Future Earth and Urban Environment

R.B. Singh

Vice President, IGU
Member, ICSU Scientific Committee on Urban Health and Wellbeing
Department of Geography, Delhi School of Economics
University of Delhi
Delhi – 110007, INDIA
E-mail: rbsgeo@hotmail.com

FUTURE EARTH AND URBAN ENVIRONMENT

- Nutrition, Urban Environments and Future Earth
  Godwin Ndossi
- Nutrition Science and Future Earth
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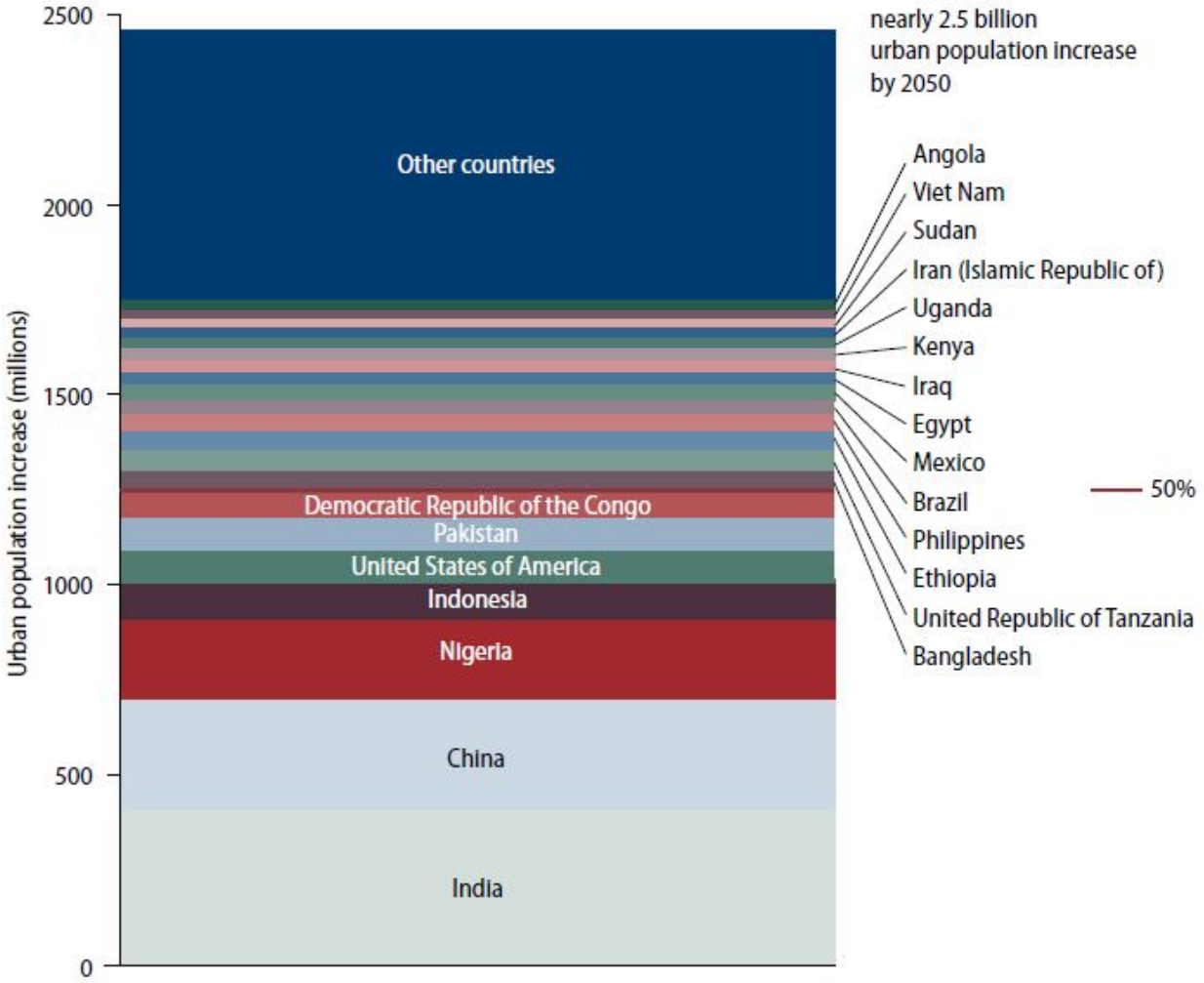
WHO at HABITAT III - Health as the Pulse of the New Urban Agenda at United Nations Conference on Housing and Sustainable Urban Development-Quito – October 2016

The most important asset of any city is the health of its citizens. The success of the New Urban Agenda will hinge on a clear understanding of how urban policies can foster good health, and how a vision for healthy, safe, inclusive and equitable cities can act as a driver of local sustainable development. Health is the vital sign – the "pulse" – of the New Urban Agenda.

European to Asian Century of Urbanisation

- The 19th century - Europe
- The 20th century – America
- The 21st century - Asia
- Out of the world's urban population of 3.4 billion in 2009, Asian urban population share was about 1.72 billion (about 50%).
- In 2011 the World counted 23 mega cities with Asia having 13 of them
- The number of such mega cities is expected to rise to 37 by 2025 with Asia adding 7 more mega cities to its share.

Share of urban population by country, 2014 to 2050



Note: The countries shown are projected to contribute 25 million or more to the global urban increment between 2014 and 2050. The category "Other countries" includes countries with urban increments of less than 25 million each.

Rank of Indian Megacities among Global Megacities

Urban Environment and Health

Urban health is of concern because:

- 21st Century: Large numbers of persons residing in urban area
- Nearly 45% of the developing world's population and 30 % of India's total population lived in urban areas in 2010 (UN Habitat, 2011b).
- As growing proportion of world's population lives in cities, the health of urban population contributes to global population health

Urbanization presents:

- Opportunities
- Risks

Urban environment and Health & wellbeing

- Direct influence
- Indirect influence

Challenges for Inclusive Urbanisation

- Unplanned haphazard rapid urban growth
- Cost of housing
- Lack of resources
- Concretization and associated microclimatic changes
- Slums and homelessness
- Traffic congestion
- Air pollution
- Solid waste management

Challenges-Cont..

- High Malnutrition Levels particularly in Women and Children
- Under-nutrition affecting productivity
- Micronutrient Malnutrition
- Emerging diet related diseases,
- High Mortality Rates-IMR and MMR
- Inadequate Access to Health Care, Immunization etc.

