

# NUTRITION-RELATED NON-COMMUNICABLE DISEASE (N-RNCD) COUNTRY PROFILES



## CAMBODIA

Evidence has been mounting to support the hypothesis that maternal undernutrition, as well as in-utero and infant and young child undernutrition, increase the risk of developing N-RNCDs later in life (Barker, 1992 and Gluckman, 2010). Recent empirical studies have demonstrated that many common manifestations of undernutrition, such as intra-uterine growth restriction (IUGR), low birth weight, and stunting are all significantly associated with later development of hypertension, insulin resistance, and obesity. These are preconditions related to the development of N-RNCDs such as Type II diabetes mellitus (diabetes) and cardiovascular disease (CVD). Addressing maternal, infant, and young child undernutrition is therefore not only important to preventing the immediate threats of child morbidity and mortality, but also to reducing the risk of N-RNCDs later in life.

In Cambodia, the burden of N-RNCDs is a moderately important health issue in the adult population (See Table 1). In addition to the data shown in the table, the average body mass index (BMI) among women stayed constant at 21 between 2005 and 2010, but overweight prevalence rose from 10 to 11 percent (2005 and 2010 DHS). Using the suggested increased risk BMI cutoff of 23 for Asian populations, those figures rise to 21 and 22 percent, respectively (WHO 2004). Prevalence of diabetes has actually decreased from 7 percent in 1998 to 5 percent in 2008 (Danaei et al, 2011).

**Table 1: Estimated Age-Standardized Adult N-RNCD Prevalence, Cambodia 2008**

	Pre-NCD conditions (% of Adults)				N-RNCDs	
	Hypertension	Raised Glucose levels	Overweight*	Raised Cholesterol	Diabetes (% of Adults)**	CVD (% of Deaths)
Women	28%	5%	11%	32%	5%	-
Total	32%	5%	-	30%	5%	21%

Source: Alwan, Ala and World Health Organization. (2011). *Global status report on noncommunicable diseases 2010*. Geneva, Switzerland: World Health Organization. \*Overweight Data from DHS 2010. \*\*Diabetes Data from Global Burden of Metabolic Risk Factors of Chronic Diseases Database (Danaei et al, 2011).

Table 2 shows percent of infants who were born low birth weight, children who are stunted, overweight, stunted and overweight, or who are stunted with an overweight mother, and overweight women, broken down by socio-economic characteristics. Of those children who were low birth weight, 86 percent were born after 8 month or full-term pregnancies, meaning the reason for their low weight was not due to length of gestation. Regarding overweight, only 2 percent of Cambodian children under 5 fall into this category. For comparison, the percentage of children ages 2 to 5 who are considered overweight in the US is 11 percent (CDC, 2012). Taking a look at the current nutritional status of children under 5, children of highly educated mothers (1.9 percent of mothers) may be at risk of obesity and N-RNCDs, with high rates of overweight and stunted-overweight, but overall N-RNCD risk is low.

**Table 2: National Survey Indicators on Nutritional Status, by Background Characteristics, Cambodia 2010**

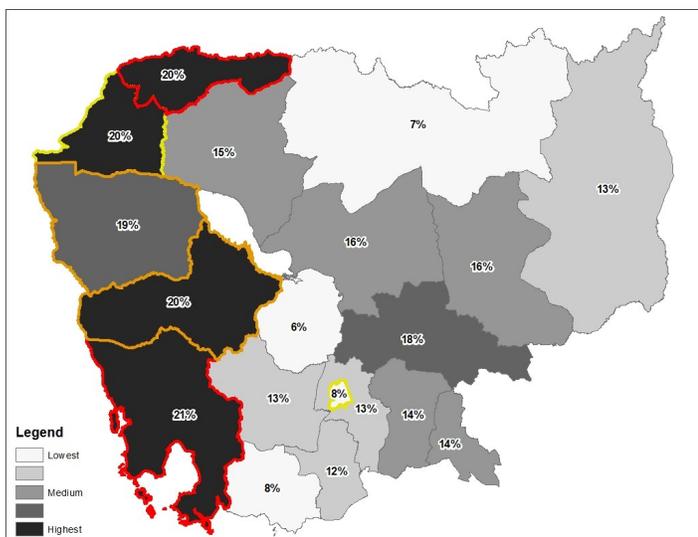
		% of Children under 5					% of Women 15-49
		Low birth weight	Stunted	Overweight	Stunted and Overweight (same child)	Stunted child with Overweight Mother	Overweight
Educational attainment of mother	No education	16%	<b>46%</b>	1%	1%	3%	<b>13%</b>
	Primary	14%	40%	2%	1%	3%	<b>12%</b>
	Secondary	12%	32%	2%	1%	4%	9%
	Above secondary	<b>8%</b>	<b>9%</b>	<b>9%</b>	<b>5%</b>	0%	5%
Wealth index of family	Poorest	16%	<b>49%</b>	2%	1%	2%	5%
	Poorer	16%	44%	2%	1%	3%	9%
	Middle	15%	39%	0%	0%	3%	9%
	Richer	12%	34%	2%	1%	5%	<b>14%</b>
	Richest	10%	22%	3%	1%	3%	<b>16%</b>
Location of household	Urban	10%	27%	3%	1%	4%	16%
	Rural	15%	41%	1%	1%	3%	10%
Total		14%	39%	2%	1%	3%	11%

Definitions: Low Birth Weight (<2500g or classified by mother as small or very small at birth); Stunted (HAZ<2SD); Child Overweight (WHZ>2SD); Maternal Overweight (BMI≥25)

Source: DHS 2010 data, weighted estimates of percent of all children under 5 or percent of women 15-49.

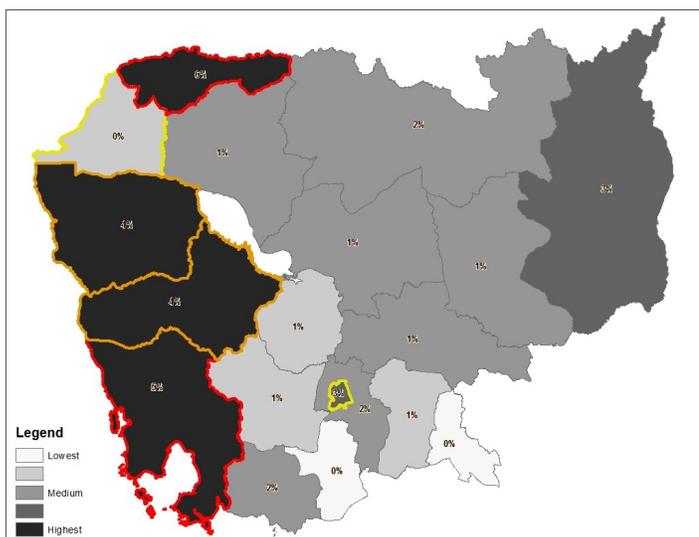
Looking further at Table 2, women with less education appear more likely to have a low birth weight baby, have a stunted child (by far still that largest nutritional concern among children under 5), or to be overweight. However, the opposite is true for their children's likelihood of being overweight, or stunted-overweight. Both children and women in urban areas had higher rates of being overweight as well, while stunting and low birth weight were more prevalent in rural areas.

### Percentage of children who are born low birth weight (<2500g)

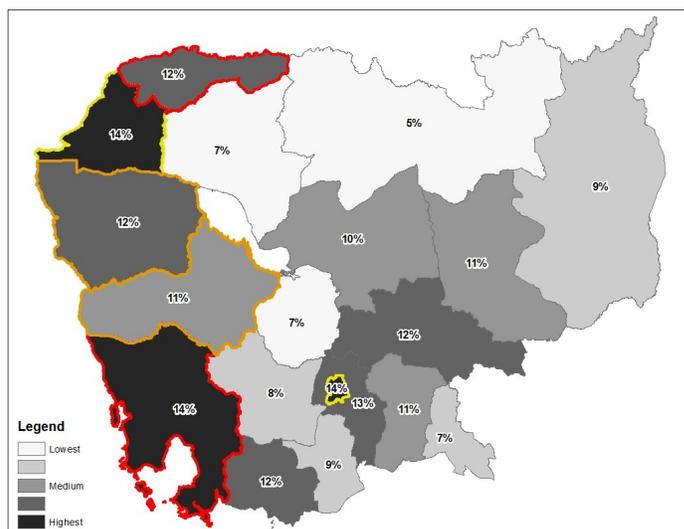


National level estimates do not adequately illustrate the wide sub-population variations that exist. The maps here show these rates at the state level. Otdar Mean Chey and the pooled provinces of Preah Sihanouk & Kaoh Kong (red borders) are among the top 5 highest burden states across 3 key indicators: low birth weight, and child and maternal overweight. Children in Pursat and the pooled provinces of Battambang & Pailin (orange borders) also face very high risk factors; these provinces rank among the 5 highest burden states for low birth weight and child overweight. Two other provinces are in the top 5 burden states for 2 of the 3 indicators (yellow borders): Banteay Mean Chey (maternal overweight and low birth weight) and Phnom Penh (both maternal and child overweight). Except for Phnom Penh, these provinces mentioned as high risk areas all cluster in the West, bordering Thailand and the Gulf of Thailand.

### Percentage of children who are overweight (WHZ>+2SD)



### Percentage of women who are overweight (BMI≥25)



Source: DHS 2010 data, weighted estimates of percent of all children under 5 or women 15-49.

This descriptive analysis begins to explore where future risks may lie for N-RNCDs in Cambodia, identifying where undernutrition programs may need to be tailored or targeted to better avoid later life health conditions. It appears stunting is still the largest concern, though there are significant differentials by sub-group. More in-depth analysis is needed to understand the determinants and dynamics influencing these relationships. SPRING is currently working to develop more evidence on why certain sub-populations are more at risk and how this information can be used to adjust nutrition programs.

### References:

- Barker DJB, ed. 1992. *Fetal and infant origins of adult disease*. London: BMJ Publishing Group.
- CDC. 2012. CHD Health Data Interactive, for NHANES Data (Round: 2007-2010). Centers for Disease Control and Prevention.
- Danaei, Goodarz, Mariel M Finucane, Yuan Lu, Gitanjali M Singh, Melanie J Cowan, Christopher J Paciorek, John K Lin, et al. 2011. "National, Regional, and Global Trends in Fasting Plasma Glucose and Diabetes Prevalence Since 1980: Systematic Analysis of Health Examination Surveys and Epidemiological Studies with 370 Country-years and 2.7 Million Participants." *The Lancet* 378 (9785) (July): 31-40.
- Demographic and Health Surveys. 2005 and 2010. Cambodia Demographic and Health Survey. MEASURE DHS.
- Gluckman PD, Hanson MA, Buklijas T. 2010. *A conceptual framework for the developmental origins of health and disease*. *J DOHaD* 1: 6-18.
- WHO. 2004. Appropriate Body-mass Index for Asian Populations and Its Implications for Policy and Intervention Strategies. *Lancet* 363: 9403.

# NUTRITION-RELATED NON-COMMUNICABLE DISEASE (N-RNCD) COUNTRY PROFILES



## ETHIOPIA

Evidence has been mounting to support the hypothesis that maternal undernutrition, as well as in-utero and infant and young child undernutrition, increase the risk of developing N-RNCDs later in life (Barker, 1992 and Gluckman, 2010). Recent empirical studies have demonstrated that many common manifestations of undernutrition, such as intra-uterine growth restriction (IUGR), low birth weight, and stunting are all significantly associated with later development of hypertension, insulin resistance, and obesity. These are preconditions related to the development of N-RNCDs such as Type II diabetes mellitus (diabetes) and cardiovascular disease (CVD). Addressing maternal, infant, and young child undernutrition is therefore not only important to preventing the immediate threats of child morbidity and mortality, but also to reducing the risk of N-RNCDs later in life.

