Undernutrition Maps of Bangladesh 2012

Key Findings

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Investing in rural people

Foreword

Over the past two decades, Bangladesh has made impressive economic and social gains. It has significantly reduced the incidence of poverty, increased education levels, reached self-sufficiency in rice production and lowered fertility rates and child mortality. However, challenges still remain to keep undernutrition levels below the World Health Organization's (WHO) public health critical thresholds. Undernutrition costs Bangladesh more than 7,000 Crore Taka (US$ 1 billion) in lost productivity every year, and even more in health care costs[1].

With an increased focus on improving child nutrition, it is critical to understand the geographical variations and spatial patterns of undernutrition in Bangladesh.

The Bangladesh Bureau of Statistics (BBS) and the World Food Programme (WFP) have a long-standing partnership and experience in developing poverty maps and undernutrition maps. Responding to the need for undernutrition maps, BBS, partnering with WFP and with generous financial contribution from the International Fund for Agricultural Development (IFAD) initiated the undernutrition mapping exercise in May 2013. We are thankful to Massey University, New Zealand for its technical expertise to conduct and complete this exercise.

The initiative has produced estimates of underweight and stunting, two measures of undernutrition, which are not subject to major seasonal variation. These estimates for children under five years of age are statistically valid down to upazila (sub-district) level. These are based on applying the Small Area Estimation technique on data from the Population and Housing Census 2011, Child and Mother Nutrition Survey 2012 and Health and Morbidity Status Survey 2012. The resulting estimates have been mapped out to create powerful visual tools, which are easily understood and objectively verifiable. The mapping exercise was also marked with providing hands-on training at BBS on poverty and undernutrition mapping, jointly with the World Bank.

The aim of the mapping exercise was to serve policy makers, planners and researchers with a tool to identify the spatial variation of undernutrition rates in Bangladesh at finer administrative levels. We hope that the district and upazila level estimates of undernutrition rates, along with the associated maps, will be used in a complementary manner with key correlates of undernutrition to strengthen decision making and investments on targeted and integrated nutrition-focused development.

Behind the colours and percentages of the maps are millions of children who require our attention to achieve full mental and physical potential for a brighter future. We hope that these maps lead to an enhanced engagement of the Government of Bangladesh and development partners in creating a Bangladesh free of child undernutrition.

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Acknowledgement

The Undernutrition Maps of Bangladesh are the final products of a collaborative effort between the Bangladesh Bureau of Statistics (BBS) of the Statistics and Informatics Division (SID), Ministry of Planning and the World Food Programme (WFP). The project was funded by the International Fund for Agricultural Development (IFAD) and WFP. Massey University, New Zealand provided technical expertise for the analytical work.

The team acknowledges the leadership and support of Ms. Suraiya Begum (Secretary, SID), Mr. Md. Nojibur Rahman (former Secretary, SID) and Mr. Golam Mostafa Kamal (Director General, BBS). The team would like to thank the members of the Steering Committee and the Technical Committee, who reviewed and endorsed both the methodology and results of the undernutrition mapping exercise.

Professor Stephen Haslett and Associate Professor Geoffrey Jones of the Institute of Fundamental Sciences, Massey University spearheaded the analytical work in deriving upazila level estimates of undernutrition rates. Dr. Marissa Isidro assisted them in this work.

The BBS team included Mr. Md. Zahidul Hoque Sardar, Dr. Dipankar Roy, Mr. Anwar Hossain, Mr. Md. Rezaul Karim, Mr. Md. Jibon Miah and Mr. Dinesh Roy. The WFP team included Ms. Nusha Choudhury, Ms. Kayenat Kabir and Mr. Mahabubul Alam of the Vulnerability Analysis and Mapping (VAM) unit working under the guidance of Ms. Christa Räder (Country Representative).

[1] Howlader, Sushil Ranjan; Sethuraman, Kavita; Begum, Ferdousi; Paul, Dipika; Sommerfelt, A. Elisabeth; Kovach, Tara. 2012. Investing in Nutrition Now: A Smart Start for Our Children, Our Future. Estimates of Benefits and Costs of a Comprehensive Program for Nutrition in Bangladesh, 2011–2021. PRO-FILES and Nutrition Costing Technical Report. Washington, DC: Food and Nutrition Technical Assistance III Project (FANTA), FHI 360

Introduction

Undernutrition mapping is a statistical exercise to estimate the percentage of the total population of children under five years of age who are suffering from undernutrition in a defined geographical area. As with the Bangladesh Poverty Maps[2], there has been considerable demand from policy makers, development partners and researchers for disaggregated level undernutrition maps to aid policy making and programme targeting. The Bangladesh Bureau of Statistics (BBS), in partnership with the World Food Programme (WFP) initiated the undernutrition mapping exercise in May 2013 to produce reliable undernutrition estimates and maps for key sub-divisional administrative units (district and upazila[3]) applying the Small Area Estimation (SAE) technique on data mainly from the Population and Housing Census (Census) 2011 and the Child and Mother Nutrition Survey (CMNS) 2012.

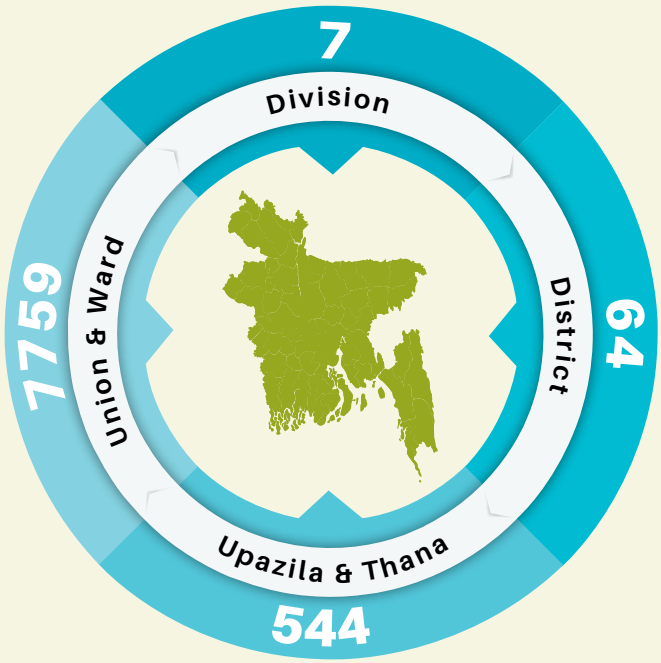
Undernutrition encompasses low birth weight, stunting, wasting, underweight and micronutrient deficiencies. Two central measures of undernutrition which are not subject to seasonal variation are considered for small area estimation in this mapping exercise, both based on body measurements–stunting[4] (low height-for-age) and underweight (low weight-for-age) among children under five.

[2] The third generation of upazila level poverty maps of Bangladesh were published in August 2014 by BBS, the World Bank and WFP.

[3] Upazila and metropolitan thana are referred together as Upazila in this report.

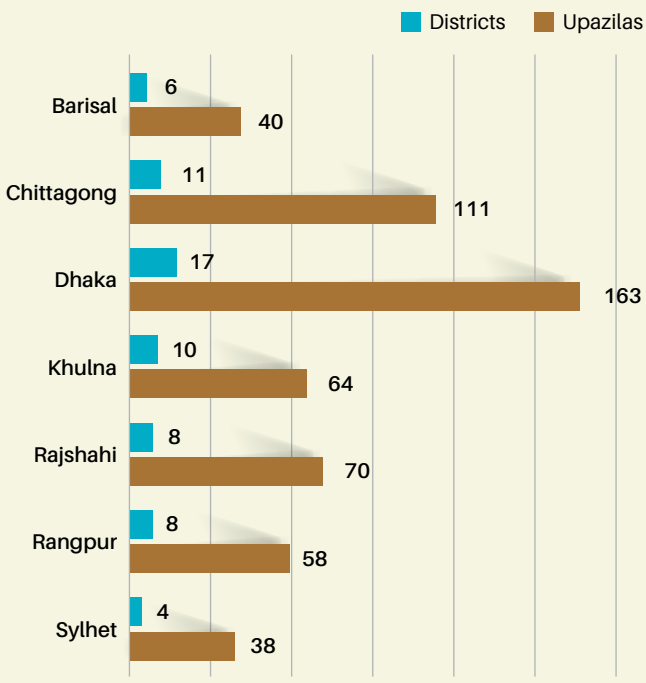
[4] Within a particular area, stunting is defined as the proportion of such children with a standardized height-for-age (HAZ) value below –2 standard deviations. Children with standardized height-for-age below –3 standard deviations are considered "severely stunted". Similarly underweight is the proportion with a standardized weight-for-age (WAZ) value below –2 deviations, and severe underweight below –3 deviations.

Administrative Structure of Bangladesh



Source: Bangladesh Population and Housing Census 2011

By Division



Source: Bangladesh Population and Housing Census 2011

Stunting can be regarded as evidence of chronic undernutrition. Unlike wasting (low weight-for-height), the development of stunting is a slow cumulative process that may not be evident immediately. It has been recommended as the Sustainable Development Goal (SDG) undernutrition indicator.