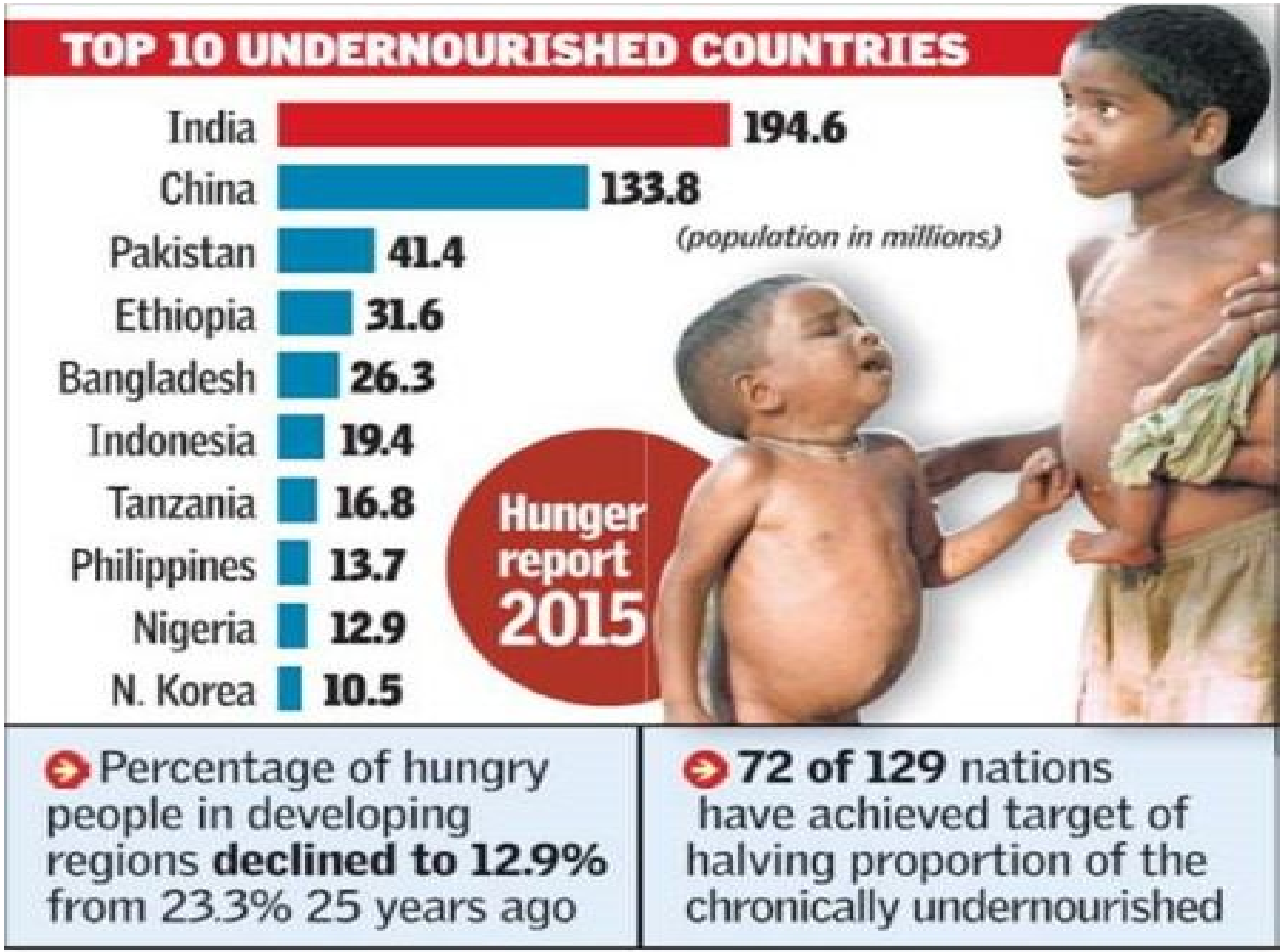
Health and wellbeing

- **Health**
  - State of complete physical, mental and social wellbeing and not merely absence of disease or infirmity (WHO, 1996)
  - Multi-dimensional concept

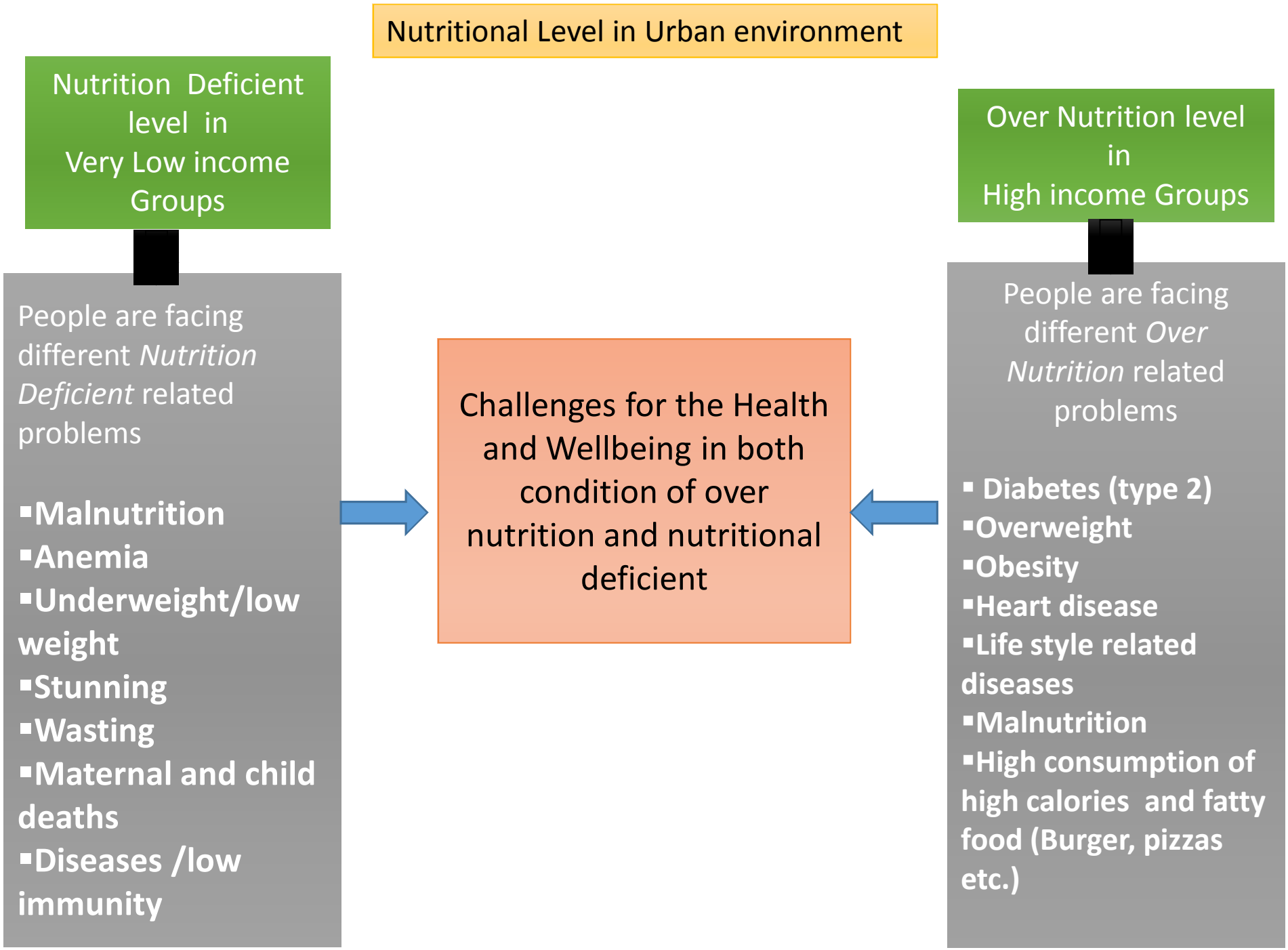
- **Wellbeing**
  - Newton (2007) mentions that wellbeing, "*is a positive physical, social and mental state; it is not just the absence of pain, discomfort and incapacity. It requires that basic needs are met, that individuals have a sense of purpose, that they feel able to achieve important personal goals and participate in society. It is enhanced by conditions that include supportive personal relationships, strong and inclusive communities,* ***good health****, financial and personal security, rewarding employment, and* ***a healthy and attractive environment***"

