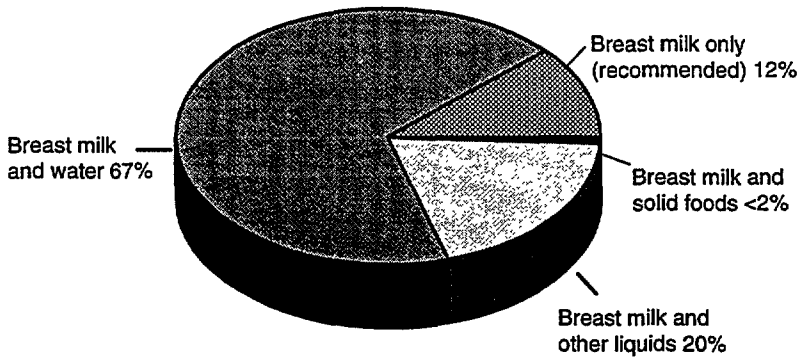
Background characteristic	Ever breastfed	Started breastfeeding: First 1 hour	First 24 hours	After 24 hours	Total	Number of children[1]
Residence						
Rural	99.7	8.8	51.0	40.1	100.0	3,430
Urban	99.7	11.3	66.3	22.4	100.0	1,231
	NS		p<0.0001			
Region						
Bamako	99.8	13.6	71.6	14.9	100.0	482
Koulikoro	99.7	6.1	52.4	41.4	100.0	829
Sikasso	99.8	16.2	52.4	31.4	100.0	1,001
Segou	99.6	3.5	71.1	25.4	100.0	875
Mopti	99.8	15.9	57.3	26.8	100.0	711
Timbuktu/Gao	99.7	9.3	54.5	36.2	100.0	79
Kayes	99.7	2.0	27.8	70.2	100.0	685
	NS		p<0.0001			
Mother's age						
15-19 yrs	100.0	9.6	51.9	38.6	100.0	470
20-24 yrs	99.5	9.2	54.4	36.4	100.0	1,058
25-29 yrs	100.0	9.9	55.3	34.8	100.0	1,164
30-34 yrs	99.4	10.8	57.7	31.5	100.0	936
35-49 yrs	99.7	8.2	54.6	37.2	100.0	1,034
	p<0.1		NS			
Mother's occupation						
Not working	99.7	7.9	61.0	31.1	100.0	2,112
Professional[2]	99.6	9.6	61.1	29.3	100.0	1,049
Agriculture[3]	99.7	11.4	41.2	47.4	100.0	1,063
Manual[4]	99.9	11.6	44.5	43.9	100.0	356
Domestic/Service	100.0	17.0	52.3	30.8	100.0	73
	NS		p<0.0001			
Possession score[5]						
0	99.7	9.8	53.0	37.3	100.0	1,570
1	99.7	8.6	55.0	36.5	100.0	2,565
2+	99.7	13.9	63.1	23.0	100.0	478
	NS		p<0.0001			
Assistance at delivery						
Doctor	96.8	3.6	46.9	49.5	100.0	30
Nurse	99.5	12.1	66.3	21.6	100.0	1,126
TBA[6]	99.8	11.7	47.5	40.8	100.0	983
Relative/other	99.7	6.5	53.0	40.5	100.0	1,951
No one	100.0	11.1	53.1	35.8	100.0	567
	p<0.02		p<0.0001			
Source of prenatal care						
Doctor	100.0	16.1	41.2	42.7	100.0	51
Nurse	99.5	8.5	59.7	31.9	100.0	2,278
Other/no one	99.9	10.4	50.9	38.7	100.0	2,328
	NS		p<0.0001			
Birth status						
Single	99.7	9.6	55.2	35.2	100.0	4,555
Multiple	99.1	4.4	49.6	46.1	100.0	106
	NS		p<0.05			
Total	99.7	9.5	55.0	35.5	100.0	4,661

NS = Not significant
[1] Totals vary due to missing values
[2] Professional, technical, management
[3] Includes self-employed and employed workers
[4] Includes skilled and unskilled
[5] Score of one for availability/ownership of electricity, radio, television or refrigerator. Maximum score of 4.
[6] Traditional birth attendant

3.3 Exclusive Breastfeeding

Exclusive breastfeeding, a behaviour most important to infant health and survival, is also not commonly practised; only 12 percent of all infants less than 4 months of age are exclusively breastfed (Figure 3.1). This low prevalence of exclusive breastfeeding is similar to that found in the 1987 MDHS (10 percent). The provision of only water in addition to breast milk is practised by slightly over two-thirds of women (67 percent), which again is similar to the previous survey (72 percent) (Nestel, Lutter and Rutstein, 1994). Another 20 percent of infants under 4 months of age receive other liquids in addition to breast milk, and less than 2 percent receive any solids with breast milk.

Figure 3.1 Feeding Practices for Infants under 4 Months, Mali



Note: WHO recommends that all infants be breastfed exclusively until they are about 6 months old.

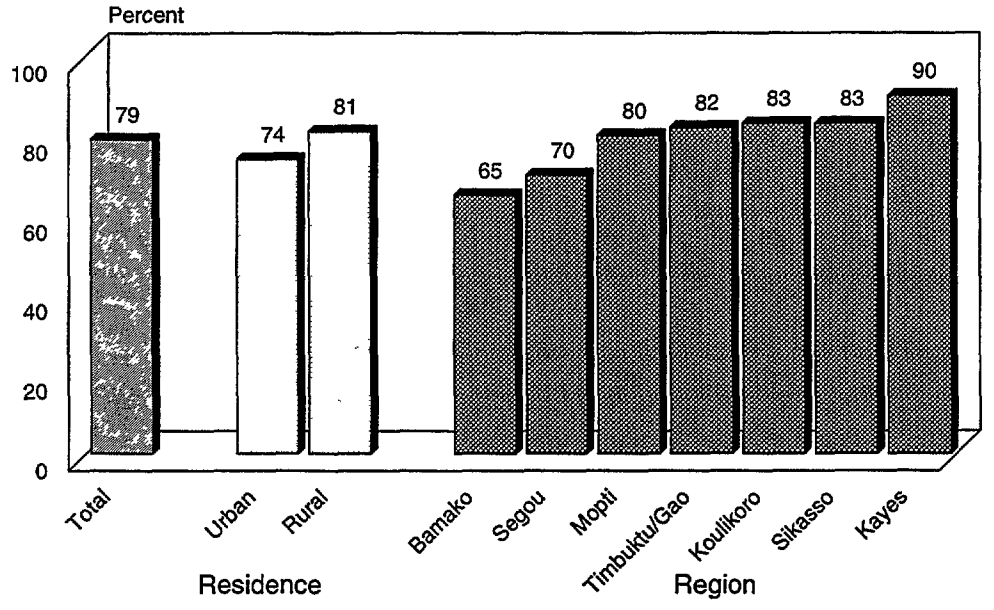
Source: MDHS 1995/96

Because the proportion of infants exclusively breastfed was low, exclusive breastfeeding and breastmilk plus water, which we call "full breastfeeding", are examined in figure 3.2. Full breastfeeding for infants under 4 months of age varies by region and residence. Urban children are less likely to be fully breastfed than are rural children (74 compared to 81 percent), and children in Bamako town (65 percent) and Segou region (70 percent) are less likely to be fully breastfed than are children in other regions. Given that urban children and children from Bamako town and Segou region are more likely to belong to better-off families than rural children or children from other regions, it would appear that while better-off women may initiate breastfeeding earlier than poorer women, they are less likely to fully breastfeed their children in the first place, compared to poorer women.

3.4 Introduction of Complementary Foods

Optimal infant feeding practices include the introduction of complementary foods at about 6 months of age. Therefore, all infants between 6 and 9 months of age should receive complementary foods in addition to breast milk. In Mali, however, less than one third of infants in this age group (31 percent) receive both breast milk and complementary foods (Figure 3.3). Virtually all the others receive either only breast milk, or breast milk and water or other liquids, with no other source of nutrients. Thus, the introduction of

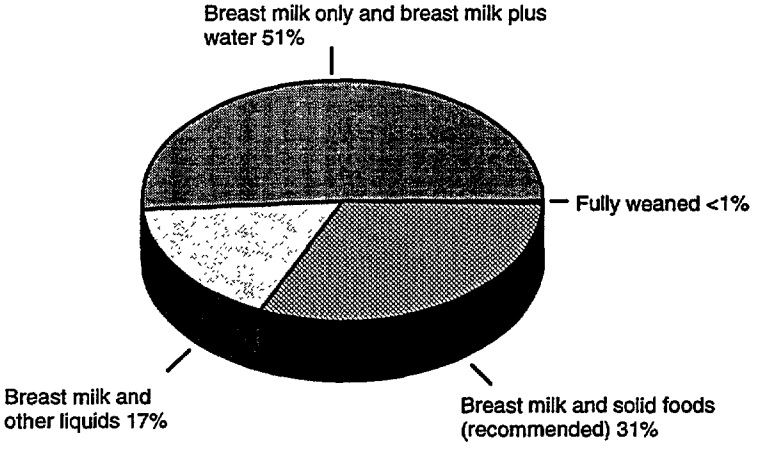
Figure 3.2 Full Breastfeeding among Infants under 4 Months by Residence and Region, Mali



Note: Full breastfeeding includes children exclusively breastfed and those who received water as well as breast milk

Source: MDHS 1995/96

Figure 3.3 Feeding Practices for Infants Age 6 to 9 Months, Mali



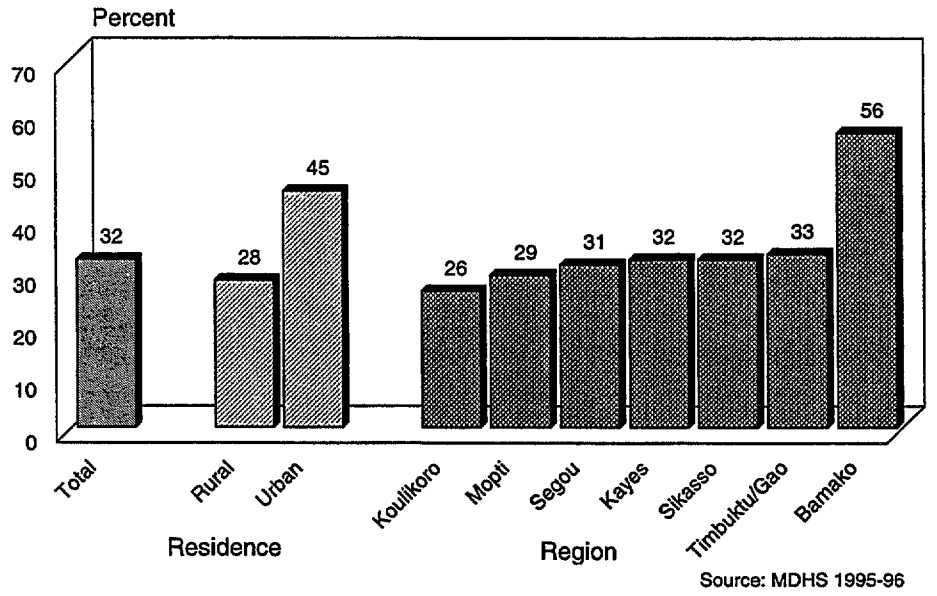
Note: WHO recommends that by the age of 6 months all infants should receive solid foods in addition to breast milk.

Source: MDHS 1995/96

complementary foods, critical at about 6 months because breast milk can no longer satisfy an infant's energy, protein, and micronutrient needs, is seriously delayed for a large proportion of Malian infants.

There are significant regional differences in the introduction of complementary solid foods among infants age 6 to 9 months (Figure 3.4). A much larger proportion of infants in Bamako town (56 percent) receives complementary solid foods between 6 to 9 months of age than in any other region (26 to 33 percent). Similarly, about one and a half times more infants in urban (45 percent) than in rural (28 percent) areas receive complementary solid foods in this age group.

Figure 3.4 Breastfeeding with Complementary Solid Foods among Infants Age 6 to 9 Months, by Residence and Region, Mali



Source: MDHS 1995-96

The kind of complementary food children received in the 24 hours prior to the survey varied by child's age and by whether or not the child was breastfeeding (Table 3.2). Among all children at all ages except the first month of life, more than 90 percent received other liquids in addition to breast milk. The use of infant formula, other milk and solids varied enormously by age and breastfeeding status. Until 10 months of age, less than half of all breastfeeding children received any solids, and very few were given either infant formula or other milk. Among breastfed children, receipt of solids increased rapidly between 9 and 12 months of age. Among children over 12 months of age, fewer breastfeeding than non-breastfeeding children received solids in the 24 hours preceding the survey.

3.5 Bottle Use

Bottle feeding was not common in Mali, with only 3 percent of infants under age 1 year being bottle fed (Table 3.3). However, significant bivariate differences in bottle feeding existed for many background characteristics examined. Bottle feeding was more prevalent among children whose mothers were urban, living in Bamako town, had secondary or higher education, were assisted at delivery by a doctor or nurse, came from households with a high possession score and private drinking water facilities, and had frequent exposure to newspapers; and among children whose fathers had secondary or higher education and were professionals. Bottle feeding was 10 times more likely among multiple births than singleton births.

Table 3.2 Types of foods received by children in preceding 24 hours

Percentage of children under three years who received specific types of food, and the percentage who used a bottle with a nipple, in the 24 hour before the interview, by breastfeeding status and child's age in months, Mali 1995/96

Age (in months)	Infant formula	Other[1] milk	Other[2] liquid	Other[3] solid/ porridge	Used bottle with a nipple
Breastfeeding children					
0-1	2.3	3.1	81.1	0.7	2.3
2-3	3.1	6.1	92.9	2.3	3.8
4-5	4.2	7.2	98.2	9.0	4.2
6-7	5.1	14.0	94.8	22.5	3.8
8-9	5.2	11.9	98.7	43.8	1.2
10-11	5.2	15.0	97.3	65.9	2.6
12-13	5.9	18.1	98.0	84.7	1.1
14-15	6.3	22.8	99.6	90.6	1.7
16-17	7.0	27.3	99.0	90.7	1.9
18-23	4.6	21.5	98.4	90.6	0.5
24-29	3.2	26.6	98.8	93.0	0.0
30-35	2.8	17.0	99.2	91.3	0.0
0-3 months	2.8	5.0	88.3	1.7	3.2
4-6 months	4.2	9.7	96.8	11.1	3.5
7-9 months	5.4	12.4	97.6	38.5	2.8
Total	4.0	8.6	93.8	15.2	3.2
Number (0-9)[4]	1,582	1,584	1,583	1,584	1,580
Number (0-35)[4]	3,303	3,312	3,312	3,311	3,303
Non-breastfeeding children					
12-17 months	24.1	33.9	100.0	92.2	7.8
18-23 months	15.1	30.3	99.9	98.8	5.8
24-29 months	12.1	27.4	99.2	97.8	1.1
30-35 months	7.0	27.8	99.8	99.1	0.5
Total	10.8	28.2	99.6	98.3	1.8
Number (12-35)[4]	1,346	1,357	1,357	1,357	1,355

[1] Powder/tinned milk, fresh milk
[2] Plain water, sugared water, juice, herbal tea, other liquids
[3] Other solid, semi-solid foods, local grains, local tubers, eggs/fish/poultry, meat
[4] Totals vary due to missing cases

Since many of the factors associated with bottle feeding are highly correlated, a logistic regression model was developed to identify the influence on the risk of bottle feeding of each factor independently of all other factors, and to develop a model that best explains bottle feeding risks. A forward step-wise regression procedure was used. This procedure starts with a model that has none of the specified factors in it, and then includes the factors one at a time according to their statistical significance to finally arrive at a model with the combination of factors that best explains the dependent variable, which, in this case, is bottle feeding.

The estimates of relative risk, based on the odds ratios from the regression model, are presented in the third column of Table 3.3. For each factor, one category of the factor serves as the reference category, as indicated by the value of 1. A net relative risk greater than 1 indicates greater risk while a net relative risk less than 1 indicates reduced risk. The magnitude of increased or reduced risk is directly proportional to the net relative risk value. For example, for the factor "assistance at delivery," the reference category is "doctor/nurse" and is assigned a value of 1. The net relative risk of 0.3 for TBA indicates that children whose mothers were assisted at delivery by a TBA have 30 percent the risk of being bottle fed compared with children whose mothers assisted at delivery by a doctor or nurse.

Table 3.3 Prevalence and estimated net relative risk of bottle use

Percentage of children under one year using a bottle and the estimated net relative risk of using a bottle, by selected background characteristics, Mali

Background characteristic	Net bottle use	Relative risk
Region		
Bamako	11.0	
Koulikoro	1.3	
Sikasso	1.5	
Segou	2.1	
Mopti	3.4	
Timbuktu/Gao	5.9	
Kayes	3.3	
	p<.0001	
Residence		
Rural	1.7	
Urban	7.7	
	p<.0001	
Mother's education		
None	1.9	
Primary	4.5	
Secondary+	24.2	
	p<.0001	
Father's education		
None	2.0	
Primary	2.8	
Secondary+	11.1	
Don't know/ missing	9.6	
	p<.0001	
Father's occupation		
Not working	4.9	
Professional[1]	11.8	
Sales	4.9	
Agriculture[2]	1.6	
Other[3]	4.1	
	p<.0001	

Continued

Table 3.3— *Continued*

Background characteristic	Net bottle use	Relative risk
Assistance at delivery		
Doctor/nurse	8.8	1.0[a]
TBA[4]	1.4	0.3[b]
Other[5]	1.2	0.3[b]
No one	3.2	0.7
	p<.0001	
Single birth		
No	21.1	1.0[a]
Yes	2.7	0.1
	p<.0001	
Drinking water source		
Private tap	15.7	
Public tap	6.4	
Other[6]	2.1	
	p<.0001	
Reads newspaper weekly		
No	2.4	1.0[a]
Yes	25.4	2.4
	p<.0001	
Possession score[7]		
0	1.8	1.0[a]
1	2.0	0.8
2+	14.9	3.3[b]
	p<.0001	
Total	3.2	

Note: Regression analysis based on 1,725 children. Level of significance determined using chi-square test. Net relative risk estimates based on odds ratios from logistic forward step-wise regression analysis.

[1] Includes professional, technical, management, clerical
[2] Includes self-employed and employed workers
[3] Includes domestic, services, skilled manual
[4] Traditional birth attendant
[5] Includes relative/friend, other
[6] Includes public and private well, spring, river, pond, lake, dam
[7] Score of one for availability/ownership of electricity, radio, television or refrigerator. Maximum score of 4.
[a] Overall p<.05; for "reads newspaper daily", overall p<.06
[b] p<.05 compared with reference category

After controlling for a variety of socioeconomic and other factors in the multivariate logistic regression, assistance at delivery, multiple/single birth, possession score, and exposure to a newspaper all contributed significantly to the net relative risk of bottle use. Women who received assistance from a TBA or a nurse were significantly less likely to bottle feed compared with those who were assisted by a doctor while giving birth. Multiple births were 10 times more likely to be bottle fed than singleton births. Women who read a newspaper regularly were more than twice as likely, and women from households with a high possession score more than three times as likely to bottle feed than women who did not read a newspaper weekly or women from poorer households. Both newspaper access and possession score point to household wealth being a significant factor in bottle use. That wealthier women are more likely to bottle feed than are

poorer women is also consistent with previous results in this chapter that wealthier women are less likely to fully breastfeed their infants compared with poorer mothers. The health risk that bottle feeding presents for infants of wealthy women cannot be determined here because this model does not fully control for the fact that wealthy women may make use of their greater access to resources to use bottles hygienically. There is, however, the danger that poor women, who do not have access to these resources, may regard bottle feeding as a status symbol and copy this behaviour.

3.6 Duration of Breastfeeding[1]

The median duration of exclusive breastfeeding among all children under 3 years old, or the time for which 50 percent of children receive only breast milk, is only half a month, and did not differ by any of the characteristics examined (Table 3.4). The median duration of full breastfeeding (breast milk only or breast

Table 3.4 Median duration of breastfeeding

Median duration of breastfeeding (in months) among children under three years, by selected background characteristics, Mali 1995/96

	Median duration of breastfeeding (months)				Children under 6 months	
Background characteristic	Any breastfeeding	Exclusive breastfeeding	Full breastfeeding[1]	Number of children under 3 years of age	Percentage breastfed 6+ times in last 24 hours	Number of children
Sex						
Male	21.3	0.5	6.4	2,956	94.4	505
Female	21.9	0.4	7.1	3,063	95.0	547
Residence						
Bamako	20.3	0.4	4.2	617	91.0	119
Other towns	20.8	0.5	6.3	925	96.2	172
Total urban	20.6	0.5	5.4	1,541	94.1	291
Rural	22.2	0.5	7.2	4,477	94.9	762
Region						
Kayes	21.7	0.4	6.8	943	98.1	153
Koulikoro	22.0	0.4	7.8	1,032	95.8	157
Sikasso	23.4	0.5	7.3	1,256	92.3	207
Segou	20.6	0.5	6.2	1,130	95.9	189
Mopti	22.1	0.5	6.8	940	95.5	207
Timbuktu/Gao	19.7	0.4	5.6	102	87.2	20
Bamako	20.3	0.4	4.2	617	91.0	119
Mother's education						
No education	21.9	0.5	6.9	5,104	94.7	884
Primary	21.3	0.4	6.7	665	96.9	122
Secondary+	18.7	0.5	3.5	249	88.7	46
Assistance at delivery						
Health professional	21.2	0.4	6.4	2,330	93.6	408
Traditional birth attendant	22.7	0.5	7.2	1,269	94.6	234
Other or no one	21.5	0.5	7.0	2,409	95.8	409
Total	21.6	0.5	6.8	6,019	94.7	1,052
Mean	21.6	1.5	7.5	-	-	-
Prevalence/incidence mean	21.4	0.8	7.7	-	-	-

Note: Medians and means are based on breastfeeding status at the time of the survey.
[1] Either exclusive breastfeeding or plain water only.