Underweight reflects both chronic undernutrition and acute undernutrition - it is a combined indicator. Progress towards the Millenium Development Goal (MDG) of halfing the proportion of people who suffer from hunger between 1990 and 2015 is monitored through this indicator.

Undernutrition Mapping Methodology

Small-area estimates (SAE) of stunting and underweight in children under five years of age in Bangladesh are produced at upazila (sub-district) level by combining survey data from CMNS 2012 and Health and Morbidity Status Survey (HMSS) 2012 with auxiliary data derived from Census 2011. SAE is a mathematical technique to extract more detailed information from existing data sources by statistical modelling. The SAE method used for the undernutrition mapping exercise is an extended and modified version of the ELL method (developed by Elberts et al, 2003) which has also been used for developing the Bangladesh Poverty Maps.

The CMNS, which is conducted by BBS every 4-5 years, is one of the three main regular surveys[5] in Bangladesh which provides nationally representative data on anthropometric measurements with which stunting and underweight can be estimated. However, the data from CMNS is representative only at division level because of the limited sample size. The Population and Housing Census includes all households in the country but it has more limited data in terms of topics covered and does not include child weight or height needed to estimate stunting and underweight directly.

The SAE technique takes advantage of the combined strengths of the survey and the census. The data sources have a common set of explanatory variables. Using these, two models, one for standardized height-for-age and the second for standardized weight-for-age, have been fitted to the CMNS data. These models provide predictions of the two measures for every child under five years in the census. In turn, the predictions have then been used for estimating stunting and underweight and their accuracy for children under five, by converting height-for-age to stunting and weight-for-age to underweight, followed by aggregation to district and upazila levels.

In August 2014, the preliminary undernutrition maps and technical report were reviewed by the Technical Committee members. The final versions of the maps were endorsed in the meeting of the Steering Committee on 3 November 2014.

For visual display of the spatial variation in stunting and underweight at district level and upazila level the estimates have been presented in the four maps on the next pages.

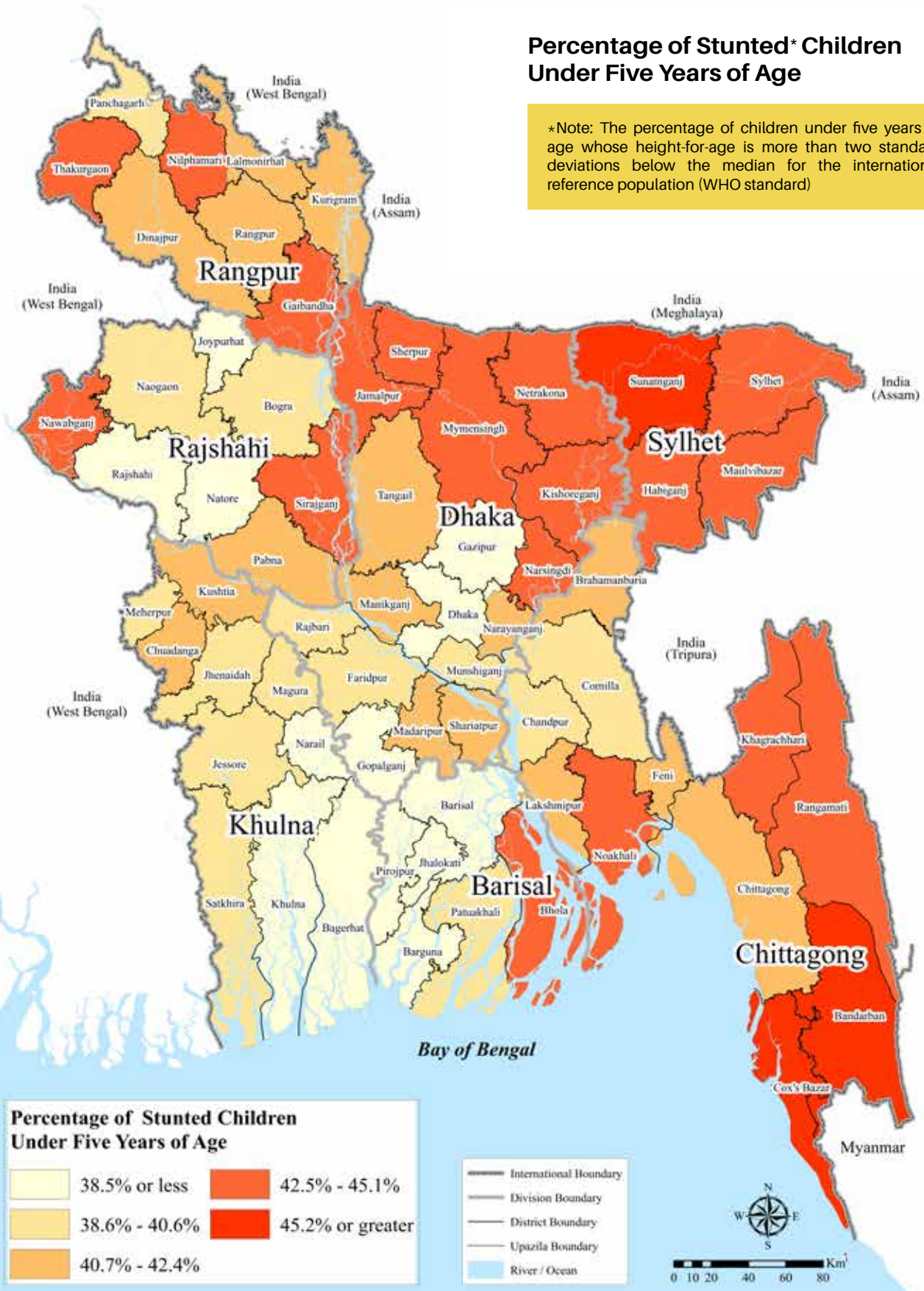
[5] The other two are Bangladesh Demographic and Health Survey (BDHS) conducted under the authority of the National Institute of Population Research and Training (NIPORT) of the Ministry of Health and Family Welfare and the Multiple Indicator Cluster Survey (MICS) conducted by BBS. The MICS 2009 did not survey for anthropometric measurements and the MICS 2012-13 dataset which does have them was not available yet during the study period.

Stunting Map

District Level

Percentage of Stunted* Children Under Five Years of Age

*Note: The percentage of children under five years of age whose height-for-age is more than two standard deviations below the median for the international reference population (WHO standard)