In Ethiopia, the burden of N-RNCDs is a moderately important health issue in the adult population (See Table 1). In addition to the data shown in the table, the average body mass index (BMI) among women stayed constant at 22 between 2005 and 2011, but overweight prevalence rose by 50 percent, from 4 to 6 percent (2005 and 2011 DHS). Prevalence of diabetes has stayed essentially the same at around 7 percent between 1998 and 2008 (Danaei et al, 2011).

**Table 1: Estimated Age-Standardized Adult N-RNCD Prevalence, Ethiopia 2008**

	Pre-NCD conditions (% of Adults)				N-RNCDs	
	Hypertension	Raised Glucose levels	Overweight*	Raised Cholesterol	Diabetes (% of Adults)**	CVD (% of Deaths)
Women	39%	7%	6%	22%	7%	-
Total	41%	7%	-	21%	7%	15%

Source: Alwan, Ala and World Health Organization. (2011). Global status report on noncommunicable diseases 2010. Geneva, Switzerland: World Health Organization. \*Overweight Data from DHS 2011. \*\*Diabetes Data from Global Burden of Metabolic Risk Factors of Chronic Diseases Database (Danaei et al, 2011).

Table 2 shows percent of infants who were born low birth weight, children who are stunted, overweight, stunted and overweight, or who are stunted with an overweight mother, and overweight women, broken down by socio-economic characteristics. Of those children who were low birth weight, 96 percent were born after 8 month or full-term pregnancies, meaning the reason for their low weight was not due to length of gestation. Regarding overweight nationally, only 2 percent of Ethiopian children under 5 fall into this category. For comparison, the percentage of children ages 2 to 5 who are considered overweight in the US is 11 percent (CDC, 2012). Taking a look at the current nutritional status of children under 5, there is some evidence that children of highly educated mothers (2.9 percent of mothers) may be at risk of obesity and N-RNCDs, but overall N-RNCD risk is low.

**Table 2: National Survey Indicators on Nutritional Status, by Background Characteristics, Ethiopia 2011**

		% of Children under 5					% of Women 15-49
		Low birth weight	Stunted	Overweight	Stunted and Overweight (same child)	Stunted child with Overweight Mother	Overweight
Educational attainment of mother	No education	32%	47%	2%	1%	1%	4%
	Primary	25%	42%	2%	1%	1%	5%
	Secondary	27%	20%	4%	2%	2%	13%
	Above secondary	21%	19%	8%	0%	1%	17%
Wealth index of family	Poorest	35%	49%	2%	1%	1%	2%
	Poorer	30%	48%	2%	1%	1%	2%
	Middle	32%	46%	1%	0%	0%	2%
	Richer	26%	45%	2%	1%	0%	3%
	Richest	24%	29%	3%	1%	3%	15%
Location of household	Urban	26%	31%	3%	1%	3%	15%
	Rural	30%	46%	2%	1%	1%	3%
Total		30%	44%	2%	1%	1%	6%

Definitions: Low Birth Weight (<2500g or classified by mother as small or very small at birth); Stunted (HAZ<-2SD); Child Overweight (WHZ>+2SD); Maternal Overweight (BMI≥25)

Source: DHS 2011 data, weighted estimates of percent of all children under 5 or percent of women 15-49.



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## GHANA

Evidence has been mounting to support the hypothesis that maternal undernutrition, as well as in-utero and infant and young child undernutrition, increase the risk of developing N-RNCDs later in life (Barker, 1992 and Gluckman, 2010). Recent empirical studies have demonstrated that many common manifestations of undernutrition, such as intra-uterine growth restriction (IUGR), low birth weight, and stunting are all significantly associated with later development of hypertension, insulin resistance, and obesity. These are preconditions related to the development of N-RNCDs such as Type II diabetes mellitus (diabetes) and cardiovascular disease (CVD). Addressing maternal, infant, and young child undernutrition is therefore not only important to preventing the immediate threats of child morbidity and mortality, but also to reducing the risk of N-RNCDs later in life.

In Ghana, the burden of hypertension and women's overweight are quite high (See Table 1). In addition to the data shown in the table, the average body mass index (BMI) among women also rose from 23 to 24 between 2003 and 2008, while overweight prevalence rose from 25 to 30 percent (2003 and 2008 DHS). Prevalence of diabetes rose slightly from 9 percent in 1998 to 10 percent in 2008 (Danaei et al, 2011).

**Table 1: Estimated Age-Standardized Adult N-RNCD Prevalence, Ghana 2008**

	Pre-NCD conditions (% of Adults)				N-RNCDs	
	Hypertension	Raised Glucose levels	Overweight*	Raised Cholesterol	Diabetes (% of Adults)**	CVD (% of Deaths)
Women	41%	9%	30%	21%	10%	-
Total	42%	9%	-	18%	10%	18%

Source: Alwan, Ala and World Health Organization. (2011). *Global status report on noncommunicable diseases 2010*. Geneva, Switzerland: World Health Organization. \*Overweight Data from DHS 2008. \*\*Diabetes Data from Global Burden of Metabolic Risk Factors of Chronic Diseases Database (Danaei et al, 2011).

Table 2 shows percent of infants who were born low birth weight, children who are stunted, overweight, stunted and overweight, or who are stunted with an overweight mother, and overweight women, broken down by socio-economic characteristics. Of those children who were low birth weight, 89 percent were born after 8 month or full-term pregnancies, meaning the reason for their low weight was not due to length of gestation. Regarding overweight, 5 percent of Ghanaian children under 5 fall into this category. For comparison, the percentage of children ages 2 to 5 who are considered overweight in the US is 11 percent (CDC, 2012). Taking a look at the current nutritional status of children under 5, there is reason to be concerned that obesity and N-RNCDs will continue to rise as this cohort grows into adulthood (see Table 2).

**Table 2: National Survey Indicators on Nutritional Status, by Background Characteristics, Ghana 2008**

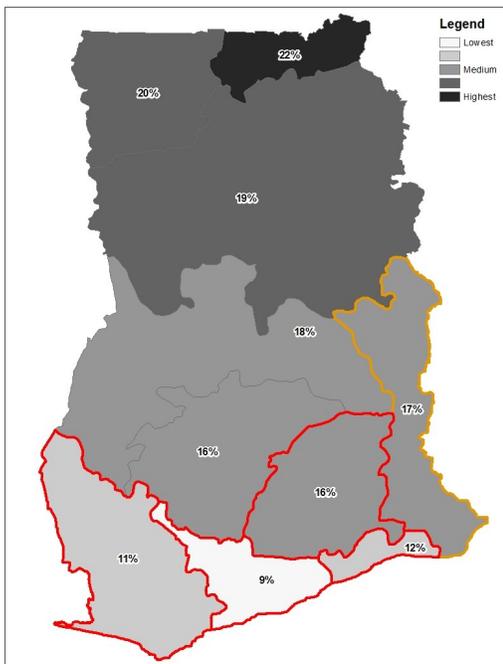
		% of Children under 5					% of Women 15-49
		Low birth weight	Stunted	Overweight	Stunted and Overweight (same child)	Stunted child with Overweight Mother	Overweight
Educational attainment of mother	No education	17%	30%	5%	3%	4%	22%
	Primary	16%	32%	5%	3%	6%	30%
	Secondary	15%	24%	6%	2%	6%	32%
	Above secondary	8%	12%	7%	0%	2%	51%
Wealth index of family	Poorest	19%	34%	3%	2%	3%	12%
	Poorer	14%	34%	4%	3%	5%	16%
	Middle	14%	28%	6%	2%	7%	23%
	Richer	14%	21%	8%	3%	6%	41%
	Richest	16%	14%	6%	2%	8%	46%
Location of household	Urban	15%	20%	7%	3%	7%	40%
	Rural	16%	32%	4%	2%	4%	20%
Total		16%	28%	5%	2%	5%	30%

Definitions: Low Birth Weight (<2500g or classified by mother as small or very small at birth); Stunted (HAZ<-2SD); Child Overweight (WHZ>+2SD); Maternal Overweight (BMI≥25)

Source: DHS 2008 data, weighted estimates of percent of all children under 5 or percent of women 15-49.

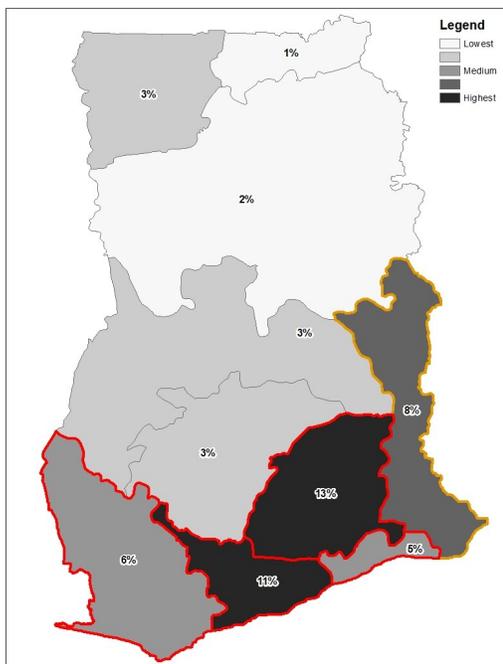
Looking further at Table 2, women with less education appear more likely to have a low birth weight baby and to have a stunted child, but are conversely less likely to be overweight, as are their children. Wealthier and urban households were associated with higher prevalence of both child and maternal overweight, lower prevalence of having a stunted child, and higher prevalence of

having a stunted child-overweight mother pair. Overweight prevalence for both mother and child are quite high in these sub-populations, with approximately half the women in the top education (2.4 percent of all women) and wealth categories being overweight, and prevalence of overweight children reaching 6 to 8 percent in wealthy households.



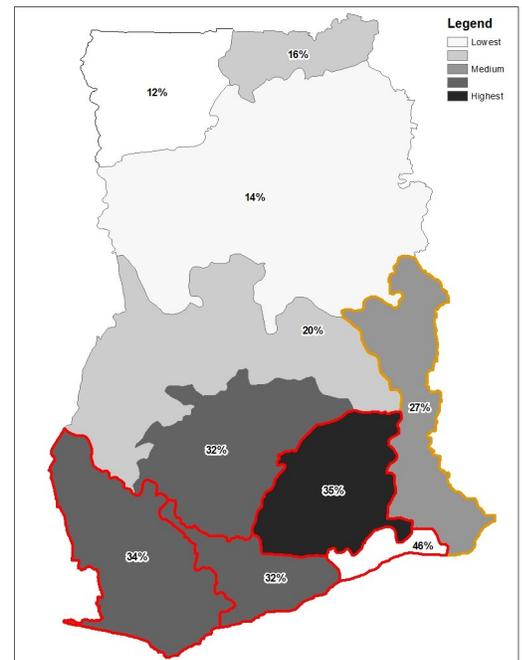
*National level estimates do not adequately illustrate the wide sub-population variations that exist. The maps here show these rates at the region level. The Eastern, Central, Western, and Greater Accra regions (red border) are among the top 5 highest burden regions for maternal and child overweight. Child overweight tops 13 percent in Eastern region. The Volta region (orange border) has among the top 5 highest rates of low birth weight and child overweight. Except for Volta, none of the other regions with the highest rates of low birth weight also rank among the regions with high rates of overweight for mothers or children. In general, low birth weight is concentrated in the northern part of the country while maternal and child overweight prevalence is highest in the south along the Atlantic coast.*

**Percentage of children who are born low birth weight (<2500g)**



**Percentage of children who are overweight (WHZ>+2SD)**

**Percentage of women who are overweight (BMI≥25)**



Source: DHS 2008 data, weighted estimates of percent of all children under 5 or women 15-49.

