

# Do We Produce Enough Fruits and Vegetables to Meet Global Health Needs?

Karen R. Siegel<sup>1,2</sup>, Mohammed K. Ali<sup>1,2</sup>, Adithi Srinivasiah<sup>3</sup>, Rachel A. Nugent<sup>4</sup>, K.M. Venkat Narayan<sup>2</sup>

<sup>1</sup> Division of Diabetes Translation, Centers for Disease Control and Prevention, Atlanta, GA, USA ; <sup>2</sup> Hubert Department of Global Health, Emory University, Atlanta, GA, USA; <sup>3</sup> Emory College, Emory University, Atlanta, GA, USA; <sup>4</sup> Department of Global Health, University of Washington, Seattle, WA, USA

## BACKGROUND

- Low fruit and vegetable (FV) intake contributes to 16.0 million disability-adjusted life years and 1.7 million deaths worldwide
- Dietary guidelines recommend 5+ servings of FV daily (need)
- However, global availability of FV (supply) to meet need is not known

## OBJECTIVES

- Assess current FV supply and need (assuming individuals of all ages meet their daily recommended intake of FV)
- Assess how need for FV may change by 2025 and 2050

## DATA SOURCES

**Table 1: Data Sources and Descriptions**

Source	Description
Food and Agricultural Organization (FAO) 2009 Food Balance Sheets [1]	Reports FV supply (in kg/person per year) globally, by region, and by individual country for over 175 countries. Takes into account production, food losses (through storage, transport, and processing, feed to livestock, or use as seeds and for non-dietary purposes), imports, and exports.
World Bank World Development Indicators [2]	Provides country-level estimates of the total population size and the proportion of the population aged 0-14 years and 15 years and older
United Nations World Population Prospects: The 2012 Revision [3]	Provides population projections up to 2100, for individual countries and regions, by five-year periods
Previously-calculated FV recommendations for individuals [4]	330 grams per day for individuals aged 0-4 years, 480 grams per day for individuals aged 5-14 years, and 600 grams per day for all individuals aged 15 years and older.

## METHODS

To calculate "supply":

- Multiplied FAO per-capita estimates by total population estimates

$$\text{Supply} = \frac{\text{FV(kg)}}{\text{person}} * \text{population}$$

To calculate "need":

- Multiplied World Bank age-specific population estimates by age-specific recommendations for FV per day
- Projected need in 2025 and 2050 was calculated similarly, using UN population projections under three different fertility scenarios

$$\begin{aligned} \text{Need} = & \left[ \text{popn}(0-4 \text{ yrs}) * \frac{0.33 \text{ kg}}{\text{persons}(0-4 \text{ yrs})} \right] \\ & + \left[ \text{popn}(5-14 \text{ yrs}) * \frac{0.48 \text{ kg}}{\text{persons}(5-14 \text{ yrs})} \right] \\ & + \left[ \text{popn}(15+ \text{ yrs}) * \frac{0.60 \text{ kg}}{\text{persons}(15+ \text{ yrs})} \right] \end{aligned}$$

To calculate "supply:need" ratio:

- Divided supply by need

All calculations were performed in Excel and data analysis was performed using Statistical Analysis Software (SAS) version 9.3.

