Original Research Article

Projection of population of stunted children under five years and anaemic women of reproductive age in thirteen low, upper and high income 100 million+ countries around the world up to 2050

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ABSTRACT

Background: In 2012, the World Health Assembly Resolution 65.6 endorsed a comprehensive implementation plan on maternal, infant and young child nutrition, which specified a set of six global nutrition targets that by 2025. The goals were aimed at reducing stunting, anaemia, low birth weight, no increase in childhood overweight, increase rates of exclusive breastfeeding and reduce and maintain wasting. Out of these an average annual rate of reduction (AARR) of 3.9% for a 40% reduction in the number of children under five years of age who are stunted and an average annual rate of reduction of 5.2% has been estimated for a 50% reduction in anaemia among women of reproductive age.

Methods: This paper uses demographic techniques to project the number of stunted children under five years and anaemic women for the thirteen 100 million plus countries as of UN population projections, 2017 of Philippines, Ethiopia, Japan, Mexico, Russian Federation, Bangladesh, Nigeria, Pakistan, Brazil, Indonesia, United States of America, India and China using average annual rate of reduction recommended in the world health assembly.

Results: The number of stunted children under five years of age is estimated to be reduced by 27% by 2025, 40% by 2030 and 72% by 2050. The number of anaemic women of reproductive age is estimated to be reduced by 32% by 2025, 46% by 2030 and 85% by 2050.

Conclusions: There is a dire need for accelerating the progress of reduction in stunting prevalence among children under five years and anaemia among women of reproductive age to achieve the global targets in selected high burden countries of India and Nigeria.

Keywords: Stunting, Anaemia, Demographic techniques, Projections, AARR

INTRODUCTION

In 2012, the World Health Assembly Resolution 65.6 endorsed a Comprehensive implementation plan on maternal, infant and young child nutrition, which specified a set of six global nutrition targets that by 2025. The goals were aimed at reducing stunting, anaemia, low birth weight, no increase in childhood overweight, increase rates of exclusive breastfeeding and reduce and maintain wasting. Out of these an average annual rate of reduction (AARR) of 3.9% for a 40% reduction in the number of children under five years of age who are stunted and an average annual rate of reduction of 5.2% has been estimated for a 50% reduction in anaemia among women of reproductive age. This paper uses demographic techniques to estimate the projected population of stunted children under five years...
and anaemic women of reproductive women for the thirteen 100 million plus countries as of UN projections, 2017 of Philippines, Ethiopia, Japan, Mexico, Russian Federation, Bangladesh, Nigeria, Pakistan, Brazil, Indonesia, United States of America, India and China. Seven of these countries hail from Asia, two from Africa, one each from north, south and central America and Europe. Among these 13 countries, there are 2 billion plus and 11, 100 million plus countries, which constitute about 62% of the total population of the world, with about 4.71 billion population. They constitute 55% of the total under five population in the world. 58.1% and 58.6% of the adolescents and youth respectively reside here. 54.6% of the births and pregnancies are from these 13 countries. 57.4% and 60.6% of the adolescent girls 10 to 19 years of age and women of reproductive age of 15 to 49 years reside in these countries respectively. These countries belong to different regions and different economies.²

Study objectives

The objective of this paper is to project the population of stunted children under five years and anaemic women of reproductive women for the thirteen 100 million plus countries as of UN projections, 2017 of Philippines, Ethiopia, Japan, Mexico, Russian Federation, Bangladesh, Nigeria, Pakistan, Brazil, Indonesia, United States of America, India and China. The demographic profile of these 13 countries have been presented below:

Table 1: Demographic profile of thirteen, 100 million plus countries in the world, 2017.