This descriptive analysis begins to explore where future risks may lie for N-RNCDs in Ghana, identifying where undernutrition programs may need to be tailored or targeted to better avoid later life health conditions. Here, child and maternal overweight overlap stunting as significant nutritional conditions. More in-depth analysis is needed to understand the determinants and dynamics influencing these relationships. SPRING is currently working to develop more evidence on why certain sub-populations are more at risk and how this information can be used to adjust nutrition programs.

**References:**

Barker DJB, ed. 1992. *Fetal and infant origins of adult disease*. London: BMJ Publishing Group.  
 CDC. 2012. CHD Health Data Interactive, for NHANES Data (Round: 2007-2010). Centers for Disease Control and Prevention.  
 Danaei, Goodarz, Mariel M Finucane, Yuan Lu, Gitanjali M Singh, Melanie J Cowan, Christopher J Paciorek, John K Lin, et al. 2011. "National, Regional, and Global Trends in Fasting Plasma Glucose and Diabetes Prevalence Since 1980: Systematic Analysis of Health Examination Surveys and Epidemiological Studies with 370 Country-years and 2.7 Million Participants." *The Lancet* 378 (9785) (July): 31-40.  
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# NUTRITION-RELATED NON-COMMUNICABLE DISEASE (N-RNCD) COUNTRY PROFILES



## KENYA

Evidence has been mounting to support the hypothesis that maternal undernutrition, as well as in-utero and infant and young child undernutrition, increase the risk of developing N-RNCDs later in life (Barker, 1992 and Gluckman, 2010). Recent empirical studies have demonstrated that many common manifestations of undernutrition, such as intra-uterine growth restriction (IUGR), low birth weight, and stunting are all significantly associated with later development of hypertension, insulin resistance, and obesity. These are preconditions related to the development of N-RNCDs such as Type II diabetes mellitus (diabetes) and cardiovascular disease (CVD). Addressing maternal, infant, and young child undernutrition is therefore not only important to preventing the immediate threats of child morbidity and mortality, but also to reducing the risk of N-RNCDs later in life.

In Kenya, rates of hypertension and overweight are relatively high, and raised cholesterol prevalence is among of the very highest among low income countries (See Table 1). In addition to the data shown in the table, the average body mass index (BMI) among women stayed constant at 22 between 2003 and 2008, but overweight prevalence rose slightly from 23 to 25 percent (2003 and 2008-09 DHS). Prevalence of diabetes varied little from 7 to 8 percent between 1998 and 2008 (Danaei et al, 2011).

**Table 1: Estimated Age-Standardized Adult N-RNCD Prevalence, Kenya 2008**

	Pre-NCD conditions (% of Adults)				N-RNCDs	
	Hypertension	Raised Glucose levels	Overweight*	Raised Cholesterol	Diabetes (% of Adults)**	CVD (% of Deaths)
Women	43%	8%	25%	27%	8%	-
Total	45%	8%	-	27%	8%	12%

Source: Alwan, Ala and World Health Organization. (2011). *Global status report on noncommunicable diseases 2010*. Geneva, Switzerland: World Health Organization. \*Overweight Data from DHS 2008-09. \*\*Diabetes Data from *Global Burden of Metabolic Risk Factors of Chronic Diseases Database* (Danaei et al, 2011).

Table 2 shows percent of infants who were born low birth weight, children who are stunted, overweight, stunted and overweight, or who are stunted with an overweight mother, and overweight women, broken down by socio-economic characteristics. Of those children who were low birth weight, 90 percent were born after 8 month or full-term pregnancies, meaning the reason for their low weight was not due to length of gestation. Regarding overweight, 5 percent of Kenyan children under 5 fall into this category. For comparison, the percentage of children ages 2 to 5 who are considered overweight in the US is 11 percent (CDC, 2012). Taking a look at the current nutritional status of children under 5, there is reason to be concerned that obesity and N-RNCDs will continue to rise as this cohort grows into adulthood (see Table 2).

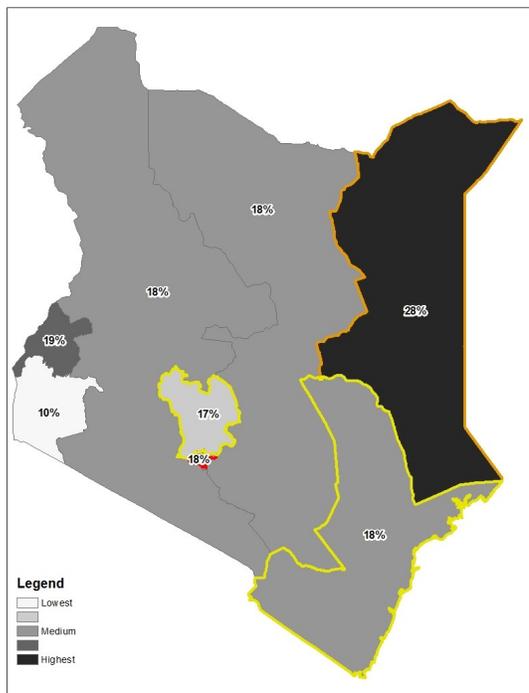
**Table 2: National Survey Indicators on Nutritional Status, by Background Characteristics, Kenya 2008**

		% of Children under 5					% of Women 15-49
		Low birth weight	Stunted	Overweight	Stunted and Overweight (same child)	Stunted child with Overweight Mother	Overweight
Educational attainment of mother	No education	26%	39%	3%	2%	1%	16%
	Primary	16%	38%	4%	3%	5%	21%
	Secondary	14%	27%	7%	3%	6%	31%
	Above secondary	14%	19%	8%	1%	8%	44%
Wealth index of family	Poorest	19%	44%	4%	3%	2%	9%
	Poorer	18%	39%	4%	2%	3%	13%
	Middle	17%	35%	4%	2%	5%	20%
	Richer	13%	29%	6%	3%	6%	31%
	Richest	17%	25%	6%	2%	9%	41%
Location of household	Urban	17%	27%	5%	2%	9%	40%
	Rural	17%	37%	5%	3%	4%	20%
Total		17%	35%	5%	2%	5%	25%

Definitions: Low Birth Weight (<2500g or classified by mother as small or very small at birth); Stunted (HAZ<-2SD); Child Overweight (WHZ>+2SD); Maternal Overweight (BMI≥25)

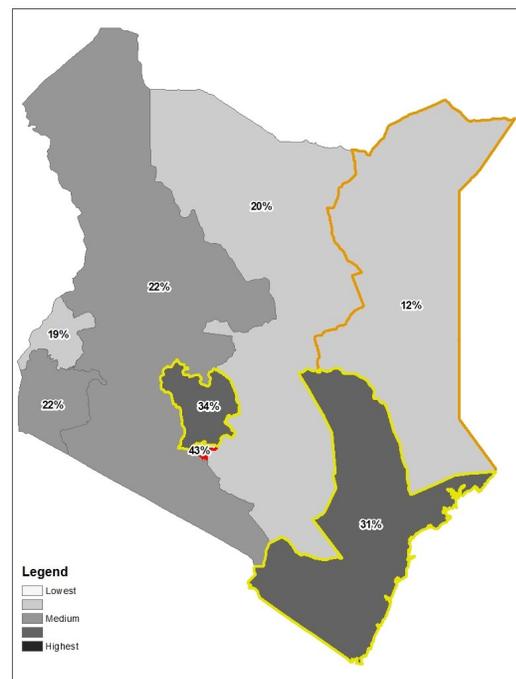
Source: DHS 2008-09 data, weighted estimates of percent of all children under 5 or percent of women 15-49.

### Percentage of children who are born low birth weight (<2500g)

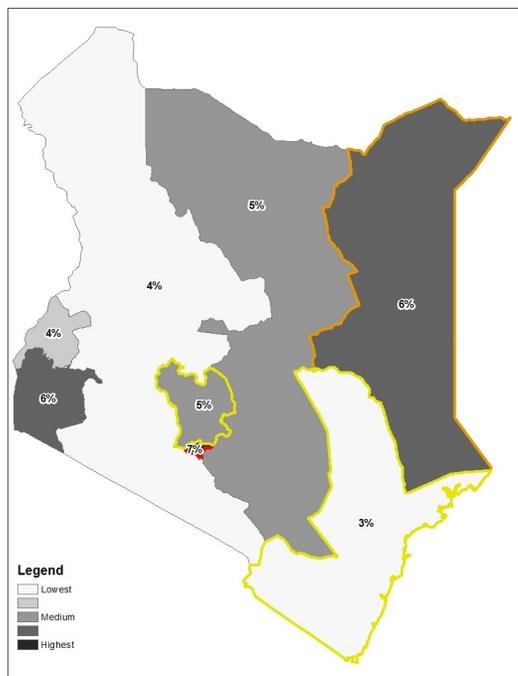


Looking further at Table 2, prevalence of overweight children, overweight women, and stunted child-overweight mother pairs trended closely with maternal education and household wealth in Kenya. The latter two were also higher in urban households. Conversely, women with no education had nearly twice the levels of low birth weight and stunting than those with secondary education or higher (4.6 percent of mothers had higher than secondary education). Stunting is also a significant issue among poor households. There is very little variation by economic status in the prevalence of low birth weight babies and children who are both stunted and overweight.

### Percentage of women who are overweight (BMI≥25)



### Percentage of children who are overweight (WHZ>+2SD)



*National level estimates do not adequately illustrate the wide sub-population variations that exist. These maps show the rates at the regional level. Nairobi (red border) is one of the 3 highest burden regions for each of the mapped indicators. The Northeast region (orange border) is among the 3 highest burden regions for its high prevalence of low birth weight and overweight children. The Central and Coast regions (yellow borders) have the second and third highest prevalence of overweight women.*

This descriptive analysis begins to explore where future risks may lie for N-RNCDs in Kenya, identifying where undernutrition programs may need to be tailored or targeted to better avoid later life health conditions. Here, child and maternal overweight overlay stunting as significant nutritional conditions. More in-depth analysis is needed to understand the determinants and dynamics influencing these relationships. SPRING is currently working to develop more evidence on why certain sub-populations are more at risk and how this information can be used to adjust nutrition programs.

Source: DHS 2008-09 data, weighted estimates of percent of all children under 5 or women 15-49.

#### References:

- Barker DJB, ed. 1992. *Fetal and infant origins of adult disease*. London: BMJ Publishing Group.
- CDC. 2012. CHD Health Data Interactive, for NHANES Data (Round: 2007-2010). Centers for Disease Control and Prevention.
- Danaei, Goodarz, Mariel M Finucane, Yuan Lu, Gitanjali M Singh, Melanie J Cowan, Christopher J Paciorek, John K Lin, et al. 2011. "National, Regional, and Global Trends in Fasting Plasma Glucose and Diabetes Prevalence Since 1980: Systematic Analysis of Health Examination Surveys and Epidemiological Studies with 370 Country-years and 2.7 Million Participants." *The Lancet* 378 (9785) (July): 31-40.
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- WHO. 2004. Appropriate Body-mass Index for Asian Populations and Its Implications for Policy and Intervention Strategies. *Lancet* 363: 9403.

# NUTRITION-RELATED NON-COMMUNICABLE DISEASE (N-RNCD) COUNTRY PROFILES



## MALAWI

Evidence has been mounting to support the hypothesis that maternal undernutrition, as well as in-utero and infant and young child undernutrition, increase the risk of developing N-RNCDs later in life (Barker, 1992 and Gluckman, 2010). Recent empirical studies have demonstrated that many common manifestations of undernutrition, such as intra-uterine growth restriction (IUGR), low birth weight, and stunting are all significantly associated with later development of hypertension, insulin resistance, and obesity. These are preconditions related to development of N-RNCDs such as Type II diabetes mellitus (diabetes) and cardiovascular disease (CVD). Addressing maternal, infant, and young child undernutrition is therefore not only important to preventing the immediate threats of child morbidity and mortality, but also to reducing the risk of N-RNCDs later in life.