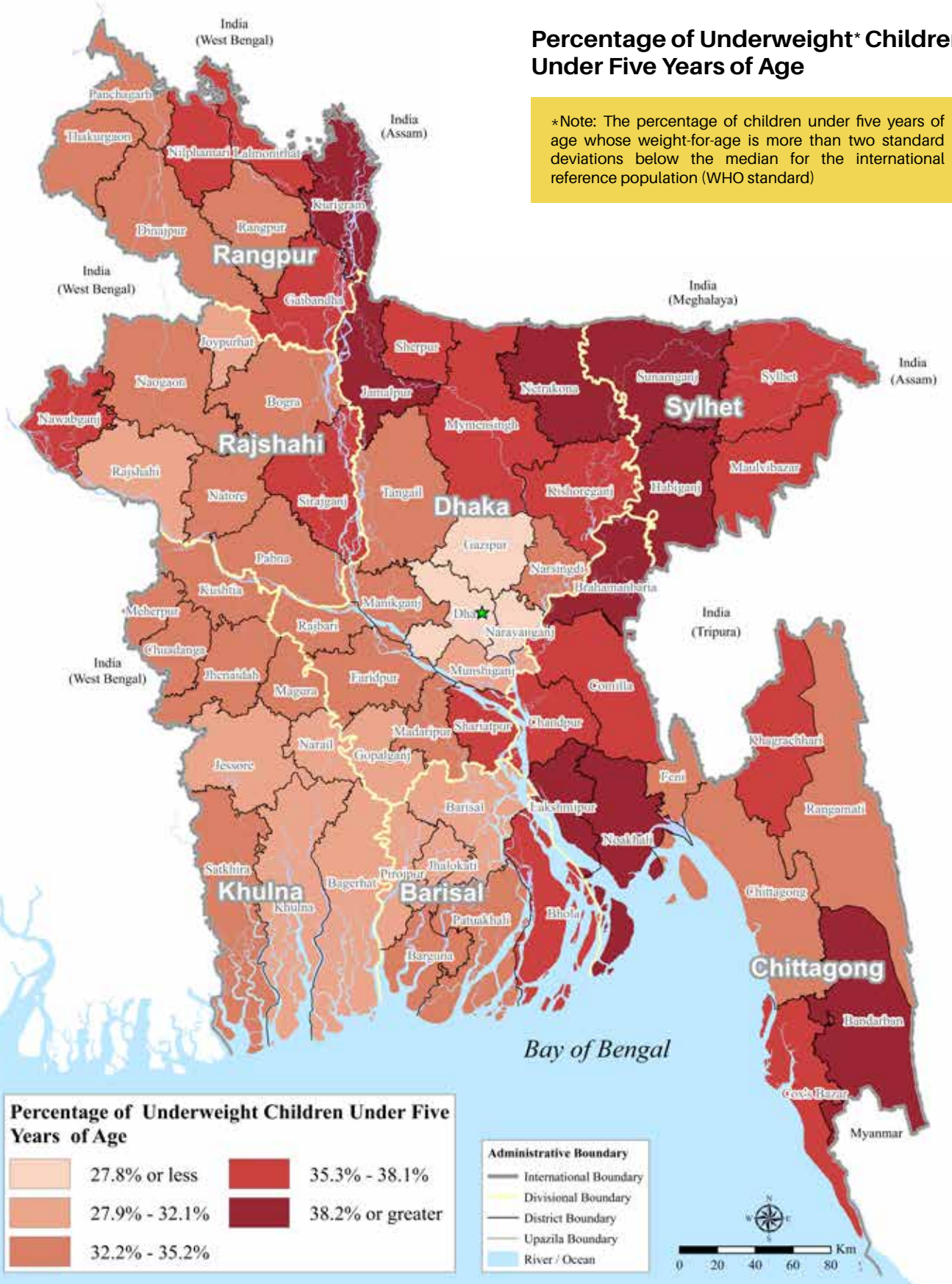


Underweight Map

District Level

Percentage of Underweight* Children Under Five Years of Age

*Note: The percentage of children under five years of age whose weight-for-age is more than two standard deviations below the median for the international reference population (WHO standard)

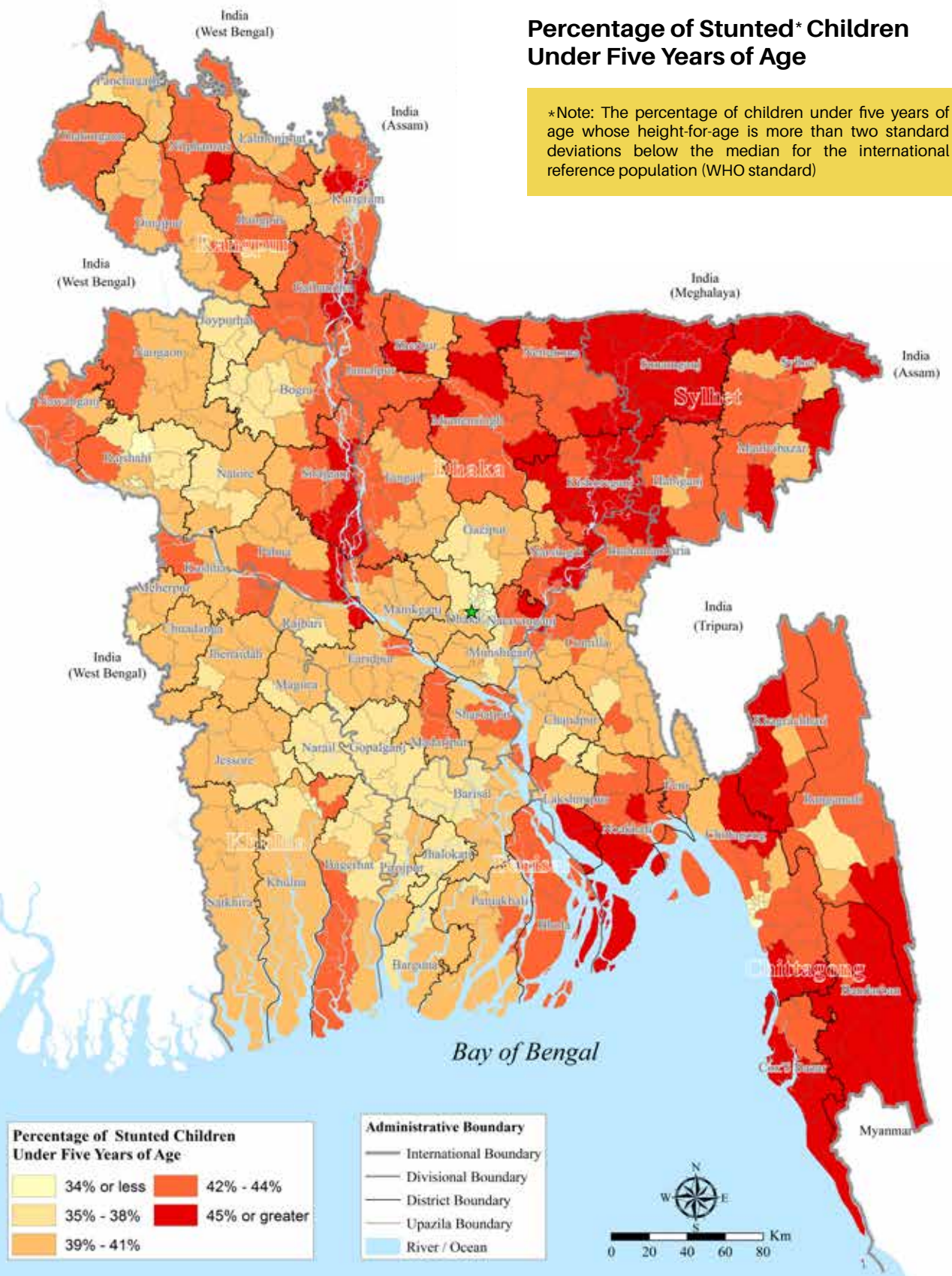


Stunting Map

Upazila Level

Percentage of Stunted* Children Under Five Years of Age

*Note: The percentage of children under five years of age whose height-for-age is more than two standard deviations below the median for the international reference population (WHO standard)

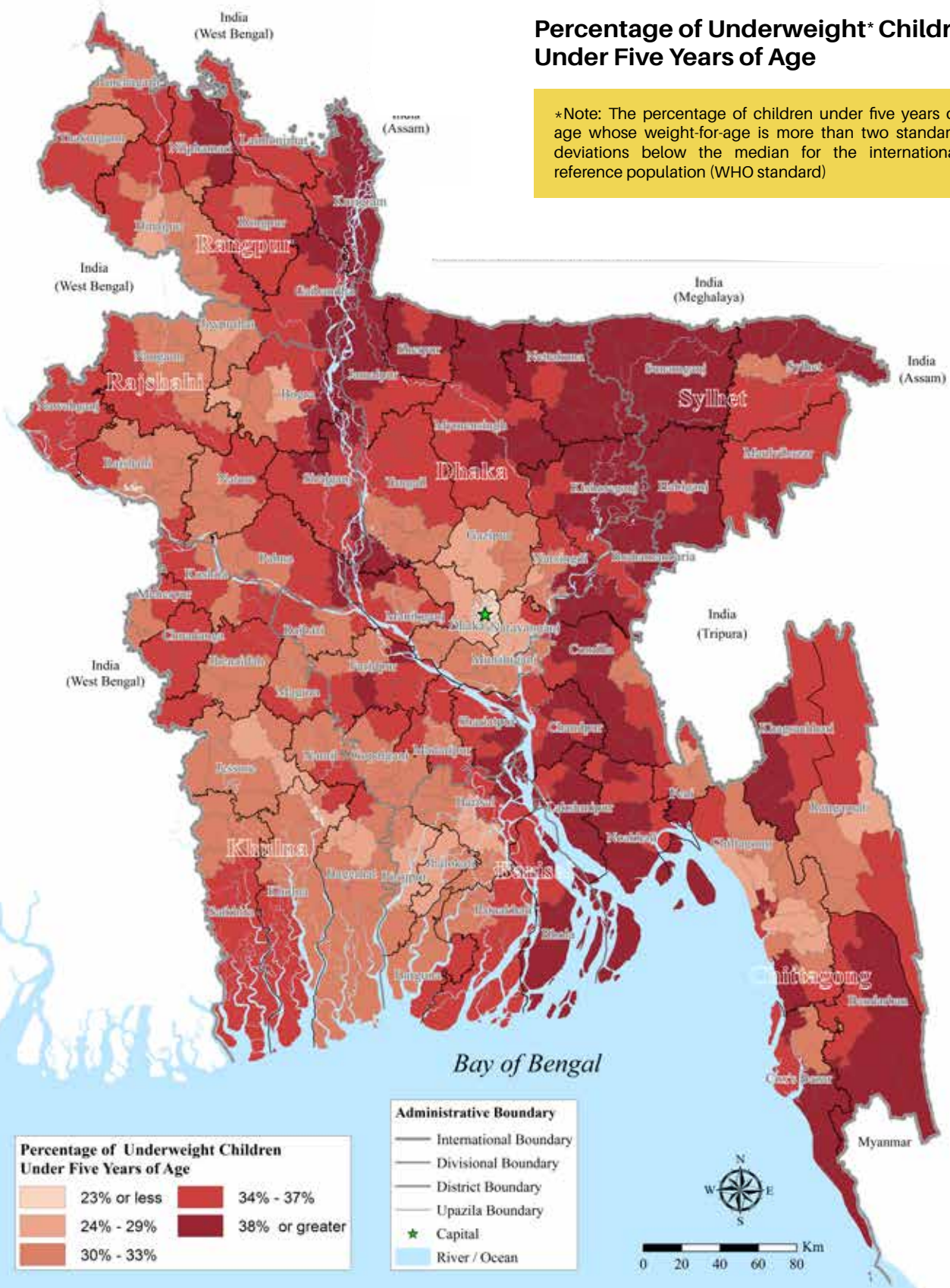


Underweight Map

Upazila Level

Percentage of Underweight* Children Under Five Years of Age

*Note: The percentage of children under five years of age whose weight-for-age is more than two standard deviations below the median for the international reference population (WHO standard)