| Countries/World | Continent | Region                      | World Bank Classification of countries, June 2017 | Total population in millions | Average annual rate of population change, percent | Proportion of total world population (%) |
|-----------------|-----------|-----------------------------|--------------------------------------------------|------------------------------|-----------------------------------------------|---------------------------------------|
| Bangladesh      | Asia      | South Asia                  | Lower middle income                              | 164.7                        | 1.1                                           | 2.2                                   |
| Brazil          | South America | Latin America & Caribbean | Upper middle income                              | 209.3                        | 0.9                                           | 2.8                                   |
| China           | Asia      | East Asia & Pacific         | Upper middle income                              | 1,409.5                      | 0.5                                           | 18.7                                  |
| Ethiopia        | Africa    | Sub-Saharan Africa          | Low income                                       | 105.0                        | 2.6                                           | 1.4                                   |
| India           | Asia      | South Asia                  | Lower middle income                              | 1,339.2                      | 1.2                                           | 17.7                                  |
| Indonesia       | Asia      | East Asia & Pacific         | Lower middle income                              | 264.0                        | 1.2                                           | 3.5                                   |
| Japan           | Asia      | East Asia & Pacific         | High Income                                      | 127.5                        | -0.1                                          | 1.7                                   |
| Mexico          | Central America | Latin America & Caribbean | Upper middle income                              | 129.2                        | 1.4                                           | 1.7                                   |
| Nigeria         | Africa    | Sub-Saharan Africa          | Lower middle income                              | 190.9                        | 2.6                                           | 2.5                                   |
| Pakistan        | Asia      | South Asia                  | Lower middle income                              | 197.0                        | 2.1                                           | 2.6                                   |
| Philippines     | Asia      | East Asia & Pacific         | Lower middle income                              | 104.9                        | 1.6                                           | 1.4                                   |
| Russian Federation | Europe | Europe & Central Asia       | Upper middle income                              | 144.0                        | 0.1                                           | 1.9                                   |
| United States of America | Northern America | North America | High income                                      | 324.5                        | 0.7                                           | 4.3                                   |
| 13, 100 million plus countries | - | -                           | -                                                 | 4,710                        | -                                             | -                                    |
| World           | -         | -                           | -                                                 | 7,550                        | 1.2                                           | 100.0                                 |

Source: United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP/248²

Region and economy classification: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

METHODS

This paper uses demographic techniques to estimate the population of stunted children under five years and anaemic women of reproductive age in thirteen 100 million plus countries as of UN projections, 2017 of Philippines, Ethiopia, Japan, Mexico, Russian Federation, Bangladesh, Nigeria, Pakistan, Brazil, Indonesia, United States of America, India and China. Seven of these countries hail from Asia, two from Africa, one each from north, south and central America and Europe.² The prevalence of moderate and sever stunting (Height-for-Age) has been considered here, which is defined as per cent of children (aged 0–59 months) who are below minus two standard deviations from median height-for-age of the WHO child growth standards. The prevalence of anaemia among women of reproductive age has been considered here. Anaemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs, which vary by age, sex, altitude, smoking, and pregnancy status (http://www.who.int/topics/anaemia/en/). The cut-off levels for diagnosing anaemia are different for different age groups of population; for children 6-59 months of age, the cut off for anaemia is less than 110 g/l of haemoglobin, for children 5 to 11 years of age, the cut off...
is less than 115 g/l of haemoglobin, for children 12 to 14 years of age, the cut off is less than 120 g/l of haemoglobin, for non-pregnant women, the cut off is less than 120 g/l and for pregnant women, the cut off is less than 110 g/l of haemoglobin and for men, it is less than 130 g/l of haemoglobin.

Table 2: Haemoglobin levels to diagnose anaemia at sea level (g/l).

| Population                          | Non- anaemia | Anaemia            |
|-------------------------------------|--------------|--------------------|
|                                     | Non- anaemia | Mild               |
| Children 6 to 59 months of age      | 110 or higher | 100-109            |
| Children 5 to 11 years of age       | 115 or higher | 110-114            |
| Children 12 to 14 years of age      | 120 or higher | 110-119            |
| Non-pregnant women (15 years of age and above) | 120 or higher | 110-119            |
| Pregnant women                      | 110 or higher | 100-109            |
| Men (15 years of age and above)     | 130 or higher | 110-129            |

Source: WHO. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and mineral nutrition Information System. Geneva, World Health Organization, 2011 (WHO/NMH/NHD/MNM/11.1) http://www.who.int/vmnis/indicators/haemoglobin.pdf.

All the computations have been carried out in Microsoft Excel 2013. The formula for the projected estimates are as follows:³

1. Projected stunted population at 2025 based on 2017 estimates of stunting prevalence: Proportion of stunted population under five years of age at $P_{2025} = P_{2017} \times (1-AARR)$ where $AARR$ is the average annual rate of reduction of stunting. A geometric or compound annual growth rate formula is used.