In Malawi, the burden of N-RNCDs is already a problem in the adult population, with particularly high levels of hypertension and cholesterol (See Table 1). In addition to the data shown in the table, the average body mass index (BMI) among women stayed constant at 22 between 2004 and 2010, but overweight prevalence rose from 14 to 17 percent (2004 and 2010 DHS). Prevalence of diabetes has actually decreased from 7 percent in 1998 to 6 percent in 2008 (Danaei et al, 2011).

**Table 1: Estimated Age-Standardized Adult N-RNCD Prevalence, Malawi 2008**

	Pre-NCD conditions (% of Adults)				N-RNCDs	
	Hypertension	Raised Glucose levels	Overweight*	Raised Cholesterol	Diabetes (% of Adults)**	CVD (% of Deaths)
Women	48%	6%	17%	25%	6%	-
Total	50%	6%	-	24%	6%	13%

Source: Alwan, Ala and World Health Organization. (2011). *Global status report on noncommunicable diseases 2010*. Geneva, Switzerland: World Health Organization. \*Overweight Data from DHS 2010. \*\*Diabetes Data from Global Burden of Metabolic Risk Factors of Chronic Diseases Database (Danaei et al, 2011).

Table 2 shows percent of infants who were born low birth weight, children who are stunted, overweight, stunted and overweight, or who are stunted with an overweight mother, and overweight women, broken down by socio-economic characteristics. Of those children who were low birth weight, 88 percent were born after 8 month or full-term pregnancies, meaning the reason for their low weight was not due to length of gestation. Regarding overweight, 8 percent of Malawian children under 5 fall into this category. For comparison, the percentage of children ages 2 to 5 who are considered overweight in the US is 11 percent (CDC, 2012). Taking a look at the current nutritional status of children under 5, there is reason to be concerned that obesity and N-RNCDs will increase as this cohort grows into adulthood (see Table 2).

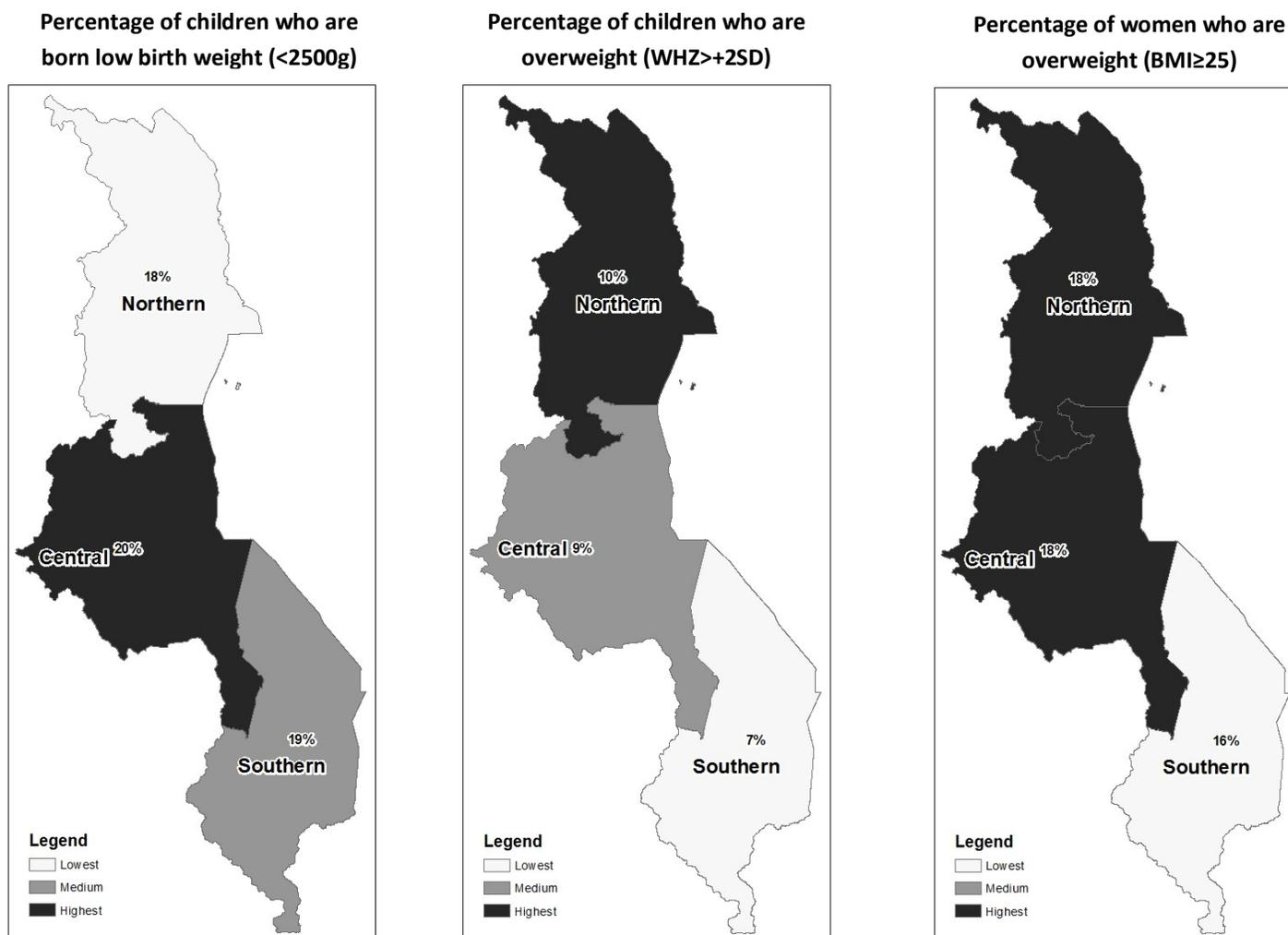
**Table 2: National Survey Indicators on Nutritional Status, by Background Characteristics, Malawi 2010**

		% of Children under 5					% of Women 15-49
		Low birth weight	Stunted	Overweight	Stunted and Overweight (same child)	Stunted child with Overweight Mother	Overweight
Educational attainment of mother	No education	21%	53%	8%	6%	5%	14%
	Primary	20%	48%	8%	5%	6%	17%
	Secondary	16%	39%	8%	5%	6%	21%
	Above secondary	10%	14%	18%	1%	2%	32%
Wealth index of family	Poorest	21%	56%	9%	6%	6%	10%
	Poorer	21%	51%	7%	5%	4%	13%
	Middle	19%	47%	8%	5%	5%	13%
	Richer	18%	47%	8%	5%	5%	16%
	Richest	17%	35%	9%	5%	9%	29%
Location of household	Urban	20%	40%	8%	6%	9%	28%
	Rural	19%	48%	8%	5%	5%	14%
Total		19%	47%	8%	5%	6%	17%

Definitions: Low Birth Weight (<2500g or classified by mother as small or very small at birth); Stunted (HAZ<-2SD); Child Overweight (WHZ>+2SD); Maternal Overweight (BMI≥25)

Source: DHS 2010 data, weighted estimates of percent of all children under 5 or percent of women 15-49.

Looking further at Table 2, prevalence of overweight in women was highest, around 30 percent, among those in wealthier, urban households and those with secondary or above education. There is relatively less variation by sub-group for most of the children's indicators as compared to other countries. One of the few notable differences in status occurs in children of highly educated women, with the prevalence of low birth weight, stunting, stunted and overweight children, and stunted children—overweight mother pairs all dropping by a large amount—however this is sample is very small (0.7 percent of mothers). Compared to other countries, Malawi also has relatively higher rates of stunted-overweight children, and extremely high stunting rates. High rates of child overweight overlapping with high rates of stunting and low birth weight may signal greater N-RNCD risk later in life.



Source: DHS 2010 data, weighted estimates of percent of all children under 5 or women 15-49.

National level estimates do not adequately illustrate the sub-population variations that exist. The maps here show these rates at the regional level. While the Southern region shows the lowest rates of overweight for both women and children, it still has high rates of low birth weight. The Northern and Central regions are nearly the same in their rates of all the indicators detailed in Table 2, except for the North having slightly lower low birth weight (18 vs. 20 percent) rates than the Central region.

This descriptive analysis begins to explore where future risks may lie for N-RNCDs in Malawi, identifying where undernutrition programs may need to be tailored or targeted to better avoid later life health conditions. Here, child and maternal overweight are a concern, but stunting is still pervasive. More in-depth analysis is needed to understand the determinants and dynamics influencing these relationships. SPRING is currently working to develop more evidence on why certain sub-populations are more at risk and how this information can be used to adjust nutrition programs.

**References:**

Barker DJB, ed. 1992. *Fetal and infant origins of adult disease*. London: BMJ Publishing Group.  
 CDC. 2012. CHD Health Data Interactive, for NHANES Data (Round: 2007-2010). Centers for Disease Control and Prevention.  
 Danaei, Goodarz, Mariel M Finucane, Yuan Lu, Gitanjali M Singh, Melanie J Cowan, Christopher J Paciorek, John K Lin, et al. 2011. "National, Regional, and Global Trends in Fasting Plasma Glucose and Diabetes Prevalence Since 1980: Systematic Analysis of Health Examination Surveys and Epidemiological Studies with 370 Country-years and 2.7 Million Participants." *The Lancet* 378 (9785) (July): 31–40.  
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# NUTRITION-RELATED NON-COMMUNICABLE DISEASE (N-RNCD) COUNTRY PROFILES



## MALI

Evidence has been mounting to support the hypothesis that maternal undernutrition, as well as in-utero and infant and young child undernutrition, increase the risk of developing N-RNCDs later in life (Barker, 1992 and Gluckman, 2010). Recent empirical studies have demonstrated that many common manifestations of undernutrition, such as intra-uterine growth restriction (IUGR), low birth weight, and stunting are all significantly associated with later development of hypertension, insulin resistance, and obesity. These are preconditions related to the development of N-RNCDs such as Type II diabetes mellitus (diabetes) and cardiovascular disease (CVD). Addressing maternal, infant, and young child undernutrition is therefore not only important to preventing the immediate threats of child morbidity and mortality, but also to reducing the risk of N-RNCDs later in life.

In Mali, the burden of N-RNCDs is a moderately important health issue in the adult population (See Table 1). In addition to the data shown in the table, the average body mass index (BMI) among women stayed constant at 22, but overweight prevalence rose from 15 to 18 percent (2001 and 2006 DHS). Prevalence of diabetes has increased from 8 percent in 1998 to 9 percent in 2008 (Danaei et al, 2011).

**Table 1: Estimated Age-Standardized Adult N-RNCD Prevalence, Mali 2008**

	Pre-NCD conditions (% of Adults)				N-RNCDs	
	Hypertension	Raised Glucose levels	Overweight*	Raised Cholesterol	Diabetes (% of Adults)**	CVD (% of Deaths)
Women	41%	10%	18%	20%	10%	-
Total	41%	9%	-	19%	9%	8%

Source: Alwan, Ala and World Health Organization. (2011). *Global status report on noncommunicable diseases 2010*. Geneva, Switzerland: World Health Organization. \*Overweight Data from DHS 2006. \*\*Diabetes Data from Global Burden of Metabolic Risk Factors of Chronic Diseases Database (Danaei et al, 2011).