[1] The median duration of breastfeeding is calculated based on all 6,019 children under 3 years of age covered by the 1995/96 MDHS.

milk and water) was just under 7 months. Girls were fully breastfed slightly longer than boys; children whose mothers were assisted at delivery by medical personnel were fully breastfed for a shorter period than those whose mothers were assisted at delivery by a TBA. Children in urban areas and in Bamako town were fully breastfed for a shorter period than children in rural areas or in other regions. Maternal education was negatively associated with median duration of full breastfeeding, with children of mothers with secondary or higher education being fully breastfed only half as long as children whose mothers had no or primary education. These associations again point to the fact that wealthier women—those who were assisted at delivery by medical personnel, live in Bamako town or in urban areas, have secondary or higher education—are less likely to fully breastfeed than are poorer women.

The overall duration of any breastfeeding was a little over 21 months, illustrating that children are breastfed well into the second year of life. This practice is consistent with optimal breastfeeding practices. Although the duration of any breastfeeding did not differ by infant sex or assistance at delivery, differences similar to those for full breastfeeding were found by region, urban-rural residence, and maternal education.

3.7 Reasons for Weaning

Information on the reasons for weaning was obtained from mothers for all children less than 3 years old. The survey identified four major categories of reasons for weaning: maternal factors (maternal illness, nipple/breast problems, insufficient milk, mother working), child factors (child ill or weak, child refused breast milk), weaning age, or pregnancy (Table 3.5). The majority of children under three years of age were still breastfeeding (71 percent). Child age (time to wean) was the most common reason given for weaning (17.5 percent), and the proportion of children weaned for this reason increased, as expected, with child's age. Pregnancy (8 percent) was the next most important, followed by maternal factors (2 percent) and child factors (1 percent).

3.8 Summary

In Mali, nearly all women (99 percent) breastfeed their infants. There are no significant differences for this by region, residence, mother's occupation or her socioeconomic status. However, mothers who were assisted by a medical doctor at delivery are less likely to breastfeed than others. Breastfeeding behaviour does not follow the WHO recommendations.

Less than 10 percent of newborns are put to the breast in the first hour following birth and one in three children is initially breastfed on the second day or later. Late initiation of breastfeeding prevents the newborn from receiving the benefits of colostrum; and raises the likelihood that other liquids will be given, thus exposing the newborn to pathogens.

Exclusive breastfeeding in the first six months is an infrequent practice; 88 percent of infants are given other liquids or even solid foods before the fourth month. These practices put nutritional status, health and survival of the infant in danger.

Moreover, delaying the introduction of complementary foods exposes infants to significant risks of malnutrition since beyond the age of 6 months, breast milk alone is inadequate to meet energy, protein, and micronutrient needs. In Mali, less than a third of infants 6 to 9 months of age receive both breast milk and complementary foods.

3.9 Recommendations

The nutritional situation of infants and children in Mali has been problematic for more than a decade. The serious consequences of this situation on the social and economic level as well as for the individual

Table 3.5 Reason for weaning child

Among all children under three years, the percent distribution of children who were fully weaned because of various factors, or still breastfeeding by selected background characteristics, Mali 1995/96.

Background characteristic	Maternal factors[1]	Child factors[2]	Time to wean	Pregnancy	Other	Still breast feeding	Total	Number of children[3]
Child's age (months)								
0-5	0.3	0.0	0.0	0.0	0.0	99.7	100.0	964
6-11	0.1	0.0	0.0	0.4	0.1	99.4	100.0	904
12-17	1.0	0.2	2.3	3.5	0.6	92.5	100.0	793
18-23	3.0	1.3	12.6	13.3	0.6	69.3	100.0	599
24-29	4.2	2.3	49.3	17.5	1.6	25.1	100.0	689
30-35	3.2	3.0	53.1	21.9	0.8	18.0	100.0	729
Residence								
Rural	1.5	1.0	14.8	9.1	0.4	73.2	100.0	3,443
Urban	2.5	1.1	25.1	6.1	1.0	64.1	100.0	1,235
Region								
Bamako	3.8	1.3	22.6	6.2	1.6	64.5	100.0	483
Koulikoro	1.9	1.5	14.1	9.7	0.4	72.4	100.0	833
Sikasso	2.0	1.0	15.7	9.7	0.5	71.1	100.0	1,003
Segou	2.0	0.8	21.4	10.9	0.5	64.5	100.0	880
Mopti	0.4	0.8	14.5	5.9	0.4	78.1	100.0	714
Timbuktu/Gao	3.5	1.1	22.4	8.5	0.5	64.0	100.0	79
Kayes	0.7	0.7	18.6	5.4	0.3	74.2	100.0	687
Mother's education								
No education	1.5	0.9	16.8	8.7	0.4	71.6	100.0	3,944
Primary	2.1	1.4	20.8	6.8	1.0	67.9	100.0	516
Secondary+	6.3	1.2	23.2	5.1	1.5	62.7	100.0	218
Possession score[4]								
0	1.0	1.0	15.6	7.3	0.5	74.6	100.0	1,576
1	1.8	0.8	17.6	9.6	0.6	69.6	100.0	2,574
2+	3.9	1.7	23.6	5.2	0.9	64.7	100.0	479
Mother listens to radio								
No	0.9	0.9	14.7	7.8	0.6	75.1	100.0	1,896
Yes	2.4	1.1	19.5	8.7	0.5	67.8	100.0	2,778
Mother watches TV								
No	1.2	0.9	16.2	9.0	0.5	72.3	100.0	3,412
Yes	3.4	1.3	21.1	6.6	0.7	66.7	100.0	1,235
Total	1.8	1.0	17.5	8.3	0.6	70.8	100.0	4,678

[1] Mother ill/weak, nipple/breast problem, insufficient milk, working
[2] Child ill/weak, refused
[3] Totals vary due to missing values
[4] Score of one for availability/ownership of electricity, radio, television or refrigerator. Maximum score of 4.

require the creation of short and long term actions for improving the nutritional status of Malian children. The most significant recommendations are the following:

- Undertake qualitative research to understand the motivations and constraints which explain the practices of mothers or persons in charge of feeding children. In particular, to understand: a) breastfeeding initiation practices at birth; b) behaviours related to introduction of complementary foods; c) behaviours related to the introduction of liquids other than breast milk; d) the quality of and conditions under which complementary foods are prepared; e) the timing and frequency of feeding complementary foods.

- Undertake qualitative research to identify the most effective educational messages and the most appropriate channels of dissemination for promoting adequate feeding of children.

- Establish training and/or retraining of social and health personnel for nutrition education and follow-up as well as taking charge of the treatment of cases of malnutrition by adopting the IMCI (integrated management of childhood illnesses) strategy of WHO/UNICEF which particularly emphasizes infant and child feeding.

- Both qualitative and operations research are needed to test the acceptability and sustainability of locally available nutritious, low-cost and easily prepared and served complementary foods at the household level, such as those developed by the Food Technology Laboratory of the INRSP.

Chapter 4

MORBIDITY AND MORTALITY

Illness and inadequate food intake are direct causes of malnutrition (Jamison, 1993), which, in turn, results in increased risk of death (Pelletier et al., 1993). In many developing countries, malaria, acute respiratory infection (ARI) and diarrhoeal diseases are the most common childhood illness and account for the greatest proportion of infant and under-five mortality. In this chapter, the prevalence of morbidity and rates of mortality are described and compared with results from the 1987 MDHS. The prevalence and age-specific patterns of common childhood illnesses and care-seeking behaviours are also described.

4.1 Infant and Under-five Mortality

Infant and under-five mortality rates were calculated for the five and ten year periods preceding the 1995/96 MDHS. The infant mortality rate (IMR) is the probability of death in the first year of life and is calculated per 1,000 live births. Similarly, the under-five mortality rate (U5MR) is the probability of dying before the child's fifth birthday and is calculated per 1,000 live births. Although total mortality rates are calculated for a five year period preceding the DHS, ten year rates are used in the calculations of specific background factors.

According to the 1995/96 MDHS, Mali has very high levels of infant and child mortality. The IMR for the five years preceding the 1995/96 MDHS is 122 per 1,000. Based on the ten years preceding the MDHS, the IMR is 133.5 per 1,000. The IMR differs significantly by region, urban/rural residence, maternal education, maternal age at birth, previous birth interval, and infant sex (Table 4.1).[1] Infants living in Bamako town and in urban areas have a much lower IMR (84 per 1,000 and 99 per 1,000, respectively) than infants in any other region or infants in rural areas (145 per 1,000). Similarly, maternal education is a powerful predictor of IMR, with secondary or higher education levels having the strongest effect. Thus, children of mothers with primary education have a somewhat lower IMR than those whose mothers are illiterate (113 compared to 140), while children whose mothers have at least secondary education have an infant mortality rate of 60, less than half that of children whose mothers are illiterate. Infants born when their mothers were less than 20 years of age have the highest IMR at 181, compared to children of mothers who were older at birth (IMR ranging from 122 to 135). Previous birth interval of less than two years is also strongly positively associated with a higher IMR. Infants born less than 2 years after a previous sibling have an IMR of 186 compared with 102 for infants born 2 to 3 years after a previous sibling, and 60 for infants born more than 4 years after a previous sibling. Male infants have a higher infant mortality rate (141) than do female infants (127).

The U5MR is 238, indicating that a little over half of all deaths before age 5 years occur during the first year of life and the rest occur during the subsequent 4 years. As with IMR, U5MR also differs significantly and with a similar pattern by region, urban/rural residence, maternal education, maternal age at birth, previous birth interval, and infant sex (Table 4.1).

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[1] In Table 4.1 infant and under-five mortality rates for the ten-year period preceding the 1995/96 MDHS are analyzed according to background characteristics. Five-year rates are shown, but these are not used in the analysis of differentials. Ten-year rates have been found to give stronger statistical validity to these analyses.

Because the relationships reported in this section between mortality and the various characteristics associated with it are bivariate associations and may themselves be correlated, they do not imply causality. Differences based on region and urban/rural residence are likely to be related to other socioeconomic characteristics of the population in these regions and/or access to medical care.

4.2 Changes in Mortality Since 1988/89

A comparison of estimates of IMR and U5MR from the 1987 and 1995/96 MDHS, for the period 5 to 9 years before the survey, shows a decline in both IMR and U5MR for the period between 1977-81 and 1985-89. The IMR declined from 152 per 1,000 for 1977-81 (the 5-9 years preceding the 1987 survey) to 145 per 1,000 for 1985-89 (the 5-9 years preceding the 1995/96 survey). Similarly, the U5MR declined from 315 per 1,000 to 268 per 1,000 between these two time periods. This represents a decline of about 5 percent in the IMR and a decline of 15 percent in the U5MR between these two time periods. Unfortunately, the estimates for the more recent periods of 0-4 years prior to both surveys cannot be compared since data quality checks revealed an underestimate of IMR for the period 0-4 years before the 1987 MDHS (Coulibaly et al., 1996:162).

4.3 Comparison with Other Sub-Saharan Countries

The under-five mortality of 238 in Mali for 0-4 years preceding the survey is the second highest among sub-Saharan countries. The overall range is 53 in Botswana to 318 in Niger.

4.4 Mortality and Malnutrition

Malnourished children are at much greater risk of morbidity and subsequent death. In Mali, the pre-valence of malnutrition is lower in urban areas, which also have lower IMRs and U5MRs compared with rural areas. Regionally, the prevalence of severe stunting is highest in Segou region, which also has the highest IMR and the second highest U5MR of all the regions. However, while the prevalence of both severe and moderate wasting is highest in Bamako town, Bamako town has the lowest IMR and U5MR. These low infant and child mortality rates despite a high prevalence of wasting might reflect the fact that Bamako town, as the capital city and the most urban area, has better health facilities than other regions. It may also suggest that, in the Malian

Table 4.1 Infant and under-five mortality rates

Infant and under-five mortality rates for the ten-year period preceding the survey, by selected background characteristics, Mali 1995/96

Background characteristic	Mortality rates (per 1,000) Infant	Under-five
Residence		
Urban	98.7	190.1
Rural	145.0	272.5
Region		
Bamako	83.9	149.2
Koulikoro	131.8	232.0
Sikasso	138.7	232.3
Segou	147.9	274.0
Mopti	142.4	325.3
Timbuktu/Gao	(106.2)	(237.2)
Kayes	134.9	259.0
Mother's education		
No education	139.6	265.0
Primary	112.7	204.7
Secondary+	59.6	101.4
Mother's age at birth		
<20	181.2	308.1
20-29	122.5	240.4
30-39	122.2	234.5
40-49	134.8	277.3
Birth order		
1	174.8	290.3
2-3	127.0	250.7
4-6	117.2	234.5
7+	135.6	252.7
Previous birth interval		
<2 years	185.9	329.0
2-3 years	102.3	216.2
4 years+	60.2	115.7
Sex of child		
Male	140.5	257.2
Female	126.5	247.2
Total	133.5	252.2
Five-year rate	122.5	237.5

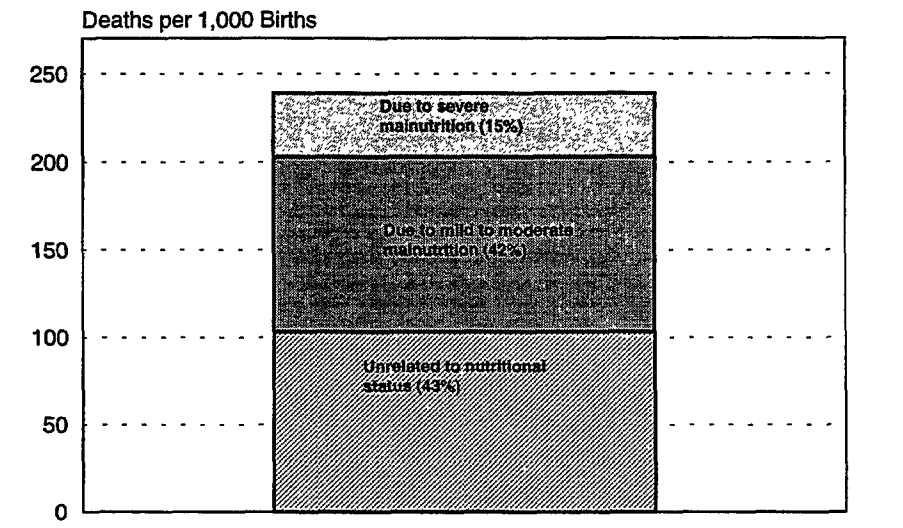
Note: *Infant mortality rate:* the probability of dying before the first birthday; *under-five mortality rate:* the probability of dying before the fifth birthday. Ten year rates are used to calculate mortality rates for specific background characteristics. Five-year rates are rates for 0-4 years before the survey. Rates based on less than 500 cases exposed to mortality risks are enclosed in parentheses.

context, stunting is more closely associated with increased child mortality risks than is wasting. However, these associations do not prove causality and further research is needed to show the causal pathways between malnutrition and child mortality in Mali.

4.5 Contribution of Malnutrition to Under-five Mortality

Malnutrition is an important factor in the death of many young children because it has a synergistic relationship with disease that causes an increase in the risk of death. The contributions of moderate and severe malnutrition to child mortality are presented in Figure 4.1. In Mali, more than half of all deaths that occur before age five are related to malnutrition (57 percent). Because of its high prevalence, moderate rather than severe malnutrition contributes to the majority of these deaths (42 percent), while severe malnutrition con-tributes to the remaining 15 percent of deaths attributable to malnutrition. This suggests that nutrition programmes established to prevent and treat moderate and severe malnutrition could have an important impact on child mortality.

Figure 4.1 Contribution of Malnutrition to Under-five Mortality, in Mali



Note: Calculation based on Pelletier et al., 1994.

Source: MDHS 1995/96

4.6 Regional and Age-specific Patterns of Morbidity

The prevalence of common childhood illnesses, namely, diarrhoea, ARI, and fever, were examined by maternal recall for the two-week period preceding the interview. Based on these reports, one-quarter of the children had diarrhoea (Table 4.2). This prevalence is lower than the 1987 MDHS when 42 percent of children under 3 years had diarrhoea. A little over one third (39 percent) had a fever, and 29 percent had a cough. About 15 percent of children had cough with rapid breathing in the preceding two weeks, twice the level of the 7 percent observed in the 1987 survey. These data should be interpreted with caution because of the methodological problems often associated with maternal recall (Haggerty et al., 1994b; Martorell et al., 1976). Moreover, some of the difference in the prevalences of diarrhoea and cough with rapid breathing between the two surveys may be due to differences in the season of data collection of the 1987 and 1995/96 surveys.

Significant differences for these illnesses were found by region and urban/rural residence (Table 4.2). Diarrhoea and fever were less prevalent in urban than rural areas, though no urban-rural differences were found for cough or cough with rapid breathing. Regionally, for both diarrhoea and fever, the prevalence was lowest in Bamako town and highest in Timbuktu/Gao urban areas, with the prevalence of diarrhoea twice as high and fever almost three times higher in Timbuktu/Gao urban areas than in Bamako town. Koulikoro region had the lowest prevalence of cough (including with rapid breathing) and Kayes region had the highest.

Table 4.2 Prevalence and treatment of diarrhoea, fever and cough

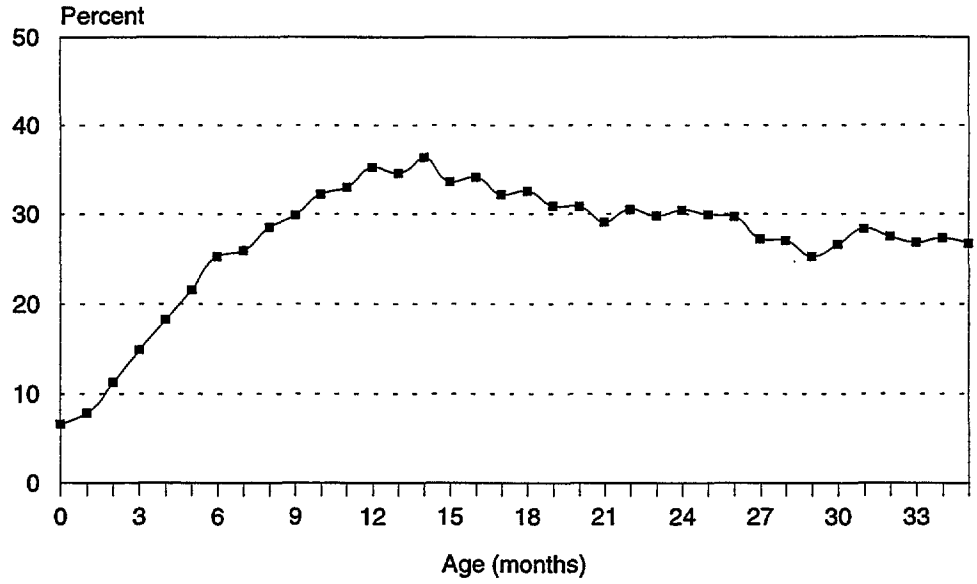
Percentage of children under three years with diarrhoea, fever, and cough with short, rapid breathing in the two weeks preceding the survey and whether any advice or treatment was sought, by residence and region, Mali 1995/96

	Percentage of children with:				Advice/treatment[1] sought for:	
Residence and region	Diarrhoea	Fever	Cough	Cough/ rapid breathing	Diarrhoea	Fever/ cough
Residence						
Rural	28.0	40.7	29.0	15.5	47.0	50.4
Urban	18.6	34.5	28.2	14.7	40.6	29.5
	p<.0001	p<.0001	NS	NS	p<.08	p<.0001
Region						
Bamako	17.5	27.3	28.4	16.6	26.9	20.5
Koulikoro	22.6	35.5	21.3	8.6	43.3	53.8
Sikasso	25.7	41.4	30.7	18.1	52.8	43.2
Segou	25.4	38.6	24.8	12.2	34.8	44.9
Mopti	28.2	35.0	22.8	11.4	54.3	52.4
Timbuktu/Gao	34.2	70.7	43.8	16.4	61.2	43.0
Kayes	30.8	49.6	45.3	26.5	48.7	49.1
	p<.0001	p<.0001	p<.0001	p<.0001	p<.0001	p<.0001
Total	25.5	39.1	28.8	15.3	45.8	45.0

Note: Level of significance determined using Chi-square test
NS = not significant (p> 0.1)
[1] Includes all sources where advice or treatment was sought

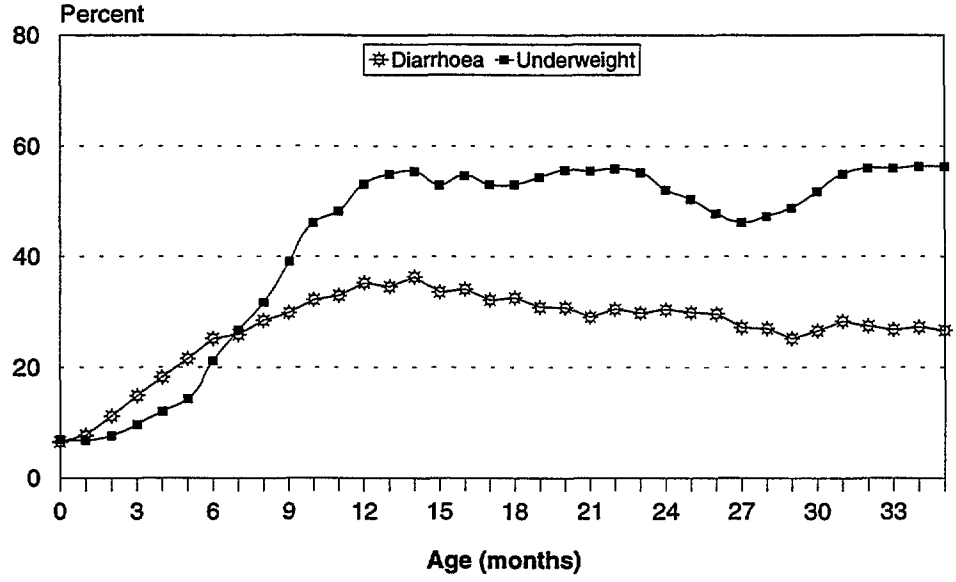
As with malnutrition, significant age-related patterns were found in the prevalence of diarrhoea, fever, and cough. The prevalence of diarrhoea (Figure 4.2) climbs precipitously during infancy peaking at about 14 months of age. By 21 months of age the prevalence of diarrhoea declines to about 30 percent, and in the third year of life it declines further to an average of 25 percent. At the peak at 14 months, a little over 35 percent of all mothers reported diarrhoea in the preceding two weeks. The increase in the prevalence of diarrhoea during infancy reflects in part the consequences of the early introduction of water and other liquids, as well as the increased risk of pathogens due to the introduction of liquids and solids which may be contaminated due to unhygienic handling or preparation. In addition, once infants begin to crawl and move around, they tend to put objects into their mouth, again increasing the risk of pathogen contamination. Diarrhoea frequently causes fluid loss and dehydration, decreased food intake because of anorexia, malabsorption and increased nutrient loss (Molla et al., 1976). Both dehydration and decreased food intake can lead directly to weight loss. It is noteworthy that the age-specific pattern of diarrhoea is similar to that for underweight, illustrating the direct relationship between diarrhoea and malnutrition (Figure 4.3).