2. Projected stunted population at 2030 based on 2017 estimates of stunting prevalence: Proportion of stunted population under five years of age at $P_{2030} = P_{2017} \times (1-AARR) / (1 + 0.03)$

3. Projected stunted population at 2050 based on 2017 estimates of stunting prevalence: Proportion of stunted population under five years of age at $P_{2050} = P_{2017} \times (1-AARR) / (1 + 0.03)^2$

4. Projected anaemic population at 2025 based on 2011 estimates of anaemia prevalence from the world health organization: Proportion of anaemic population at $P_{2025} = P_{2011} \times (1-AARR)$

5. Projected anaemic population at 2030 based on 2011 estimates of anaemia prevalence from the world health organization: Proportion of anaemic population at $P_{2030} = P_{2011} \times (1-AARR) / (1 + 0.03)$

6. Projected anaemic population at 2050 based on 2011 estimates of anaemia prevalence from the world health organization: Proportion of anaemic population at $P_{2050} = P_{2011} \times (1-AARR) / (1 + 0.03)^2$

7. Average Annual Rate of Reduction $(AARR) = \exp (\beta)$.

8. Per cent change $= \left( \frac{P_2 - P_1}{P_1} \right) \times 100$, where $P_1$ is population at time point 1 and $P_2$ is population at the future time point 2.

RESULTS

The estimated number of anaemic women of reproductive age women and stunted children for the year 2025, for the world health assembly goal year and 2030, the SDG goal year and for 2050 have been estimated using the average annual rate reduction of 3.9% for children under five years of age, who are stunted and 5.2% for anaemia among reproductive age. The average annual rate of reduction of 3.9% for a 40% reduction in the number of children under five years of age who are stunted and 5.2% has been estimated for a 50% reduction in anaemia among women of reproductive age. These AARR have been used in the computations of estimated number of anaemic women and stunted children in future years, up to 2050 by using the methodology suggested by experts.⁴ The population of the world is projected to be 8.552 in 2030 and 9.772 billion by 2050. India, which is projected to top the chart, is projected to be 1.513 billion by 2030 and 1.659 billion by 2050, followed by China, which is projected to be 1.441 billion by 2030 and 1.364 billion by 2050.

Estimated number of stunted children under five years of age at 2025, 2030 and 2050: Applying the estimated average annual rate of reduction of 3.9% to achieve the target of 40% reduction in the number of children under five years of age, who are stunted is estimated to be 113.7 million by 2025, 93.2 million by 2030 and 43.4 million by 2050.⁵

Estimated number of anaemic women in the reproductive age at 2025, 2030 and 2050: Applying the estimated average annual rate of reduction of 5.2% to achieve the target of 50% reduction in anaemia among women of reproductive age, the population of anaemic women is estimated to be 363 million by 2025, 287 million by 2030 and 80 million by 2050.
Table 3: Estimated total population at five points of time used for estimation 2011 (Global Anaemia estimate year), for 2017 (most recent completed, calendar year), 2025 (world health assembly goal year) and 2030 (SDG goal year) and a future year time point (2050).

| Countries/World | Total Population, 2011 (millions) | % of world population, 2011 | Total Population, 2017 (millions) | % of world population, 2017 | Total Population, 2025 (millions) | % of world population, 2025 | Total Population, 2030 (millions) | % of world population, 2030 | Total Population, 2050 (millions) | % of world population, 2050 |
|-----------------|----------------------------------|-----------------------------|----------------------------------|-----------------------------|----------------------------------|-----------------------------|----------------------------------|-----------------------------|----------------------------------|-----------------------------|
| Bangladesh      | 154                              | 2.2                         | 165                              | 2.2                         | 178                              | 2.2                         | 186                              | 2.2                         | 202                              | 2.1                         |
| Brazil          | 199                              | 2.8                         | 209                              | 2.8                         | 220                              | 2.7                         | 225                              | 2.6                         | 233                              | 2.4                         |
| China           | 1,367                            | 19.4                        | 1,410                            | 18.7                        | 1,439                            | 17.6                        | 1,441                            | 16.9                        | 1,364                            | 14.0                        |
| Ethiopia        | 90                               | 1.3                         | 105                              | 1.4                         | 126                              | 1.5                         | 140                              | 1.6                         | 191                              | 2.0                         |
| India           | 1,247                            | 17.7                        | 1,339                            | 17.7                        | 1,452                            | 17.7                        | 1,513                            | 17.7                        | 1,659                            | 17.0                        |
| Indonesia       | 246                              | 3.5                         | 264                              | 3.5                         | 285                              | 3.5                         | 296                              | 3.5                         | 322                              | 3.3                         |
| Japan           | 129                              | 1.8                         | 128                              | 1.7                         | 124                              | 1.5                         | 122                              | 1.4                         | 109                              | 1.1                         |
| Mexico          | 119                              | 1.7                         | 129                              | 1.7                         | 141                              | 1.7                         | 148                              | 1.7                         | 164                              | 1.7                         |
| Nigeria         | 163                              | 2.3                         | 191                              | 2.5                         | 234                              | 2.9                         | 264                              | 3.1                         | 411                              | 4.2                         |
| Pakistan        | 174                              | 2.5                         | 197                              | 2.6                         | 227                              | 2.8                         | 244                              | 2.9                         | 307                              | 3.1                         |
| Philippines     | 95                               | 1.3                         | 105                              | 1.4                         | 118                              | 1.4                         | 125                              | 1.5                         | 151                              | 1.5                         |
| Russian Federation | 143                         | 2.0                         | 144                              | 1.9                         | 143                              | 1.7                         | 141                              | 1.6                         | 133                              | 1.4                         |
| United States of America | 311                          | 4.4                         | 325                              | 4.3                         | 343                              | 4.2                         | 355                              | 4.2                         | 390                              | 4.0                         |
| 13, 100 million plus countries total | 4,437                      | 63.0                        | 4,710                            | 62.4                        | 5,030                            | 61.4                        | 5,199                            | 60.8                        | 5,635                            | 57.7                        |
| WORLD           | 7,043                            | 100                         | 7,550                            | 100.0                       | 8,186                            | 100.0                       | 8,551                            | 100.0                       | 9,772                            | 100.0                       |