Table 2 shows percent of infants who were born low birth weight, children who are stunted, overweight, stunted and overweight, or who are stunted with an overweight mother, and overweight women, broken down by socio-economic characteristics. Regarding overweight, 4 percent of Malian children under 2 fall into this category. For comparison, the percentage of children ages 2 to 5 who are considered overweight in the US is 11 percent (CDC, 2012). Taking a look at the current nutritional status of children under 5, there is still a significant burden of stunting across sub-groups, peaking at 45 percent in the poorest wealth quintile, while women's overweight can reach 30 to 40 percent for richer, more educated women (see Table 2).

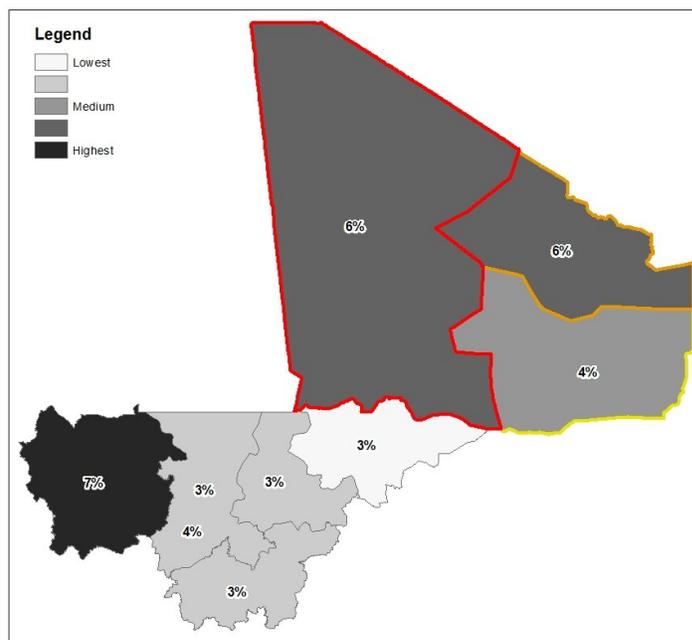
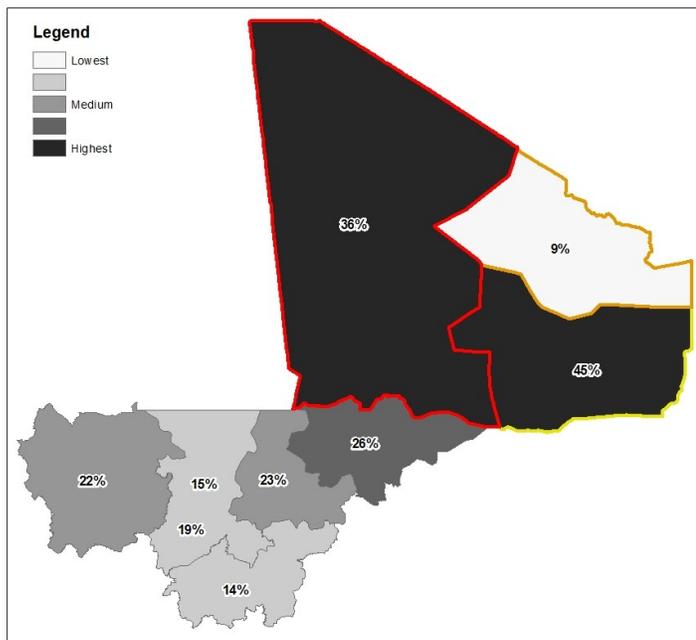
**Table 2: National Survey Indicators on Nutritional Status, by Background Characteristics, Mali 2006**

		% of Children under 5					% of Women 15-49
		Low birth weight	Stunted	Overweight	Stunted and Overweight (same child)	Stunted child with Overweight Mother	Overweight
Educational attainment of mother	No education	21%	<b>40%</b>	4%	2%	5%	16%
	Primary	20%	30%	3%	1%	6%	21%
	Secondary	24%	20%	<b>5%</b>	2%	<b>8%</b>	<b>29%</b>
	Above secondary	20%	13%	3%	0%	3%	<b>42%</b>
Wealth index of family	Poorest	17%	<b>45%</b>	4%	2%	3%	8%
	Poorer	21%	42%	5%	3%	4%	9%
	Middle	22%	43%	4%	2%	5%	13%
	Richer	24%	36%	4%	2%	<b>6%</b>	<b>22%</b>
	Richest	21%	22%	4%	2%	<b>7%</b>	<b>32%</b>
Location of household	Urban	24%	27%	4%	2%	<b>7%</b>	<b>31%</b>
	Rural	20%	<b>42%</b>	4%	2%	4%	11%
Total		21%	38%	4%	2%	5%	18%

Definitions: Low Birth Weight (<2500g or classified by mother as small or very small at birth); Stunted (HAZ<-2SD); Child Overweight (WHZ>+2SD); Maternal Overweight (BMI≥25)

Source: DHS 2006 data, weighted estimates of percent of all children under 5 or percent of women 15-49.

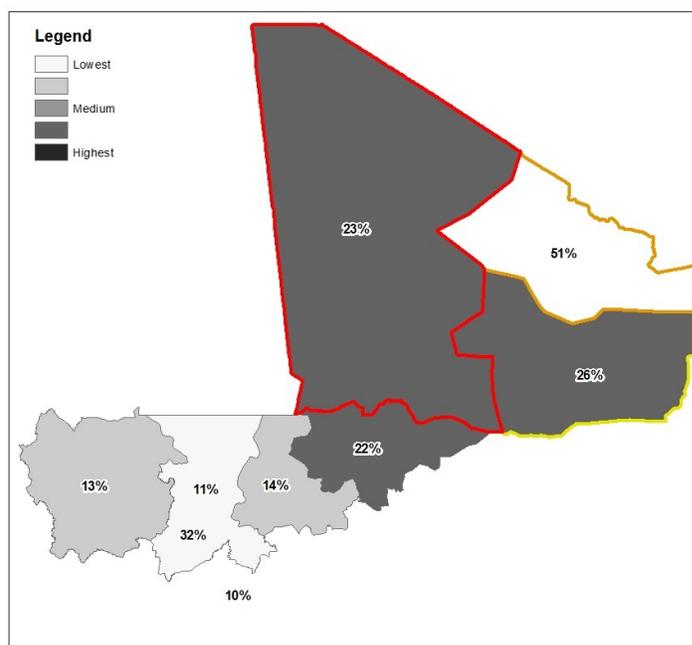
Looking further at Table 2, there is relatively little variation by sub-group for low birth weight, child overweight, and stunted-overweight children. Prevalence of overweight women, and stunted child-overweight mother pairs, increased with education and wealth and was higher in urban areas, while child stunting trended in the opposite direction. Note that the percentages for women with above secondary education may not be valid as less than 0.5 percent of mothers fall into that category.



**Maps clockwise from top left: Percentage of children who are born low birth weight (<2500g); Percentage of children who are overweight (WHZ>+2SD); Percentage of women who are overweight (BMI≥25).**

National level estimates do not adequately illustrate the wide sub-population variations that exist. The maps here show these rates at the regional level. The region of Tombouctou (red border) is in the top 3 highest burden regions for maternal overweight and low birth weight. Similarly, the region of Gao (yellow border) exhibits the dual burden of over- and undernutrition, with high rates of women's overweight and low birth weight. Kidal (orange border) is one of the 3 highest burden states for overweight women and children. Here, the rate of overweight for women top 50 percent.

This descriptive analysis begins to explore where future risks may lie for N-RNCDs in Mali, identifying where undernutrition programs may need to be tailored or targeted to better avoid later life health conditions. Here, child and maternal overweight are a concern, but stunting is still pervasive. More in-depth analysis is needed to understand the determinants and dynamics influencing these relationships. SPRING is currently working to develop more evidence on why certain sub-populations are more at risk and how this information can be used to adjust nutrition programs.



Source: DHS 2006 data, weighted estimates of percent of all children under 5 or women 15-49.

#### References:

- Barker DJB, ed. 1992. *Fetal and infant origins of adult disease*. London: BMJ Publishing Group.
- CDC. 2012. CHD Health Data Interactive, for NHANES Data (Round: 2007-2010). Centers for Disease Control and Prevention.
- Danaei, Goodarz, Mariel M Finucane, Yuan Lu, Gitanjali M Singh, Melanie J Cowan, Christopher J Paciorek, John K Lin, et al. 2011. "National, Regional, and Global Trends in Fasting Plasma Glucose and Diabetes Prevalence Since 1980: Systematic Analysis of Health Examination Surveys and Epidemiological Studies with 370 Country-years and 2.7 Million Participants." *The Lancet* 378 (9785) (July): 31-40.
- Demographic and Health Surveys. 2001 and 2006. Mali Demographic and Health Survey. MEASURE DHS.
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# NUTRITION-RELATED NON-COMMUNICABLE DISEASE (N-RNCD) COUNTRY PROFILES



## NEPAL

Evidence has been mounting to support the hypothesis that maternal undernutrition, as well as in-utero and infant and young child undernutrition, increase the risk of developing N-RNCDs later in life (Barker, 1992 and Gluckman, 2010). Recent empirical studies have demonstrated that many common manifestations of undernutrition, such as intra-uterine growth restriction (IUGR), low birth weight, and stunting are all significantly associated with later development of hypertension, insulin resistance, and obesity. These are preconditions related to the development of N-RNCDs such as Type II diabetes mellitus (diabetes) and cardiovascular disease (CVD). Addressing maternal, infant, and young child undernutrition is therefore not only important to preventing the immediate threats of child morbidity and mortality, but also to reducing the risk of N-RNCDs later in life.

In Nepal, the burden of N-RNCDs is a moderately important health issue in the adult population (See Table 1). In addition to the data shown in the table, the average body mass index (BMI) among women rose slightly from 20 to 21 between 2006 and 2011, while overweight prevalence rose from 9 to 14 percent (2006 and 2011 DHS). Using the suggested increased risk BMI cutoff of 23 for Asian populations, those figures rise to 18 and 27 percent, respectively (WHO 2004). Prevalence of diabetes has gone up by 30 percent, from 8 percent in 1998 to 10 percent in 2008.

**Table 1: Estimated Adult N-RNCD Prevalence, Nepal 2008**

	Pre-NCD conditions (% of Adults)				N-RNCDs	
	Hypertension	Raised Glucose levels	Overweight*	Raised Cholesterol	Diabetes (% of Adults)**	CVD (% of Deaths)
Women	39%	9%	14%	24%	9%	-
Total	39%	10%	-	23%	10%	25%

Source: Alwan, Ala and World Health Organization. (2011). *Global status report on noncommunicable diseases 2010*. Geneva, Switzerland: World Health Organization. \*Overweight Data from DHS 2011. \*\*Diabetes Data from Global Burden of Metabolic Risk Factors of Chronic Diseases Database (Danaei et al, 2011).

Table 2 shows proportions of infants who were born low birth weight, children who are stunted, overweight, or stunted and overweight, children who are stunted with an overweight mother, and overweight women, broken down by socio-economic characteristics. Of those children who were low birth weight, 91 percent were born after 8 month or full-term pregnancies, meaning the reason for their low weight was not due to length of gestation. Regarding overweight, only 1 percent of Nepali children under 5 fall into this category. For comparison, the percentage of children ages 2 to 5 who are considered overweight in the US is 11 percent (CDC, 2012). Taking a look at the current nutritional status of children under 5, there is little evidence of obesity risk and N-RNCDs in any subgroup. However, overweight spikes for women in the richest (29 percent) and urban (27 percent) households.