Continued

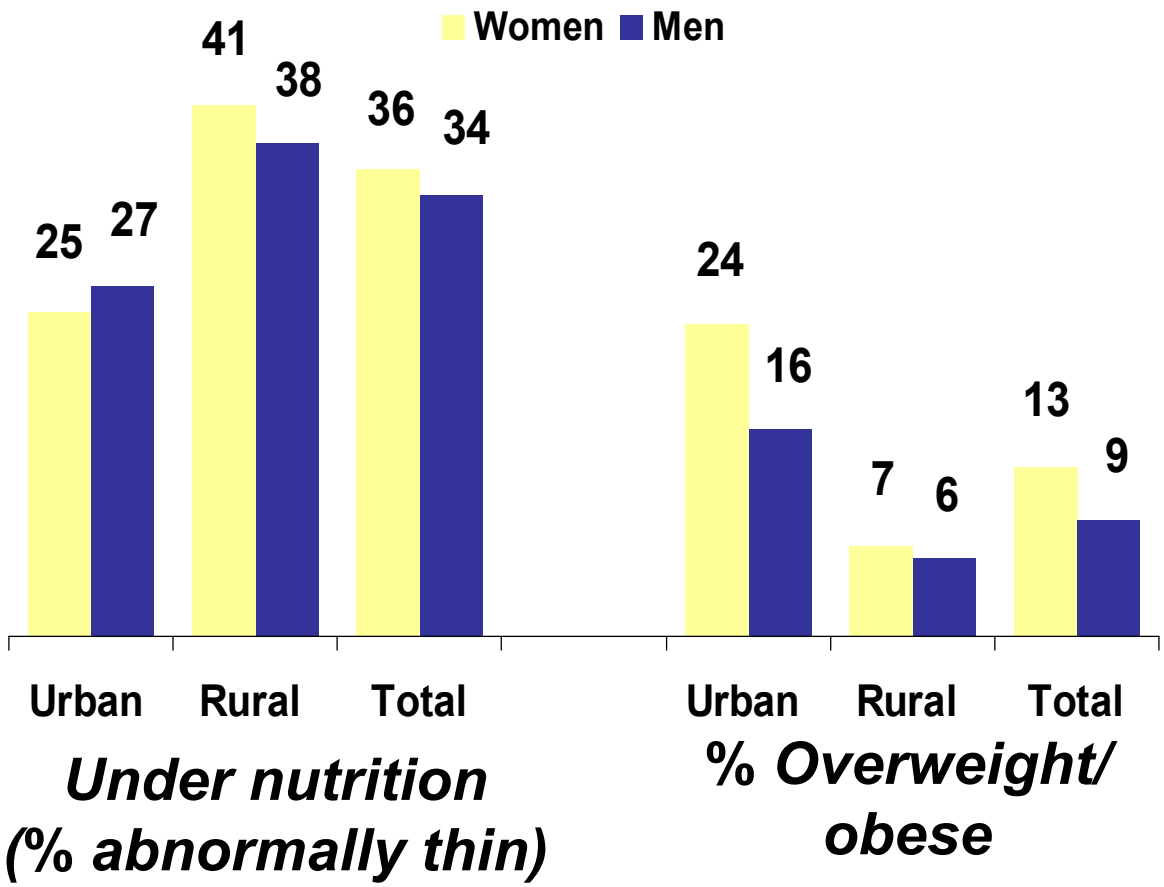
- **Health and wellbeing**
  - Closely integrated : economic, social, political, residential, psychological and behavioral circumstances have essential bearing on health consequences (WHO, 2005)
  - Hence, physical health is one of the basic determinants of wellbeing (WHO, 2005)



Source:- The Hindu newspaper, 28 may 2015


Nutritional Level in Urban environment
Nutrition Deficient level in Very Low income Groups
People are facing different *Nutrition Deficient* related problems
▪Malnutrition
▪Anemia
▪Underweight/low weight
▪Stunning
▪Wasting
▪Maternal and child deaths
▪Diseases /low immunity
Challenges for the Health and Wellbeing in both condition of over nutrition and nutritional deficient
Over Nutrition level in High income Groups
People are facing different *Over Nutrition* related problems
▪ Diabetes (type 2)
▪Overweight
▪Obesity
▪Heart disease
▪Life style related diseases
▪Malnutrition
▪High consumption of high calories and fatty food (Burger, pizzas etc.)