Results at a Glance

Division Level Undernutrition Estimates

The small area estimates for the child undernutrition measures, stunting and underweight, were accumulated to high levels of aggregation for comparison with the direct estimates available from the CMNS 2012. The tables below show a comparison of the estimates from CMNS 2012, the mapping exercise, the Bangladesh Demographic and Health Survey (BDHS) 2011 and the Multiple Indicator Cluster Survey (MICS) 2012-2013. The division level estimates from the mapping exercise have better agreement with both CMNS 2012 and BDHS 2011, than they have among themselves.

Comparison of estimates of prevalence of stunting

CMNS 2012, Undernutrition Mapping Exercise (SAE), BDHS 2011 and MICS 2012-2013

Division	CMNS	SAE	BDHS	MICS	Share of stunted children (as % of overall no. of stunted children-SAE result)
Barisal	31.0	39.7	45.1	41.4	5.5
Chittagong	45.9	42.1	41.3	43.1	22.1
Dhaka	42.6	40.4	43.3	42.1	**31.3**
Khulna	34.9	39.5	34.1	34.4	8.9
Rajshahi	39.3	41.0	33.7	39.4	11.7
Rangpur	36.2	42.1	42.9	43.7	11.4
Sylhet	**51.3**	**44.6**	**49.3**	**50.6**	9.1

Comparison of estimates of prevalence of underweight

CMNS 2012, Undernutrition Mapping Exercise (SAE), BDHS .2011 and MICS 2012-2013

Division	CMNS	SAE	BDHS	MICS
Barisal	26.7	33.4	40.0	35.2
Chittagong	39.4	36.8	37.4	32.2
Dhaka	33.5	32.3	36.6	30.8
Khulna	26.2	32.0	29.1	28.5
Rajshahi	37.3	34.0	34.2	29.9
Rangpur	32.7	35.7	34.5	32.6
Sylhet	**39.5**	**38.5**	**44.9**	**39.7**

- Results from CMNS 2012 and the undernutrition mapping exercise show that both stunting and underweight rates at division level are highest in Sylhet, followed by Chittagong. Stunting and underweight rates according to BDHS 2011 and MICS 2012-13 are also highest in Sylhet. Sylhet and Chittagong also have the highest share of the country's total stunted children.
- Barisal and Khulna have the lowest stunting and underweight rates as well as the lowest share of the country's total stunted children.

District and Upazila Level Undernutrition Estimates

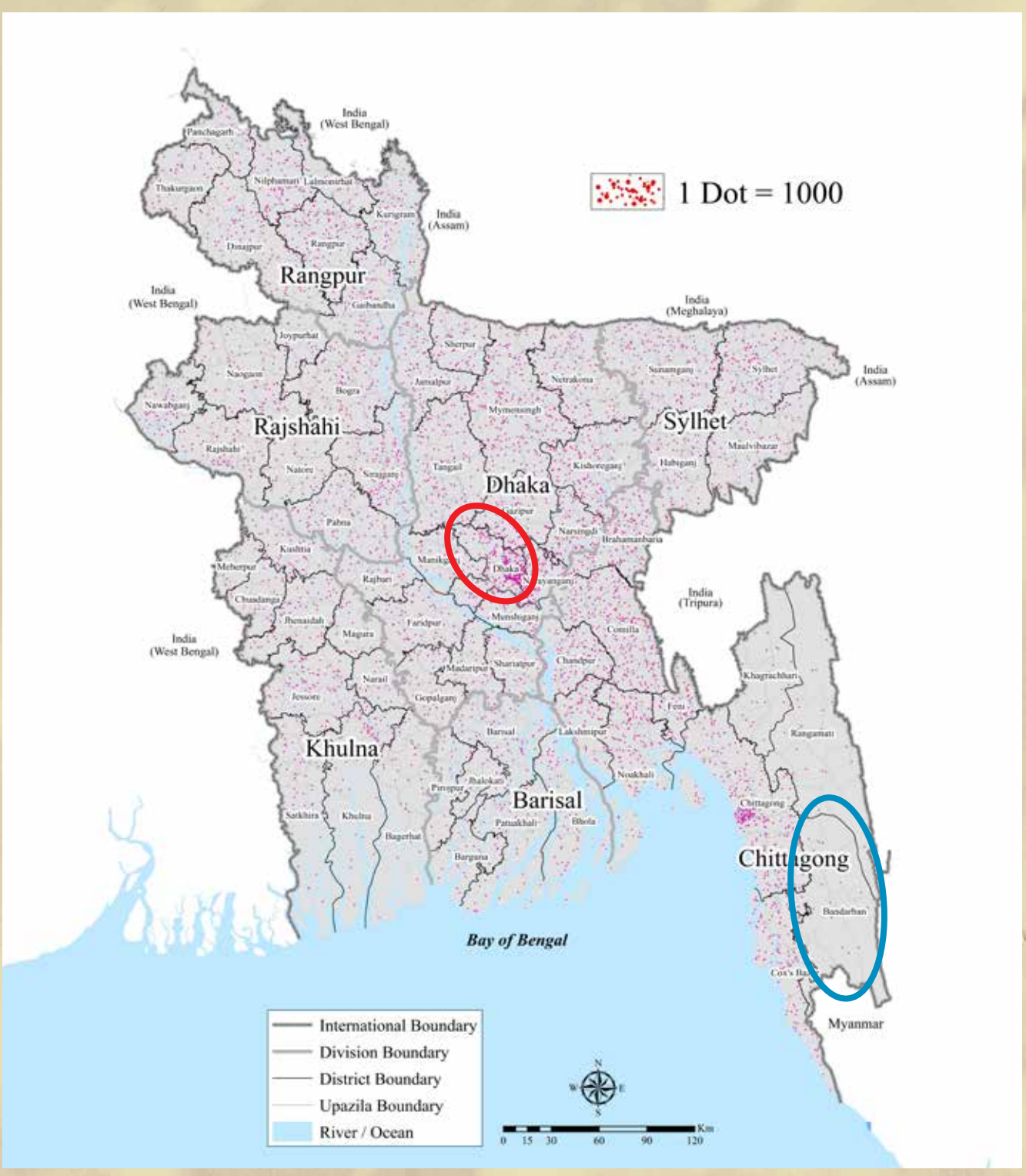
Division	Stunting Rate (at District Level)		Underweight Rate (at District Level)	
	Minimum	**Maximum**	**Minimum**	**Maximum**
Barisal	37.0 (Jhalokati)	42.9 (Bhola)	28.8 (Jhalokati)	38.1 (Bhola)
Chittagong	40.1 (Chandpur)	**47.7 (Bandarban)**	32.8 (Rangamati)	39.7 (Lakshmipur)
Dhaka	**34.2 (Dhaka)**	44.3 (Kishoreganj)	**22.8 (Dhaka)**	39.1 (Netrakona)
Khulna	36.7 (Narail)	41.7 (Kushtia)	29.1 (Khulna)	34.2 (Chuadanga)
Rajshahi	36.9 (Joypurhat)	45.1 (Sirajganj)	30.1 (Joypurhat)	36.7 (Sirajganj)
Rangpur	40.6 (Panchagarh)	43.4 (Nilphamari)	33.0 (Dinajpur)	38.7 (Kurigram)
Sylhet	43.8 (Maulvibazar)	46.1 (Sunamganj)	36.7 (Maulvibazar)	**40.9 (Sunamganj)**

- Stunting rates are highest in Bandarban district of Chittagong division, which is a hilly area; followed by Cox's Bazar district in the coastal belt of Chittagong division and Sunamganj district of Sylhet division which largely consists of haor (wetland) areas. Both stunting and underweight rates are lowest in Dhaka district where the national capital is situated.
- 39 out of 64 districts in Bangladesh have stunting rates above the WHO critical threshold level for stunting (40 percent). And 55 districts are above WHO critical threshold level for underweight (30 percent).
- At upazila level 300 out of a total of 544 upazilas (55 percent) in Bangladesh have a stunting rate above 40 percent and 440 upazilas (81 percent) have an underweight rate above 30 percent.
- The stunting rate varies from as low as 28 percent in Dakhshinkhan thana, Dhaka district to as high as 51 percent in Ukhiya upazila, Cox's Bazar district.
- The upazilas surrounding the divisional cities of Dhaka, Chittagong, Khulna and Rajshahi have the lowest rates of stunting in the respective divisions.
- Upazilas within a district have considerable spatial variation in undernutrition rates. The difference in stunting rate between the highest and lowest ranked upazila within the respective districts range from 5 to 13 percent. Within Dhaka district, which has the lowest stunting rate in Bangladesh, the stunting rates varies from as low as 28 percent in Dakhshinkhan thana to as high as 41 percent in Keraniganj thana.