Note: Author’s computations based on United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP/2482.
Table 4: Estimation of stunted children under five years of age based on a 3.9% average annual rate of reduction (AARR) for 2017 (most recent completed, calendar year), as per the target of the world health assembly for 2025 (WHA goal year) and 2030 (SDG goal year).

| Countries/ World            | Prevalence of moderate and Severe Stunting, 2017 (%) | Estimated number of Under five years children, 2017 (millions) | Estimated number of Under five years children, 2025 (millions) | Estimated number of Under five years children, 2030 (millions) | Prevalence of Moderate and Severe Stunting, 2017 (%) | Prevalence of Moderate and Severe Stunting, 2025 (%) | Prevalence of Moderate and Severe Stunting, 2030 (%) | Estimated number of stunted children under five years, 2017 | Estimated number of stunted children under five years, 2025 | Estimated number of stunted children under five years, 2030 |
|-----------------------------|-----------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
| Bangladesh                  | 36.0                                                | 15.2                                                        | 14.2                                                        | 13.5                                                        | 36.0                                                | 26.2                                                | 21.5                                                | 5.5                                             | 3.7                                             | 2.9                                             |
| Brazil                      | 7.0                                                 | 14.8                                                        | 13.6                                                        | 12.9                                                        | 7.0                                                 | 5.1                                                 | 4.2                                                 | 1.0                                             | 0.7                                             | 0.5                                             |
| China                       | 8.0                                                 | 85.1                                                        | 73.3                                                        | 68.0                                                        | 8.0                                                 | 5.8                                                 | 4.8                                                 | 6.8                                             | 4.3                                             | 3.2                                             |
| Ethiopia                    | 38.0                                                | 15.4                                                        | 16.4                                                        | 16.7                                                        | 38.0                                                | 27.6                                                | 22.7                                                | 5.8                                             | 4.5                                             | 3.8                                             |
| India                       | 38.0                                                | 119.8                                                       | 119.8                                                       | 117.6                                                       | 38.0                                                | 27.6                                                | 22.7                                                | 45.5                                            | 33.1                                            | 26.6                                            |
| Indonesia                   | 36.0                                                | 24.7                                                        | 23.1                                                        | 22.6                                                        | 36.0                                                | 26.2                                                | 21.5                                                | 8.9                                             | 6.1                                             | 4.9                                             |
| Japan                       | 7.0                                                 | 5.3                                                         | 4.9                                                         | 4.8                                                         | 7.0                                                 | 5.1                                                 | 4.2                                                 | 0.4                                             | 0.3                                             | 0.2                                             |
| Mexico                      | 12.0                                                | 11.5                                                        | 10.8                                                        | 10.4                                                        | 12.0                                                | 8.7                                                 | 7.2                                                 | 1.4                                             | 0.9                                             | 0.7                                             |
| Nigeria                     | 33.0                                                | 32.4                                                        | 36.8                                                        | 40.0                                                        | 33.0                                                | 24.0                                                | 19.7                                                | 10.7                                            | 8.8                                             | 7.9                                             |
| Pakistan                    | 45.0                                                | 25.1                                                        | 25.2                                                        | 24.9                                                        | 45.0                                                | 32.7                                                | 26.8                                                | 11.3                                            | 8.2                                             | 6.7                                             |
| Philippines                 | 33.0                                                | 11.6                                                        | 12.0                                                        | 12.1                                                        | 33.0                                                | 24.0                                                | 19.7                                                | 3.8                                             | 2.9                                             | 2.4                                             |
| Russian Federation          | -                                                   | 9.5                                                         | 8.1                                                         | 7.2                                                         | -                                                   | -                                                   | -                                                   | -                                               | -                                               | -                                               |
| United States of America    | 2.0                                                 | 19.7                                                        | 21.6                                                        | 22.0                                                        | 2.0                                                 | 1.5                                                 | 1.2                                                 | 0.4                                             | 0.3                                             | 0.3                                             |
| 13, 100 million plus countries total | -                      | 390.2                                                       | 379.9                                                       | 372.7                                                       | -                                                   | -                                                   | -                                                   | -                                               | -                                               | -                                               |
| WORLD                       | 23.0                                                | 677.9                                                       | 679.3                                                       | 680.0                                                       | 23.0                                                | 16.7                                                | 13.7                                                | 155.9                                           | 113.7                                           | 93.2                                            |