Prevalence of Under nutrition and Overweight/Obesity among Adults by Residence

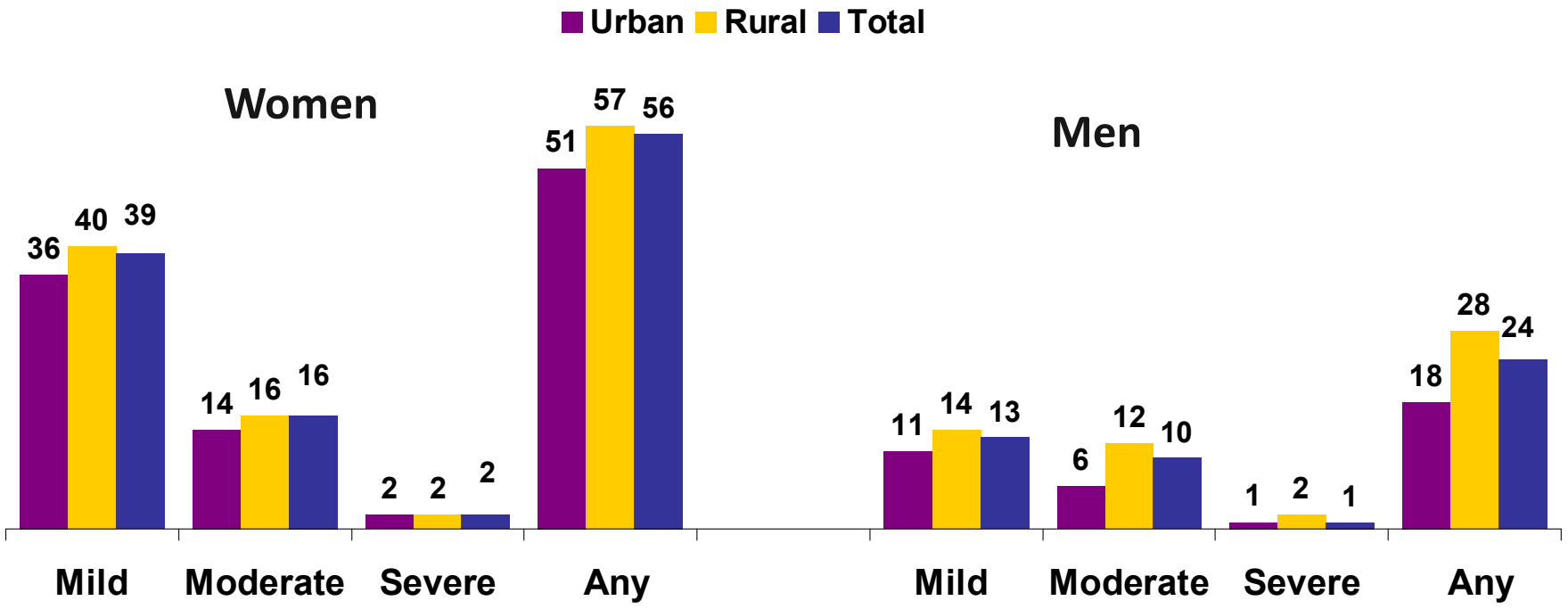


Under nutrition is more prevalent in rural areas.

Overweight and obesity are more than three times higher in urban than in rural areas.

Under nutrition and overweight/ obesity are both higher for women than men

Anaemia Prevalence among Women and Men by Residence



The anaemia prevalence levels are more than two times higher among women than men with almost half of them with moderate to severe anaemia.

The prevalence of anaemia is marginally higher in rural than urban areas but anaemia is a common problem in both urban and rural areas.

More than 50 percent of women in urban areas are anaemia, with almost a third of them with moderate to severe anaemia.

Direct and indirect impacts on human health

Level I: System	**Diseases of Respiratory System**			**Diseases of Circulatory System**	**Tuberculosis (TB)**	**Neoplasms**	**Infections & Parasitic diseases**
Level II: Major Classification	Diseases of the Upper Respiratory Tract (URT)	Diseases of the Lower Respiratory Tract (LRT)	Other Respiratory system Diseases (ORD)			Malignant neoplasm of respiratory and intrathoricic organs	Other bacterial diseases
Level III: Disease	Acute pharyngitis and acute tonsilitis	Acute Bronchitis and acute bronchiolitis	Influenza	Heart attack	Respiratory TB	Malignant neoplasm of larynx	Whooping cough
	Acute laryngistis and trachetis	Bronchitis, chronic and unspecified emphysema	Pneumonia			Malignant neoplasm of trachea, bronchus and lung	
	Acute upper respiratory infections	Asthma	Pleurisy			Other malignant neoplasm of respiratory and intrathoricic organs	
	Other diseases of URT	Other LR disorders	Other diseases of respiratory system				

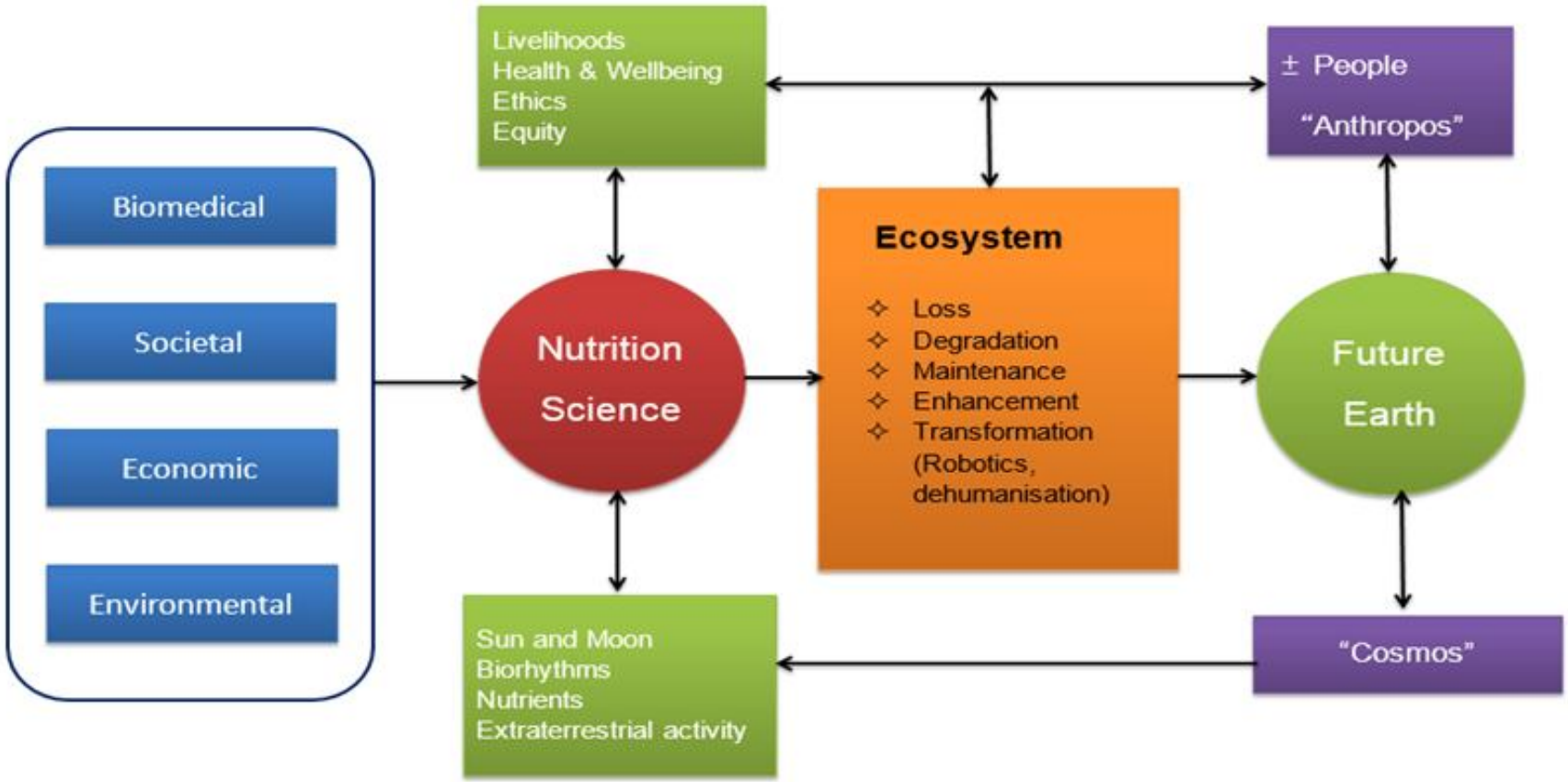
Nutrition Science & Future Earth

Prof Mark L Wahlqvist AO

BMedSc, MD, BS (Adelaide), MD (Uppsala), FRACP, FAFPHM, FACN, FTSE

Monash University, Australia; National Health Research Institutes, Taiwan; Zhejiang University, China