Figure 4.2 Diarrhoea by Age of Child, Mali



Source: MDHS 1995/96

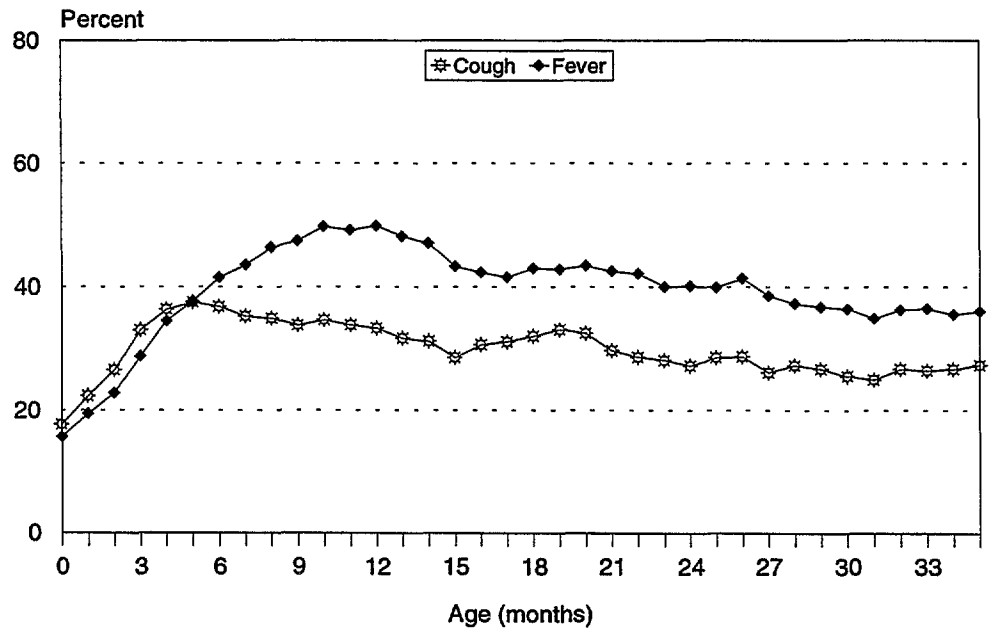
Figure 4.3 Diarrhea and Underweight by Age of Child, Mali



Source: MDHS 1995/96

The age-specific patterns of fever and cough, shown in Figure 4.4, also rise abruptly starting at birth but peak earlier, with cough peaking at about 4 to 5 months and fever peaking at about 12 months of age. Both fever and cough drop slightly after reaching their peak prevalence, after which the prevalence of these two childhood illnesses remains largely unchanged through the third year of life.

Figure 4.4 Fever and Cough by Age of Child, Mali



Source: MDHS 1995/96

4.7 Morbidity, Breastfeeding, and Treatment

Overall, advice or treatment was sought for less than half of the reported illnesses (Table 4.2). Paradoxically, women in rural areas were slightly more likely than urban women to seek advice or treatment if their child had diarrhoea, and almost twice as likely as urban women to seek advice or treatment if their child had a fever/cough. Similarly, women in the town of Bamako town were less likely to seek advice or treatment for diarrhoea or fever/cough compared with women in the other regions (27 percent versus about 40 to 60 percent). Persistent untreated diarrhoea or fever in Bamako town may, in part, account for the higher prevalence of wasting in Bamako town compared with other regions. Women in the Timbuktu/Gao urban areas were significantly more likely to seek advice or treatment for diarrhoea, and women in Koulikoro region for fever/cough, compared with women in other regions.

Data on the source of treatment can help explain the surprising result above that urban women and women in Bamako town are less likely to seek treatment for childhood diseases than are rural women and women in other regions. Almost three quarters of mothers who sought treatment for their child's episodes of diarrhoea in the past two weeks reported going to a traditional practitioner, friends and relatives, shop or other non-medical sources (Table 4.3). Regionally, women in Bamako town were less likely to use a traditional practitioner than women in any other region except Timbuktu/Gao urban areas. On the other hand, women in Bamako town were more likely to use a private or public medical facility than women in most of the other regions; however, a minority of the women who sought treatment went to these sources (17

Table 4.3 Source for treatment of diarrhoea

Percent distribution of children under three years with diarrhoea whose mothers sought advice/treatment from various sources, by residence and region, Mali 1995/96

Residence and region	Source for treatment of diarrhoea: Public facility[1]	Private facility[2]	Traditional/ Other[3]	Total	Number of Children	Urban-rural/ inter-region difference
Residence						
Rural	15.3	11.3	73.4	100.0	505	
Urban	21.2	19.5	59.2	100.0	134	p<.005
Region						
Bamako	24.6	21.1	54.4	100.0	61	
Koulikoro	22.9	17.7	59.5	100.0	106	
Sikasso	18.3	4.8	76.9	100.0	120	
Segou	14.2	5.4	80.5	100.0	143	
Mopti	11.1	12.6	76.3	100.0	89	
Timbuktu/Gao	39.4	18.9	41.7	100.0	11	
Kayes	9.1	23.0	67.9	100.0	108	p<.0001
Total	16.5	13.0	70.4	100.0	639	

Note: Level of significance determined using Chi-square test
[1] Public hospital, health center, community health worker, para-statal agencies
[2] Private hospital/clinic, pharmacy, doctor, pharmaceutical depot
[3] Traditional practitioner, friends/relatives, shop, other

percent to a public and 13 percent to a private facility). Similarly, women in urban areas were less likely than women in rural areas to use traditional practitioners, and more likely than rural women to use public or private medical facilities.

About half of all women who sought treatment for their child's episodes of fever/cough reported going to a traditional practitioner, friends and relatives, shop or other non-medical sources (Table 4.4). As with diarrhoea treatment, women from Bamako town were among the least likely to use traditional practitioners, and among the most likely to use public or private facilities; however, fewer women who sought treatment went to either public (27 percent) or private (24 percent), compared to traditional (48 percent) sources. The heavy weight given to traditional practitioners over public or private medical facilities for both diarrhoea and fever/cough, and the fact that few women from urban areas or from Bamako town used traditional practitioners, could help to explain why for all sources of treatment combined, fewer women from urban areas or from Bamako town were reported as seeking treatment (Table 4.2).

Among children with diarrhoea in the two weeks preceding the survey, only 16 percent were some form of oral rehydration therapy (ORT), almost all of which was prepackaged oral rehydration salts (ORS) (Table 4.5). More than twice as many urban than rural children suffering from diarrhoea were given ORT. ORT was also significantly higher in Bamako town than in any of the other regions (43 percent compared to 5 to 19 percent in other regions). This suggests that better socioeconomic status, education or health facilities usually associated with urban residence may be associated with use of ORT during diarrhoeal episodes.

Current recommendations by WHO and UNICEF call for the continuation of feeding, with an increase in fluids, during a diarrhoeal episode. Women who are breastfeeding are encouraged not only to continue breastfeeding, but also to increase the frequency of these feeds. In Mali, among children under 3

Table 4.4 Source for treatment of fever and cough

Percent distribution of children under three years with fever/cough whose mothers sought advice/treatment from various sources, by residence and region, Mali 1995/96

Residence and region	Source for treatment of fever/cough			Total	Number of children	Urban-rural/ inter-region difference
	Public facility[1]	Private facility[2]	Traditional/ Other[3]			
Residence						
Rural	22.1	17.8	60.1	100.0	487	
Urban	37.9	37.0	25.1	100.0	245	p<.0001
Region						
Bamako	38.6	35.6	25.7	100.0	108	
Koulikoro	19.0	29.6	51.4	100.0	80	
Sikasso	36.7	15.7	47.6	100.0	173	
Segou	18.8	22.5	58.6	100.0	119	
Mopti	29.8	8.3	62.0	100.0	75	
Timbuktu/Gao	36.5	43.3	20.1	100.0	20	
Kayes	17.7	29.5	52.8	100.0	157	p<.0001
Total	27.4	24.2	48.4	100.0	732	

Note: Level of significance determined using Chi-square test
[1] Public hospital, health center, community health worker, para-statal agencies
[2] Private hospital/clinic, pharmacy, doctor, pharmaceutica depot
[3] Traditional practitioner, friends/relatives, shop, other

Table 4.5 Use of oral rehydration therapy for treatment of diarrhoea

Percent of children under three years who had diarrhoea in the two weeks preceding the survey whose mothers treated them with oral rehydration salts (ORS), recommended home fluids (RHF), and oral rehydration therapy (ORT), by residence and region, Mali 1995/96

Residence and region	Received ORS[1]		Received RHF[2]		Received ORT[3]	
	Percent	Number	Percent	Number	Percent	Number
Residence						
Rural	12.2	946	1.5	964	12.3	946
Urban	29.2	226	3.0	229	29.2	226
	p<.0001		NS		p<.0001	
Region						
Bamako	43.0	85	6.3	85	43.0	85
Koulikoro	13.3	187	2.0	188	13.3	187
Sikasso	14.5	254	1.3	258	14.5	254
Segou	14.6	221	3.0	223	15.1	221
Mopti	17.9	195	0.7	202	17.9	195
Timbuktu/Gao	18.6	27	0.5	27	18.6	27
Kayes	5.3	205	0.5	212	5.3	205
	p<.0001		p<.02		p<.0001	
Total	15.5	1,173	1.8	1193	15.5	1,173

Note: Level of significance determined using Chi-square test
NS = Not significant
[1] Solution prepared from ORS packet (oral rehydration salts)
[2] Recommended home fluids (e.g., sugar/salt/water solution)
[3] Oral rehydration therapy (ORS and/or RHF)

Table 4.6 Changes in feeding practices among children with diarrhoea

Among children under three years with diarrhoea in the two weeks preceding the survey, the percent distribution of those who received the same, more, or less food and fluids, by selected background characteristics, Mali 1995/96.

Background characteristic	Amount of foods received				Number of children	Amount of fluids received				Number of children
	Same	More	Less	Total		Same	More	Less	Total	
Residence										
Rural	43.0	19.4	37.5	100.0	919	43.9	36.0	20.1	100.0	916
Urban	39.2	31.5	29.3	100.0	220	31.7	54.2	14.1	100.0	218
		p<.01					p<.0001			
Region										
Bamako	25.6	50.0	24.4	100.0	84	15.8	75.0	9.2	100.0	81
Koulikoro	52.2	25.8	21.9	100.0	181	51.3	33.9	14.7	100.0	179
Sikasso	22.8	24.6	52.6	100.0	249	18.4	57.5	24.2	100.0	246
Segou	48.4	15.7	35.9	100.0	210	48.6	30.3	21.1	100.0	214
Mopti	39.1	23.7	37.3	100.0	192	40.7	37.3	22.0	100.0	199
Timbuktu/Gao	27.4	22.1	50.5	100.0	26	17.4	55.2	27.3	100.0	26
Kayes	63.5	7.0	29.5	100.0	197	69.6	16.9	13.5	100.0	189
		p<.0001					p<.0001			
Mother's age										
15-19	34.0	31.4	34.7	100.0	95	35.4	50.9	13.8	100.0	96
20-24	45.4	22.4	32.2	100.0	245	43.4	37.1	19.5	100.0	240
25-29	45.0	23.1	32.0	100.0	267	43.8	39.9	16.3	100.0	267
30-34	40.7	21.8	37.4	100.0	257	40.4	39.9	19.7	100.0	254
35-49	41.3	16.5	42.2	100.0	275	40.9	37.0	22.1	100.0	277
		P<.05					NS			
Mother's education										
None	42.7	20.7	36.6	100.0	1,005	41.9	37.7	20.4	100.0	1,000
Primary	41.9	26.0	32.1	100.0	102	45.8	45.3	8.9	100.0	105
Secondary+	32.0	41.7	26.4	100.0	32	15.1	80.9	4.0	100.0	30
		p<.05					p<.0001			
Child's sex										
Female	39.6	22.0	38.5	100.0	573	39.2	38.6	22.3	100.0	568
Male	45.0	21.5	33.4	100.0	566	43.9	40.5	15.6	100.0	566
		NS					p<.02			
Possession score[1]										
0	43.5	18.5	38.0	100.0	411	42.7	37.7	19.7	100.0	414
1	42.0	22.3	35.7	100.0	640	42.1	38.1	19.8	100.0	634
2+	37.9	37.9	24.1	100.0	73	27.4	64.9	7.7	100.0	71
		p<.01					p<.01			
Mother watches TV										
No	43.5	18.9	37.5	100.0	881	44.0	35.9	20.1	100.0	881
Yes	38.4	32.4	29.2	100.0	246	33.4	51.8	14.8	100.0	243
		p<.0001					p<.0001			
Total	42.4	21.9	35.7	100.0	1,127	41.7	39.4	18.9	100.0	1,124

Note: Level of significance determined using Chi-square test
NS=not significant (p>0.1)
[1] Score of one for availability/ownership of electricity, radio, television or refrigerator. Maximum score of 4.

who had diarrhoea in the two weeks preceding the survey, about 39 percent of children were given increased fluids during a diarrhoeal episode (Table 4.6). Another 42 percent were given the same amount, with the remaining 19 percent being given less. Thus most children are receiving either the same or more fluids during diarrhoea. Male children living in urban areas, in the Bamako town, from families with a high possession score, and whose mothers had secondary or higher education and watched TV weekly were the most likely to be given more fluids during diarrhoea. Maternal education had a particularly strong effect, with the proportion of children given increased fluids going up from about one third of children for illiterate mothers to over 80 percent for mothers with secondary education.

Fewer children were given same or increased foods, with a little over one third of children receiving less food during diarrhoea. The proportion of children receiving more food was higher in urban areas, Bamako town, for children from families with a high possession score, and for children of younger mothers, mothers with a secondary education and mothers who watched TV weekly. Thus, not surprisingly, the amount of food and fluids received during diarrhoea appear to be strongly positively associated with high socioeconomic status.

4.8 Factors Associated with Diarrhoea

Diarrhoea in the previous two-weeks was significantly related to a number of both biological and non-biological factors (Table 4.7). Bivariate analysis showed that diarrhoea was less prevalent among children living in Bamako town or in urban areas compared to other regions or rural areas. Maternal and paternal education at the secondary level reduced the prevalence of diarrhoea to half that of children whose mothers or fathers were illiterate. Children of professional fathers had a much lower prevalence of diarrhoea compared to other paternal occupations; diarrhoeal prevalence was also low among children whose mothers read a newspaper weekly, and children from families with a high possession score, private tap as the main drinking water facility, and flush toilet. Among biological factors, as previously seen in figure 4.2, child's age was important, with children between 12 to 17 months of age at greatest risk and infants less than 5 months of age at lowest risk of diarrhoea. Children who had fever or cough in the past two weeks, and children (over 9 months of age) who had not had a measles vaccination were also found to be at high risk of diarrhoeal infection.

The factors identified as important in the bivariate analyses were used in a logistic regression model to explain diarrhoeal disease among Malian children less than 3 years of age. Although a number of factors were associated with diarrhoeal disease in the bivariate analyses, the multivariate analysis showed that much of the variation in the prevalence of diarrhoea can be explained by six factors: urban-rural residence, father's education, child's age, fever in the preceding two weeks, cough in the preceding two weeks, and drinking water source.

Child's age was highly significant, with children above 12 months of age at least twice as likely to have had diarrhoea in the past two weeks as infants between 0 to 5 months old. The increase in diarrhoeal disease with child age reflects the effect mentioned earlier of the introduction of pathogens once the infant is mobile, and once foods other than breast milk form the child's primary diet. Other significant biological factors were fever and cough, with children who had fever in the preceding two weeks more than twice as likely to have had diarrhoea as were children who didn't have a fever in this time period. The statistically significant socioeconomic factors all point to the strong influence of high socioeconomic status on reducing diarrhoea risk. Thus, diarrhoea risk was 40 percent lower among children of fathers who had secondary or higher education compared to fathers with no education. Urban children were 20 percent less likely to have had diarrhoea in the past two weeks than were rural children. Children living in families whose main source of drinking water was a spring, river, pond or other open source had almost twice the risk of diarrhoea compared to children whose families had a private tap. The beneficial effect of a private tap could reflect

Table 4.7 Prevalence and estimated net relative risk of diarrhoea among children under three years

Percentage of children under three years who had diarrhoea in the preceding two weeks and the estimated relative risk of diarrhoea, by selected background characteristics, Mali, 1995/96

Background characteristic	Diarrhoea	Net relative risk
Region		
Bamako	17.5	
Koulikoro	22.6	
Sikasso	25.7	
Segou	25.4	
Mopti	28.2	
Timbuktu/Gao	34.2	
Kayes	30.8	
	p<.0001	
Residence		
Rural	28.0	1.0[a]
Urban	18.6	0.8
	p<.0001	
Mother's education		
None	26.7	
Primary	20.8	
Secondary+	15.3	
	p<.0001	
Father's education		
None	27.4	1.0[a]
Primary	22.8	0.9
Secondary+	13.4	0.6[b]
Don't know/missing	21.8	0.9
	p<.0001	
Father's occupation		
Not working	25.1	
Professional[1]	13.6	
Sales	20.7	
Agriculture[2]	28.0	
Other[3]	22.9	
	p<.0001	
Child's age (months)		
0-5	12.6	1.0[a]
6-11	27.8	1.9
12-17	34.1	2.4[b]
18-23	29.0	2.2
24-29	27.5	2.1
30-35	25.8	2.0[b]
	p<.0001	
Fever (2 weeks)		
No	14.4	1.0[a]
Yes	42.8	2.6
	p<.0001	

Continued

Table 4.7—*Continued*

Background characteristic	Diarrhoea	Net relative risk
Cough (2 weeks)		
No	21.1	1.0[a]
Yes	36.5	1.3
	p<.0001	
Measles immunization[4]		
No	31.3	
Yes	27.4	
	p<.02	
Drinking water source		
Private tap	13.4	1.0[a]
Public tap	22.2	1.3
Private well	22.1	1.1
Public well	27.6	1.4
Borehole	27.4	1.3
Open water source[5]	38.3	1.9[b]
	p<.0001	
Type of toilet		
Flush toilet	7.8	
Traditional pit	24.3	
Latrine	22.6	
None/other	29.8	
	p<.0001	
Possession score[6]		
0	27.8	
1	25.9	
2+	15.5	
	p<.0001	
Reads newspaper weekly		
No	25.9	
Yes	16.9	
	p<.005	
Total	25.5	

Note: Regression analysis based on 4414 children. Level of significance determined using chi-square test. Net relative risk estimates based on odds ratios from logistic forward step-wise regression analysis.

[1] Includes professional, technical, management, clerical

[2] Includes self-employed and employed workers

[3] Includes domestic, services, skilled manual

[4] Includes only children over 9 months old

[a] Overall p<.05

[b] p<.05 compared with reference category

[5] Spring, river, pond, lake, dam

[6] Score of one for availability/ownership of electricity, radio, television or refrigerator. Maximum score of 4.

the effect of high socioeconomic status, as well as better access to clean water and thus less exposure to pathogens for children from families with a private tap, compared to children whose families had to rely on other, less hygienic drinking water sources. It should be noted that some of these differences in diarrhoeal risks could be due to differential reporting among mothers with different characteristics, rather than a true difference in the risk of having diarrhoea itself.

4.9 Summary and Recommendations

The results presented in this chapter show that infant and child mortality rates are very high, and that they seem to be related to socioeconomic, demographic, behavioural and environmental factors. Malnutrition plays a particularly important role in infant and child mortality in Mali, where over half of all deaths that occur before age five are related to malnutrition. These various facts point to infancy as a critical period in child development and suggest the following recommendations in order to reduce infant and child mortality:

- Reinforce programs designed to promote nutritional status which emphasize nutritional surveillance of infants and children, nutritional education of mothers, and the treatment of malnutrition within the integrated management of childhood illnesses approach.