Note: Author’s computations based on United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP/248. Source: https://data.unicef.org/wp-content/uploads/2015/12/Technical_Note_AARR_185.pdf.
Table 5: Estimation of stunted children under five years of age based on a 3.9% average annual rate of reduction (AARR) for 2050.

| Countries/ World | Projected levels of prevalence of Moderate and Severe Stunting, 2050 (%) | Estimated number of Under five years children, 2050 (millions) | Estimated number of stunted children under five years, 2050 (millions) | Per cent of stunted children to total world population of stunted children under five years of age in 2050 (%) |
|------------------|--------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------|
| Bangladesh       | 10                                                                              | 11.0                                            | 1.1                                                             | 2.5                                                          |
| Brazil           | 2                                                                               | 11.0                                            | 0.2                                                             | 0.5                                                          |
| China            | 2                                                                               | 62.4                                            | 1.3                                                             | 3.0                                                          |
| Ethiopia         | 10                                                                              | 16.8                                            | 1.7                                                             | 3.9                                                          |
| India            | 10                                                                              | 101.4                                           | 10.4                                                            | 24.0                                                         |
| Indonesia        | 10                                                                              | 20.8                                            | 2.0                                                             | 4.6                                                          |
| Japan            | 2                                                                               | 4.5                                             | 0.1                                                             | 0.2                                                          |
| Mexico           | 3                                                                               | 9.0                                             | 0.3                                                             | 0.7                                                          |
| Nigeria          | 9                                                                               | 51.6                                            | 4.6                                                             | 10.6                                                         |
| Pakistan         | 12                                                                              | 25.4                                            | 3.1                                                             | 7.1                                                          |
| Philippines      | 9                                                                               | 12.0                                            | 1.1                                                             | 2.5                                                          |
| Russian Federation | 0                                                                  | 8.0                                             | -                                                               | -                                                            |
| United States of America | 1                                      | 22.5                                            | 0.1                                                             | 0.2                                                          |
| 13, 100 million plus countries total | -                                  | -                                               | -                                                               | -                                                            |
| WORLD            | 6                                                                               | 701.7                                           | 43.4                                                            | 100.0                                                        |

Note: Author’s computations based on United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP/248. UNICEF, 2017. The State of the world’s Children 2017: Children in a digital world.

Estimated requirement of iron and folic acid supplements (IFAS) for pregnant women

Women suffer disproportionally from many nutritional deficiencies, including iron deficiency (ID) and anaemia. As a significant proportion of the anaemia is estimated to be iron deficiency anaemia, iron and folic acid supplementation has been recommended as the intervention to prevent iron deficiency anaemia. By preventing and controlling iron deficiency and anaemia in pregnancy, the IFA supplementation in pregnancy program supports women’s health and nutrition. In order to estimate the requirement for IFAS, number of annual pregnancies and number of pregnancies in any given month have been used here. For a six month supply of 180 IFAS, there would be a requirement of about 27.810 billion tablets for the whole world. The requirement is estimated to vary from 4.950 billion tablets for India to 198 million tablets in Japan for a six months of supply. For an one month of supply for pregnant women, the requirement is estimated to vary from 2.317 billion to 3.2445 billion tablets around the globe based on two estimates of 50% to 70% respectively of the pregnancies occur in any given month of the total expected annual pregnancies.

Per cent change in number of stunted children and anaemic women of reproductive age of 15 to 49 years by 2025 (WHA goal year) and 2030 (SDG goal year) and 2050 (future year):

The number of stunted children under five years of age is estimated to be reduced by 275 by 2025, 40% by 2030 and 72% by 2050. The number of anaemic women of reproductive age is estimated to be reduced by 32% by 2025, 46% by 2030 and 85% by 2050.