Nutrition Science: It's 4 Dimensions & Relevance to Future Earth (people & planet)



Climate change is at the core of future nutrition & health

- ***The Lancet commission, has made the point that climate change 'strikes at the heart of humanity' and needs to be framed as a health issue*** (Wang and Horton, 2015). This commission considers that the indirect effects of climate change on our present and future health are wide and include the effects of air pollution, disease vector proliferation, food and nutrition insecurity, loss of home, and mental illness.
- ***Climate change must now be 'at the heart' of nutrition science.***
- ***Ecosystem loss and dysfunction contribute to health and nutritional disorders in complex ways, not amenable to conventional biomedical science.***
- ***Biodiverse diets (and the ecosystems that support them) are crucial to health.***

Food Diversity, Why is it important?

- Sustainability
- Food quality
- Provides alternatives
- Homo Sapiens is omnivorous with plant food orientation
- More likely to be micronutrient adequate
- Dilutional effects on toxicants & contaminants

  (eg melamine, maleic acid, endocrine disruptors)
- Favours energy regulation
- Favourably predicts health outcomes
- Is a measure of household & personal food security

The advent of the automobile: it's nutritional & health consequences

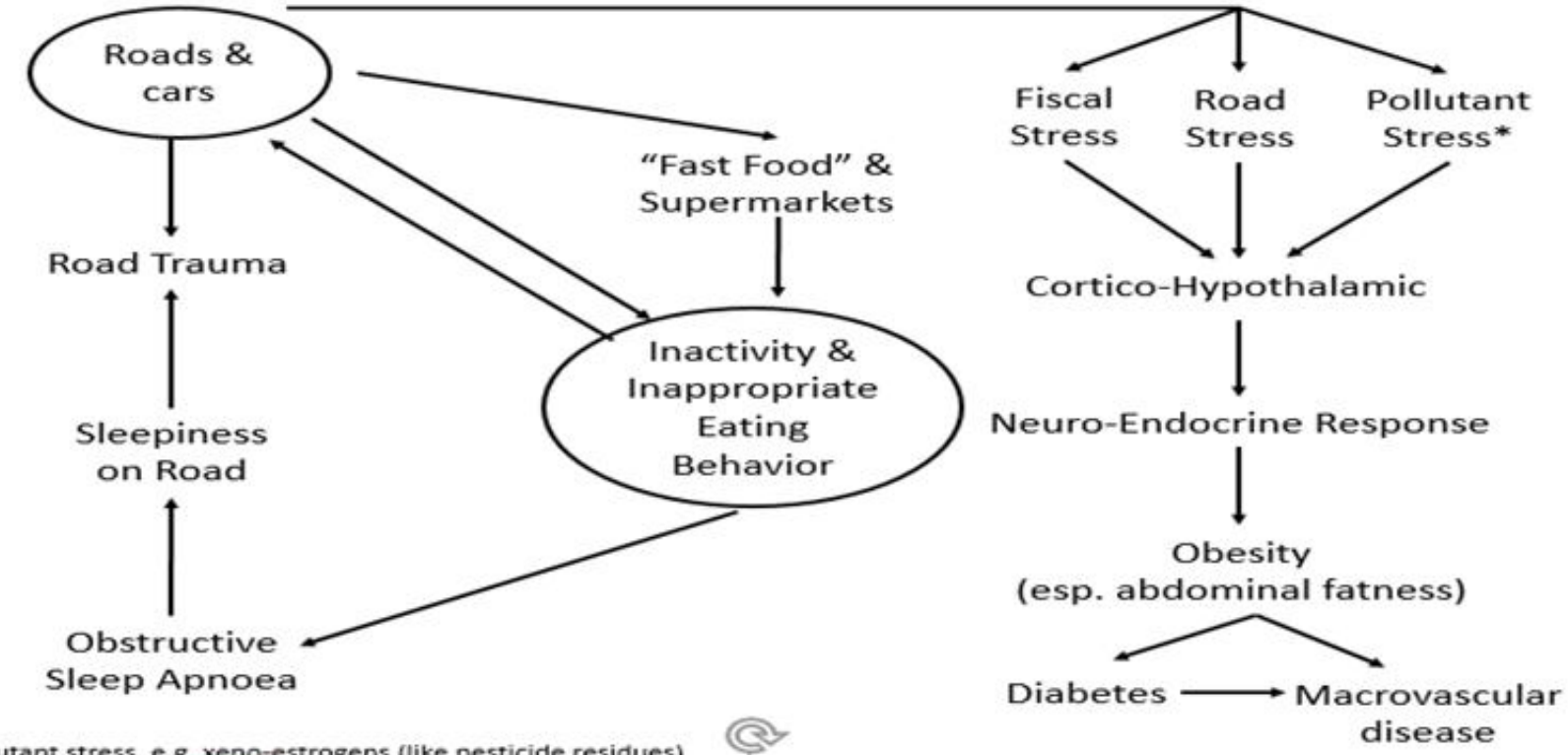


Figure. Fundamental and Intermediate Causes of Ecologically and Nutritionally-related Disease (END): the example of eating, activity, cars and the road. Based on Wahlqvist ML & Lee MS. *J Med Sci 2006;26*(5):157-64.

EHDs – Ecosystem Health Disorders

Wahlqvist ML. Ecosystem Health Disorders - changing perspectives in clinical medicine and nutrition. Asia Pac J Clin Nutr. 2014;23(1):1-15

EHDs –what are they?
Manifestations of Ecosystem Dysequilibrium

For example:

- **Energy Dysregulation & Body Compositional Disorders**
- **Food Intake Quality Disorders**, eg. biodiversity, ultra-processing
- **Sensory input disorders**
- **Biorhythm disorders**, eg. sleep, eating patterns
- **Contaminant disorders**, eg. plastics, endocrine disruptors