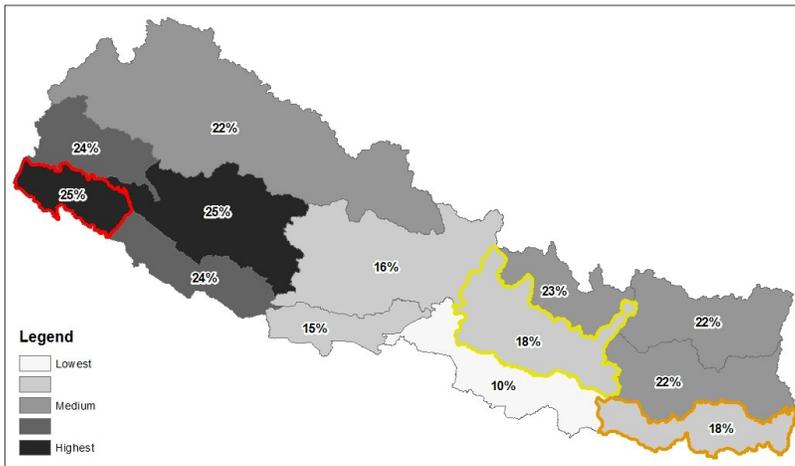
**Table 2: National Survey Indicators on Nutritional Status, by Background Characteristics, Nepal 2011**

		% of Children under 5					% of Women 15-49
		Low birth weight	Stunted	Overweight	Stunted and Overweight (same child)	Stunted child with Overweight Mother	Overweight
Educational attainment of mother	No education	19%	<b>48%</b>	1%	0%	1%	11%
	Primary	17%	41%	1%	0%	2%	16%
	Secondary	17%	31%	3%	1%	4%	14%
	Above secondary	16%	23%	2%	1%	5%	18%
Wealth index of family	Poorest	22%	<b>56%</b>	2%	1%	1%	3%
	Poorer	17%	45%	0%	0%	1%	6%
	Middle	16%	35%	2%	0%	2%	9%
	Richer	17%	30%	2%	1%	2%	15%
	Richest	16%	25%	2%	1%	<b>8%</b>	<b>29%</b>
Location of household	Urban	19%	27%	2%	1%	<b>6%</b>	<b>27%</b>
	Rural	18%	<b>42%</b>	1%	1%	2%	11%
Total		18%	40%	1%	1%	3%	14%

Definitions: Low Birth Weight (<2500g or classified by mother as small or very small at birth); Stunted (HAZ<-2SD); Child Overweight (WHZ>+2SD); Maternal Overweight (BMI≥25)

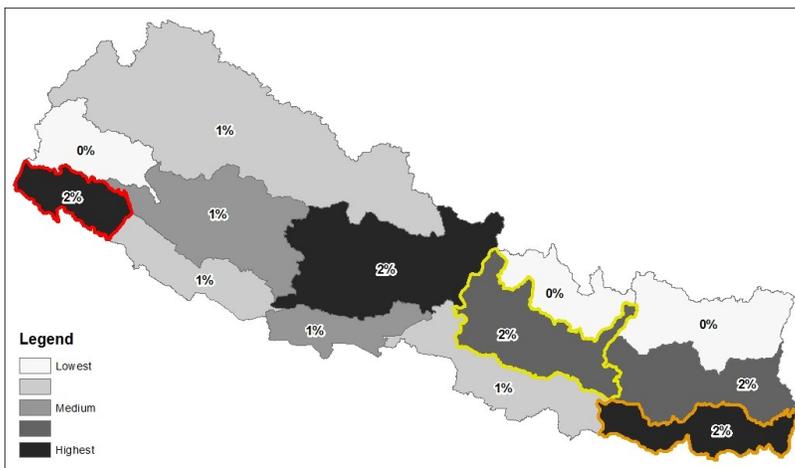
Source: DHS 2011 data, weighted estimates of percent of all children under 5 or percent of women 15-49.

Looking further at Table 2, women with less education and from households with less wealth appear more likely to have a low birth weight baby and/or a stunted child, but conversely look less likely to be overweight. Urban areas had a higher prevalence of overweight women, and stunted child-overweight mother pairs, and slightly higher prevalence of low birth weight. Prevalence of stunting is very high, and highest (42–56 percent) in rural areas, poor households, and when mothers have no education.

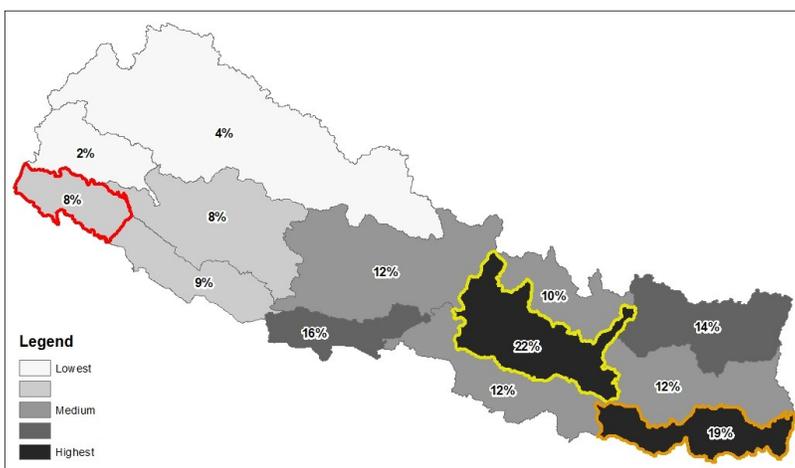


**Maps, from top to bottom: Percentage of children who are born low birth weight (<2500g); Percentage of children who are overweight (WHZ>+2SD); Percentage of women who are overweight (BMI≥25).**

Source: DHS 2011 data, weighted estimates of percent of all children under 5 or women 15-49.



National level estimates do not adequately illustrate the wide sub-population variations that exist. The maps here show these rates at the regional level. The Far West Terai region (red border) ranks among the 3 highest burden regions for both low birth weight and overweight children. The Eastern Terai region (orange border) shows high levels of both child and women overweight. The Central Hills (yellow border) have the highest levels of maternal overweight in the country.



This descriptive analysis begins to explore where future risks may lie for N-RNCDs in Nepal, identifying where undernutrition programs may need to be tailored or targeted to better avoid later life health conditions. It appears stunting is still the largest concern. More in-depth analysis is needed to understand the determinants and dynamics influencing these relationships. SPRING is currently working to develop more evidence on why certain sub-populations are more at risk and how this information can be used to adjust nutrition programs.

#### References:

- Barker DJB, ed. 1992. *Fetal and infant origins of adult disease*. London: BMJ Publishing Group.
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# NUTRITION-RELATED NON-COMMUNICABLE DISEASE (N-RNCD) COUNTRY PROFILES



## NIGERIA

Evidence has been mounting to support the hypothesis that maternal undernutrition, as well as in-utero and infant and young child undernutrition, increase the risk of developing N-RNCDs later in life (Barker, 1992 and Gluckman, 2010). Recent empirical studies have demonstrated that many common manifestations of undernutrition, such as intra-uterine growth restriction (IUGR), low birth weight, and stunting are all significantly associated with later development of hypertension, insulin resistance, and obesity. These are preconditions related to the development of N-RNCDs such as Type II diabetes mellitus (diabetes) and cardiovascular disease (CVD). Addressing maternal, infant, and young child undernutrition is therefore not only important to preventing the immediate threats of child morbidity and mortality, but also to reducing the risk of N-RNCDs later in life.

In Nigeria, the burden of N-RNCDs is already an important health issue in the adult population (See Table 1). In addition to the data shown in the table, the average body mass index (BMI) among women rose from 22 to 23 between 2003 and 2008, while overweight prevalence rose slightly, from 21 to 22 percent (2003 and 2008 DHS). Prevalence of diabetes has increased from 9 percent in 1998 to 10 percent in 2008 (Danaei et al, 2011). Diabetes is significantly higher among women.

**Table 1: Estimated Age-Standardized Adult N-RNCD Prevalence, Nigeria 2008**

	Pre-NCD conditions (% of Adults)				N-RNCDs	
	Hypertension	Raised Glucose levels	Overweight*	Raised Cholesterol	Diabetes (% of Adults)**	CVD (% of Deaths)
Women	50%	12%	22%	19%	12%	-
Total	49%	10%	-	17%	10%	12%

Source: Alwan, Ala and World Health Organization. (2011). *Global status report on noncommunicable diseases 2010*. Geneva, Switzerland: World Health Organization. \*Overweight Data from DHS 2008. \*\*Diabetes Data from Global Burden of Metabolic Risk Factors of Chronic Diseases Database (Danaei et al, 2011).

Table 2 shows percent of infants who were born low birth weight, children who are stunted, overweight, stunted and overweight, or who are stunted with an overweight mother, and overweight women, broken down by socio-economic characteristics. Of those children who were low birth weight, 96 percent were born after 8 month or full-term pregnancies, meaning the reason for their low weight was not due to length of gestation. Regarding overweight, 9 percent of Nigerian children under 5 fall into this category. For comparison, the percentage of children ages 2 to 5 who are considered overweight in the US is 11 percent (CDC, 2012). Taking a look at the current nutritional status of children under 5, there is reason to be concerned that obesity and N-RNCDs will continue to rise as this cohort grows into adulthood (see Table 2).

**Table 2: National Survey Indicators on Nutritional Status, by Background Characteristics, Nigeria 2008**

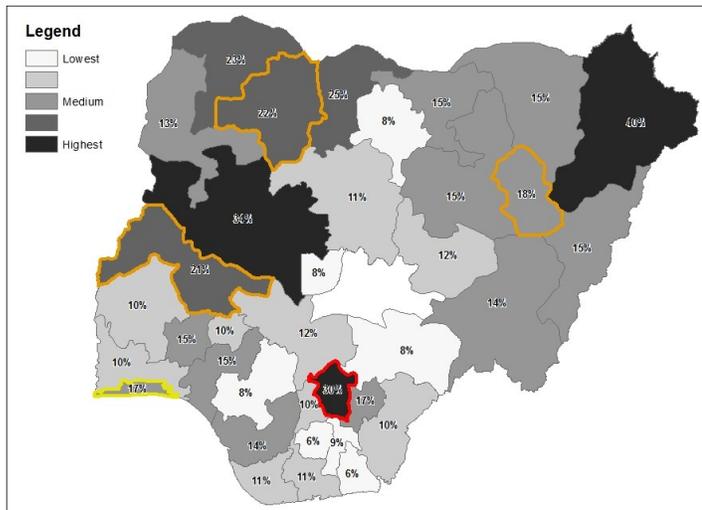
		% of Children under 5					% of Women 15-49
		Low birth weight	Stunted	Overweight	Stunted and Overweight (same child)	Stunted child with Overweight Mother	Overweight
Educational attainment of mother	No education	20%	51%	8%	6%	5%	14%
	Primary	12%	40%	9%	5%	6%	24%
	Secondary	11%	29%	9%	5%	7%	24%
	Above secondary	11%	19%	10%	4%	8%	41%
Wealth index of family	Poorest	20%	52%	9%	7%	4%	9%
	Poorer	16%	49%	9%	6%	4%	13%
	Middle	14%	42%	9%	6%	7%	19%
	Richer	12%	34%	9%	4%	8%	25%
	Richest	12%	24%	9%	5%	9%	38%
Location of household	Urban	14%	31%	9%	5%	8%	31%
	Rural	16%	45%	9%	6%	5%	17%
Total		15%	41%	9%	6%	6%	22%

Definitions: Low Birth Weight (<2500g or classified by mother as small or very small at birth); Stunted (HAZ<-2SD); Child Overweight (WHZ>+2SD); Maternal Overweight (BMI≥25)

Source: DHS 2008 data, weighted estimates of percent of all children under 5 or percent of women 15-49.