- Establish programs designed to prevent and treat moderate and severe malnutrition, which could have an important impact on child mortality.

- Undertake in-depth research in order to account for significant geographical variations in the prevalence of illness and treatment behaviour with the goal of targeting interventions within certain regions. Public health campaigns are needed to encourage the use of ORT during diarrhoea in all regions of the country, but particularly in regions other than Bamako.

- Reinforce the outreach efforts of the expanded immunization program (PEV).

- Improve the availability of prenatal and family planning services. Reinforcement of reproductive health programs is needed to help couples better plan births so that birth spacing is increased to 2 years or more.

- The ultimate underlying factor that contributes to higher disease prevalence among children is poverty. Providing better educational and occupational opportunities for poor women and men will, in the long run, also reduce both infant and child mortality and the prevalence of infectious diseases among children.

CHAPTER 5

FACTORS ASSOCIATED WITH MALNUTRITION

Although the direct causes of malnutrition are inadequate dietary intake and morbidity, these in turn are related to a number of biological, demographic, and socioeconomic factors. The relationship between these factors and malnutrition is described in this chapter using both bivariate and multivariate statistical techniques.

5.1 Biological and Health Characteristics of Stunting

Stunting and wasting are associated with a large number of biological and health characteristics (Table 5.1). However, because stunting is a cumulative process and increases with age, differences in the age distribution of children may in part explain some of the findings. Differences in age distributions are of particular concern for factors such as the reasons for weaning, current pregnancy status, and measles vaccination. Moreover, many of these factors are highly correlated and the bivariate relationships presented in this table do not control for confounding.

Among children less than three years of age stunting is significantly associated with child age, maternal perception of small size at birth, low birth weight, birth order, twin birth, reason for weaning, maternal pregnancy status, diarrhoea or fever in the previous two weeks, measles immunization, and the source of antenatal care. Given that stunting is a cumulative process, it is not surprising that age is significantly related to stunting, with the youngest children at least risk and older children at increasing risk. Noteworthy is the fact that almost one third of children are already stunted by age 12 to 17 months, showing how early in life stunting begins. By age 18 to 23 months, a little over half of all children are stunted. Thus, the first two years of life is the critical period to intervene to prevent child malnutrition. The prevalence of stunting drops slightly for children 24 to 29 months, and rises again to peak at 54 percent for children 30 to 35 months.

A little less than one-quarter (23 percent) of all infant birth weights were reported by their mothers. Among those for whom birth weight is reported, the prevalence of stunting among low birth weight infants is 32 percent compared with 20 percent among normal weight infants. Mothers' perception of their child's size at birth is also closely related to stunting: 41 percent of children perceived to be very small are stunted compared with 29 percent of those perceived by their mothers to be at least average size at birth. Twin birth is another risk factor for stunting, in part because of its correlation with low birth weight. The prevalence of stunting among twins was 43 percent compared with 30 percent among singletons. The prevalence of stunting is also positively associated with birth order, with 2 to 4 percent more children stunted among higher birth order children (6 or higher) than among lower birth order children (first to fifth).

Both diarrhoea and fever in the previous two weeks are associated with stunting (Table 5.1). Although it is unlikely that diarrhoea or fever in the previous two weeks are the direct cause of stunting, children reported to have diarrhoea or fever may be more likely than other children to have had repeated episodes of illnesses in the past, which would, over time, contribute to stunting. Stunting is also more prevalent among children who were not immunized against measles compared with children who were immunized. Measles immunization could be a proxy for child health care in general, thus children not immunized may also be children who received less health care overall and are therefore the children more likely to be stunted as well. Alternatively, more children not immunized against measles could be stunted because of measles infection and it's subsequent morbid sequelae.

Table 5.1 Stunting and wasting, by selected biological characteristics

Percentage of children under three years who are stunted and wasted, by selected biological characteristics, Mali 1995/96

Biological characteristic	Stunted	Wasted
Age Group		
0-5	5.3	12.3
6-11	13.9	27.7
12-17	31.2	33.8
18-23	53.2	32.5
24-29	40.6	18.8
30-35	54.2	18.2
	p<.0001	p<.0001
Size of child at birth		
Average +	29.2	22.3
Small	36.0	27.8
Very small	41.3	35.3
	p<.0001	p<.0001
Birth Weight[1]		
Normal	19.8	21.7
Low	31.9	25.7
	p<.001	NS
Birth Order		
1	29.7	20.3
2-3	26.6	21.2
4-5	30.5	23.6
6+	33.5	26.4
	p<.001	p<.002
Sex		
Female	29.3	22.2
Male	31.4	24.6
	NS	p<.06
Single birth		
No	43.1	30.2
Yes	30.0	23.2
	p<.004	p<.0001
Diarrhoea (2 weeks)		
No	27.0	20.1
Yes	40.0	32.9
	p<.0001	NS

Continued

Table 5.1—*Continued*

Biological characteristic	Stunted	Wasted
Fever (2 weeks)		
No	28.3	20.1
Yes	33.5	28.5
	p<.001	p<.0001
Measles immunization		
No	42.6	28.1
Yes	38.6	25.1
	p<.05	p<.1
Reason for full weaning		
Maternal factors[3]	30.4	15.8
Child factors[4]	33.3	18.1
Weaning age	38.0	15.9
Became pregnant	43.0	22.8
Other	36.2	35.0
Still breastfeeding	26.8	25.5
	p<.0001	p<.0001
Current pregnancy status		
No or unsure	28.3	23.6
Yes	46.3	21.4
	p<.0001	NS
Source of antenatal care		
Doctor	23.9	24.8
Nurse/midwife	25.5	21.6
TBA[5]	44.8	16.6
Other/no one	34.5	25.2
	p<.0001	p<.05
Total	30.3	23.4
Number of children	4,678	4,678

Note: Level of significance determined using Chi-square test
NS = not significant
[1] Normal birth weight = 2500 grams or more; low birth weight = less than 2500 grams
[2] Children 9 months and older only
[3] Mother ill/weak, nipple/breast problem, insufficient milk, working
[4] Child ill/weak, refused
[5] Traditional birth attendant

Children who were currently breastfed were least likely to be stunted compared with children who had been weaned for various reasons (Table 5.1). However, because current breastfeeding status is strongly associated with age, which in turn is strongly associated with stunting, it is likely that the positive effect of breastfeeding on stunting is a proxy for the lower risk of stunting among younger children. Children who had been weaned because their mother was pregnant were most likely to be stunted. Surprisingly, children weaned because their mothers felt they were at the correct weaning age are the next most likely to be stunted.

This could suggest that weaned children do not receive adequately nutritious food to replace breast milk. It could, however, also be an age effect since older children are more likely to be weaned due to weaning age than are younger children. Stunting is also associated with maternal pregnancy status, with children of women who are currently pregnant facing a greater risk of stunting than children of women who are not pregnant. Although this finding may reflect greater risk associated with short birth intervals, it may also reflect differences in the age distribution of the children and the fact that mothers of older children, who are at greater risk of the cumulative effects of stunting, may also be more likely to be pregnant than mothers of younger children.

The prevalence of stunting for children of mothers who received antenatal care from a traditional birth attendant (TBA) was almost twice as high (45 percent) as those whose mothers received antenatal care from a doctor (24 percent). Antenatal care can help prevent low birth weight, birth complications, and poor foetal and maternal health while, at the same time, providing mothers with valuable information about child care, health, and nutrition. However, the source of antenatal care is also related to socioeconomic status as well as care-seeking behaviours, and mothers who seek antenatal care from a doctor are likely to come from wealthier families than are mothers who go to a TBA or have no antenatal care. Both socioeconomic status and care-seeking behaviours are, in turn, themselves positively correlated with child health and nutritional status.

5.2 Biological and Health Characteristics of Wasting

In general, the direction and magnitude of the associations of wasting with biological and health characteristics are similar to that for stunting (Table 5.1). Several exceptions, however, are noted. As expected, the prevalence of wasting peaks earlier than stunting, at 12 to 17 months of age (also see Figure 2.6), and the prevalence is higher at younger ages than is the case for stunting. Male children are slightly more likely than female children to be wasted. Currently breastfed children have the second highest risk of wasting, which is probably because they are more likely to be in the age range where wasting is most prevalent. The mother's current pregnancy status does not appear to significantly affect the risk of wasting. Unlike for stunting, the prevalence of wasting is lowest for children of mothers who receive antenatal care from a TBA. However, as these bivariate associations do not control for confounders it is difficult to ascertain the exact relationship at work.

5.3 Socioeconomic and Demographic Characteristics of Stunting

The associations between social and economic factors and stunting presented in Table 5.2 should be interpreted with caution as many of the factors are highly correlated. In general, the results confirm the fact that poverty as measured by maternal and paternal education and occupation, possession score, water source, type of toilet, and floor material are highly associated with stunting. Rural children were one and a half times more likely to be stunted compared with urban children; children living in Bamako town were 40 to 50 percent less likely to be stunted than children in any other region of the country.

Particularly noteworthy is the strong negative association of maternal education with stunting, which illustrates the fact that even some primary school maternal education can have a positive effect on child nutrition. The prevalence of stunting for children whose mothers have a primary education is almost 24 percent lower than for children whose mothers have no education; children of mothers with at least secondary education are only half as likely to be stunted as are children whose mothers have no education. Although maternal educational level is highly correlated with household income, which also positively affects child nutritional status, many studies have shown that even after holding household income constant, maternal education has a positive effect on child nutritional status. Thus, as a long-term health and nutrition investment, maternal education is likely to have important and lasting positive effects.

Table 5.2 Stunting and wasting, by selected socioeconomic characteristics

Percentage of children under three years who are stunted and wasted, by selected socioeconomic characteristics, Mali 1995/96

Socioeconomic characteristic	Stunted	Wasted
Residence		
Rural	33.3	23.4
Urban	21.9	23.5
	p<.0001	NS
Region		
Bamako	17.3	27.9
Koulikoro	30.9	23.5
Sikasso	33.2	24.8
Segou	33.2	21.7
Mopti	27.6	26.6
Timbuktu/Gao	29.8	26.3
Kayes	33.6	16.5
	p<.0001	p<.0001
Mother's age		
15-19	25.6	19.4
20-24	26.7	20.0
25-29	31.1	23.9
30-34	33.3	26.7
35-49	32.5	25.2
	p<.002	p<.001
Mother's education		
None	31.9	24.1
Primary	24.3	19.4
Secondary+	15.2	20.5
	p<.0001	p<.05
Mother's occupation		
Not working	30.7	24.3
Professional[1]	26.2	23.7
Agriculture[2]	34.5	20.9
Manual[3]	30.6	24.3
Domestic/Service	17.8	24.7
	p<.0002	NS
Marital status		
Not married	21.3	21.6
Married	30.7	23.5
	p<.01	NS
Father's education		
None	32.8	24.2
Primary	30.0	22.2
Secondary+	15.2	18.1
Don't know/missing	18.8	21.0
	p<.0001	p<.005
Father's occupation		
Not working	37.8	11.9
Professional[4]	15.7	16.1
Sales	28.5	20.9
Agriculture[3]	33.8	24.5
Other[5]	23.4	24.1
	p<.0001	p<.05

Continued

Table 5.2—*Continued*

Socioeconomic characteristic	Stunted	Wasted
No. of dead children		
0	27.9	21.9
1	30.4	23.6
2+	34.3	25.9
	p<.0005	p<.05
No. of children under three in household		
0-1	27.8	22.9
2-3	30.0	22.7
4-5	32.8	23.8
6+	30.5	25.9
	p<.1	NS
Main floor material		
Natural[6]	33.1	23.8
Rudimentary/Finished[7]	19.8	21.7
	p<.0001	NS
Drinking water source		
Private tap	18.5	24.2
Public tap	26.5	22.8
Well/borehole[8]	31.6	23.2
Surface water[9]	28.8	26.4
	p<.0005	NS
Has any toilet facility		
No	33.8	24.7
Yes	29.0	22.7
	p<.002	NS
Possession score[10]		
0	33.7	26.0
1	30.5	21.9
2+	17.7	22.0
	p<.0001	p<.01
Listens to radio weekly		
No	32.8	25.6
Yes	28.6	21.8
	p<.005	p<.005
Reads newspaper weekly		
No	30.9	23.6
Yes	18.0	19.4
	p<.0001	NS
Watches TV weekly		
No	32.2	23.8
Yes	25.0	21.9
	p<.0001	NS
Total	30.3	23.4
Number of children	4,678	4,678

Note: Level of significance determined using Chi-square test
NS=not significant (p>0.1)
[1] Includes professional, technical, management
[2] Includes self-employed and employed workers
[3] Includes skilled and un-skilled
[4] Includes professional, technical, management, clerical
[5] Includes domestic, services, skilled manual
[6] Earth, sand, dung
[7] Palm/bamboo, parquet/polished wood, vinyl/asphalt strips, ceramic tiles, cement, carpet
[8] Includes public and private well
[9] Spring, river/stream, pond/lake, dam
[10] Score of one for availability/ownership of electricity, radio, television or refrigerator. Maximum score of 4.

Children whose mothers worked in the domestic or service industry were least likely to be stunted (18 percent). This could reflect the fact that these mothers may have more time for child care than do professional mothers, yet bring in more income than mothers who are not working or who work in agriculture or in manual labour. Listening to the radio, watching television and reading a newspaper on a regular basis were all negatively associated with stunting (Table 5.2). Access to a radio or television is associated with household wealth, which in turn is highly and positively associated with child nutritional status. Frequent exposure to mass media could also provide information for mothers which could improve child care and nutrition; further, mothers who read the newspaper are clearly educated mothers and maternal education, as shown above, is strongly associated with lower stunting.

Stunting is associated with the number of previous child deaths in a family and the number of living children in the household under the age of three. The prevalence of stunting is higher in households with 2 or more children under the age of three (30 to 33 percent) compared with households with no or only one child under the age of three (28 percent). This could reflect the deleterious effect on child nutrition of the increased competition for household resources when there are more young children present in a family. It could also reflect the negative effect on child nutrition of small birth intervals between many young children, or, if larger families are also poorer families, the positive relationship between poverty and stunting. Children of mothers with two or more dead children are more likely to be stunted than those of mothers with one or no dead children. Mothers with more dead children are likely to be from poorer families that may have less access to health care than are mothers with fewer dead children, reflecting, once again, the association between poverty, mortality, and malnutrition.

Several other variables associated with household income were found to have a significant association with stunting. Paternal education has an effect very similar to that of maternal education; stunting is also less prevalent among children of married compared with non-married mothers, children whose fathers are professionals, and who come from families with a high possession score, a house with a finished floor, a family that had some toilet facility, and a private tap as the main source of drinking water. While improved water and sanitation facilities may reflect higher income, they also have a direct impact on nutritional status because they reduce levels of infectious disease. Poor households are more likely to obtain water from public or open-air sources and less likely to have toilet facilities. Where water is not readily available, food hygiene is often inadequate, and where sanitation is poor the increased presence of insects (such as flies) increases levels of contamination of food and water.

5.4 Socioeconomic and Demographic Characteristics of Wasting

The findings for wasting have some important differences compared with stunting (Table 5.2). As noted in Chapter 2, unlike for stunting, the prevalence of wasting is higher in Bamako town than in any other region in the country. While maternal education is still significantly negatively associated with wasting, the effect is not as strong as that for stunting, particularly at the level of secondary education. Thus, the prevalence of wasting among children of mothers with secondary or higher education is 18 percent less than for children with uneducated mothers, compared with a 50 percent difference for stunting. Similarly, father's education and occupation, the number of dead children in the household, possession score, and listening to radio on a weekly basis all have similar but smaller effects on wasting compared with stunting. Unlike for stunting, rural-urban residence, mother's occupation, mother's marital status, the number of children under three in the household, main floor material, drinking water source, and frequent use of newspaper or television have no statistically significant bivariate associations with wasting.

5.5 Possible Causes of Malnutrition in Mali

Based on an analysis of agricultural production, incomes, and prices in Mali, we have identified the following possible reasons that may explain why mothers and children suffer from malnutrition:

1. An unequal distribution of the agricultural production nationwide due to the isolation of certain areas (notably during the rainy season) and the prevailing insecurity in parts of the Northern Region.

2. While purchasing power was already a preoccupying factor for the population, it worsened in 1994 following the devaluation of the CFA Franc and the sustained price increase that this caused. This situation limits the capacity for a large proportion of families in Mali to be adequately fed, particularly the women and children.

3. Despite food diversification, mothers do not necessarily change their habits regarding feeding their children. It is generally because of a lack of knowledge that populations, especially in rural areas, do not regularly and properly eat the products they grow (lettuce, potatoes, melons, cucumbers, green beans, soya, etc.).

4. The workload of women (especially in the rural areas) does not leave them enough time to adequately feed their newborns. The latter, in most cases, are only breastfed when they cry and not given sufficient quantity.

5.6 Multivariate Regression Analysis

The biological, health, social, and economic factors identified as important in the bivariate analyses were used in a logistic regression model to explain stunting and wasting among Malian children less than 3 years of age. (See Appendix G for an explanation of logistic regression models.) This model estimates the probability that stunting or wasting will occur by any one background characteristic in the model, controlling for all other background characteristics included in the model. Estimates of net relative risk greater than 1 indicate that the risk of malnutrition is greater than that for the reference category; estimates less than 1 indicate that the risk of malnutrition is less than that for the reference category.

The following variables were used to develop the best model to explain childhood malnutrition in Mali. Only those variables which are significant are discussed in the sections that follow.

Biological and Health Variables

Age of child (0-5, 6-11, 12-17, 18-23, 24-29, 30-35 months)
Sex of child (female, male)
Birth order (1, 2-3, 4-5, 6+)
Single birth (no, yes)
Size at birth (average+, small, very small)
Diarrhoea in last two weeks (no, yes)
Fever in last two weeks (no, yes)
Child immunized against measles (no, yes)
Reason for full weaning (maternal factors, child factors, weaning age, became pregnant, other, still breastfeeding)
Current pregnancy status (no or unsure, yes)
Source of antenatal care (doctor, nurse/midwife, TBA, other/no one)
Assistance at delivery (doctor/nurse, TBA, other, no one)

Social, Economic and Demographic Variables

Region (Bamako town, Koulikoro region, Sikasso region, Segou region, Mopti region, Timbuktu/Gao urban areas, Kayes region)
Residence (rural, urban)
Mother's age (15-19, 20-24, 25-29, 30-34, 35-49)
Mother's education (none, primary, secondary+)
Mother's occupation (not working, professional, agriculture, manual, domestic/service)
Whether mother watches television weekly (no, yes)
Whether mother listens to radio weekly (no, yes)
Whether mother reads a newspaper weekly (no, yes)
Husband's education (none, primary, secondary+)
Husband's occupation (not working, professional, sales, agriculture, other)
Possession score (0, 1, 2, 3, 4)
Source of drinking water (private tap, public tap, well/borehole, surface water)
Toilet facilities (no, yes)
Main floor material (unfinished, finished)
Number of dead children (0, 1, 2+)
Number of children under three in household (0-1, 2-3, 4-5, 6+)

Because appropriate child feeding practices are age dependent, initially separate bivariate analyses were conducted for individual age groups. Risks of malnutrition were compared with optimal feeding practices for each of the dietary age groups.[1] However, because child feeding practices are also highly related to demographic and socioeconomic characteristics, such as maternal education, age, and socioeconomic status, the age-specific bivariate analyses between diet and stunting and diet and wasting showed no association except at older ages, suggesting that socioeconomic factors and child's age were more important than the available dietary information in the relationships under study. Knowing the quality, quantity and frequency of complementary foods given may be of great help in understanding the patterns of malnutrition in Mali; however, these data are not available through the MDHS. Consequently, the model presented here includes all children and does not include diet.

5.7 Risk Factors for Stunting

The statistically significant determinants of stunting found in the multivariate analysis are: child's age, birth size, single birth, diarrhoea in the last two weeks, measles immunization, source of antenatal care, mother's pregnancy status, reason for full weaning, father's education, and main floor material (Table 5.3).

Since stunting is a cumulative process that occurs over the course of many individual episodes of nutritional deprivation and/or illness, the risk of stunting increases sharply with age. Children between 0 and 5 months of age have the lowest risk of stunting. Those age 6-11 months have twice the risk of the youngest infants, and those age 12-17 months have five times the risk of infants. Beyond 17 months the risk of stunting rises sharply, until by age 30 to 35 months it is fourteen times that of the youngest infants. This dramatic rise with age reflects the cumulative effects of repeated illness, inadequate nutrient intake, and most importantly their negative interactive effect during this critical period of child development. The older ages, which have the highest stunting rates, are also the ages when diarrhoeal disease prevalence is relatively high compared with the prevalence of diarrhoea among the youngest infants.

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[1] The dietary age groups used were 0 to 3 months (fully breastfed, partially breasted); 4 to 6 months (breastfed, fully weaned); 7 to 11 months (breastfed with complementary foods; breastfed but no complementary foods); 12 to 23 months (breastfed with complementary foods, fully weaned); 24 to 36 months (fully weaned, breastfed with complementary foods).