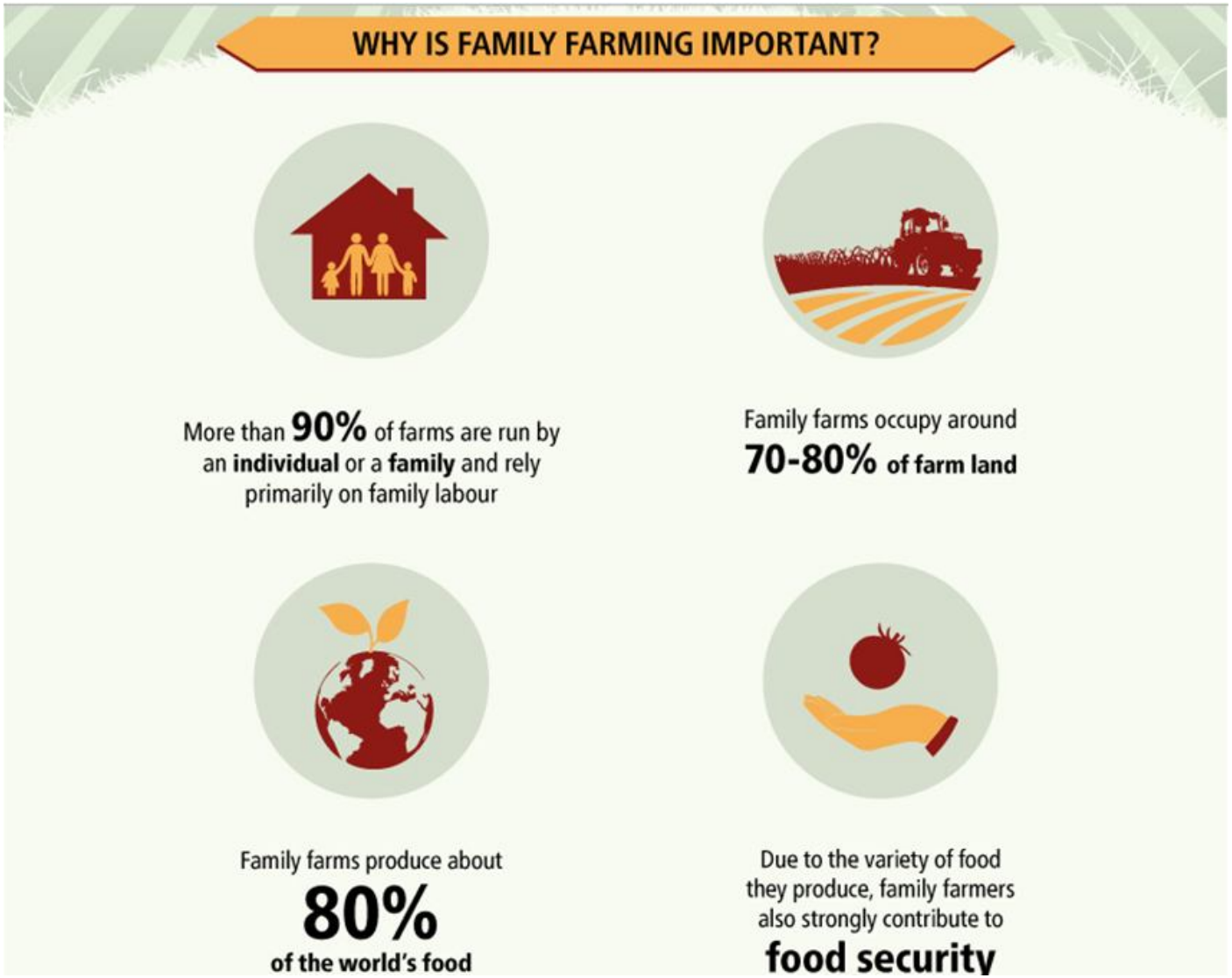
Nutritional policy dilemmas (1)

- In ***formulating food and nutrition policy for optimal health***, we need to have ***our habitat*** uppermost in mind: ***Urbanisation; Agribusiness***; ***Population displacement***
- ***Digital and robotic solutions*** of our future nutritional and health needs ***primary advice to consume foods of biodiverse origin***
- There are serious ***threats to the successful implementation of the FBDGs*** (***Food Based Dietary Guidelines)*** as a way of mitigating the risks of climate change to health through dietary biodiversification: the proliferation of ultraprocessed foods across all socio-economic gradients

Nutritional policy dilemmas (2)

- ***Foods to be eaten in the smallest amounts nutritionally necessary***
- The value of ***food waste reduction***
- Soil , agricultural water and ocean ***contamination***
- ***Packaging:*** *a microplastic crisis*
- ***Risk-benefit ratios will be increasingly difficult to ensure ,obtain and communicate***
- ***Antibiotic resistance genes*** (ARGs) as a result of antibiotic use as growth promotants
- ***Ageing : Intergenerationalism-nutritional needs and imperatives***

Family farming



Source: FAP. http://www.fao.org/resources/infographics/infographics-details/en/c/270462/

Urbanisation & Food System Alternatives

Rock N Roll McDonald's in Chicago.

Mindless Eating

–a 2 lane drive restaurant

Unmanned Meal Vending: Taipei

Wahlqvist APJCN Future Food

Floating Farms

http://www.urbangardensweb.com/

The Netherlands is reinventing urban dairy farming. By January 2017, the port city Rotterdam will be home to the world's first Floating Dairy Farm.

Urban & Home Gardens

https://en.wikipedia.org/wiki/Collingwood_Children%27s_Farm

What should nutrition science address?

- With the current multidimensional appreciation of a collaborative nutrition science, how it can enable collective strategies for ecosystem optimisation where we live, encourage agreement on livelihood provision, develop a culture in which we eat no more than we need, have a plant-based biodiverse diet, not waste food, use renewable energy, and ensure that all have access to education and health care.
- The application of ethical as well as knowledge-driven deductions for a food and nutrition future in which science and technology-at-large can play a constructive role.