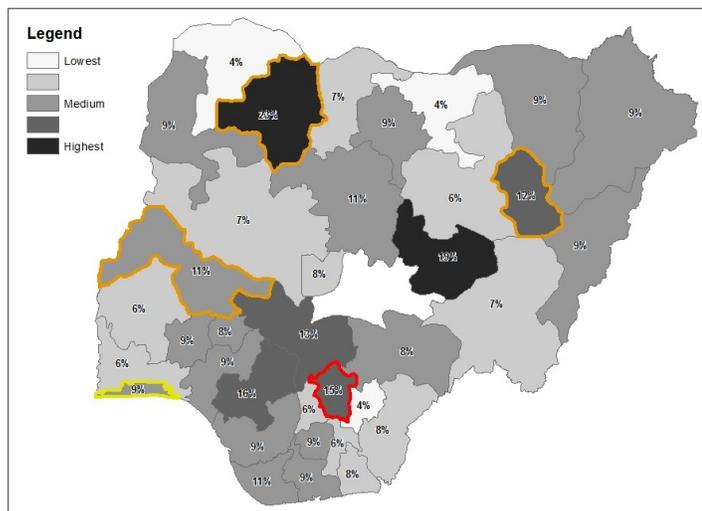
Looking further at Table 2, rural women, as well as those with less education and from families with less wealth, appear more likely to have a low birth weight baby, a stunted child, or a stunted-overweight child, but conversely look less likely to be overweight or be in a stunted child-overweight mother pair. Stunting is extremely high and widespread across most sub-groups. Women's overweight can reach 30 to 40 percent among wealthiest quintile and highly educated women (5.4 percent of mothers). There is very little variation by socio-economic status in the prevalence of children who are overweight, suggesting this is a pervasive issue.

### Percentage of children who are born low birth weight (<2500g)

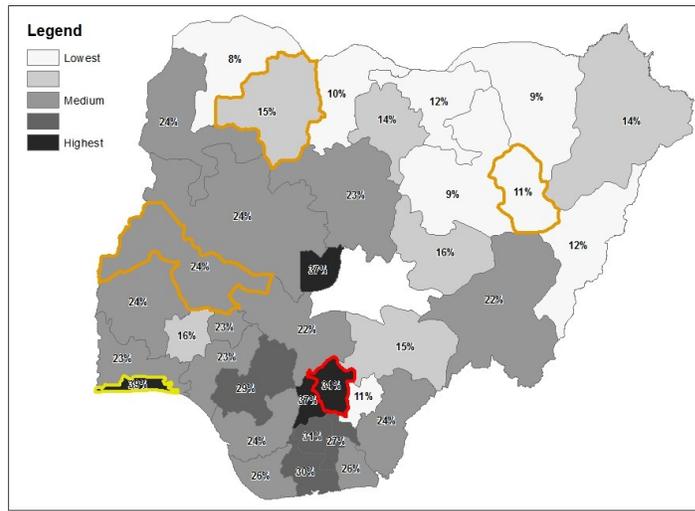


*National level estimates do not adequately illustrate the wide sub-population variations that exist. The maps here show these rates at the state level. Enugu (red border) is among the top 5 highest burden states across the 3 indicators. Children in Zamfara, Kwara and Gombe (orange borders) also face very high risk factors; these states rank among the 10 highest burden states for low birth weight rates and children's overweight status. In Zamfara, 22 percent of infants are born low birth weight while at the same time 23 percent of children under 5 are overweight. Lagos (yellow borders) has the highest rate of women's overweight of all the states (39 percent), while having the ninth highest low birth weight rate (17 percent).*

### Percentage of children who are overweight (WHZ>+2SD)



### Percentage of women who are overweight (BMI≥25)



Source: DHS 2008 data, weighted estimates of percent of all children under 5 or women 15-49.

This descriptive analysis begins to explore where future risks may lie for N-RNCDs in Nigeria, identifying where undernutrition programs may need to be tailored or targeted to better avoid later life health conditions. Here, child and maternal overweight overlap pervasive stunting as significant nutritional conditions. More in-depth analysis is needed to understand the determinants and dynamics influencing these relationships. SPRING is currently working to develop more evidence on why certain sub-populations are more at risk and how this information can be used to adjust nutrition programs.

#### References:

- Barker DJB, ed. 1992. *Fetal and infant origins of adult disease*. London: BMJ Publishing Group.
- CDC. 2012. CHD Health Data Interactive, for NHANES Data (Round: 2007-2010). Centers for Disease Control and Prevention.
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# NUTRITION-RELATED NON-COMMUNICABLE DISEASE (N-RNCD) COUNTRY PROFILES



## TANZANIA

Evidence has been mounting to support the hypothesis that maternal undernutrition, as well as in-utero and infant and young child undernutrition, increase the risk of developing N-RNCDs later in life (Barker, 1992 and Gluckman, 2010). Recent empirical studies have demonstrated that many common manifestations of undernutrition, such as intra-uterine growth restriction (IUGR), low birth weight, and stunting are all significantly associated with later development of hypertension, insulin resistance, and obesity. These are preconditions related to development of N-RNCDs such as Type II diabetes mellitus (diabetes) and cardiovascular disease (CVD). Addressing maternal, infant, and young child undernutrition is therefore not only important to preventing the immediate threats of child morbidity and mortality, but also to reducing the risk of N-RNCDs later in life.

In Tanzania, the burden of N-RNCDs is already a problem in the adult population (See Table 1). In addition to the data shown in the table, the average body mass index (BMI) among women rose from 22 to 23 between 2004-05 and 2010, and prevalence of overweight rose from 18 to 22 percent (2004-05 and 2010 DHS). Prevalence of diabetes varied little from around 8 or 9 percent between 1998 and 2008 (Danaei et al, 2011).

**Table 1: Estimated Age-Standardized Adult N-RNCD Prevalence, Tanzania 2008**

	Pre-NCD conditions (% of Adults)				N-RNCDs	
	Hypertension	Raised Glucose levels	Overweight*	Raised Cholesterol	Diabetes (% of Adults)**	CVD (% of Deaths)
Women	44%	9%	22%	26%	9%	-
Total	45%	8%	-	24%	8%	12%

Source: Alwan, Ala and World Health Organization. (2011). *Global status report on noncommunicable diseases 2010*. Geneva, Switzerland: World Health Organization. \*Overweight Data from DHS 2010. \*\*Diabetes Data from Global Burden of Metabolic Risk Factors of Chronic Diseases Database (Danaei et al, 2011).

Table 2 shows percent of infants who were born low birth weight, children who are stunted, overweight, stunted and overweight, or who are stunted with an overweight mother, and overweight women, broken down by socio-economic characteristics. Of those children who were low birth weight, 90 percent were born after 8 month or full-term pregnancies, meaning the reason for their low weight was not due to length of gestation. Regarding overweight, 5 percent of Tanzanian children under 5 fall into this category. For comparison, the percentage of children ages 2 to 5 who are considered overweight in the US is 11 percent (CDC, 2012). Taking a look at the current nutritional status of children under 5, there is reason to be concerned that obesity and N-RNCDs will continue to rise as this cohort grows into adulthood (see Table 2).

**Table 2: National Survey Indicators on Nutritional Status, by Background Characteristics, Tanzania 2010**

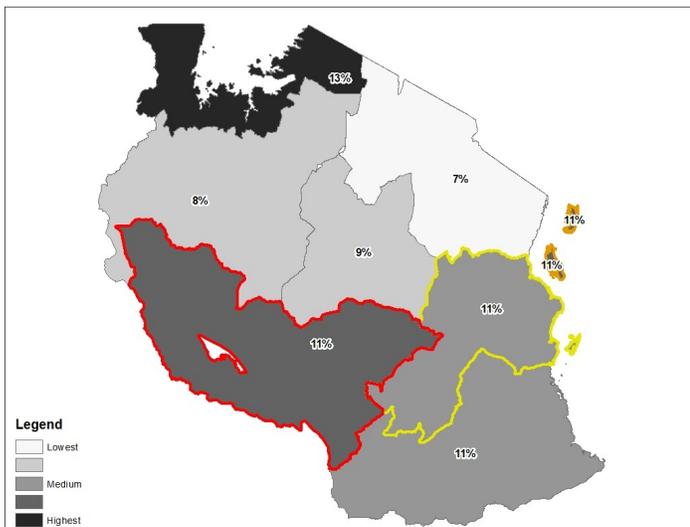
		% of Children under 5					% of Women 15-49
		Low birth weight	Stunted	Overweight	Stunted and Overweight (same child)	Stunted child with Overweight Mother	Overweight
Educational attainment of mother	No education	9%	45%	5%	3%	5%	16%
	Primary	10%	42%	5%	3%	6%	22%
	Secondary	14%	23%	5%	1%	7%	27%
	Above secondary	12%*	0%*	17%*	0%*	0%*	75%*
Wealth index of family	Poorest	10%	48%	5%	3%	4%	9%
	Poorer	8%	45%	5%	3%	4%	10%
	Middle	10%	44%	5%	3%	7%	14%
	Richer	11%	38%	5%	2%	7%	25%
	Richest	13%	27%	6%	2%	9%	41%
Location of household	Urban	14%	31%	6%	2%	9%	36%
	Rural	9%	44%	5%	3%	5%	15%
Total		10%	42%	5%	3%	6%	22%

Definitions: Low Birth Weight (<2500g or classified by mother as small or very small at birth); Stunted (HAZ<-2SD); Child Overweight (WHZ>+2SD); Maternal Overweight (BMI≥25)

Source: DHS 2010 data, weighted estimates of percent of all children under 5 or percent of women 15-49. \*Very small sample of children for these mothers.

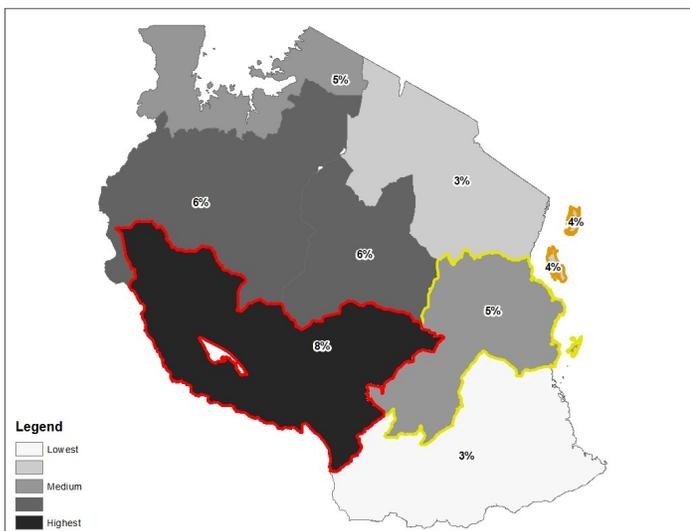
Looking further at Table 2, the statistics demonstrate unexpected findings. For example, prevalence of child overweight, stunted child-overweight mother pairs, and maternal overweight all increased with education and in urban households, along with low birth weight. This pattern is lessened but still present for wealth, with the highest prevalence of low birth weight occurring in the richest wealth quintile. Stunting is still quite high in the least advantaged sub-groups. The extremely high percentages for overweight in the top education category may be due to the low number of women who fell into that category (0.3 percent of mothers), but overall these results could suggest some double burden of stunting and overnutrition.