Table 5.3 Estimated net relative risk of stunting and wasting

Estimated net relative risk of stunting and wasting for children under three years, by selected background characteristics, Mali 1995/96

Background characteristic[1]	Net relative risk	
	Stunted	Wasted
Child's age (months)		
0-5m	1.0[a]	1.0[a]
6-11m	2.2[b]	2.0[b]
12-17m	5.0[b]	2.5[b]
18-23m	10.7[b]	2.8[b]
24-29m	10.8[b]	1.7[b]
30-35m	13.8[b]	1.9[b]
Birth Size		
Average+	1.0[a]	1.0[a]
Small	1.3[b]	1.3[b]
Very small	1.4[b]	1.8[b]
Child's sex		
Female		1.0[a]
Male		1.1
Birth order		
1		1.0[a]
2-3		1.1
4-5		1.2
6+		1.3[b]
Single birth		
No	1.0[a]	
Yes	0.5	
Diarrhoea (2 weeks)		
No	1.0[a]	1.0[a]
Yes	1.3	1.5
Fever (2 weeks)		
No		1.0[a]
Yes		1.2
Measles immunization		
No	1.0[a]	
Yes	0.7	
Source of antenatal care		
Doctor	1.0[a]	
Nurse/midwife	0.5[b]	
TBA	0.9	
Other/no one	0.6	
Pregnancy status		
No/unsure	1.0[a]	
Yes	1.3	

Continued

Table 5.3—*Continued*

Background characteristic[1]	Net relative risk	
	Stunted	Wasted
Reason for full weaning		
Maternal factors	1.0[a]	1.0[a]
Child factors	0.9	1.2
Weaning age	1.0	1.0
Pregnancy	1.1	1.3
Other	1.1	2.1[b]
Still breastfeeding	2.0[b]	1.6[b]
Listens to radio weekly		
No		1.0[a]
Yes		0.8
Father's education		
None	1.0[a]	
Primary	1.0	
Secondary +	0.6[b]	
Don't know/missing	0.7[b]	
Father's occupation		
Not working		0.6[b]
Professional		0.8[b]
Sales		1.0
Agriculture		1.0[a]
Other		1.0
Main floor material		
Natural	1.0[a]	
Rudimentary/finished	0.8	
Region		
Bamako		1.0[a]
Koulikoro		0.6[b]
Sikasso		0.7[b]
Segou		0.6[b]
Mopti		0.7[b]
Timbuktu/Gao		0.6[b]
Kayes		0.4[b]

Note: Net relative risk estimates based on odds ratios from logistic forward step-wise regression analysis.
[1] Background characteristics categorized and grouped as in tables 5.1 and 5.2
[a] Overall $p<.05$
[b] $p<.05$ compared with reference category

Children who had diarrhoea in the two weeks preceding the survey have a 30 percent higher risk of stunting than children who had no diarrhoea. Measles vaccination is protective, with lower risks among children who were vaccinated compared with those who were not. Not surprisingly, children perceived by their mothers as small or very small have a 30 to 40 percent higher risk of stunting compared with children perceived to be at least average size at birth. In addition, children of pregnant mothers were 30 percent more likely to be stunted than children of non-pregnant mothers. Singleton births have only half the risk of stunting compared with twins. Twins are more likely to be low birth weight and have to compete between themselves (and possibly with other siblings as well) for food, parental care and other household resources. Twins represent a group that may require targeting of specialized health and nutrition services to prevent poor growth.

Children whose mothers go to a nurse or midwife for antenatal care have only half the risk of being stunted as children whose mothers go to a doctor. This is the opposite result to what was found in the bivariate associations in Table 5.1, and suggests that the beneficial effect, in Table 5.1, of doctors as care-givers (at least for antenatal care) on child nutrition may have been rather a socioeconomic effect. After controlling for family income in this model, the beneficial effect of nurse/midwife on child nutrition compared with a doctor could suggest that, during antenatal visits, nurses or midwives are more likely to give mothers information about correct child feeding and child care practices than are doctors, or that, even to start with, these mothers follow better feeding practices for their children than mothers receiving care from doctors.

Whether or not a child is currently breastfed and, if not, the reasons for stopping breastfeeding are associated with stunting. Children who are currently breastfed appear to have the greatest risk of stunting, being, on average, twice as likely to be stunted than children who were weaned because of any reason. It is well known that breastfeeding is highly beneficial during the first two years of life, but beyond six months of age it must be accompanied by appropriate complementary foods. In Mali, as discussed in Chapter 3, many breastfed children six months of age and older do not receive complementary foods, which puts them at high risk of malnutrition.

Among socioeconomic factors, children of fathers educated at least through secondary school are less likely to be stunted than children of illiterate or primary school educated fathers, and children living in a house with a finished floor have lower risks of stunting than do children in a house with an unfinished floor. These two associations suggest, once again, that poverty plays an important part in child nutrition.

5.8 Risk Factors for Wasting

Risk factors for wasting reflect differences in the etiologies and age-specific patterns of wasting compared with stunting (Table 5.3). As with stunting, infants less than 5 months of age are least likely to be wasted. This reflects the fact that breastfeeding, which is nearly universal, is protective of child health during this period. However, between 6 to 11 months of age, infants are twice as likely to be wasted compared with younger infants, and this risk increases to almost threefold that of younger infants by age 18-23 months. This increase in risk reflects the delayed introduction of complementary foods, rapid rise in diarrhoeal disease, and most importantly the negative interactive effect of the two on child nutritional status. Diarrhoeal disease peaks at age 12 months and continues to remain much higher than at infancy for the rest of a child's first three years of life. Also, because of the delayed introduction of complementary foods, many children in these age intervals are not receiving complementary foods or, because these foods were only recently introduced, are not receiving enough nutrients from them. By 24 months of age, when almost all children are receiving complementary foods, the risk of wasting drops but continues to remain significantly higher than that for the youngest infants.

As with stunting, very small birth size and diarrhoea in the last two weeks increase the risks of wasting. In addition, children who had a fever in the last two weeks have a 20 percent higher chance of being wasted than those who did not, male children have slightly higher risks of being wasted than do female children, the risks of wasting increase with birth order, children still breastfeeding are more likely to be wasted than children weaned for maternal factors, and children of mothers who listen to the radio weekly are less likely to be wasted compared with mothers who do not. Regionally, children in Bamako town have the highest risk of wasting compared with other regions. As mentioned earlier in this chapter, this initially surprising result may be due to higher wasting risks faced by more deprived sub-populations living in Bamako town whose characteristics are not separately controlled for in this model.

As one would expect, children whose fathers are professionals (and thus probably well off) have a 20 percent lower risk of being wasted than those whose fathers work in agriculture (and are likely poor), reflecting, once again, the relationship between poverty and malnutrition. However, surprisingly, children whose fathers are reported as not working have an even lower risk of wasting, compared with children whose fathers are in agriculture. It is not entirely clear from these data what is the socioeconomic level of "not working" fathers, but it is possible that these households have alternate sources of income and are thus not as poor as might be assumed by the fact of non-working fathers.

5.9 Summary and Recommendations

Child nutritional status is largely associated with age of child, birth size as perceived by the mother, exposure to infectious diseases such as diarrhoea, infant weaning practices, and other factors associated with poverty. Delayed introduction of complementary foods, poor sanitation, disease and the interactive negative effect of malnutrition and disease, result in a rapid rise in both stunting and wasting at about 6 months of age. Risks of both stunting and wasting remain high throughout the second year of life, suggesting that the first two years of life is a critical period for public health intervention.

Thus, the key recommendations to improve child nutritional status are as follows:

- Public health efforts to improve child feeding behaviours should focus on the first two years of life. Specifically, these efforts should concentrate on encouraging women to introduce nutritious weaning foods at about 6 months of age, increasing the frequency of breastfeeding, and using oral rehydration therapy during diarrhoeal episodes. Since poverty is an important factor in Mali, research is needed to identify low-cost, locally available nutritious foods that poorer women can afford. The results of research which is already available must be disseminated to the public.

- Given that babies that are perceived to be very small at birth are at high risk for both stunting and wasting, public health programs should pay special attention to mother's perceptions of child's size, and should target efforts to improve child feeding to those children perceived by their mothers as small or very small. Similarly, twins need to be targeted to prevent greater stunting among them. The availability of prenatal care must be expanded to allow for long term improvement in the nutritional status of children.

- Over the long run, providing better education and income earning opportunities to both men and women to improve household income will help bring down the rates of stunting and wasting in a sustainable way.

- Efforts must be made towards improving hygiene conditions in order to prevent exposure to pathogens responsible for diarrhoeal diseases.

Chapter 6

NUTRITIONAL STATUS OF WOMEN

Women's nutritional status prior to conception and during pregnancy is important both as an indicator of overall women's health and as a predictor of pregnancy outcome for both the mother and infant. Women of childbearing age are particularly vulnerable to malnutrition because of the large nutritional costs associated with pregnancy and lactation. In countries such as Mali, where the fertility rate is 6.7, the average woman bears nearly seven children during her reproductive years. Women's bodies are repeatedly challenged by the nutritional stress of reproduction. In this final chapter, anthropometric measures of women who are the mothers of children under 3 years of age are described and the implications for maternal health discussed.

6.1 Background

Maternal nutritional factors, including low caloric intake or gestational weight gain, pre-pregnant weight, and height, are the most important determinants of poor fetal growth or intrauterine growth retardation (IUGR) in rural developing countries (Kramer, 1987). These factors alone account for over half of the difference between the rates of IUGR in developed compared with rural developing countries (Krasovec and Anderson, 1991). IUGR infants have a higher risk of perinatal mortality and other adverse outcomes. Additionally, women who gain too much weight given their pre-pregnancy weight-for-height have a greater risk of delivering a high birth weight baby, with resulting increased rates of prolonged labour, shoulder dystocia, Caesarean delivery, and birth trauma (IOM, 1990).

Pre-pregnancy weight is an important determinant of birth weight in both developed and developing countries (IOM, 1990). Gestational weight gain is also an important determinant of fetal growth, with the optimal gestational weight gain based on pre-pregnancy weight for height. To minimize poor pregnancy outcomes, women with lower prepregnancy weight for height need to gain more weight than women with high prepregnancy weight for height. The recommended weight gain ranges for pregnant women are shown in Table 6.1. However, the high pregnancy weight gains associated with positive pregnancy outcomes for women with low prepregnancy weight may be unrealistic for many women in developing countries (Krasovec and Anderson, 1991). Therefore, it is important to focus attention not only on pregnant women but on improving the nutritional status of women in general so they do not enter pregnancy in a nutritionally disadvantaged state.

Table 6.1 Recommended total weight gain ranges for pregnant women

Recommended total weight gain ranges for pregnant women, by prepregnancy body mass index (BMI)

Prepregnant weight-for-height category	Recommended total gain (kg)
Low (BMI < 19.8)	12.5-18.0
Normal (BMI of 19.8 to 26.0)	11.5-16.0
High (BMI >26.0 to 29.0)	7.0-11.5

Source: IOM, 1990

The nutritional cost of pregnancy has been estimated at 85,000 kcals. This figure assumes that women will store some 35,000 kcals of fat for lactation (Hytten, 1980). More recent work suggests that the energy cost of pregnancy is closer to 55,000 kcals (IOM, 1990). Nevertheless, the US Recommended Dietary Allowances recommends that pregnant women consume an additional 300 kcals per day during their second and third trimesters based on Hytten's estimate. The USRDA also recommends that lactating women consume an additional 300 kcal per day. These additional kcals must be consumed above a woman's regular food intake to maintain energy balance.

6.2 Data Collected

Maternal height and weight measures were collected from women having children under the age of three years. This selection criteria produces a sample that is biased toward women who are between 20 and 39 years of age, as this is the age interval in which women are most likely to have a child under three years (Table 6.2). Consequently, the age intervals 15 to 19 and 40 to 49 years are underrepresented.

Women were weighed on a digital scale and weight was recorded in kilograms to the nearest 100g. Height was measured using a standard anthropometer specifically made for the survey and recorded to the nearest millimeter. A total of 4,643 women were measured, of whom 583 (13 percent) were pregnant, 3,460 (75 percent) were lactating and 600 (13 percent) were neither pregnant nor lactating at the time of the survey (Tables 6.3 and 6.4). Since pregnancy does not affect height, height data are provided here for all women (Table 6.3). However, since weight is affected by pregnancy, and by the stage of pregnancy (about which there is no information in these data), weight data are provided for nonpregnant women, both lactating and nonlactating (Table 6.4).

Table 6.2 Age distribution of women with children born in the last 3 years

Percent distribution of women with children born in the last 3 years by age, Mali 1995/96

Age	Percent
15-19	11.0
20-24	22.6
25-29	24.3
30-34	20.0
35-39	14.9
40-44	5.8
45-59	1.4
Total	100.0
Number of women	4,643

Table 6.3 Distribution of height for women with children born in the last 3 years

Percent distribution, mean, standard deviation and median for height, for women with children born in the last 3 years, Mali 1995/96

Height (cm)	Distribution of women
Less than 145	0.3
145 - 149.9	1.7
150 - 154.9	11.5
155 - 159.9	25.5
160 - 164.9	32.4
165 - 169.9	19.8
170 +	8.7
Mean height	161.6
Standard deviation	6.1
Median height	161.4
Total	100.0
Number of women	4,643

Table 6.4 Distribution of weight and body mass index (BMI) for women with children born in the last 3 years

Percent distribution, mean, standard deviation and median for weight and for BMI, for nonpregnant, lactating or nonlactating women with children born in the last 3 years, Mali 1995/96

	Nonpregnant women		
Indicator	Nonlactating women	Lactating women	Total
Weight (kg)			
Less than 40	1.7	1.4	1.4
40 - 44.99	6.2	6.9	6.8
45 - 49.99	16.7	20.3	19.8
50 - 54.99	25.3	27.7	27.3
55 - 59.99	23.7	22.3	22.5
60 +	26.5	21.4	22.2
Mean weight	56.8	54.9	55.2
Standard deviation	10.7	8.5	8.9
Median weight	55.0	53.8	54.0
Body mass index (kg/m^2)			
Less than 16	1.5	1.1	1.1
16 - 16.99	2.8	3.0	3.0
17 - 18.49	10.3	12.1	11.8
18.5 - 24.99	71.5	76.0	75.3
25 - 26.99	6.3	4.0	4.3
27 +	7.5	3.9	4.4
Mean BMI	21.6	21.0	21.1
Standard deviation	3.6	2.8	3.0
Median BMI	20.8	20.6	20.7
Number of women	600	3,460	4,060

6.3 Indicators of Maternal Nutritional Status

To date, the assessment of nutritional status in nonpregnant women has been based on normative distributions (Krasovec and Anderson, 1991). Commonly used anthropometric references for adult women represent averages of the healthy populations studied and should not necessarily be interpreted as "ideal" or desirable for each individual.

Weight is predominantly a measure of current nutritional status and is often used as an indicator of overall health and nutritional status. The desirable or appropriate level of weight at different stages of the life cycle, however, is still unknown.

Height is a measure of past nutritional status as well as the genetic potential of the individual. It also reflects, in part, the cumulative effect of social and economic status over generations. No international standard exists for adult women's height, however, women whose height falls below 145 cm have been found to be at a greater risk of maternal mortality than taller women. This cutoff has been used in the case of Mali (Coulibaly et al., 1996:157). This relationship reflects the association between short stature and small pelvic size which can result in obstructed labor (WFPHA, 1983). Young women may have an immature pelvis, which can lead to cephalopelvic disproportion (Liljestrand, 1985). Short stature is correlated with low birth-weight infants, high risk of stillbirth, and high rate of miscarriage (Krasovec and Anderson, 1991).

Body mass index (BMI) or Quetlet index, calculated as weight in kilograms divided by height in metres squared (kg/m^2) can be used to assess women's nutritional status. It was originally developed to diagnose obesity but James et al. (1988) have advocated its use for assessing chronic energy deficiency (CED). CED has been defined "...as a steady state at which a person is in energy balance although at a cost either in terms of risk to health or as an impairment of functions and health" (James, 1988).

The key advantage of using BMI to assess maternal nutritional status is that it is a self-contained ratio and does not require reference Tables. Data from well-nourished populations show that a normal range maternal BMI is between 21.5 and 23.1. The International Dietary Energy Consultative Group suggests that Quetlet BMIs between 17.0 and 18.4 are indicative of Grade I CED, those between 16.0 and 17.0 of Grade II CED, and those below 16 of Grade III (severe) CED (James et al., 1988). A Quetlet BMI of 12 is the absolute lower limit compatible with life. At the other extreme, women who are 20 percent overweight have BMIs between 25.8 and 27.3 whereas those who are severely overweight, i.e., 40 percent overweight, have BMIs between 30.1 and 32.3. In the case of Mali, overweight is defined as a BMI of 25.0 or more (Coulibaly et al., 1996:158).

6.4 Height, Weight and Body Mass Index

For all women with children under age 3, the distribution of their heights, and the mean, standard deviation and median height, are presented in Table 6.3. Only 2 percent of these fell below the critical lower level of 145-150 cm. Almost one-third of these women were between 160-165 cm (32 percent). The mean height was 162 cm.

Table 6.4 shows the distribution of weights and BMI, and the mean, standard deviation and median weights and BMI for nonpregnant women, both lactating and nonlactating. There is little difference in weight between nonlactating and lactating women. Less than 10 percent of nonpregnant women are below 45 kg; almost three-quarters of women are 50 kg or more, with more than 20 percent of women (27 percent nonlactating and 21 percent lactating) weighing more than 60 kg. The mean weight is 57 kg for nonlactating, and 55 kg for lactating women.

Since weight typically varies by height, it is perhaps more informative to examine the body mass index (BMI) to assess women's nutritional status. There is little difference in mean BMI between nonlactating and lactating nonpregnant women (Table 6.4). About 16 percent of nonpregnant Malian women are undernourished according to this index (BMI less than 18.5). Close to 9 percent of nonpregnant women are 20 percent and above overweight (BMI of 25.0 or more). The large majority—three-quarters—of nonpregnant women fall within the normal BMI range of 18.5 to 24.99 (72 percent for nonlactating and 76 percent for lactating women). The mean BMI is about 21 for all nonpregnant women.

A number of social and economic factors were associated with low BMIs, defined as below 18.5, and high BMIs, defined as greater than 25.0 (Table 6.5). The variables identified as important in the bivariate analyses, and presented in the first and third columns of Table 6.5, were included in multivariate analyses in order to determine their net effects on low and high BMI. The odds ratios derived from the logistic regression analysis were used to estimate the net relative risks of these factors for maternal chronic energy deficiency (low BMI) and overweight (high BMI).

6.5 Maternal Chronic Energy Deficiency

The multivariate analysis suggests that the important determinants of CED among Malian women are region of residence, whether the mother watches TV weekly, total number of births the mother has had, whether the mother has an underweight child under age 3 years, and whether the mother received any tetanus toxoid injections during pregnancy (Table 6.5).

Regionally, women in all regions except those in Koulikoro region have a lower net relative risk of CED (low BMI) compared with women in Bamako town. Women in Koulikoro region have a 20 percent higher risk of CED compared with women in Bamako town. Risks in Kayes region, Sikasso region and Segou region are almost the same as those in Bamako town. At first glance this result may seem surprising, given that Bamako town is, on the whole, a better-off region than is, for example, Kayes region. However, these results are similar to those for wasting for children, where children in Bamako town had higher risks of wasting than children in other regions. As with child nutrition, these results may reflect the poor nutritional status of the low-income, more deprived sub-populations living in Bamako town, or of behavioural and cultural factors that differ between regions and that are not captured by these data.

Women who watch TV weekly are 30 percent less likely to have CED. This probably reflects the effect on nutrition of high socioeconomic status, since only the wealthier women are likely to have access to TV. It could also reflect a positive effect on nutrition of information that these women receive through TV. Women who received at least one tetanus injection during pregnancy were also less likely to suffer from CED compared with women who received no tetanus injections. The use of tetanus injections could be regarded as a proxy for the use of health care by the household for the mother, and suggests, as would be expected, that women from households where they receive better care are less likely to be undernourished than are women from households where they receive less care.

Women who have a wasted child are 40 percent more likely to be undernourished themselves, reflecting the close link between child and maternal nutrition. Women who have had a high number of children ever born are slightly less likely to be undernourished than women who have had 1-3 children. It could be the case that women with more children, who represent proportionately more of the older women who are less malnourished than younger women (as shown in Table 6.5), get more help with their work from their older children, earn more money than older women, do less strenuous work than younger women, or some contribution of the above.

Table 6.5 Prevalence and estimated net relative risk of low body mass and high body mass among nonpregnant women with children born in the last 3 years

Percentage of nonpregnant women with children born in the last 3 years who have low body mass (chronic energy deficiency) or high body mass (overnutrition), and the estimated relative risk of low body mass and high body mass by selected background characteristics, Mali 1995/96.