DISCUSSION

Projection of population of stunted children and anaemic women can help us to understand the quantum of change that is expected considering the rate of progress made. A major proportion of cases of anaemia are considered to be due to iron deficiency, but the proportion probably varies among population groups and in different areas, according to local conditions.
Table 6: Estimation of anaemic women of reproductive age of 15 to 49 years of age based on a 5.2% average annual rate of reduction (AARR) for 2017 (most recent completed, calendar year), as per the target of the world health assembly for 2025 (WHA goal year) and 2030 (SDG goal year).

| Country/ World | No. of women of reproductive age of 15 to 49 years of age (millions), 2011 | No. of women of reproductive age of 15 to 49 years of age (millions), 2017 | No. of women of reproductive age of 15 to 49 years of age (millions), 2025 | No. of women of reproductive age of 15 to 49 years of age (millions), 2030 | Prevalence of Anaemia among women, 15 to 49 years of age, 2011 (%) | Estimated Prevalence of Anaemia among women, 15 to 49 years of age, 2017 (%) | Prevalence of Anaemia among women, 15 to 49 years of age, 2025 (%) | Prevalence of Anaemia among women, 15 to 49 years of age, 2030 (%) | No. of estimated anaemic women, 15 to 49 years of age, 2011 (millions) | No. of estimated anaemic women, 15 to 49 years of age, 2017 (millions) | No. of estimated anaemic women, 15 to 49 years of age, 2025 (millions) | No. of estimated anaemic women, 15 to 49 years of age, 2030 (millions) |
|----------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Bangladesh     | 43                                            | 42                                            | 62                                            | 65                                            | 65                              | 65                              | 43                              | 34                              | 31                              | 20                              | 16                              | 18                              | 19                              | 13                              | 10                             |
| Brazil         | 20                                            | 55                                            | 73                                            | 72                                            | 71                              | 20                              | 15                              | 9                               | 7                               | 11                              | 11                              | 11                              | 11                              | 5                               | 5                              |
| China          | 20                                            | 378                                           | 427                                           | 394                                           | 385                             | 20                              | 15                              | 9                               | 7                               | 76                              | 62                              | 37                              | 28                              |                                 |                                |
| Ethiopia       | 19                                            | 21                                            | 39                                            | 47                                            | 52                              | 19                              | 14                              | 9                               | 7                               | 4                               | 5                               | 4                               | 4                               |                                 |                                |
| India          | 48                                            | 318                                           | 465                                           | 492                                           | 499                             | 48                              | 35                              | 23                              | 17                              | 153                             | 162                             | 112                             | 87                              |                                 |                                |
| Indonesia      | 23                                            | 67                                            | 93                                            | 97                                            | 99                              | 23                              | 17                              | 11                              | 8                               | 15                              | 16                              | 11                              | 8                               |                                 |                                |
| Japan          | 22                                            | 27                                            | 31                                            | 28                                            | 26                              | 22                              | 16                              | 10                              | 8                               | 6                               | 5                               | 3                               | 2                               |                                 |                                |
| Mexico         | 14                                            | 32                                            | 47                                            | 48                                            | 49                              | 14                              | 10                              | 7                               | 5                               | 5                               | 5                               | 3                               | 2                               |                                 |                                |
| Nigeria        | 49                                            | 37                                            | 65                                            | 82                                            | 93                              | 49                              | 36                              | 23                              | 18                              | 18                              | 23                              | 19                              | 16                              |                                 |                                |
| Pakistan       | 51                                            | 44                                            | 69                                            | 80                                            | 87                              | 51                              | 37                              | 24                              | 18                              | 22                              | 25                              | 19                              | 16                              |                                 |                                |
| Philippines    | 25                                            | 25                                            | 37                                            | 41                                            | 43                              | 25                              | 18                              | 12                              | 9                               | 6                               | 7                               | 5                               | 4                               |                                 |                                |
| Russian Federation | 21                          | 37                                            | 41                                            | 41                                            | 40                              | 21                              | 15                              | 10                              | 8                               | 8                               | 6                               | 4                               | 3                               |                                 |                                |
| United States of America | 12                          | 73                                            | 95                                            | 97                                            | 99                              | 12                              | 9                               | 6                               | 4                               | 9                               | 8                               | 6                               | 4                               |                                 |                                |
| 13, 100 million plus countries total | -               | 1,157                                         | 1,544                                         | 1,583                                         | 1,608                           | -                               | -                               | -                               | -                               | -                               | -                               | -                               | -                               |                                 |                                |
| World          | 29.4                                         | 1,813                                         | 2,477                                         | 2,607                                         | 2,689                           | 29                              | 21                              | 14                              | 11                              | 533                             | 529                             | 363                             | 287                             |                                 |                                |