Undernutrition Rate vs. Size of Undernourished Population

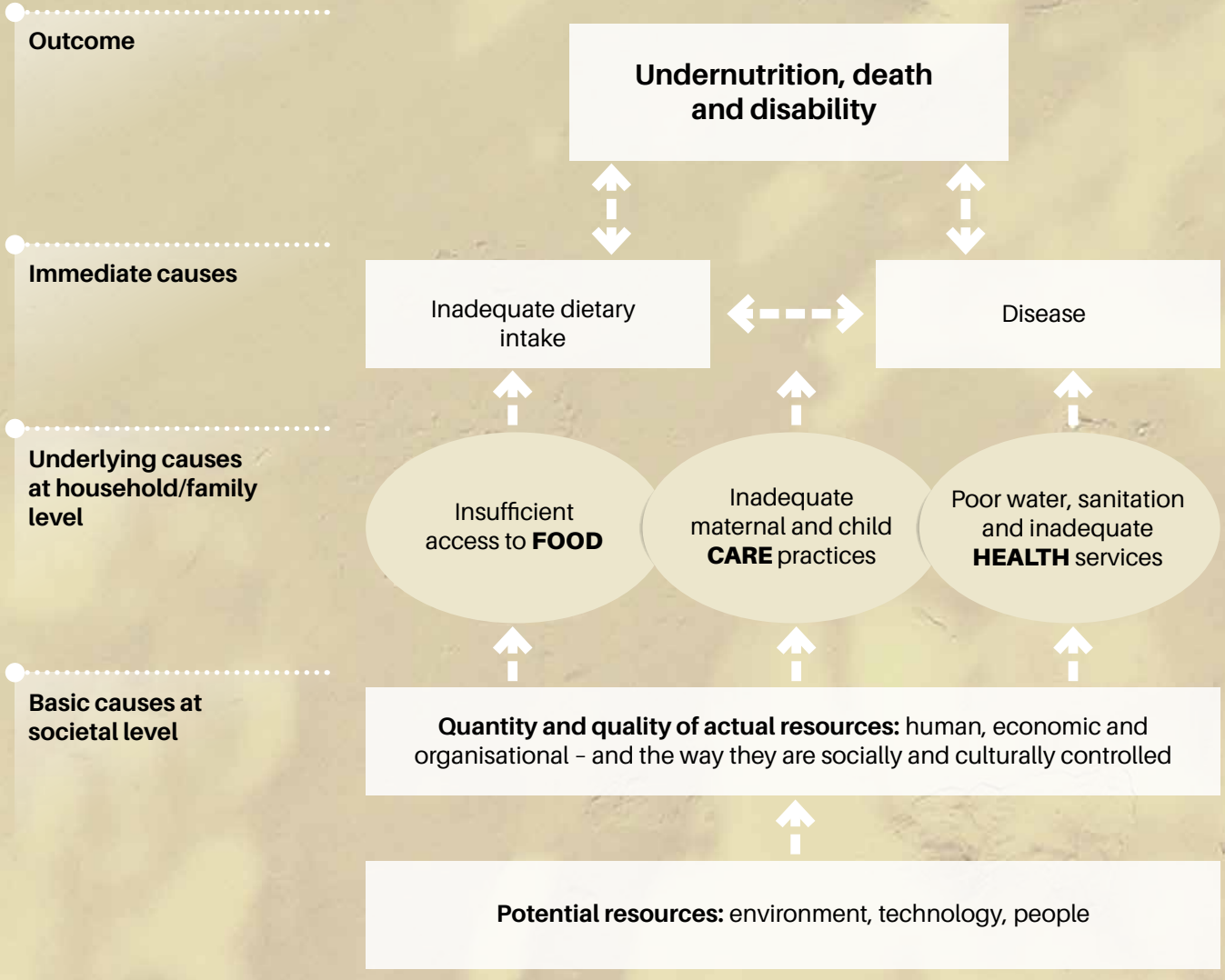
The upazila level stunting/underweight maps are based on the percentage of stunted/underweight children of the total population of children under five in the respective upazilas. A map based on headcount rate can be different from a map based on absolute numbers. The area circled in red is Dhaka district which has the lowest rate of stunting among all the districts in Bangladesh, yet it has a large number of stunted children residing in the area as the total population of children under five in Dhaka itself is high. Whereas in the hilly Bandarban district (circled in blue), the stunting rate is very high, but the number of stunted children is relatively small.

Density of Stunted Children



Causes of Undernutrition

Undernutrition is the *outcome* of insufficient intake of energy, protein and/or micronutrients; poor absorption or rapid loss of nutrients due to illness or increased energy expenditure. The causes of undernutrition are multi-level and multi-sectoral. The underlying causes at household level are insufficient access to food, inadequate maternal and child care practices and poor water, sanitation, and inadequate health services. Basic causes at societal level include power relationships and socio-economic conditions that are not specific to nutrition but can have powerful impacts[6]. The next section explores the upazila level stunting map in Bangladesh in relation to the widely accepted *underlying and basic causes* of undernutrition.