NUTRITION, URBAN ENVIRONMENTS AND FUTURE EARTH

By

Godwin D. Ndossi, PhD.,

and

Keto E. Mshigeni, PhD.,

Hubert Kairuki Memorial University,

322 Kairuki Road, P.O.Box 65300, Dar es Salaam , Tanzania.

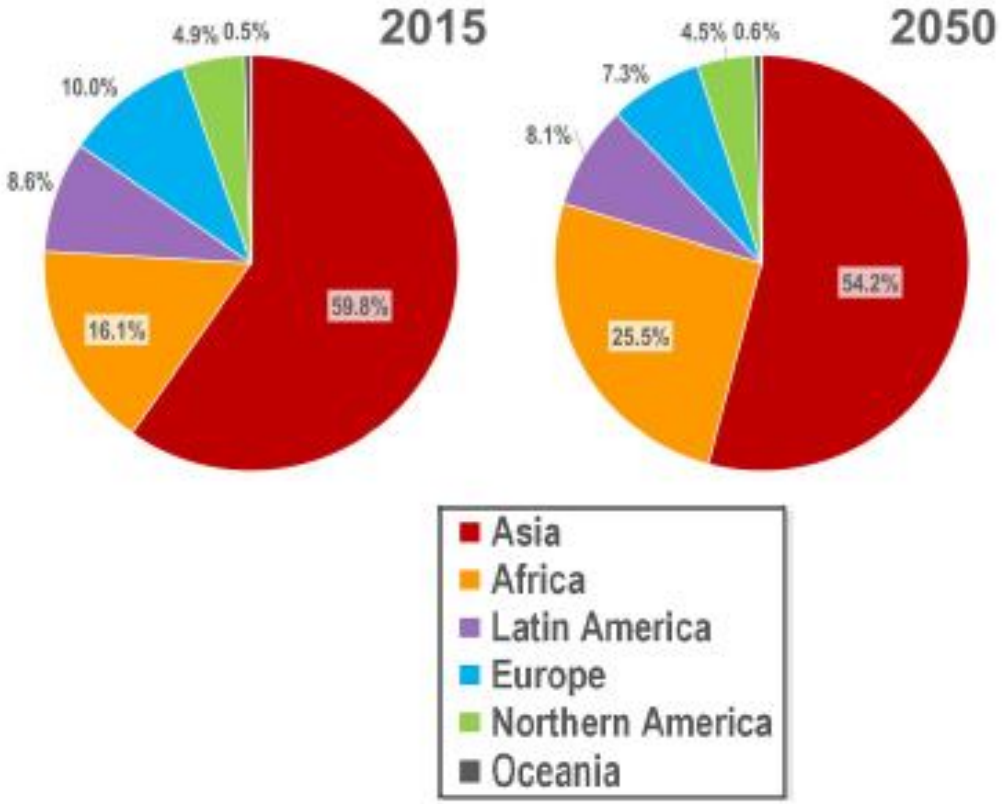
Focus...

- on the relationship between nutrition, urbanization and the earth's future environments

- It will highlight the dynamics of population change in general, provide global and regional trends, and relate these to concurrent changes in the environment and how it might affect future growth and sustainability

- Nutrition is an important determinant of health and wellbeing.

2015-2050 Population Projection by Major Region

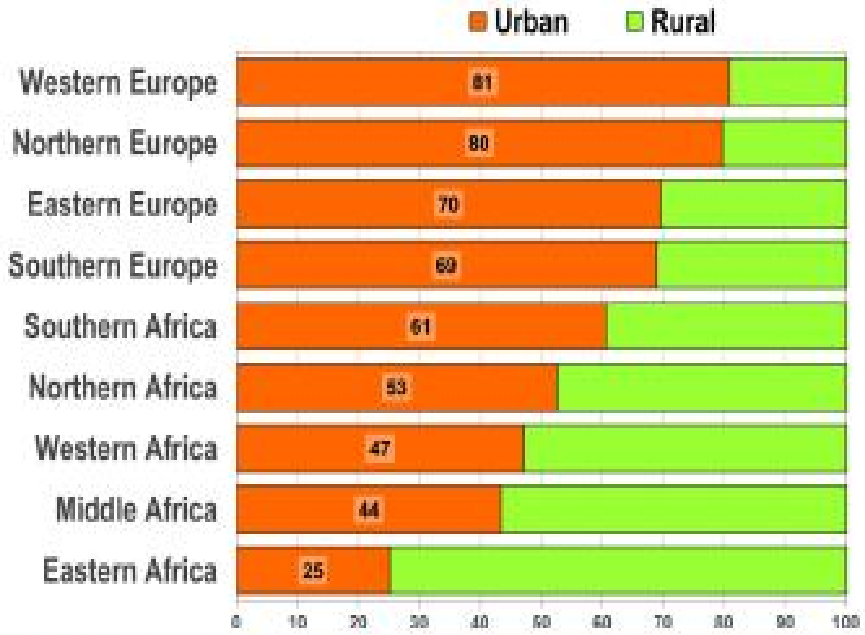


Source: International Food Policy Research Institute (IFPRI), 2016. *Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030*. Washington, DC.

Figure 1: 2015-2050 Population Projection by Major Region

Africa – Europe Urbanization, 2015 (%urban/rural)

- Globally 54 percent of the population lives in urban areas and by 2050 the global population is projected to be 34 percent rural and 66 percent urban (UN, 2015). North America, Latin America and the Caribbean and Europe are more urbanized compared to Africa and Asia, which are mostly rural. The trend is for all regions to urbanize further, thus posing sustainable development challenges.



Source: UN World Population Prospects, the 2015 Revision. PowerPoint presentation by Gerhard K. Heilig, 7 September, 2015 (www.gerhard-k-heilig.com).

Key definitions and use of terminology

- **Food security** exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

Household food security is the application of this concept to the family level, with individuals within households as the focus of concern (FAO, 2009).

- **Food insecurity** exists when people do not have adequate physical, social or economic access to food as defined above (FAO, 2009).

- **Nutrition security** exists when food security is combined with a sanitary environment, adequate health services, and proper care and feeding practices to ensure a healthy life for all household members.

This section refers to food and nutrition security throughout, because achieving nutrition security is imperative to reducing malnutrition (Shekar, 2006).

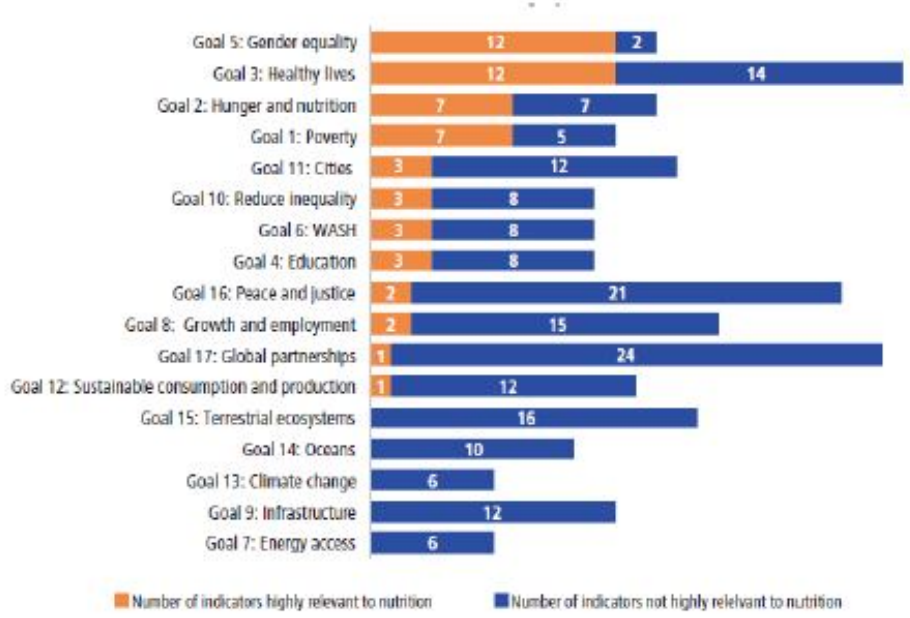
Contd.

- **Undernourishment** measures aspects of food security and exists when energy intake is below the minimum dietary energy requirement, which is the amount of energy needed for light activity and a minimum acceptable weight for attained height (FAO, 2009). Although undernourishment is based on national level data, it may be used as a proxy for food consumption in contexts where regional or household level data are unavailable or unreliable. It varies by country and from year to year, depending on the gender and age structure of the population. Sometimes the words "hunger" and "undernourishment" are used interchangeably.