Author’s computations based on Global Prevalence of Anaemia in 2011, WHO, 2015
http://apps.who.int/iris/bitstream/10665/177094/1/9789241564960_eng.pdf~United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP/248.
Table 7: Estimation of population of anaemic women of reproductive age of 15 to 49 years of age based on a 5.2% average annual rate of reduction (AARR) for 2050.

| Country/ World    | Projected levels of prevalence of anaemia among women, 15 to 49 years of age, 2050 (%) | No. of women of reproductive age of 15 to 49 years of age (millions), 2050 | No. of estimated anaemic women, 15 to 49 years of age, 2050 (millions) | Per cent of anaemic women, 15 to 49 years of age to total world population of anaemic women of 15 to 49 years of age in 2050 (%) |
|-------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Bangladesh        | 5                                                                                       | 47                                                                              | 3                                                                              | 3.8                                                                            |
| Brazil            | 2                                                                                       | 48                                                                              | 1                                                                              | 1.3                                                                            |
| China             | 2                                                                                       | 243                                                                             | 6                                                                              | 7.5                                                                            |
| Ethiopia          | 2                                                                                       | 51                                                                              | 1                                                                              | 1.3                                                                            |
| India             | 6                                                                                       | 388                                                                             | 23                                                                             | 28.8                                                                          |
| Indonesia         | 3                                                                                       | 77                                                                              | 2                                                                              | 2.5                                                                            |
| Japan             | 3                                                                                       | 18                                                                              | 0                                                                              | 0.0                                                                            |
| Mexico            | 2                                                                                       | 37                                                                              | 1                                                                              | 1.3                                                                            |
| Nigeria           | 6                                                                                       | 104                                                                             | 6                                                                              | 7.5                                                                            |
| Pakistan          | 6                                                                                       | 77                                                                              | 5                                                                              | 6.3                                                                            |
| Philippines       | 3                                                                                       | 38                                                                              | 1                                                                              | 1.3                                                                            |
| Russian Federation| 3                                                                                       | 27                                                                              | 1                                                                              | 1.3                                                                            |
| United States of America | 1                                             | 82                                                                              | 1                                                                              | 1.3                                                                            |
| 13, 100 million plus countries total | -                                                | -                                                                              | -                                                                              | -                                                                            |
| WORLD             | 4                                                                                       | 2,195                                                                           | 80                                                                             | 100.0                                                                          |

Author’s computations based on Global Prevalence of Anaemia in 2011, WHO, 2015 [http://apps.who.int/iris/bitstream/10665/177094/1/9789241564960_eng.pdf](http://apps.who.int/iris/bitstream/10665/177094/1/9789241564960_eng.pdf)<sup>6</sup>

United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP/248.

Table 8: Estimated requirement of iron and folic acid supplements (IFAS) for pregnant women (millions), 2017.

| Country/ World | Total Population, 2017 (in millions) | Annual Pregnancies (in millions) | 180 IFAS for six months (180 days) (in millions) | Number of pregnancies in a given month @ 0.5<sup>7</sup> (in millions) | Number of pregnancies in a given month @ 0.7<sup>8</sup> (in millions) | 30 IFAS for one month @ 0.5 in a given month (in millions) | 30 IFAS for one month @ 0.7 in a given month (in millions) |
|----------------|-------------------------------------|----------------------------------|-----------------------------------------------|-------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|
| Bangladesh     | 165                                 | 3.4                              | 612                                           | 1.7                                             | 2.38                                                               | 51.0                                                        | 71.4                                                        |
| Brazil         | 209                                 | 3.2                              | 576                                           | 1.6                                             | 2.24                                                               | 48.0                                                        | 67.2                                                        |
| China          | 1,410                               | 18                               | 3,240                                         | 9.0                                             | 12.6                                                               | 270.0                                                       | 378.0                                                       |
| Ethiopia       | 105                                 | 3.6                              | 648                                           | 1.8                                             | 2.52                                                               | 54.0                                                        | 75.6                                                        |
| India          | 1,339                               | 27.5                             | 4,950                                         | 13.8                                            | 19.25                                                               | 412.5                                                       | 577.5                                                       |
| Indonesia      | 264                                 | 5.3                              | 954                                           | 2.7                                             | 3.71                                                               | 79.5                                                        | 111.3                                                       |
| Japan          | 128                                 | 1.1                              | 198                                           | 0.6                                             | 0.77                                                               | 16.5                                                        | 23.1                                                        |
| Mexico         | 129                                 | 2.5                              | 450                                           | 1.3                                             | 1.75                                                               | 37.5                                                        | 52.5                                                        |