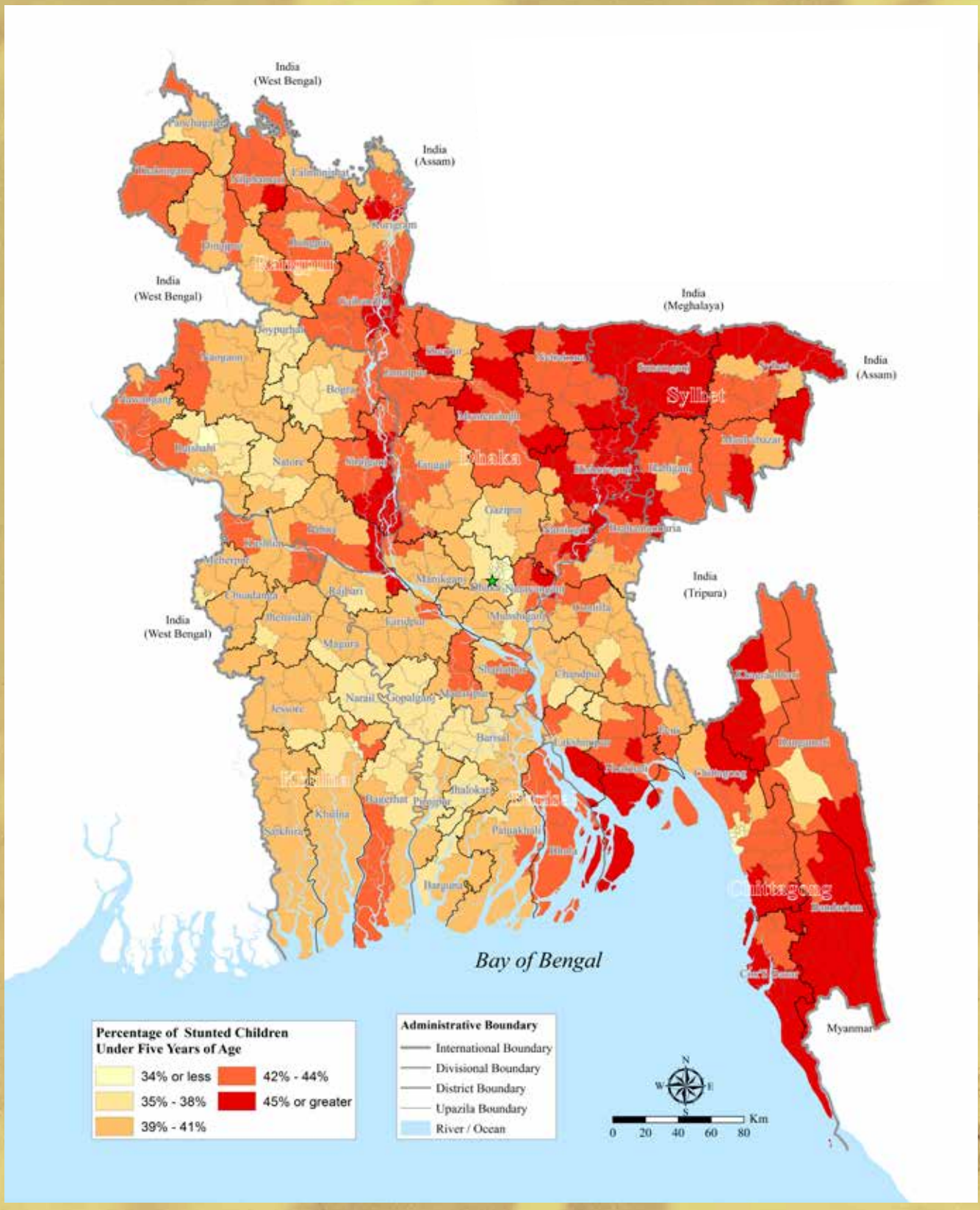
Adapted from UNICEF 1990 model

[6] UNICEF 1998, The State of World's Children

Undernutrition and Poverty

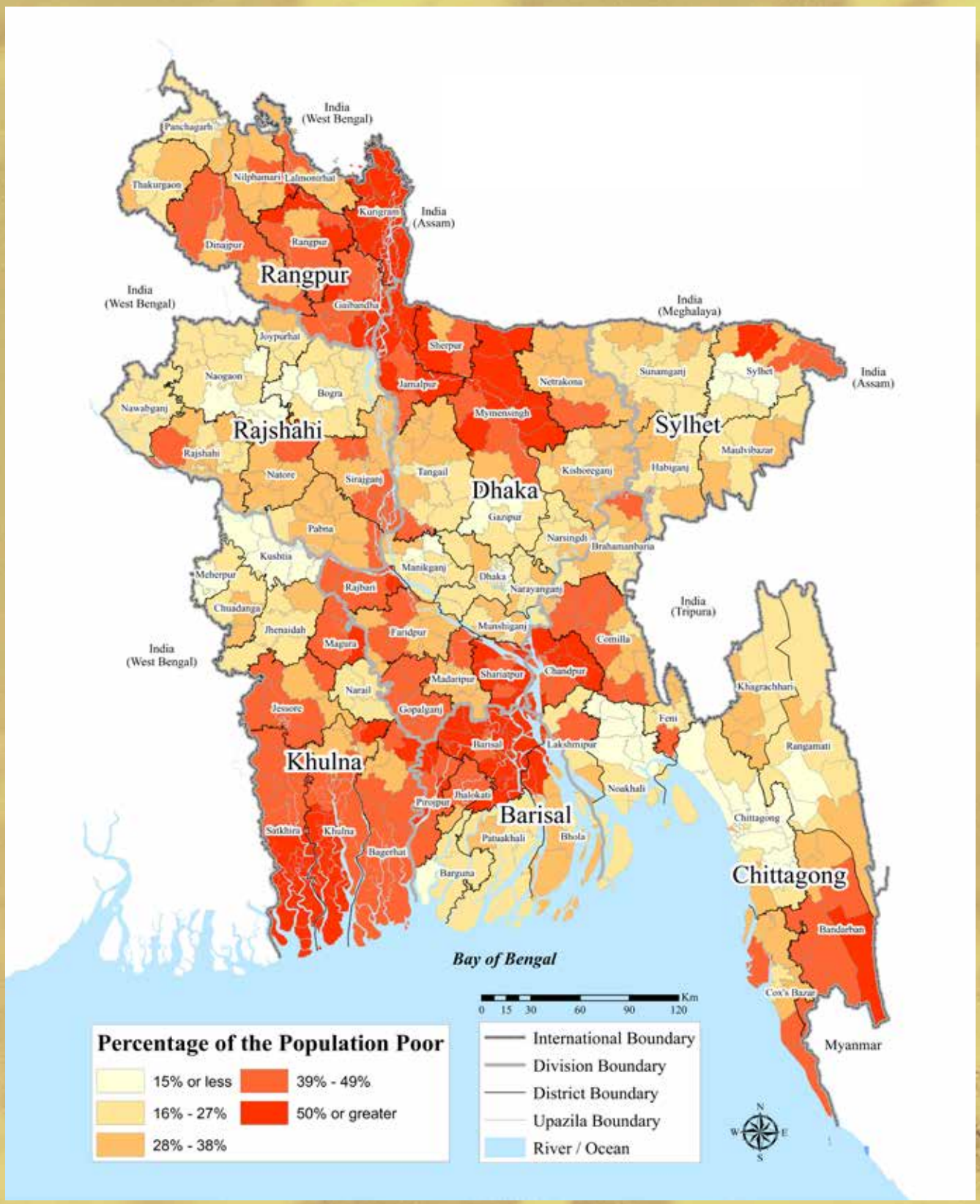
While the eastern divisions namely Sylhet and Chittagong fare better at poverty status than their western counterparts of Khulna and Rajshahi, the scenario reverses in the undernutrition maps. In Sylhet division, stunting and underweight rates are not only high in the upazilas of the north eastern haor region, but in all upazilas stunting and underweight rates are above WHO critical threshold level. In contrast, although Khulna division has one of

Stunting Map



the highest poverty rates, it has one of the lowest stunting rates. The BDHS 2011 reports one in four children (26 percent) under five years old stunted and one in five children (21 percent) underweight, even in the highest household wealth quintile. Clearly factors contributing to undernutrition lie beyond household income levels.

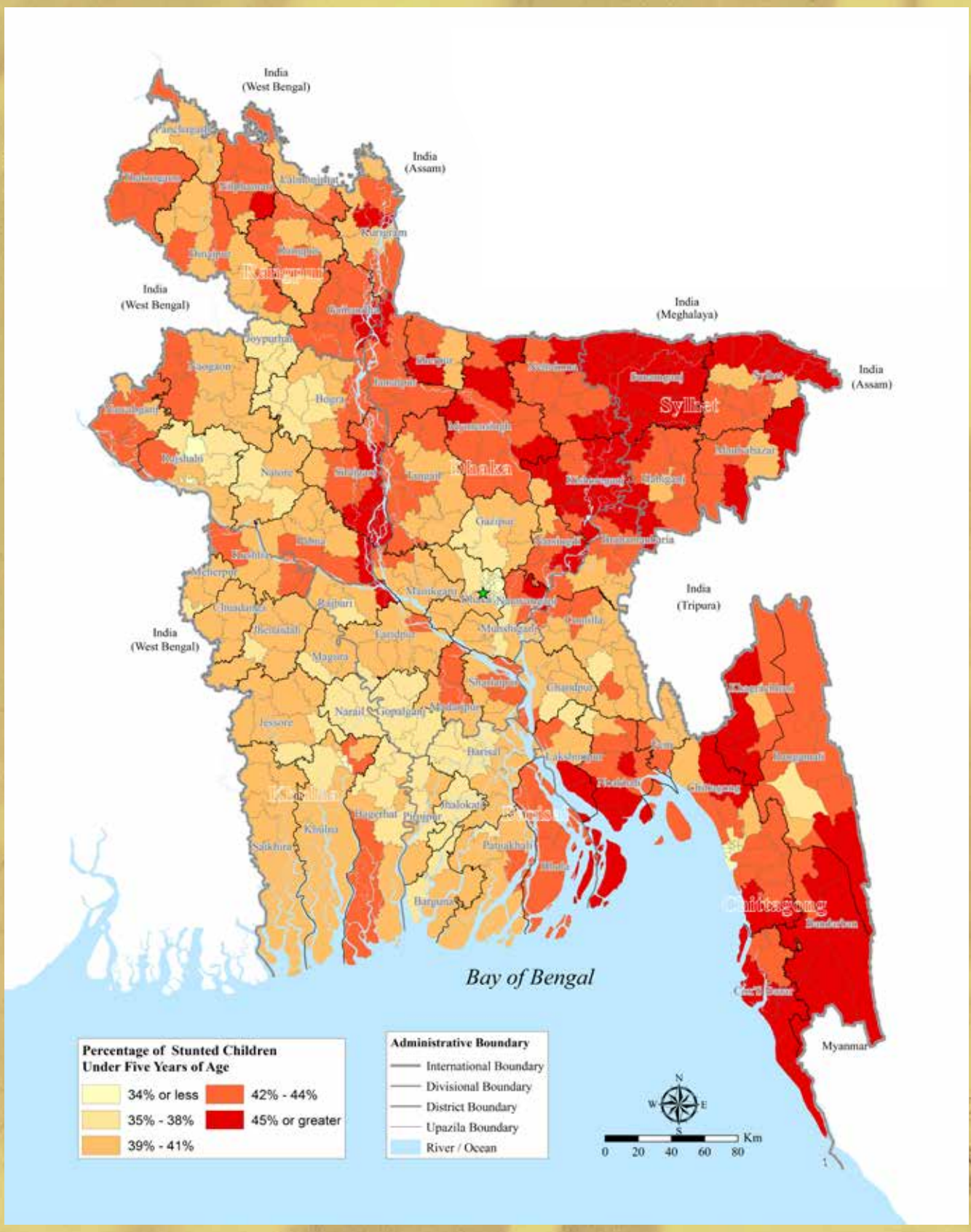
Upper Poverty Line Map 2010



Undernutrition and Care Practices

The first 1000 days (from conception to two years of age) is the most crucial time for a child's growth potential. Appropriate infant and young child feeding (IYCF) practices include initiating timely feeding of solid or semisolid foods at the age of six months and increasing the amount and variety of foods and frequency of feeding as the