#### Percentage of children who are born low birth weight (<2500g)

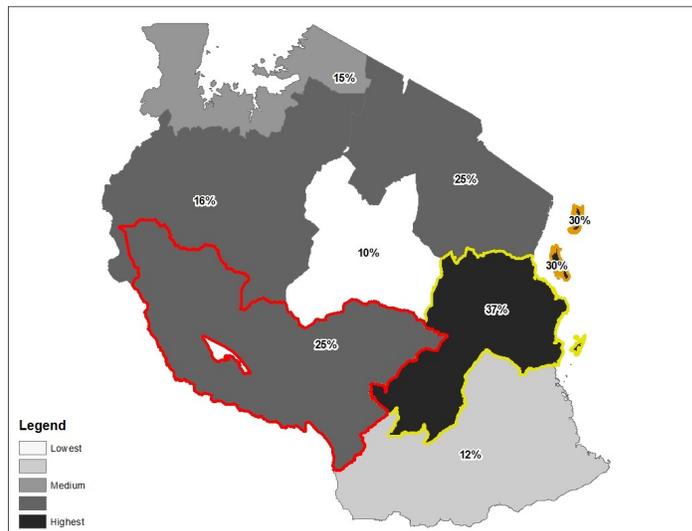


*National level estimates do not adequately illustrate the wide sub-population variations that exist. The maps here show these rates at the regional level. The Southern Highlands (red border) are in the 3 highest burden regions for overweight children (8 percent) and low birth weight (11 percent). Zanzibar (orange border) exhibits high rates of both maternal overweight (30 percent) as well as low birth weight (11 percent). The Eastern region (yellow border) has the highest rate of maternal overweight (37 percent).*

#### Percentage of children who are overweight (WHZ>+2SD)



#### Percentage of women who are overweight (BMI ≥ 25)



Source: DHS 2010 data, weighted estimates of percent of all children under 5 or women 15-49.

This descriptive analysis begins to explore where future risks may lie for N-RNCDs in Tanzania, identifying where undernutrition programs may need to be tailored or targeted to better avoid later life health conditions. Here, child and maternal overweight overlap stunting as significant nutritional conditions. More in-depth analysis is needed to understand the determinants and dynamics influencing these relationships. SPRING is currently working to develop more evidence on why certain sub-populations are more at risk and how this information can be used to adjust nutrition programs.

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- Barker DJB, ed. 1992. *Fetal and infant origins of adult disease*. London: BMJ Publishing Group.
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# NUTRITION-RELATED NON-COMMUNICABLE DISEASE (N-RNCD) COUNTRY PROFILES



## ZAMBIA

Evidence has been mounting to support the hypothesis that maternal undernutrition, as well as in-utero and infant and young child undernutrition, increase the risk of developing N-RNCDs later in life (Barker, 1992 and Gluckman, 2010). Recent empirical studies have demonstrated that many common manifestations of undernutrition, such as intra-uterine growth restriction (IUGR), low birth weight, and stunting are all significantly associated with later development of hypertension, insulin resistance, and obesity. These are preconditions related to the development of N-RNCDs such as Type II diabetes mellitus (diabetes) and cardiovascular disease (CVD). Addressing maternal, infant, and young child undernutrition is therefore not only important to preventing the immediate threats of child morbidity and mortality, but also to reducing the risk of N-RNCDs later in life.

In Zambia, the burden of N-RNCDs is already an important health issue in the adult population, with particularly high levels of hypertension and cholesterol (See Table 1). In addition to the data in the table, average body mass index (BMI) among women stayed constant at 22 between 2001-02 and 2007, but the overweight prevalence rose from 12 to 19 percent (2001-02 and 2007 DHS). Prevalence of diabetes has actually decreased from 8 percent in 1998 to 7 percent in 2008 (Danaei et al, 2011).

**Table 1: Estimated Age-Standardized Adult N-RNCD Prevalence, Zambia 2008**

	Pre-NCD conditions (% of Adults)				N-RNCDs	
	Hypertension	Raised Glucose levels	Overweight*	Raised Cholesterol	Diabetes (% of Adults)**	CVD (% of Deaths)
Women	46%	8%	19%	29%	8%	-
Total	48%	7%	-	28%	7%	12%

Source: Alwan, Ala and World Health Organization. (2011). *Global status report on noncommunicable diseases 2010*. Geneva, Switzerland: World Health Organization. \*Overweight Data from DHS 2007. \*\*Diabetes Data from Global Burden of Metabolic Risk Factors of Chronic Diseases Database (Danaei et al, 2011).

Table 2 shows percent of infants who were born low birth weight, children who are stunted, overweight, stunted and overweight, or who are stunted with an overweight mother, and overweight women, broken down by socio-economic characteristics. Of those children who were low birth weight, 98 percent were born after 8 month or full-term pregnancies, meaning the reason for their low weight was not due to length of gestation. Regarding overweight, 8 percent of Zambian children under 5 fall into this category. For comparison, the percentage of children ages 2 to 5 who are considered overweight in the US is 11 percent (CDC, 2012). Taking a look at the current nutritional status of children under 5, there is reason to be concerned that obesity and N-RNCDs will continue to rise as this cohort grows into adulthood, particularly among the sub-groups that reach 9 to 10 percent overweight (see Table 2).

**Table 2: National Survey Indicators on Nutritional Status, by Background Characteristics, Zambia 2007**

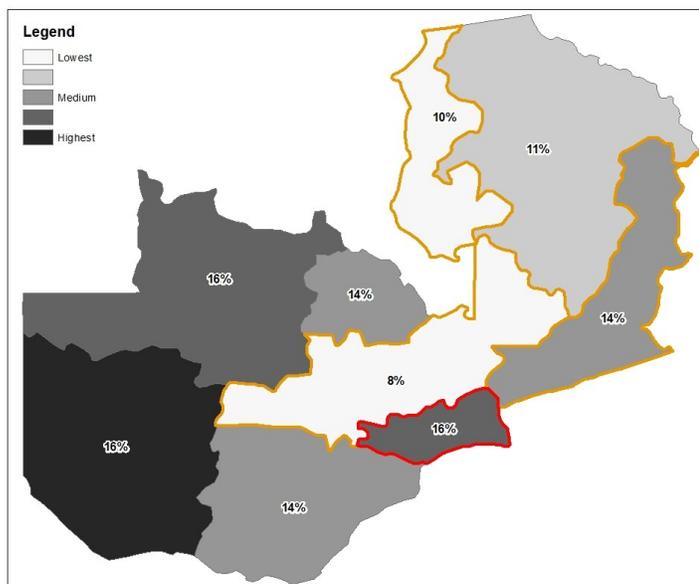
		% of Children under 5					% of Women 15-49
		Low birth weight	Stunted	Overweight	Stunted and Overweight (same child)	Stunted child with Overweight Mother	Overweight
Educational attainment of mother	No education	13%	45%	7%	4%	2%	10%
	Primary	13%	48%	9%	6%	7%	17%
	Secondary	13%	39%	7%	5%	6%	22%
	Above secondary	21%	23%	5%	0%	14%	47%
Wealth index of family	Poorest	13%	48%	10%	7%	2%	7%
	Poorer	13%	51%	8%	6%	5%	9%
	Middle	13%	47%	10%	6%	5%	11%
	Richer	15%	41%	6%	4%	9%	23%
	Richest	14%	34%	7%	3%	13%	35%
Location of household	Urban	15%	39%	7%	4%	11%	30%
	Rural	13%	48%	9%	6%	4%	11%
Total		13%	45%	8%	5%	6%	19%

Definitions: Low Birth Weight (<2500g or classified by mother as small or very small at birth); Stunted (HAZ<-2SD); Child Overweight (WHZ>+2SD); Maternal Overweight (BMI≥25)

Source: DHS 2007 data, weighted estimates of percent of all children under 5 or percent of women 15-49.

Looking further at Table 2, the statistics demonstrate unexpected findings. For example, sub-groups at risk for overweight also have stunting rates at close to 50 percent, such as children of mothers with only primary education, rural households, or those in the poorest or middle wealth quintiles. Low birth weight varies little by sub-group, with the exception of those born to women with more than a secondary education (2.4 percent of women) — here the prevalence rises to 21 percent. Child stunting, child

**Percentage of children who are born low birth weight (<2500g)**

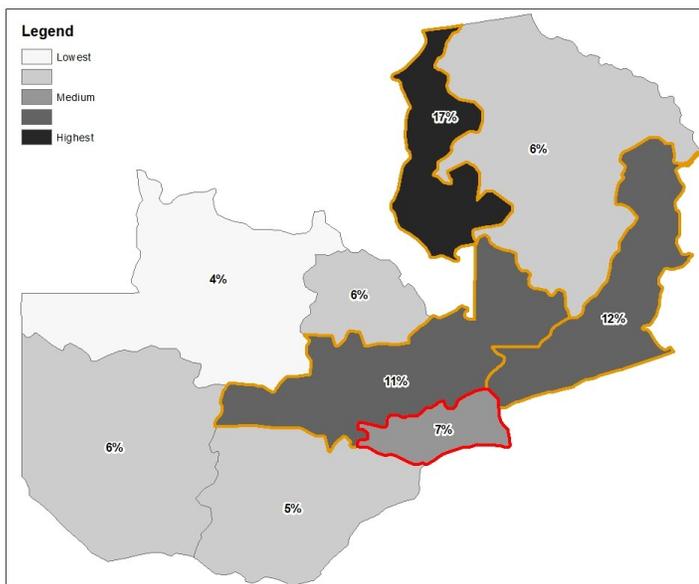


overweight, and stunted-overweight child prevalence were all highest in those households with lower education and lower wealth quintiles, suggesting a dual burden in these sub-groups. However, maternal overweight and stunted child-overweight mother pairs trended in the opposite direction for all demographic indicators.

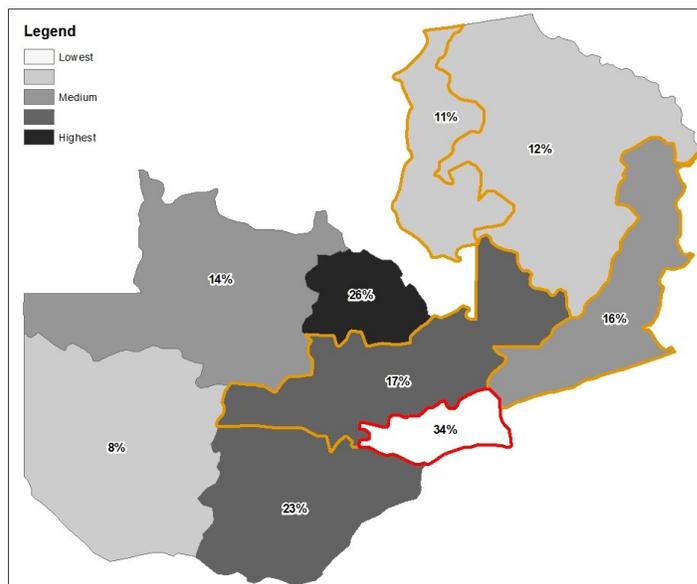
*National level estimates do not adequately illustrate the wide sub-population variations that exist. The maps here show these rates at the regional level. Lusaka (red border) is in the top three highest burden regions for both overweight women (34 percent) and low birth weight (16 percent). Luapula, Eastern, and Central regions (orange borders) have very high rates for child overweight (17, 12, and 11 percent respectively), but lower rates of maternal overweight and low birth weight than most of the other regions.*

Source: DHS 2007 data, weighted estimates of percent of all children under 5 or women 15-49.

**Percentage of children who are overweight (WHZ>+2SD)**



**Percentage of women who are overweight (BMI≥25)**



This descriptive analysis begins to explore where future risks may lie for N-RNCDs in Zambia, identifying where undernutrition programs may need to be tailored or targeted to better avoid later life health conditions. Here, child and maternal overweight overlap stunting as significant nutritional conditions. More in-depth analysis is needed to understand the determinants and dynamics influencing these relationships. SPRING is currently working to develop more evidence on why certain sub-populations are more at risk and how this information can be used to adjust nutrition programs.

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