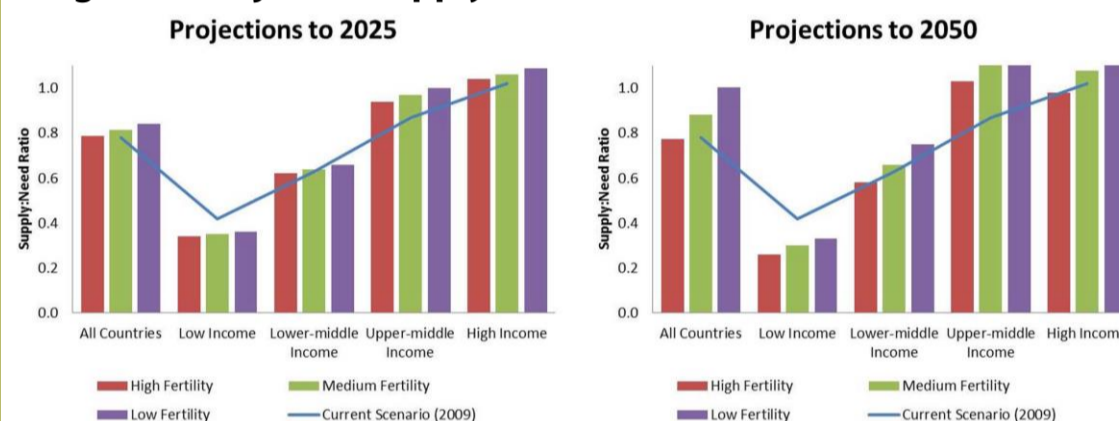
## RESULTS

**Table 2: Fruit and Vegetable Supply, Need, and Supply:Need Ratio**

	n	Supply	Need	Supply:Need Ratio
<b>Full Sample, all countries</b>	<b>170</b>	<b>1.15 (0.01 – 524.25)</b>	<b>1.90 (0.02 – 282.50)</b>	<b>0.78 (0.05 – 2.01)</b>
<b>Low Income</b>	<b>34</b>	<b>0.97 (0.05 – 7.50)</b>	<b>2.36 (0.13 – 30.18)</b>	<b>0.42 (0.05 – 0.99)</b>
<b>Lower-middle Income</b>	<b>43</b>	<b>1.01 (0.01 – 142.51)</b>	<b>1.49 (0.02 – 241.62)</b>	<b>0.63 (0.19 – 1.72)</b>
<b>Upper-middle Income</b>	<b>50</b>	<b>1.52 (0.01 – 524.25)</b>	<b>1.71 (0.02 – 282.50)</b>	<b>0.87 (0.24 – 2.01)</b>
<b>High Income</b>	<b>43</b>	<b>1.60 (0.04 – 71.63)</b>	<b>1.64 (0.05 – 64.59)</b>	<b>1.02 (0.55 – 1.86)</b>

**Notes:** All numbers provided as median (range). Supply and Need are reported in billions of kilograms of fruits and vegetables. Country Income Level defined according to World Bank categories: Low-income economies (\$1,025 or less), Lower-middle-income economies (\$1,026 to \$4,035), Upper-middle-income economies (\$4,036 to \$12,475), High-income economies (\$12,476 or more).

**Figure 1: Projected Supply:Need Ratio, 2025 and 2050**



**Notes:** Country Income Level defined according to World Bank categories: Low-income economies (\$1,025 or less), Lower-middle-income economies (\$1,026 to \$4,035), Upper-middle-income economies (\$4,036 to \$12,475), High-income economies (\$12,476 or more). Fertility is defined according to the United Nations World Population Prospects, 2012 Revision: high fertility (5 or more children per woman), medium fertility (2-3 children per woman), and low fertility (less than 2.1 children per woman).

## CONCLUSIONS

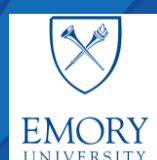
- Global FV supply currently falls 22% short of need; by 2050, the gap may decrease to 12% globally but widen to 70% and 34% in low income and lower-middle income countries, respectively
- Lack of availability varies across country income level, with lower-income countries exhibiting lower availability relative to population need as compared to higher-income countries
- Addressing inadequate supply may be one potential lever for ensuring that populations meet nutritional fruit and vegetable needs and reducing death and disability worldwide

## REFERENCES

1. FAO, Food and Agricultural Organization Food Balance Sheets, 2009, FAO.
2. WB, The World Bank World Development Indicators, 2013, The World Bank.
3. UNDESA, World Population Prospects: The 2012 Revision, 2012, United Nations, Dept of Economic and Social Affairs: Population Division, Population Estimates and Projections Section.
4. Lock, K., et al., Low Fruit and Vegetable Consumption, in Comparative Quantification of Health Risks: Global and Regional Burden of Diseases Attributable to Selected Major Risk Factors, M. Ezzati, et al., Editors. 2004, World Health Organization: Geneva.

## CONTACT INFORMATION

Karen Rae Siegel, [yu00@cdc.gov](mailto:yu00@cdc.gov)



National Center for Chronic Disease Prevention and Health Promotion  
Division of Diabetes Translation