Stunting Map



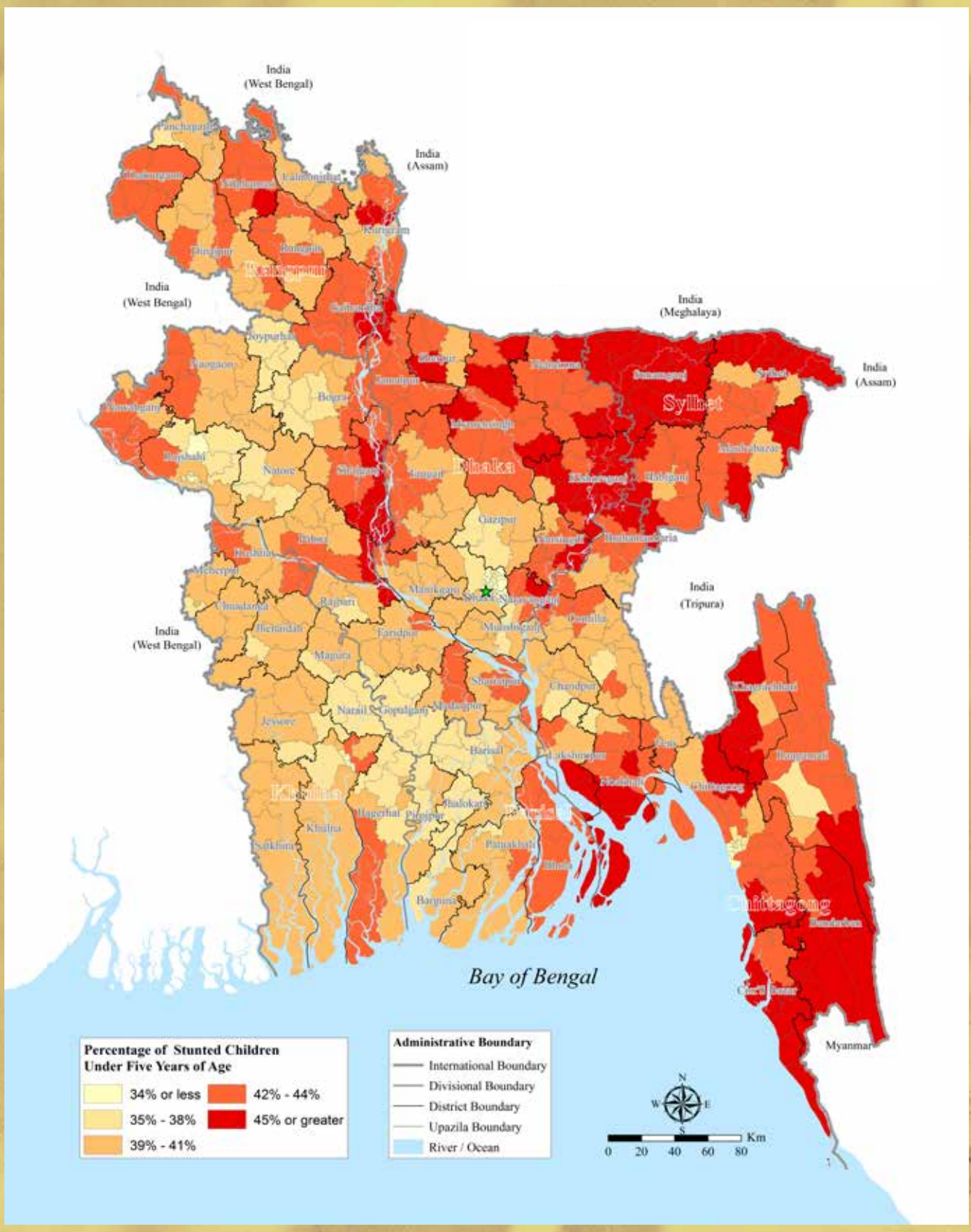
child gets older, while maintaining frequent breastfeeding. A comparison of the maps below show that Khulna division which has a low stunting rate compared to other divisions also has better IYCF practices; while Sylhet and Chittagong divisions, which have high stunting rates, do not fare well on this indicator.

Quality of Infant and Young Child Feeding Practices

Undernutrition and the Public Environment

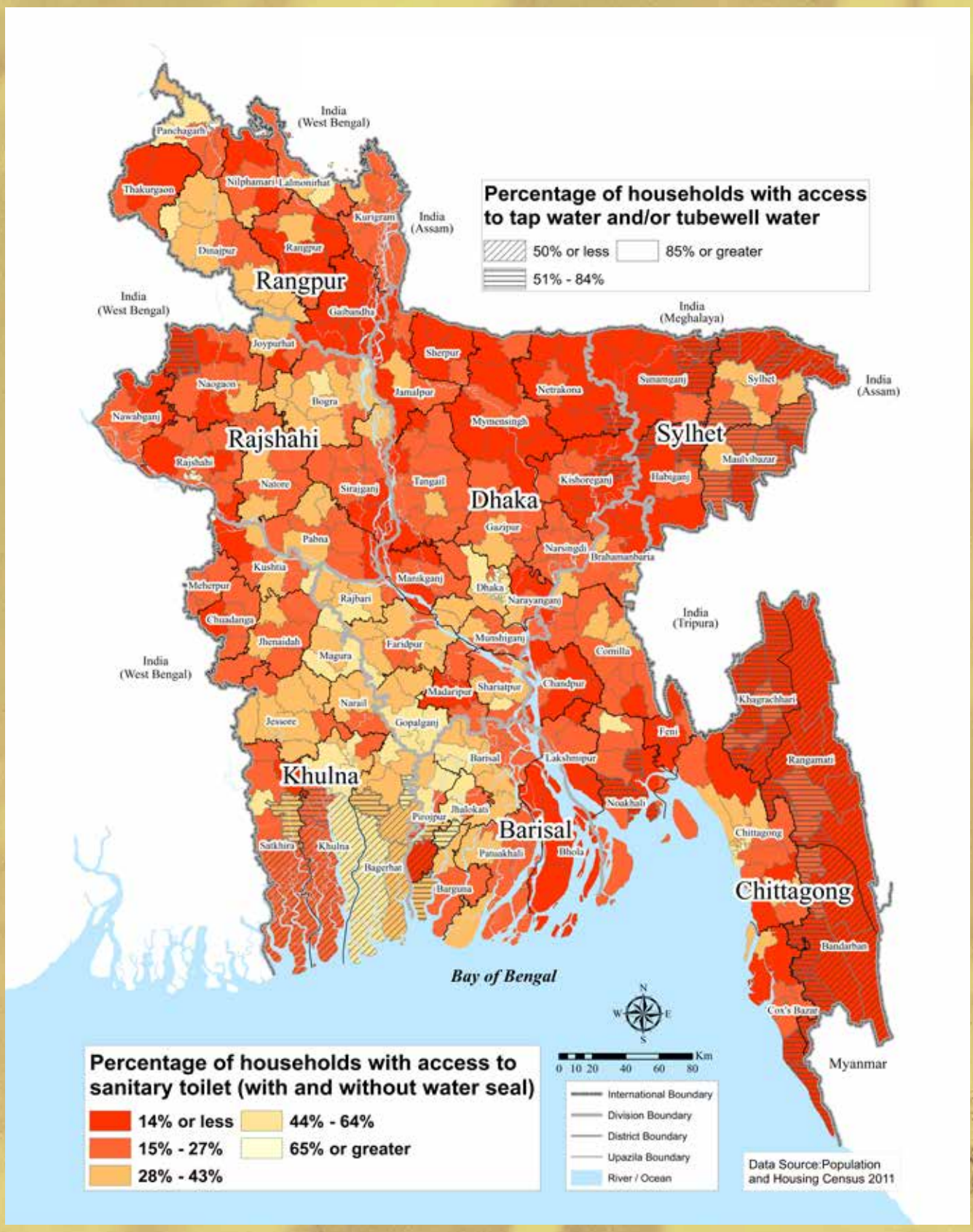
In Bangladesh, the use of unsafe water for bathing and washing is a major cause of diarrhoea and other infections that lead to undernutrition, as is the use of open space as toilet. A combined spatial overview of household access to drinking water and adequate sanitation is provided. Areas along the coastal belt, in the Chittagong Hill Tracts,

Stunting Map



in Sylhet division and in the drought zone in the westernmost part of Rajshahi division are among the regions performing worst on access to drinking water and sanitary toilet.