Continued.
### Table 9: Per cent change in number of stunted children and anaemic women of reproductive age of 15 to 49 years by 2025 (WHA goal year) and 2030 (SDG goal year) and 2050 (future year).

| Country/World | Per cent change in number of stunted children in 2025 compared to 2017 (%) | Per cent change in number of stunted children in 2030 compared to 2017 (%) | Per cent change in number of stunted children in 2050 compared to 2017 (%) | Per cent change in the number of anaemic women in 2025 compared to 2011 (%) | Per cent change in the number of anaemic women in 2030 compared to 2011 (%) | Per cent change in the number of anaemic women in 2050 compared to 2011 (%) |
|---------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Bangladesh    | -32                                                                              | -47                                                                              | -81                                                                              | -28                                                                              | -44                                                                              | -86                                                                              |
| Brazil        | -33                                                                              | -48                                                                              | -80                                                                              | -38                                                                              | -54                                                                              | -89                                                                              |
| China         | -37                                                                              | -52                                                                              | -80                                                                              | -51                                                                              | -63                                                                              | -92                                                                              |
| Ethiopia      | -22                                                                              | -35                                                                              | -71                                                                              | 6                                                                                | -10                                                                              | -69                                                                              |
| India         | -27                                                                              | -41                                                                              | -77                                                                              | -27                                                                              | -43                                                                              | -85                                                                              |
| Indonesia     | -32                                                                              | -45                                                                              | -77                                                                              | -32                                                                              | -47                                                                              | -86                                                                              |
| Japan         | -32                                                                              | -46                                                                              | -77                                                                              | -51                                                                              | -65                                                                              | -92                                                                              |
| Mexico        | -32                                                                              | -46                                                                              | -79                                                                              | -30                                                                              | -45                                                                              | -86                                                                              |
| Nigeria       | -17                                                                              | -26                                                                              | -57                                                                              | 4                                                                                | -9                                                                              | -65                                                                              |
| Pakistan      | -27                                                                              | -41                                                                              | -73                                                                              | -14                                                                              | -28                                                                              | -78                                                                              |
| Philippines   | -25                                                                              | -38                                                                              | -72                                                                              | -21                                                                              | -36                                                                              | -81                                                                              |
| Russian Federation | -                                                                              | -                                                                              | -                                                                              | -48                                                                              | -60                                                                              | -91                                                                              |
| United States of America | -20                                                                        | -34                                                                              | -69                                                                              | -37                                                                              | -51                                                                              | -86                                                                              |
| 13, 100 million plus countries total | -                                                                              | -                                                                              | -                                                                              | -                                                                              | -                                                                              | -                                                                              |
| WORLD         | -27                                                                              | -40                                                                              | -72                                                                              | -32                                                                              | -46                                                                              | -85                                                                              |

Author’s computations based on the data of the Global Prevalence of Anaemia in 2011, WHO, 2015 [http://apps.who.int/iris/bitstream/10665/177094/1/9789241564960_eng.pdf](http://apps.who.int/iris/bitstream/10665/177094/1/9789241564960_eng.pdf). United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP/248.
Other causes of anaemia include other micronutrient deficiencies (e.g. folate, riboflavin, vitamins A and B12), acute and chronic infections (e.g. malaria, cancer, tuberculosis and HIV), and inherited or acquired disorders that affect haemoglobin synthesis, red blood cell production or red blood cell survival (e.g. haemoglobinopathies). So, this paper tries to estimate the requirement of iron and folic acid supplements for pregnant women considering two scenarios. There is need to focus on high population burden countries like; India and Nigeria, where concerted efforts are needed to bring about an expedited change. This is an attempt to estimate the burden of the stunting and anaemia in future years, which would bring in more focussed attention to the high burden countries.

CONCLUSION

The projection of the future population of stunted children and anaemic women would determine the quantum of efforts required for achieving the global nutrition targets of the world health assembly. There is need to focus on high population burden countries, where the number of anaemic women of reproductive age and children under five years, who are stunted, is alarmingly high. India and Nigeria together are projected to contribute to more than one-third of the stunted children and anaemic women in the world by 2050. Though these two countries are projected to constitute about a fifth of the world’s population, they are projected to contribute to a third of the burden of stunted children and anaemic women of reproductive age.

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