Background characteristic	BMI <18.5 Low	BMI <18.5 Net relative risk	BMI >25.0 High	BMI >25.0 Net relative risk
Mother's age group				
15-19 yrs	18.4		2.4	1.0[a]
20-24 yrs	16.8		4.9	1.9[b]
25-29 yrs	15.3		9.5	3.6[b]
30-34 yrs	14.2		11.6	4.5[b]
35-49 yrs	16.1		12.3	4.5[b]
	NS		p<.0001	
Residence				
Rural	16.7		4.5	1.0[a]
Urban	14.2		17.9	2.1
	p<.05		p<.0001	
Region				
Bamako	14.0	1.0[a]	21.5	1.0[a]
Koulikoro	21.2	1.2	4.0	0.7
Sikasso	16.3	0.9	4.5	0.7
Segou	15.3	0.9[b]	6.6	1.0[b]
Mopti	10.8	0.5[b]	11.7	1.8
Timbuktu/Gao	13.8	0.7	16.1	1.2
Kayes	16.5	0.9	6.3	1.2
	p<.0001		p<.0001	
Mother's education				
None	16.7		6.5	1.0[a]
Primary	13.8		15.7	1.9[b]
Secondary+	9.1		30.3	2.0[b]
	p<.01		p<.0001	
Mother's occupation[1]				
Not working	16.7		9.0	
Professional	14.8		13.4	
Agriculture	16.1		2.9	
Manual	14.6		9.4	
Domestic/Services	15.6		11.1	
	NS		p<.0001	
Father's education				
None	16.6		7.0	
Primary	12.8		8.8	
Secondary +	14.4		21.8	
Missing/don't know	15.2		11.0	
	NS		p<.0001	
Father's occupation[1]				
Not working	10.3		5.2	
Professional	11.0		26.7	
Sales	14.4		14.9	
Agriculture	17.6		4.4	
Other	13.1		15.3	
Missing/don't know	17.0		7.5	
	p<.005		p<.0001	
Listens to radio (weekly)				
No	17.7		5.1	
Yes	14.8		11.1	
	p<.05		p<.0001	

Continued

Table 6.5—*Continued*

Background characteristic	BMI <18.5 Low	BMI <18.5 Net relative risk	BMI >25.0 High	BMI >25.0 Net relative risk
Reads newspaper (weekly)				
No	16.2		7.8	
Yes	10.6		28.2	
	p<.1		p<.0001	
Watches TV (weekly)				
No	17.1	1.0[a]	6.6	
Yes	12.9	0.7[b]	14.9	
	p<.001		p<.0001	
Type of floor				
Earth/sand	16.6		6.3	1.0[a]
Dung	17.6		3.4	0.7[b]
Cement/other finished	12.1		21.3	1.6[b]
	p<.003		p<.0001	
Possession score[1]				
0	17.1		4.5	
1	16.3		7.8	
2+	10.2		26.8	
	p<.003		p<.0001	
Total number of births				
1-3	17.3	1.0[a]	6.2	1.0[a]
4-7	15.3	0.9[b]	10.1	1.2[b]
8+	14.2	0.8[b]	11.7	1.7[b]
	NS		p<.0001	
Has a wasted child <3 years				
No	14.6	1.0[a]	8.8	
Yes	20.5	1.4[b]	8.4	
	p<.0001		NS	
Currently breastfeeding				
No	14.7		13.8	
Yes	16.2		7.8	
	NS		p<.0001	
Assistance at delivery[1]				
Doctor/nurse	13.4		18.0	
TBA	18.4		4.3	
Other	16.2		6.4	
No one	16.0		5.9	
	p<.05		p<.0001	
Tetanus injections received when pregnant				
None	19.0	1.0[a]	5.1	
1	11.4	0.6[b]	10.6	
2+	14.5	0.8[b]	12.8	
	p<.0001		p<.0001	

Note: Level of significance determined using Chi-square test
NS=not significant (p>0.1)
Net relative risk estimates based on odds ratios from logistic forward step-wise regression analysis.
[1] Background characteristics defined and categorized as in Tables in the rest of this report
[a] Overall p<.05
[b] p<.05 compared with reference category

6.6 High Body Mass

The important determinants of high body mass, or overnutrition, among Malian women are age, region of residence, urban or rural residence, mother's education, type of floor in the home, and total children ever born (Table 6.5).

Women's age predicted overnutrition in the expected direction: BMI scores increased with age. Compared with women 15 to 19 years old, women 20 to 24 years old were almost twice as likely to be overweight, women 25 to 29 years old were more than three times as likely to be overweight, and women above age 30 were more than four times as likely to be overweight. Increasing risks of obesity with age might reflect slowing metabolism with advancing age, or greater wealth, or less work demands due to the presence of older children.

Women in urban areas were twice as likely to be overweight than were women in rural areas. This pattern coincides with the pattern for underweight, in that a smaller proportion of women in urban areas were underweight compared with rural areas, suggesting better access to food and other resources in urban than in rural areas. Regionally, compared with Bamako town, women in Mopti region were 80 percent more likely to be overweight; there was no statistically significant difference in the relative risks of being overweight for women in other regions compared with women in Bamako town. This pattern also coincides with the pattern for the risk of CED, with women in Bamako town being twice as likely to be affected by malnutrition as women in Mopti region.

The risk of being overweight increased with maternal education, with women who have primary or higher education being about twice as likely to be overweight than uneducated women. Women living in homes with a floor made of cement or other finished materials were one and a half times more likely to be overweight than women in homes with earth or sand floors. Both these results probably reflect the positive influence of socioeconomic status on the risk of obesity. Women with a higher number of births were also more likely to be overweight, compared with women with 1 to 3 children ever born.

6.7 Summary

These results indicate that malnutrition in Mali is not limited to children since adults are also victims. Among adults, women of reproductive age constitute the group which runs the highest risk: approximately 16 Malian women in 100 exhibit chronic energy deficiency (CED). This rate, along with that in Niger, is the highest of the sub-Saharan African countries who have undertaken a DHS survey. Compared with women who do not have wasted children, those having a wasted child have more than a 40 percent risk of having CED themselves. This underlines the link between the nutritional status of children and that of their mothers. It is therefore important to concentrate attention not only on improvement in the nutritional status of children but also on that of women in general and adolescent girls in particular, so that first pregnancies can unfold under optimal nutritional conditions. As with child nutrition, poor nutritional status among women is closely linked to poverty. The highest CED prevalence occurs in women from low income, disadvantaged populations.

6.8 Recommendations

Short and long term actions for improving the nutritional status of Malian women must be considered.

- Increase the quantity and quality of women's and girls' diets from early infancy to reduce the risk of disease and maternal death associated with malnutrition and deficiencies in micronutrients so that these women enter into pregnancy in the best possible nutritional state.

- Improve the energy balance and micronutrient intake of pregnant and lactating women by ensuring their dietary quantity and quality and minimizing their work related energy expenditure.
- Expand women's and adolescent girls'access to health services by emphasizing nutrition and birth spacing as part of the minimum package of activities (PMA) programme.
- Ameliorate access of women to education by augmenting literacy, school attendance and information access rates.
- Promote women's income earning opportunities in an effort to improve household economic status and thereby ameliorate the women's nutritional status and that of their children.

CHAPTER 7

KEY RECOMMENDATIONS

7.1 Recommendations

1. Create a multisectoral structure at the level of the Department of Health for reflection and follow-up on the nutritional situation in Mali.

2. Reinforce the prevention and treatment of malnutrition within the integrated management of childhood illnesses (IMCI) approach in health sector programs, and reinforce programs which emphasize nutrition surveillance of infants and children and nutrition education of mothers.

3. Introduce in schools the teaching of basic nutrition and childrearing and make compulsory the teaching of nutrition (theory and practice) and in formal training programs for health personnel.

4. Using popular media channels (television, radio, newspapers, etc.) inform and sensitize the population about the problem of malnutrition in Mali, about results of research on infant feeding, on preparation of locally developed food recipes, and on diversified uses of Malian agricultural products which can promote a good diet for mothers, children and families.

5. Encourage the increase and diversification of women's incomes by elaborating and financing (or supporting the search for financing) of projects for market gardening, transformation of agricultural products, small commerce, production of foods for children, etc.

6. Expand women's and adolescent girls' access to health services by emphasizing nutrition and birth spacing as part of the minimum package of activities (PMA) program.

7. Support development and financing of qualitative research on:

   - distribution problems of agricultural products in Mali (national level, markets, villages and families)
   - income distribution and accessibility of households to food products
   - the beliefs, motivations and constraints related to breastfeeding and infant feeding practices of mothers and child caretakers.

8. Promote the diversification of agricultural production and ensure food security throughout all regions of Mali by bringing about improvements (small dams, large diameter wells, rural roads, etc.) with the goal of a regular supply of diversified agricultural products from the populations.

7.2 Suggestions for Specific Activities to be Undertaken

For Decision Makers

At the governmental level, information and awareness meetings must be organized by the department in charge of health in order to present the results of the study to the staff and administrative heads of the social and health services. It must also organize information and training seminars and workshops in Bamako and in the regions for all sectors and NGOs involved in nutrition problems. PROFILES software will be used

for the sensitization of ministers, members of ministerial cabinets and those elected by the people (delegates and local elected officials) on the nutrition problem in Mali.

For the Population

Specific activities which could be undertaken at the population level include:

- The creation of manufacturing units for children's food made from local product;
- Wide dissemination of the research results of the Laboratoire de Technologie Allimentaire (Food Technology Laboratory) of the IER concerning food recipes for infants and children;
- Organization, with a maximum of media coverage, contest games for the "Well Fed Child" in all locales, especially in rural areas; and
- The development and financing of projects which lighten rural women's tasks (mills, water supply, solar energy, etc.).

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APPENDIX A

SAMPLE DESIGN

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SAMPLE DESIGN

The EDSM-II was carried out in seven regions of the country—Bamako town, urban areas of Timbuktu and Gao, and the regions of Kayes, Koulikoro, Sikasso, Segou and Mopti. For security reasons, the rural areas in Timbuktu and Gao were excluded from the survey. The resulting urban samples for Timbuktu and Gao were combined into one "region" so as to get an adequate sample size. The excluded rural areas of Timbuktu and Gao represent about 65 percent of Mali's total land area and close to 10 percent of the total population. The sampling frame used for the 1995/96 EDSM-II was based on the 1987 census (RGPH). The 8,928 census tracts defined by the Central Census Bureau (BCR) were used as primary sampling units (PSU), excluding the 871 census tracts for rural areas in Timbuktu and Gao.

The EDSM-II sample is stratified and weighted to be nationally representative. The seven sample regions were divided into strata: Bamako town and Timbuktu/Gao urban areas were treated as one strata each, while the remaining five regions were divided into rural and urban areas, thus resulting in a total of 13 strata. Sample selection was carried out in two stages. First, from the 13 strata, 300 Primary Sampling Units (PSU) were systematically sampled with probability proportional to size, where size was based on the number of households in each PSU as recorded by the 1987 census[1]. A list of the number of households was then made for each selected PSU. In the second stage, a sample of households was selected based on the complete household listing done for each selected PSU. For sampled households, all household members were listed in the household questionnaire, and women between the ages of 15 to 49 years were identified and interviewed using the detailed women's questionnaire. The men's survey was conducted in one-third of the sampled households. Sample selection for the households for the men's survey was undertaken at the same time as the sample selection for households for the women's survey, with systematic sampling using a one-third probability.

A total of 9,512 households were selected, of which 8,833 were identified at the time of the survey. From the households identified, a total of 8,716 households were successfully interviewed, yielding a household response rate of 98.7 percent. In these 8,716 surveyed households, a total of 10,096 eligible women (ages 15-49 years) were identified, of whom 9,704 were successfully interviewed, yielding an individual woman response rate of 96.1 percent. For the men's questionnaire, from a sub-sample of 2,869 households that were successfully interviewed, a sample of 2,810 eligible men (ages 15-59 years) were identified, of whom 2,474 were successfully interviewed, which is a response rate of 88 percent.

Mortality data were collected for all children born to the women interviewed, and health and immunization data were collected for 6,019 children born since January 1992 (aged 0-35 months) to the women interviewed. Questions on recent morbidity, nutrition and health care data were asked for 5,237 surviving children 0-35 months old; these questions included breastfeeding history, feeding patterns, and the occurrence and treatment of diarrhoea, fever, and cough in the two weeks preceding the survey. This report is based on a sub-sample of 4,678 living children ages 0-35 months for whom complete anthropometric data are available.

[1] Timbuktu/Gao urban areas were over-sampled to get an adequate sample size for statistical analyses.

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APPENDIX B

HOUSEHOLD AND RESPONDENT BACKGROUND CHARACTERISTICS

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Appendix B

HOUSEHOLD AND RESPONDENT BACKGROUND CHARACTERISTICS

A total of 4,678 living children under the age of three years who had complete anthropometric data were included in the analyses presented in chapters 1 through 5 of this report. The tables in this appendix show the distribution of the sample children by various background characteristics, according to region and residence.

Table B.1 shows the sex distribution and total numbers of children. There were slightly more male than female children, and twice as many rural as urban children. Regionally, the largest proportion of children were from Segou region and the fewest from Timbuktu/Gao urban areas. On average, slightly more rural children lived at home than did urban children (3.1 compared to 2.8) (Table B.2[2]). There is an average of 4.6 children ever born. Regionally, Bamako town had the lowest average children ever born (3.7) and dead (0.5), while Segou region had the highest mean number of children ever born and Mopti region the highest mean number of dead children.

Table B.3 shows the distribution of children by mother's age. Overall there were few children with very young mothers (15-19 years old), and more or less equal proportions of children with mothers in all other age groups, with most mothers being between 25 to 29 years old. Mothers in Timbuktu/Gao urban areas were a little older than this average, while mothers in Kayes region were a little younger than the average. There were slightly more younger mothers in urban than rural areas.

Most of the mothers were uneducated (Table B.4), with only about 11 percent with primary education, and less than 5 percent with secondary or higher education. Not surprisingly, education levels were higher in urban than rural areas. Almost all rural mothers were uneducated, compared to two-thirds of urban mothers. Significantly more urban than rural mothers had primary or secondary education. Regionally, Bamako town had the highest proportion of educated mothers, and Mopti region, one of the more remote and poor areas of the country, had the lowest proportion of educated mothers.

Almost half of all mothers were not working at the time of the survey, with most working mothers being either in the professional or agricultural sectors (Table B.5). There were more mothers in the professional sector in urban areas and in Bamako town, compared to rural areas or other regions of the country. The largest proportion of mothers in agriculture (34 percent) is in Koulikoro region, and the largest proportion working as manual labour (27 percent) in Mopti region. Few mothers worked in the domestic/service industry in any region of the country.

Table B.6 shows that almost half of all working mothers (49 percent) usually took care of their children themselves, with other children being the next most common caretaker. The mother is the most usual caretaker in all regions and both urban and rural areas. There were some differences in child care source by region and residence. For instance, the use of non-relatives (neighbors, friends or child-care services) is much higher in urban (8 percent) than in rural (1 percent) areas and in Bamako town (16 percent) than in other regions (0.2 to 4 percent). Other children were more likely to take care of their siblings in rural

[2] Unlike all the other tables in this appendix, Table B.2 includes all children under three years of age, regardless of whether they are currently dead or living, and whether or not they have complete anthropometric data.

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than in urban areas (29 compared to 14 percent), and least likely to be caretakers in Bamako town (8 percent) compared to other regions in the country (12 to 29 percent).

Table B.7 shows the distribution of children by mother's marital status. Almost all mothers were married. The largest proportion of never-married mothers was in urban areas (7 percent) and in Bamako town (9 percent). Among all the regions, Bamako town also had the lowest proportion of mothers who were married or living together (88 percent). Timbuktu/Gao urban areas had the highest proportion of mothers who were divorced, widowed or not living together (6 percent). Among married mothers, most husbands reside at home (Table B.8), with only 8 percent residing elsewhere. Fewer urban than rural husbands reside at home, and fewer husbands reside at home in Timbuktu/Gao urban areas and Bamako town than in other regions.

More than three quarters of the mother's husbands were uneducated (Table B.9): only 9 and 8 percent of husbands had primary or secondary education, respectively. There were noticeable regional differences. Almost one quarter of urban husbands had a secondary education or more, compared to less than 5 percent of rural husbands. Similarly, almost one third of husbands in Bamako town had a secondary education, much higher than in any other region. More than half the husbands in Bamako town had some education, more than in any other region. A little over two thirds of husbands (68 percent) work in the agricultural sector (Table B.10). In rural areas, and in all regions other than Bamako town and Timbuktu/Gao urban areas, more than three quarters of the husbands work in agriculture. In urban areas, Bamako town and Timbuktu/Gao urban areas, most husbands work in manual, domestic or service sectors (40 to 48 percent), followed by professional and sales, in that order. Fewer than 2 percent of husbands were not working.

Tables B.11 and B.12 show the distributions of children by the water and sanitation facilities in their households. About two thirds of the households had a traditional pit toilet (64 percent), and slightly more than one quarter (27 percent) had no toilet facility (Table B.11). There were marked regional differences. Other than in Bamako town and in urban areas, almost no families had a flush toilet. All families in Bamako town had some kind of toilet; however, in other regions there were at least 18 percent of families without any facility. About 8 times as many rural compared to urban families were likely to be without a toilet facility. The main source of drinking water for the large majority of households (81 percent) is a well or borehole (Table B.12). Access to a private or public tap is many times more likely in urban than in rural areas, and in Bamako town and Timbuktu/Gao urban areas (the two most urban regions) than in any other region. The largest proportion of households using surface water or other such sources is found in Mopti region and Kayes region, the two most remote and poor regions in Mali, and in rural rather than urban areas.

Table B.13 shows the distribution of children by their mother's exposure to mass media such as radio, television and newspaper. The mothers of 65 percent of the children listen to the radio weekly, 10 percent watch TV weekly, and 4 percent read the newspaper weekly. Frequent exposure to radio, TV and newspapers were, not surprisingly, much more common in urban than in rural areas, and in Bamako town compared to any other region. Radio appears to be quite widespread, and regional differences were much more marked for TV and newspaper than for radio. Thus, 10 times as many urban than rural children's mothers listened to the radio weekly (21 compared to 2 percent) and 12 times as many urban than rural children's mothers read a newspaper weekly (12 compared to 1 percent). Similarly, the mothers of 41 percent of children in Bamako town watched TV compared to between 0.3 and 6 percent for other regions, and 15 percent read a newspaper compared to between 1 and 5 percent for other regions.

The distribution of children according to various criteria of household socioeconomic status is described in tables B.14 through B.16. Table B.14 shows the type of floor. The main floor material in about half of all households is earth or sand (56 percent), with the remaining households almost equally split

between floors made of dung (23 percent) and of cement or other finished materials (21 percent). There were enormous regional differences. Almost 90 percent of households in Bamako town had cement or other finished floors compared to 12 to 28 percent for other regions, and 12 times as many urban than rural households had finished floors (64 compared to 5 percent). Dung floors were mostly found in Kayes region, while earth and sand floors were used by three quarters or more of households in Segou region, Sikasso region and Timbuktu/Gao urban areas. Not surprisingly, dung or earth/sand floors were many times more common in rural than in urban areas.

About 41 percent of families owned no means of transport (Table B.15). Close to half the children in the sample came from households with a bicycle (47 percent), 23 percent with a motorcycle, and very few (only 3 percent) with a car. Again, urban/rural and regional differences were important. Sixteen percent of households in Bamako town owned a car, compared to less than 6 percent in any other region; 10 percent of urban households owned a car while almost no rural households owned a car. More than twice as many rural than urban households owned a bicycle (21 compared to 56 percent), while only half as many rural compared to urban households owned a motorcycle (18 compared to 36 percent). However, more urban than rural households had no private means of transport (perhaps reflecting the greater availability of public transportation in urban than rural areas). Regionally, bicycles were most common in Sikasso region (80 percent) and motorcycles in Bamako town (30 percent). The largest proportion of households with no private means of transport is in Timbuktu/Gao urban areas (77 percent).

Table B.16 describes the distribution of children in households with varying possession scores (an index based on the availability and ownership of electricity, radio, television, and refrigerator). About half of all households owned one of these 4 items (56 percent), only 10 percent owned two or more, and the remaining 34 percent owned none. Regional and rural/urban differences followed patterns similar to those for tables B.14 and B.15. Urban areas had many more households with a high possession score than did rural areas (32 compared to 3 percent, respectively, for ownership of two or more items). Regionally, Bamako town and Timbuktu/Gao urban areas had a much higher proportion of households with two or more items, compared to any other region.

Tables B.17 and B.18 show the distribution of children by their mother's access to health services for antenatal care and delivery. Half of all children were born to mothers who had no recognized antenatal care provider (Table B.17). About 47 percent used a nurse or midwife. Very few used either a doctor or a traditional birth attendant (TBA). There were noticeable regional patterns. Few urban mothers (16 percent) or mothers in Bamako town (10 percent) had no antenatal care, compared to rural areas or other regions. Almost twice as many urban than rural mothers used a nurse/midwife; a nurse or midwife is also much more common in Bamako town (80 percent) than in any other region (56 percent or less). Among the few who had access to a doctor, not surprisingly, most were in urban areas or in Bamako town.

About 42 percent of mothers were assisted at delivery by a relative or other non-medical person (Table B.18). As with antenatal care, very few mothers were assisted at delivery by a doctor (less than 1 percent), 24 percent were assisted by a nurse and 21 percent by a traditional birth attendant (TBA). There were large regional differences. A little over two thirds of urban mothers (70 percent) were assisted by a nurse compared to less than 10 percent in rural areas. Many more rural than urban mothers were assisted by a TBA or by relatives. Among all the regions, Bamako town had the highest proportion of mothers assisted by a doctor (3 percent) or nurse (83 percent), while Kayes region had the highest proportion assisted by relatives (56 percent). Almost one quarter of mothers (21 percent) in Segou region had no assistance during delivery, higher than for any other region.