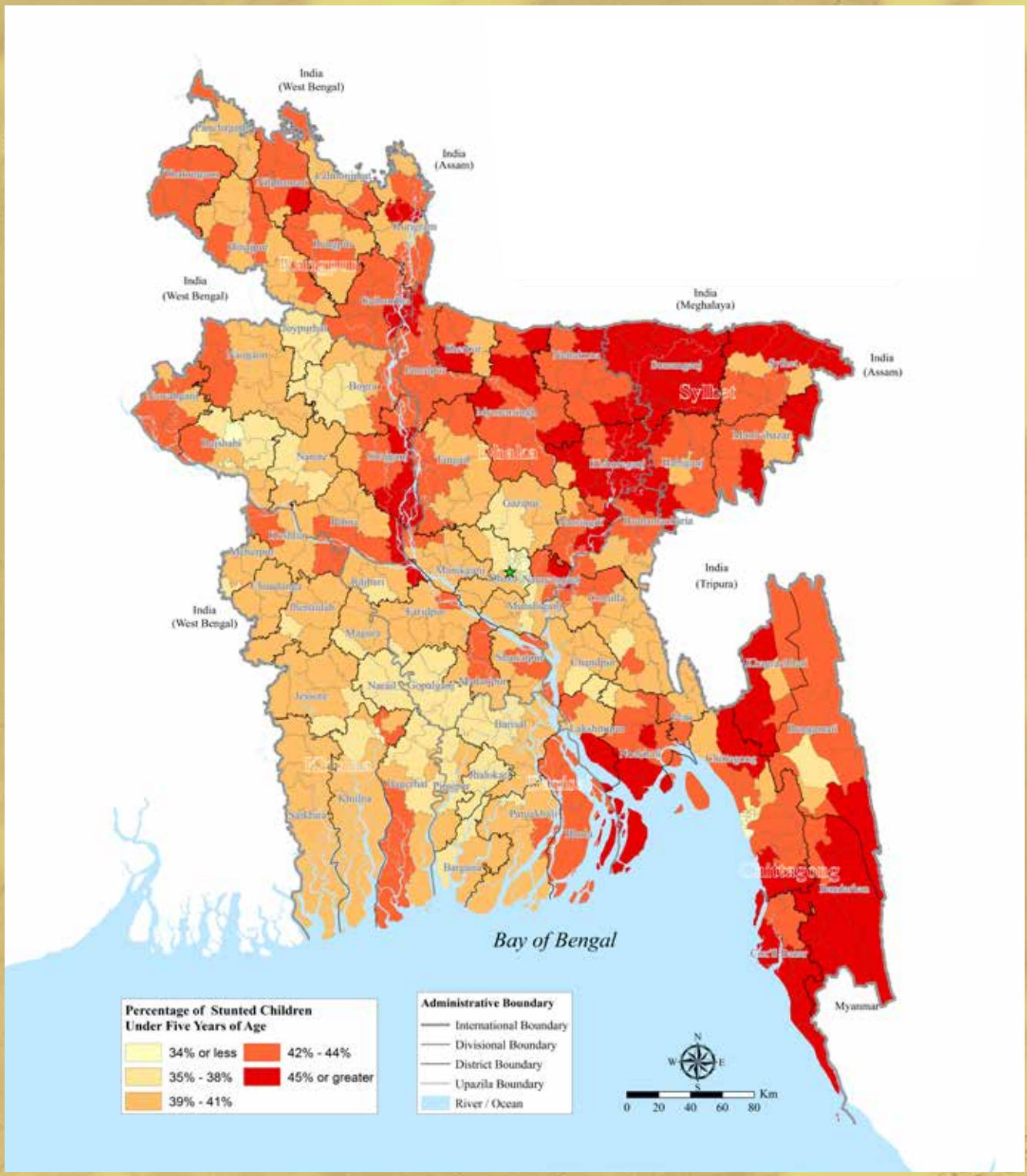
Household Access to Sanitation and Drinking Water



Undernutrition and Female Education

A mother completing secondary school is associated with having significant protective effect against her child being stunted, and this is also significantly correlated with increased dietary diversity[7].The comparative maps show pockets in Barisal division and a number of districts in Dhaka and Chittagong divisions which have high female secondary education completion rates and low stunting rates among children. Mothers with no schooling

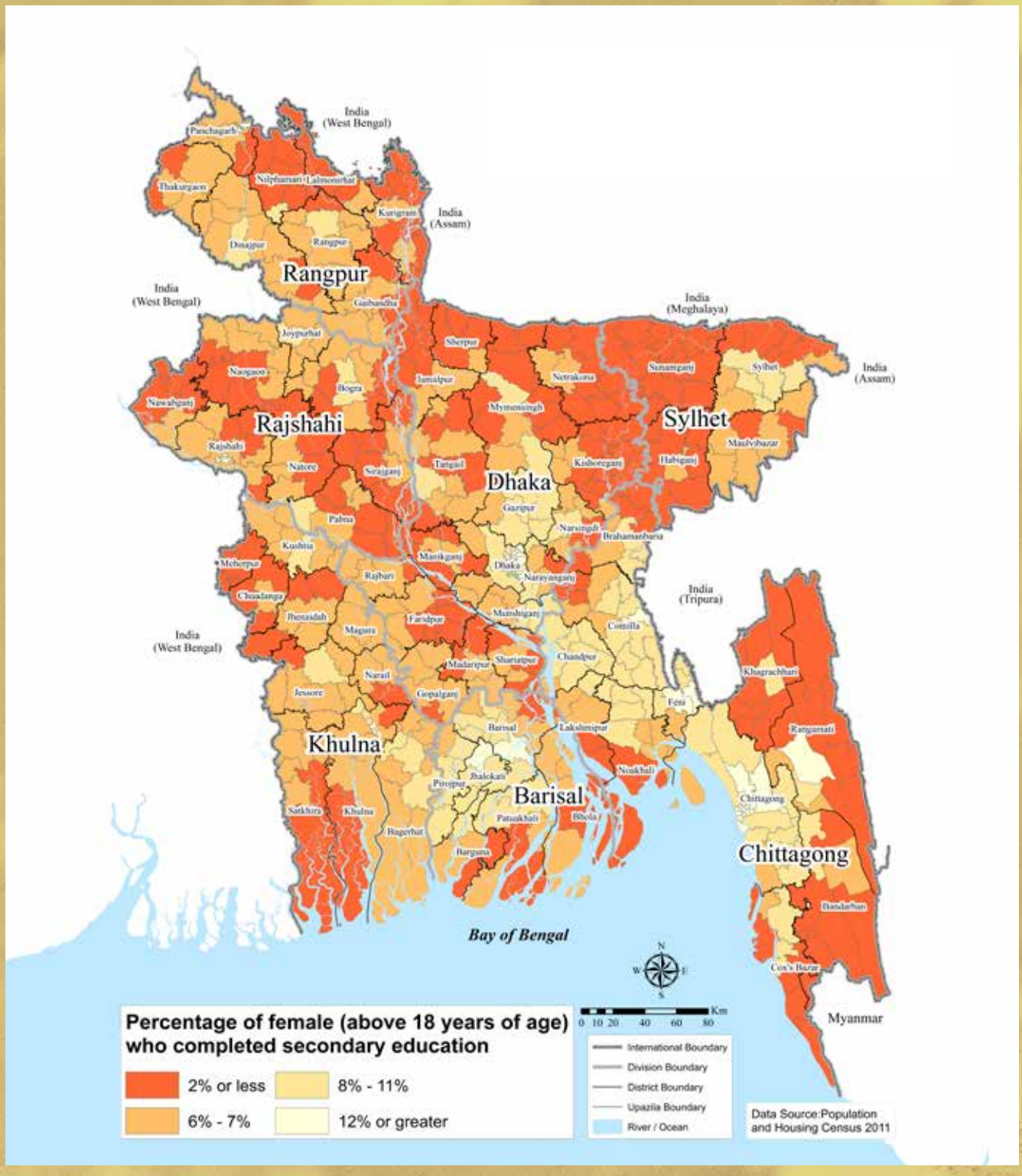
Stunting Map



[7] IFPRI (2013). Agriculture, Income, and Nutrition Linkages in India. Available from: http://www.ifpri.org/sites/default/files/publications/ifpridp01195.pdf

are more than two times more likely to have stunted children than educated mothers[8]. While higher education levels of mothers may also be indicative of the income status of the household, poverty is definitely not the only determining factor of undernutrition

Secondary Education Completion Rate of Female Adult



[8] BDHS 2011 results show that 51% of children of mothers with no schooling were stunted compared to 23% for children of mothers with secondary or higher education.

Concluding Remarks

Maps are easily understood and objectively verifiable, but they do not tell us directly about the underlying causes of a situation, in this case of undernutrition in a particular area. These maps should thus be used with caution and in a complementary manner with other maps and information on possible underlying causes and up-to-date local information. The comparison of the undernutrition maps with key causal maps indicate that the commonly identified causes do not have the same level of effect in all areas, but there is an interplay of different factors. As the causes of undernutrition are manifold- so are the solutions, there is no "one solution", but the solutions are multi-sectoral. The regional concentration of undernutrition suggests that geographic targeting of nutrition interventions can have a high pay off in achieving significant reductions in the number and rate of undernourished children.

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