Table B.1 Anthropometric measurement of children

Percent distribution of children under three years for whom height and weight measurements are collected by sex, according to region and residence, Mali 1995/96

Region and residence	Children measured			Number of children
	Male	Female	Total	
Region				
Bamako	47.5	52.5	100.0	483
Koulikoro	49.9	50.1	100.0	833
Sikasso	54.3	45.7	100.0	1,003
Segou	50.2	49.8	100.0	880
Mopti	50.7	49.3	100.0	714
Timbuktu/Gao	49.5	50.5	100.0	79
Kayes	52.2	47.8	100.0	687
Residence				
Rural	51.5	48.5	100.0	3,443
Urban	49.9	50.1	100.0	1,235
Total	51.1	48.9	100.0	4,678

Table B.2 Mean number of living and dead children

Among children less than three years of age, the mean number of children living in the home (and SD), the mean total number of children ever born to their mothers (and SD), and the mean number of dead children of their mothers (and SD), by region and residence, Mali 1995/96

Region and residence	Number of children at home		Total number of children ever born		Number of dead children		Number of children[1]
	Mean	(SD)	Mean	(SD)	Mean	(SD)	
Region							
Bamako	2.7	(1.76)	3.7	(2.43)	0.5	(0.97)	535
Koulikoro	3.2	(1.81)	4.6	(2.81)	0.9	(1.24)	957
Sikasso	3.3	(1.80)	4.9	(2.90)	1.1	(1.39)	956
Segou	3.2	(1.70)	5.0	(2.90)	1.2	(1.49)	868
Mopti	2.6	(1.56)	4.6	(2.71)	1.3	(1.54)	580
Timbuktu/Gao	2.8	(1.82)	4.2	(2.60)	0.9	(1.22)	538
Kayes	3.1	(1.77)	4.6	(2.73)	1.0	(1.40)	804
Residence							
Rural	3.1	(1.74)	4.8	(2.84)	1.1	(1.44)	3,599
Urban	2.8	(1.82)	4.1	(2.60)	0.7	(1.12)	1,639
Total	3.0	(1.77)	4.6	(2.79)	1.0	(1.36)	5,238

[1] Includes all children born in the last three years

Table B.3 Mother's age

Percent distribution of children under three years by mother's age, according to region and residence, Mali 1995/96

Region and residence	Mother's age (years)					Total	Number of children
	15-19	20-24	25-29	30-34	35-49		
Region							
Bamako	14.9	26.4	29.5	13.3	16.0	100.0	483
Koulikoro	12.9	22.8	25.2	19.2	19.8	100.0	833
Sikasso	11.2	21.4	23.8	21.2	22.4	100.0	1,003
Segou	7.7	21.2	23.8	22.0	25.4	100.0	880
Mopti	5.6	19.5	27.5	22.0	25.4	100.0	714
Timbuktu/Gao	12.1	22.8	21.1	25.3	18.8	100.0	79
Kayes	8.9	27.3	22.0	19.6	22.2	100.0	687
Residence							
Rural	9.5	21.7	24.4	21.2	23.2	100.0	3,443
Urban	11.5	25.6	26.4	17.1	19.4	100.0	1,235
Total	10.1	22.7	24.9	20.1	22.2	100.0	4,678

Table B.4 Mother's education

Percent distribution of children under three years by mother's education, according to region and residence, Mali 1995/96

Region and residence	Mother's education			Total	Number of children
	None	Primary	Secondary+		
Region					
Bamako	55.9	21.7	22.4	100.0	483
Koulikoro	84.3	12.8	2.9	100.0	833
Sikasso	89.6	8.1	2.4	100.0	1,003
Segou	88.9	7.7	3.4	100.0	880
Mopti	90.8	6.9	2.3	100.0	714
Timbuktu/Gao	73.5	17.6	8.9	100.0	79
Kayes	85.3	13.5	1.2	100.0	687
Residence					
Rural	90.7	8.2	1.1	100.0	3,443
Urban	66.6	18.9	14.5	100.0	1,235
Total	84.3	11.0	4.7	100.0	4,678

Table B.5 Mother's occupation

Percent distribution of children under three years by mother's occupation, according to region and residence, Mali 1995/96

Region and residence	Mother's occupation						Number of children
	Not working	Professional	Agriculture	Manual	Domestic/ Service	Total	
Region							
Bamako	45.8	42.7	0.2	6.2	5.1	100.0	482
Koulikoro	33.6	26.2	33.9	5.7	0.6	100.0	831
Sikasso	44.6	20.2	32.6	1.9	0.8	100.0	1,001
Segou	70.0	21.7	4.8	2.4	1.2	100.0	877
Mopti	45.5	17.4	9.1	27.2	0.8	100.0	714
Timbuktu/Gao	46.6	41.5	0.6	4.8	6.4	100.0	79
Kayes	29.0	11.8	51.2	5.9	2.1	100.0	686
Residence							
Rural	44.3	16.9	30.3	7.8	0.7	100.0	3,437
Urban	48.5	38.2	2.1	7.1	4.1	100.0	1,233
Total	45.4	22.6	22.8	7.6	1.6	100.0	4,670

Table B.6 Usual caretaker of children with working mothers

Percent distribution of children under three years cared for by their mothers, by their fathers or other relatives, by neighbors, friends or a child-care service, or by other children, according to region and residence, Mali 1995/96

Region and residence	Child's caretaker					Number of children
	Mother	Husband/ Relative	Neighbor/ Friend/ Service	Other child	Total	
Region						
Bamako	55.7	20.7	15.6	8.0	100.0	254
Koulikoro	38.5	30.5	2.4	28.6	100.0	551
Sikasso	40.1	21.1	3.7	35.1	100.0	555
Segou	60.1	17.6	0.5	21.8	100.0	266
Mopti	66.6	14.0	0.3	19.0	100.0	383
Timbuktu/Gao	54.8	31.5	1.7	12.0	100.0	42
Kayes	48.2	26.4	0.2	25.3	100.0	485
Residence						
Rural	47.5	22.6	1.4	28.6	100.0	1,910
Urban	54.5	23.7	8.2	13.6	100.0	627
Total	49.2	22.9	3.1	24.9	100.0	2,536

Table B.7 Mother's marital status

Percent distribution of children under three years by mother's marital status, according to region and residence, Mali 1995/96

Region and residence	Mother's marital status			Total	Number of children
	Never married	Married/ Living together	Separated/ Divorced/ Widowed		
Region					
Bamako	9.3	88.2	2.4	100.0	483
Koulikoro	2.8	95.6	1.5	100.0	833
Sikasso	0.6	98.4	1.0	100.0	1,003
Segou	2.1	97.6	0.3	100.0	880
Mopti	1.9	97.5	0.6	100.0	714
Timbuktu/Gao	7.6	86.1	6.4	100.0	79
Kayes	1.5	96.8	1.6	100.0	687
Residence					
Rural	1.0	98.4	0.7	100.0	3,443
Urban	7.2	90.0	2.8	100.0	1,235
Total	2.6	96.1	1.2	100.0	4,678

Table B.8 Residence of mother's husband

Percent distribution of children under three years by residence of mother's husband, according to region and residence, Mali 1995/96

Region and residence	Husband's residence		Total	Number of children
	At home	Elsewhere		
Region				
Bamako	87.4	12.6	100.0	426
Koulikoro	93.0	7.0	100.0	797
Sikasso	95.7	4.3	100.0	978
Segou	96.0	4.0	100.0	849
Mopti	86.5	13.5	100.0	687
Timbuktu/Gao	85.0	15.0	100.0	68
Kayes	89.5	10.5	100.0	665
Residence				
Rural	93.7	6.3	100.0	3,365
Urban	86.8	13.2	100.0	1,105
Total	92.0	8.0	100.0	4,470

Table B.9 Husband's education

Percent distribution of children under three years by mother's husband's education, according to region and residence, Mali 1995/96

Region and residence	Husband's education				Total	Number of children
	None	Primary	Secondary+	Don't know		
Region						
Bamako	47.9	13.2	30.8	8.1	100.0	438
Koulikoro	80.7	11.3	5.7	2.3	100.0	809
Sikasso	84.8	8.5	5.5	1.2	100.0	997
Segou	82.3	8.8	7.0	2.0	100.0	861
Mopti	89.0	3.7	5.1	2.3	100.0	700
Timbuktu/Gao	65.7	13.8	16.8	3.7	100.0	73
Kayes	79.4	6.7	4.8	9.0	100.0	676
Residence						
Rural	86.6	7.5	3.5	2.4	100.0	3,409
Urban	58.8	11.8	22.5	6.9	100.0	1,146
Total	79.6	8.6	8.3	3.6	100.0	4,555

Table B.10 Husband's occupation

Percent distribution of children under three years by mother's husband's occupation, according to region and residence, Mali 1995/96

Region and residence	Husband's occupation					Total	Number of children
	Not working	Professional	Sales	Agriculture	Manual/ Domestic/ Service		
Region							
Bamako	1.5	17.9	28.7	4.9	47.1	100.0	437
Koulikoro	0.2	3.5	6.7	77.6	11.9	100.0	806
Sikasso	1.2	4.1	5.0	79.2	10.4	100.0	996
Segou	0.3	4.6	5.5	74.0	15.6	100.0	861
Mopti	1.4	3.9	9.3	73.2	12.2	100.0	699
Timbuktu/Gao	0.4	17.4	21.9	14.8	45.5	100.0	73
Kayes	3.4	4.8	7.9	71.1	12.8	100.0	676
Residence							
Rural	1.2	2.4	3.9	84.3	8.3	100.0	3,406
Urban	1.3	15.7	24.4	18.1	40.5	100.0	1,142
Total	1.2	5.7	9.0	67.6	16.4	100.0	4,548

Table B.11 Toilet facilities

Percent distribution of children under three years by type of toilet facility, according to region and residence, Mali 1995/96

Region and residence	Type of toilet facilities				Total	Number of children
	Flush	Trad. pit toilet	Latrine	None/ Other		
Region						
Bamako	3.3	79.3	17.4	0.0	100.0	481
Koulikoro	0.3	68.0	5.5	26.2	100.0	831
Sikasso	0.3	56.8	16.5	26.4	100.0	992
Segou	0.6	77.2	4.2	18.0	100.0	878
Mopti	0.0	37.4	6.6	55.9	100.0	707
Timbuktu/Gao	1.4	64.6	5.6	28.3	100.0	79
Kayes	0.5	69.8	0.9	28.8	100.0	684
Residence						
Rural	0.0	59.5	5.4	35.1	100.0	3,423
Urban	2.4	76.8	16.5	4.2	100.0	1,228
Total	0.7	64.1	8.3	26.9	100.0	4,651

Table B.12 Source of drinking water

Percent distribution of children under three years by source of drinking water, according to region and residence, Mali 1995/96

Region and residence	Source of drinking water				Total	Number of children
	Private tap	Public tap	Well/ Borehole	Surface/ Other		
Region						
Bamako	19.8	44.9	34.7	0.7	100.0	482
Koulikoro	1.9	3.9	94.1	0.1	100.0	830
Sikasso	6.2	9.0	83.0	1.9	100.0	996
Segou	1.7	1.3	96.9	0.0	100.0	877
Mopti	3.0	4.0	81.4	11.6	100.0	707
Timbuktu/Gao	25.3	49.4	24.8	0.5	100.0	79
Kayes	3.2	5.4	80.7	10.7	100.0	685
Residence						
Rural	0.7	3.0	91.3	5.1	100.0	3,425
Urban	18.4	28.7	52.4	0.4	100.0	1,232
Total	5.4	9.8	81.0	3.8	100.0	4,656

Table B.13 Exposure to radio, television, newspaper

Percent distribution of children under three years whose mothers listen to the radio weekly, watch TV weekly, read the newspaper weekly, according to region and residence, Mali 1995/96

Region and residence	Listen to radio weekly	Number of children	Watch TV weekly	Number of children	Read news weekly	Number of children
Region						
Bamako	85.9	480	48.7	480	15.3	483
Koulikoro	68.2	833	6.4	833	2.3	833
Sikasso	70.7	996	8.3	995	3.1	1,002
Segou	60.4	876	3.1	877	4.5	880
Mopti	48.4	707	3.6	706	2.8	714
Timbuktu/Gao	65.1	79	3.4	79	8.9	79
Kayes	61.1	682	3.1	681	1.0	687
Residence						
Rural	60.5	3424	2.8	3421	1.3	3,442
Urban	77.4	1230	28.6	1230	12.3	1,235
Total	65.0	4653	9.6	4651	4.2	4,677

Note: totals vary due to missing values

Table B.14 Type of floor

Percent distribution of children under three years by type of floor in household, according to region and residence, Mali 1995/96

Region and residence	Main floor material			Total	Number of children
	Earth/ sand	Dung	Cement/ Other		
Region					
Bamako	8.9	2.0	89.1	100.0	480
Koulikoro	49.3	39.1	11.6	100.0	831
Sikasso	71.9	16.5	11.6	100.0	990
Segou	78.0	7.2	14.9	100.0	878
Mopti	81.1	5.5	13.4	100.0	707
Timbuktu/Gao	71.4	0.5	28.1	100.0	79
Kayes	18.1	70.1	11.8	100.0	684
Residence					
Rural	65.6	29.0	5.4	100.0	3,423
Urban	29.1	7.1	63.8	100.0	1,227
Total	56.0	23.2	20.8	100.0	4,649

Table B.15 Type of transport owned

Percent distribution of children under three years by type of transport owned by household, according to region and residence, Mali 1995/96

Region and residence	Type of transport owned			
	None	Bicycle	Motorbike	Car
Region				
Bamako	46.8	17.1	37.2	16.3
Koulikoro	38.3	55.5	14.4	1.0
Sikasso	11.6	79.9	31.8	3.6
Segou	38.5	50.6	23.5	1.5
Mopti	56.9	30.5	19.9	0.4
Timbuktu/Gao	76.8	6.0	17.9	5.8
Kayes	65.7	24.9	11.9	1.2
Residence				
Rural	38.5	55.8	17.8	0.7
Urban	48.1	21.4	36.3	10.3
Total	41.0	46.7	22.7	3.3
Number of children	4,655	4,655	4,653	4,649

Note: Percentages across rows do not add up to 100 because a household could own more than one type of transport. Totals differ due to missing values.

Table B.16 Possession score

Percent distribution of children under three years by household possession score, according to region and residence, Mali 1995/96

Region and residence	Possession score			Total	Number of children
	0	1	2+		
Region					
Bamako	10.4	39.0	50.7	100.0	476
Koulikoro	30.9	62.8	6.3	100.0	831
Sikasso	28.6	62.2	9.2	100.0	992
Segou	39.1	57.9	3.0	100.0	874
Mopti	50.8	45.0	4.2	100.0	699
Timbuktu/Gao	32.3	48.4	19.3	100.0	79
Kayes	38.9	57.6	3.5	100.0	679
Residence					
Rural	39.1	58.3	2.6	100.0	3,406
Urban	20.1	48.0	31.9	100.0	1,223
Total	34.0	55.6	10.4	100.0	4,629

Table B.17 Antenatal care

Percent distribution of children under three years by source of mother's antenatal care, according to region and residence, Mali 1995/96

Region and residence	Source of antenatal care				Total	Number of children
	Doctor	Nurse/ midwife	TBA[1]	No one/ Other		
Region						
Bamako	5.5	84.5	0.4	9.5	100.0	483
Koulikoro	0.2	50.1	1.6	48.0	100.0	833
Sikasso	0.1	47.1	1.6	51.2	100.0	1,001
Segou	1.0	43.3	1.2	54.4	100.0	878
Mopti	0.4	28.0	0.9	70.7	100.0	714
Timbuktu/Gao	4.3	56.5	0.0	39.2	100.0	79
Kayes	0.9	41.5	4.9	52.7	100.0	687
Residence						
Rural	0.5	35.5	2.2	61.9	100.0	3,441
Urban	2.9	79.9	0.6	16.6	100.0	1,234
Total	1.1	47.2	1.8	49.9	100.0	4,675

[1] Traditional birth attendant

Table B.18 Assistance at delivery

Percent distribution of children under three years by source of mother's assistance at delivery, according to region and residence, Mali 1995/96

Region and residence	Assistance at delivery					Total	Number of children
	Doctor	Nurse	TBA	Relative/ Other	No one		
Region							
Bamako	2.7	86.4	4.2	2.9	3.8	100.0	482
Koulikoro	0.7	16.5	27.4	48.2	7.2	100.0	833
Sikasso	0.1	18.2	25.8	40.0	15.8	100.0	1,003
Segou	0.4	19.6	14.4	44.5	21.1	100.0	879
Mopti	0.6	13.3	24.5	49.2	12.4	100.0	711
Timbuktu/Gao	0.5	31.7	15.5	51.1	1.3	100.0	79
Kayes	0.3	14.9	24.2	52.5	8.0	100.0	687
Residence							
Rural	0.3	7.8	26.6	49.9	15.5	100.0	3,440
Urban	1.7	70.0	5.8	19.7	2.8	100.0	1,233
Total	0.7	24.2	21.1	41.9	12.1	100.0	4,673

APPENDIX C

ANTHROPOMETRIC DATA VERIFICATION

APPENDIX C

ANTHROPOMETRIC DATA VERIFICATION

Of the 5,237 children under three years of age who took part in the survey, 89 percent (4,678 children) were weighed and measured. Chronic and/or acute nutritional status could not be ascertained for 559 children. Of these, 45 percent were not weighed and measured, 50 percent had invalid measurements—that is, at least one of their anthropometric measurements (height-for-age, weight-for-height and/or weight-for-age) were highly unlikely given the other two measurements—and the remaining 5 percent did not have a valid date of birth. Invalid measurements were defined as: Z-scores for height-for-age and weight-for-age below -6 standard deviations, Z-scores for weight-for-height below -4 standard deviations, or Z-scores for any index above 6 standard deviations.

Z-scores were imputed for children with invalid or missing Z-scores in order to determine whether the missing and outlying data in any way biased the results of the survey. This was done by assigning each child the Z-score of the previous child in the data set who was born in the year and whose mother had attained the same level of education. Table C.1 compares the distribution of all imputed Z-scores with that of valid Z-scores. Thirty percent of the imputed Z-scores for height-for-age fall in the mild undernutrition to normal nutrition categories. This compares with 61 percent for the valid scores in the same categories. Similarly, 30 percent of weight-for-age Z-scores fall in the mild undernutrition to normal nutrition categories. This compares with 56 percent of the valid Z-scores in the same categories. Twenty-eight percent of Z-scores for weight-for-height fall in the mild undernutrition to normal nutrition categories. This compares with 49 percent of the valid Z-scores in the same categories.

Approximately 37 percent of the imputed Z-scores for height-for-age, weight-for-age and weight-for-height fall in the year 1993 compared with slightly over 26 percent of the valid Z-scores in these same categories. Additionally, 29 percent of the imputed Z-scores for height-for-age, weight-for -age and weight-for-height fall in the year 1995 compared with nearly 40 percent of the valid Z-scores. The imputed Z-scores also showed slightly more male children than the valid Z-scores in all categories.

Table C.2 describes the differences seen in nutritional status depending on whether the imputed data were included in the analysis. For stunting, wasting and underweight, the inclusion of imputed values serves to lower the levels of undernutrition. The greatest difference is -2.5 percent for underweight when the imputed values are included in the analysis.

There appears to be a preference in the choice of digits for the height data (Table C.3); clumping appears around the integers 0, 2, 3 and 5. However, the data for weight shows very little integer preference.

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Table C.1 Imputed and valid Z-scores

Percent distribution of children under three years of age by nutritional status, year of birth, and sex of child, according to imputed and valid height-for-age, weight-for-age, and weight-for-height Z-scores, Mali 1995-1996

	Height-for-age		Weight-for-age		Weight-for-height	
	Imputed	Valid	Imputed	Valid	Imputed	Valid
Nutritional status						
Severe malnutrition	0.7	14.7	0.7	16.7	0.5	0.0
Moderate malnutrition	3.9	15.6	3.9	23.7	4.1	6.3
Mild malnutrition	13.3	23.8	13.3	26.8	12.4	17.1
Normal nutrition	16.8	36.9	16.8	28.9	16.0	32.1
Mild overnutrition	0.9	6.3	0.9	2.6	1.0	39.5
Moderate overnutrition	0.4	2.0	0.4	0.9	0.4	3.6
Severe overnutrition	0.0	0.6	0.0	0.3	0.0	0.9
Missing data	63.8	0.0	63.8	0.0	65.6	0.4
Total	100.0	100.0	100.0	100.0	100.0	100.0
Year of birth						
1992	0.0	0.4	0.0	0.4	0.0	0.4
1993	37.5	26.3	37.5	26.3	35.9	26.6
1994	26.9	28.7	26.9	28.7	27.8	28.5
1995	29.0	39.9	29.0	39.9	29.4	39.8
1996	6.7	4.7	6.7	4.7	7.0	4.7
Total	100.0	100.0	100.0	100.0	100.0	100.0
Sex of child						
Male	51.0	48.9	51.0	48.9	50.2	49.0
Female	49.0	51.1	49.0	51.1	49.8	51.0
Total	100.0	100.0	100.0	100.0	100.0	100.0
Number	559	4,678	559	4,678	533	4,705

Table C.2 Verification of anthropometric data

Percentage of children under three years by nutritional status, by whether imputed anthropometric data are included or excluded, and the difference in malnutrition when imputed data are included, Mali 1995-1996

Nutritional status	Imputed values included: Yes	Imputed values included: No	Difference
Stunted	28.9	30.3	-1.4
Number	5,237	4,678	
Underweight	37.9	40.4	-2.5
Number	5,237	4,678	
Wasted	21.5	23.4	-1.9
Number	5,237	4,705	

Table C.3 Digit preference in anthropometric data

Percentage of weight and height data falling as specific integers, Mali 1995-1996

Decimal integer	Height	Weight
0	25.0	9.4
1	6.6	9.1
2	11.1	11.7
3	10.8	10.8
4	6.7	9.2
5	15.9	11.6
6	6.5	11.6
7	6.9	10.2
8	5.9	8.3
9	4.7	8.2
Total	100.0	100.0
Number	4,705	4,705

APPENDIX D

MALNUTRITION AMONG CHILDREN
AGE 3 TO 35 MONTHS
MALI 1987 AND 1995/96

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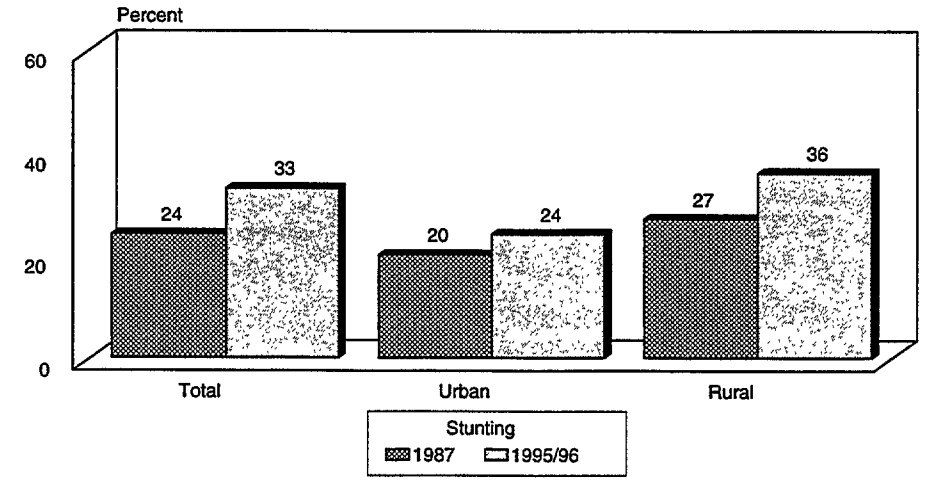
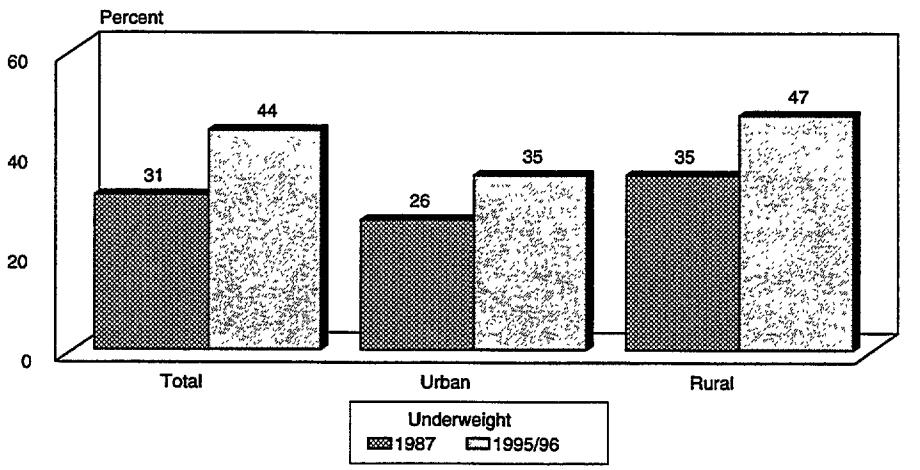
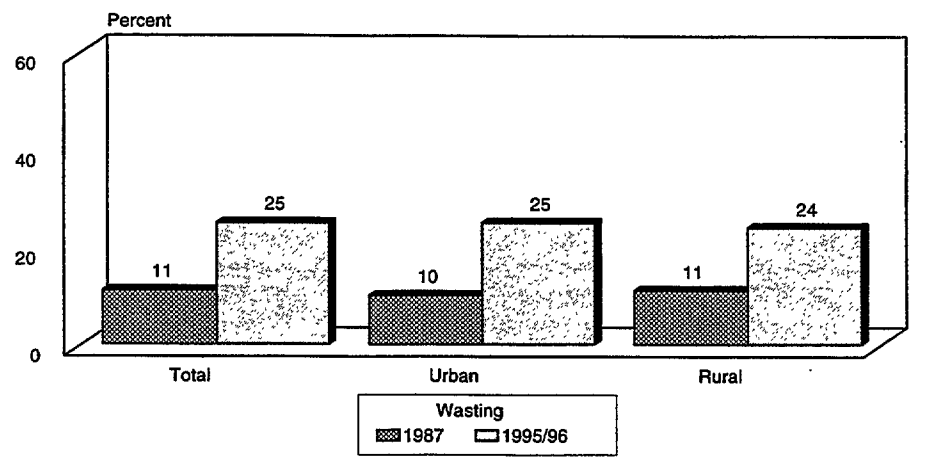
Figure D.1 Malnutrition among Children Age 3 to 35 Months, Mali 1987 and 1995/96







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APPENDIX E

REGIONAL, RESIDENTIAL, AND GENDER DIFFERENCES IN PREVALENCE OF MALNUTRITION BY CHILD'S AGE, MALI 1995/96

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Table E.1 Malnutrition by region and age

Percentage of children under three years of age who are malnourished, by region and age, Mali 1995/96

Region and age (months)	Malnutrition			Number of children
	Stunted	Wasted	Underweight	
Bamako				
0-5	2.9	15.7	7.8	109
6-11	0.0	39.2	26.6	85
12-17	29.9	32.2	43.7	93
18-23	39.6	39.6	45.3	57
24-29	17.8	28.8	34.2	78
30-35	26.3	15.8	38.6	61
Total	17.3	27.9	30.6	483
Koulikoro				
0-5	6.9	10.2	10.9	148
6-11	15.2	25.2	34.7	165
12-17	32.2	35.7	55.9	150
18-23	49.5	30.7	50.4	124
24-29	39.1	19.3	47.3	120
30-35	51.8	19.3	52.4	127
Total	30.9	23.5	41.1	833
Sikasso				
0-5	5.1	7.1	9.3	185
6-11	16.1	28.2	36.6	185
12-17	30.7	36.8	56.1	173
18-23	57.7	34.2	61.9	129
24-29	40.2	17.9	48.8	161
30-35	59.9	27.3	60.8	170
Total	33.2	24.8	44.3	1003
Segou				
0-5	6.3	12.5	9.5	177
6-11	16.4	27.8	30.1	162
12-17	32.1	34.7	54.6	136
18-23	51.8	25.7	58.5	114
24-29	48.4	19.1	53.3	142
30-35	56.0	13.4	53.3	149
Total	33.2	21.7	41.1	880
Mopti				
0-5	6.4	20.5	13.3	188
6-11	13.9	32.7	44.1	156
12-17	27.3	38.1	52.5	112
18-23	53.0	40.6	58.3	71
24-29	46.7	16.0	48.3	81
30-35	54.0	14.7	59.9	106
Total	27.6	26.6	41.5	714
Timbuktu/Gao				
0-5	1.9	7.0	6.8	17
6-11	20.7	34.2	38.9	12
12-17	30.5	44.2	60.1	14
18-23	47.1	38.8	51.7	13
24-29	41.3	20.5	47.0	11
30-35	49.7	17.5	53.0	12
Total	29.8	26.3	40.9	79
Kayes				
0-5	3.6	8.0	7.2	139
6-11	14.2	16.6	26.2	140
12-17	34.4	21.7	45.8	114
18-23	63.1	29.3	61.9	91
24-29	44.6	13.5	46.6	98
30-35	62.5	14.1	61.5	104
Total	33.6	16.5	38.6	687
Mali				
0-5	5.3	12.3	9.8	964
6-11	13.9	27.7	33.9	904
12-17	31.2	33.8	52.4	793
18-23	53.2	32.5	56.7	599
24-29	40.6	18.8	47.4	689
30-35	54.2	18.2	55.8	729
Total	30.3	23.4	40.4	4,678

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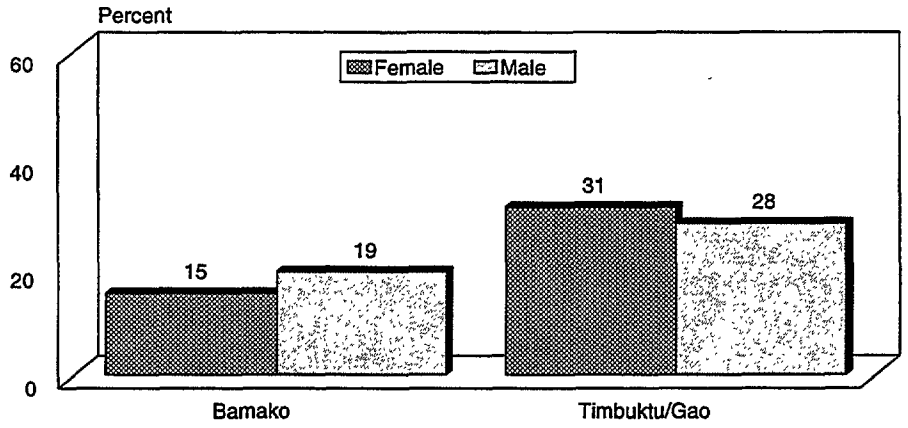
Table E.2 Malnutrition by gender, residence, and age

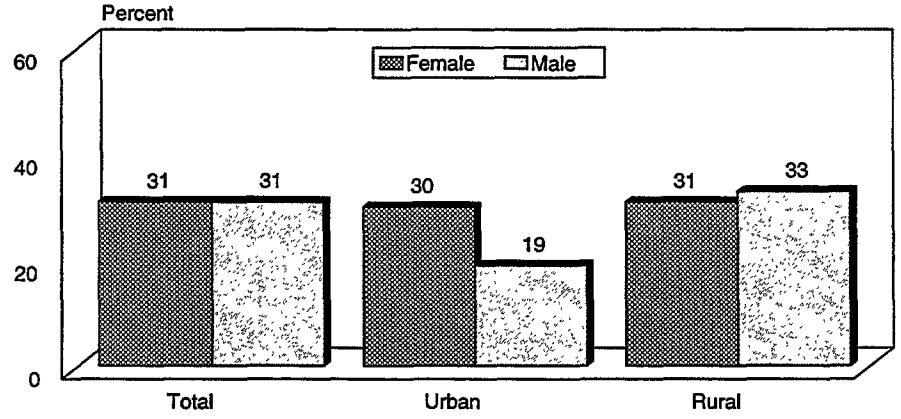
Percentage of children under three years of age who are undernourished, by gender, residence (urban-rural) and age, Mali 1995/96.

Gender, residence, and age (months)	Malnutrition			Number of children
	Stunted	Wasted	Underweight	
Female				
0-5	4.0	13.7	10.9	506
6-11	12.2	24.0	33.0	459
12-17	26.3	31.5	50.6	417
18-23	52.3	29.5	55.9	309
24-29	44.2	19.6	50.4	321
30-35	55.8	17.6	58.0	378
Total	29.3	22.2	40.7	2,390
Male				
0-5	6.8	10.7	8.6	458
6-11	15.6	31.5	34.8	445
12-17	36.7	36.4	54.4	376
18-23	54.2	35.7	57.5	290
24-29	37.4	18.2	44.9	368
30-35	52.5	18.9	53.4	351
Total	31.4	24.6	40.1	2,288
Rural				
0-5	6.1	12.5	10.1	694
6-11	16.1	26.6	36.8	690
12-17	32.0	34.5	55.2	586
18-23	55.2	33.3	59.4	444
24-29	47.6	16.6	52.8	478
30-35	60.5	19.0	58.9	551
Total	33.3	23.4	43.2	3,443
Urban				
0-5	3.3	11.7	9.1	271
6-11	6.8	31.2	24.6	214
12-17	28.9	31.9	44.7	207
18-23	47.5	30.3	49.0	154
24-29	24.7	23.8	35.3	211
30-35	34.8	15.9	46.1	178
Total	21.9	23.5	32.5	1,235
Mali				
0-5	5.3	12.3	9.8	964
6-11	13.9	27.7	33.9	904
12-17	31.2	33.8	52.4	793
18-23	53.2	32.5	56.7	599
24-29	40.6	18.8	47.4	689
30-35	54.2	18.2	55.8	729
Total	30.3	23.4	40.4	4,678

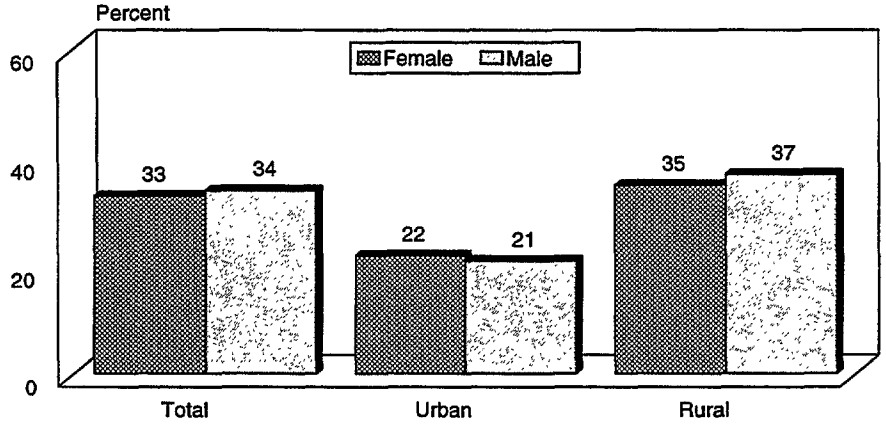
Figure E.1 Stunting among Children under Three Years by Region, Residence, and Gender, Mali 1995/96



Note: Only urban areas were sampled in Bamako and in Timbuktu/Gao



Koulikoro



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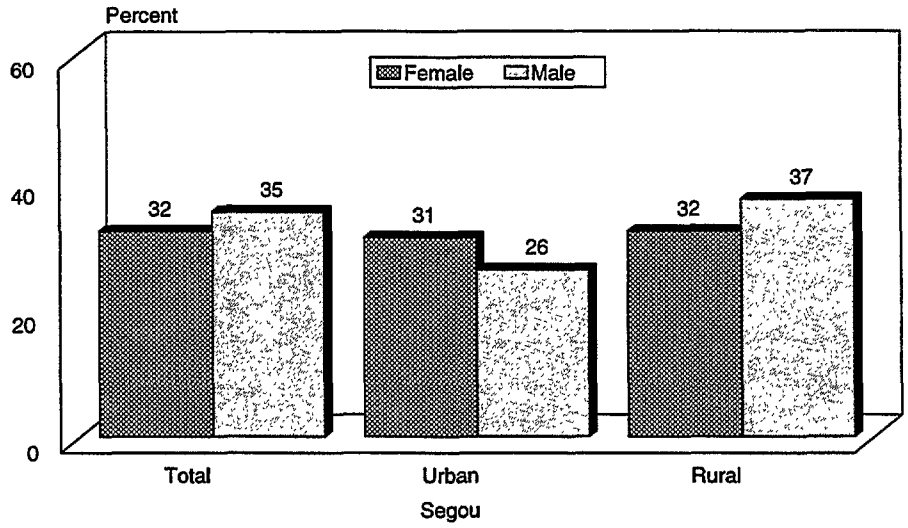
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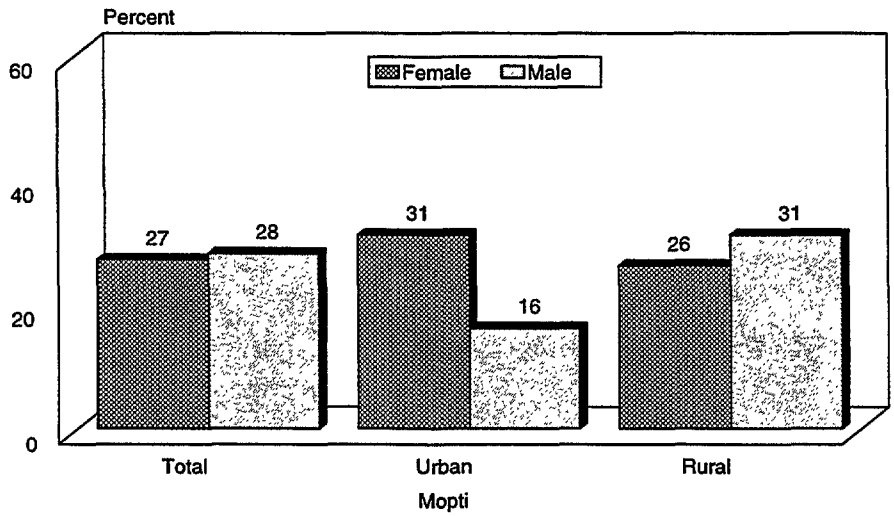
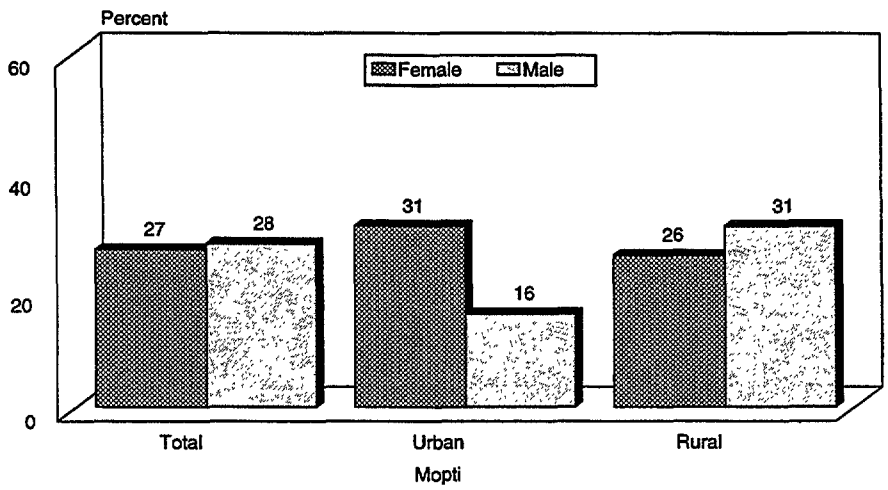
40
20
0
Female
Male
32
35
31
26
32
37
Total
Urban
Rural
Segou


Percent
60
40
20
0
Female
Male
27
28
31
16
26
31
Total
Urban
Rural
Mopti


Percent
60
40
20
0
Female
Male
27
28
31
16
26
31
Total
Urban
Rural
Mopti

APPENDIX F

FEEDING PRACTICES BY AGE

Table F.1 Feeding practices by age

Percent distribution of children under two years by feeding practices, according to age group, Mali 1995/96

Age (months)	Breastfed and: Nothing	Water	Other liquids	Milk	Solids	Milk and solids	Fully weaned	Total	Number of children
0-1	18.9	62.8	12.3	5.4	0.7	0.0	0.0	100.0	234
2-3	6.7	70.1	14.4	6.4	0.0	2.3	0.0	100.0	370
4-5	1.4	68.4	11.9	8.5	7.4	1.6	0.8	100.0	361
6-7	4.9	54.3	8.9	9.5	14.2	8.3	0.0	100.0	344
8-9	1.3	40.0	8.1	6.6	34.7	8.9	0.5	100.0	280
10-11	2.3	21.3	7.0	3.0	49.9	14.9	1.5	100.0	280
12-13	0.8	8.5	4.1	1.3	62.0	19.2	4.2	100.0	329
14-15	0.4	5.5	1.9	0.9	60.2	23.5	7.7	100.0	232
16-17	0.5	5.4	1.3	0.9	52.4	27.4	12.0	100.0	231
18-19	1.1	4.9	1.1	1.0	54.1	20.0	17.9	100.0	208
20-21	0.7	4.2	0.5	1.1	42.8	17.3	33.6	100.0	206
22-23	1.2	1.2	1.7	0.8	42.1	10.9	42.1	100.0	184
Total	3.4	33.3	6.9	4.3	32.4	11.9	7.7	100.0	3,260

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APPENDIX G

LOGISTIC REGRESSION ANALYSIS

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APPENDIX G

LOGISTIC REGRESSION ANALYSIS

Logistic regression analysis is used when the dependent (or outcome) variable is a dichotomous variable, in other words, a variable describing an event that has only two outcomes: it either occurs or it does not occur. A logistic regression model estimates the probability that the eventoccurs. In a logistic regression, for each explanatory variable there is a reference category against which all other categories of that variable are compared. The reference category for each variable may, for the most part, be arbitrary.

In this report, logistic regression models were developed to explain (or predict) six outcomes: bottle use, diarrhoea, stunting, wasting, low and high maternal body mass. Thus, the models used in this report estimate the probability of being bottle-fed, having diarrhoea in the two weeks prior to the survey, being stunted, being wasted, having low or high maternal body mass. A forward step-wise regression procedure was used. This procedure starts with a model that has none of the specified explanatory variables in it, and then includes the variables one at a time according to their statistical significance to finally arrive at a model with the combination of variables that best explains the dependent or outcome variable.

The regression coefficients in a logistic regression analysis represent the log odds of the effect of each explanatory factor on the outcome variable, controlling for all other factors in the model. These log odds can be converted to odds ratios by exponentiating the regression coefficients, and from odds ratios to relative risks. This report presents the statistically significant relative risks of the dependent variable for a number of independent variables (such as the relative risk of bottle feeding for children living in different regions of the country, for example). For each explanatory variable in the model, the relative risk for the reference category is assigned a value of 1.00, and relative risks for other categories are compared to the reference category. A relative risk greater than 1.00 indicates an increased risk for the outcome, compared to the reference category, while a relative risk less than 1.00 indicates a lower risk for the outcome, compared to the reference category.

For example, in Table 3.3 (Prevalence and estimated net relative risk for bottle use), for the explanatory variable "assistance at delivery", the reference category is "doctor/nurse" and is assigned a value of 1. The net relative risk of 0.3 for the category "TBA" indicates that children whose mothers were assisted at delivery by a TBA have 30 percent the risk of being bottle fed compared to children whose mothers were assisted at delivery by a doctor or nurse.

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