- **Undernutrition** exists when insufficient food intake and repeated infections result in one or more of the following: underweight for age, short for age (stunted), thin for height (wasted), and functionally deficient in vitamins and/or minerals (micronutrient malnutrition).

- **Malnutrition** is a broad term that refers to all forms of poor nutrition. Malnutrition is caused by a complex array of factors including dietary inadequacy (deficiencies, excesses or imbalances in energy, protein and micronutrients), infections and socio-cultural factors. Malnutrition includes undernutrition as well as overnutrition (overweight and obesity) (Shekar, 2006).

SDG and food security



Source: International Food Policy Research Institute (IFPRI), 2016. *Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030.* Washington, DC.

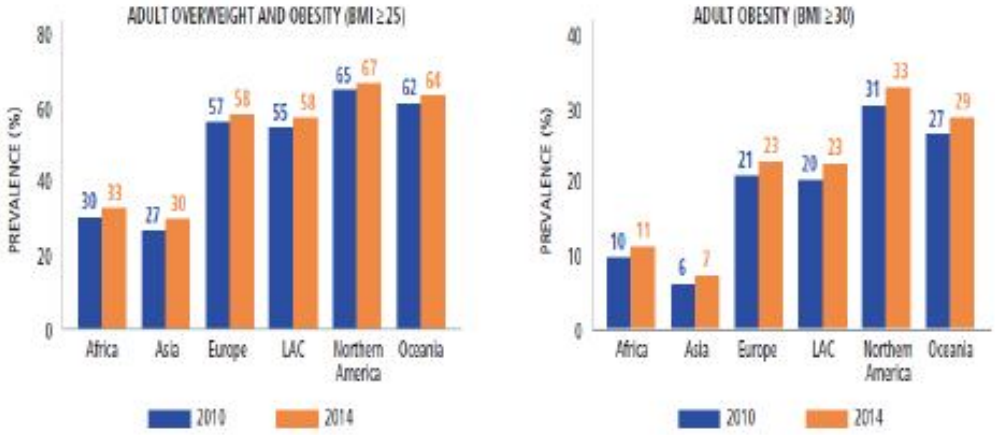
Figure 3.Number of indicators in each SDG that are highly relevant for nutrition

- At the UN Conference on Sustainable Development: Rio+20 held in 2012, the UN Secretary General proposed an ambitious goal “Zero Hunger Challenge” as one of the 17 Sustainable Development Goals.
- The vision is to eliminate global hunger by 2025. In September 2015 the UN Sustainable Development (SD) Summit set the global agenda for SD until 2030.
- It has been estimated that at least 12 of the 17 SDGs contain indicators relevant to nutrition

- Nearly all countries are off course to meet the set target for anaemia of women of reproductive age (15-49 years), adult overweight, and obesity and raised blood glucose

Source: International Food Policy Research Institute (IFPRI), 2016. *Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030.* Washington, DC.

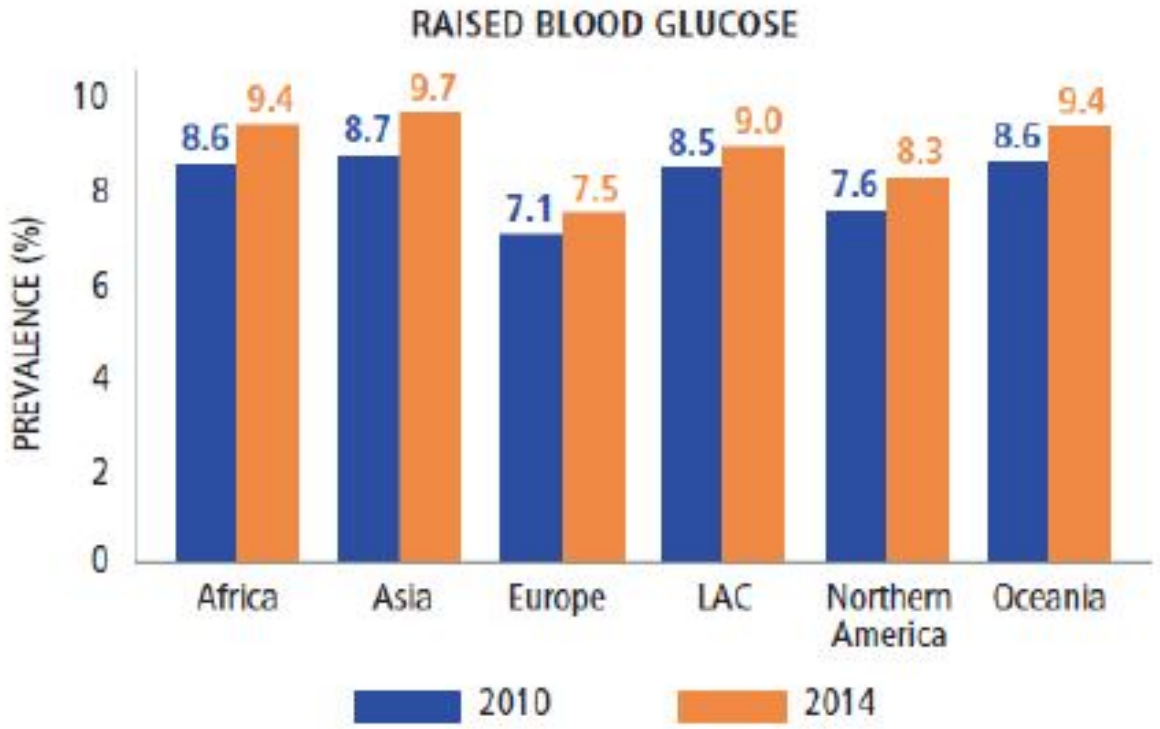
Figure 4: Number of children under 5 affected by stunting and overweight by region, 1990-2014



Source: International Food Policy Research Institute (IFPRI), 2016. *Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030.* Washington, DC.

Figure 5: Adult overweight and obesity, adult obesity by UN region, 2010 and 2014

Adult diabetes by UN region, 2010 and 2014



Source: International Food Policy Research Institute (IFPRI), 2016. *Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030*. Washington, DC.

Figure 6: Adult diabetes by UN region, 2010 and 2014

Air Pollution and Human Health Risk Reduction in Delhi Megacity

R.B. Singh[1] and Aakriti Grover[2]

[1]Department of Geography, Delhi School of Economics, University of Delhi, Delhi-110007, India. E-mail: rbsgeo@hotmail.com

[2] Department of Geography, Swami Shraddhanand College, University of Delhi, Delhi-110036, India. E-mail:

Overview

- Urbanization has caused innumerable irreversible changes on the surface of the earth.

- Apart from inculcating development, the urban areas also have modified their surroundings.

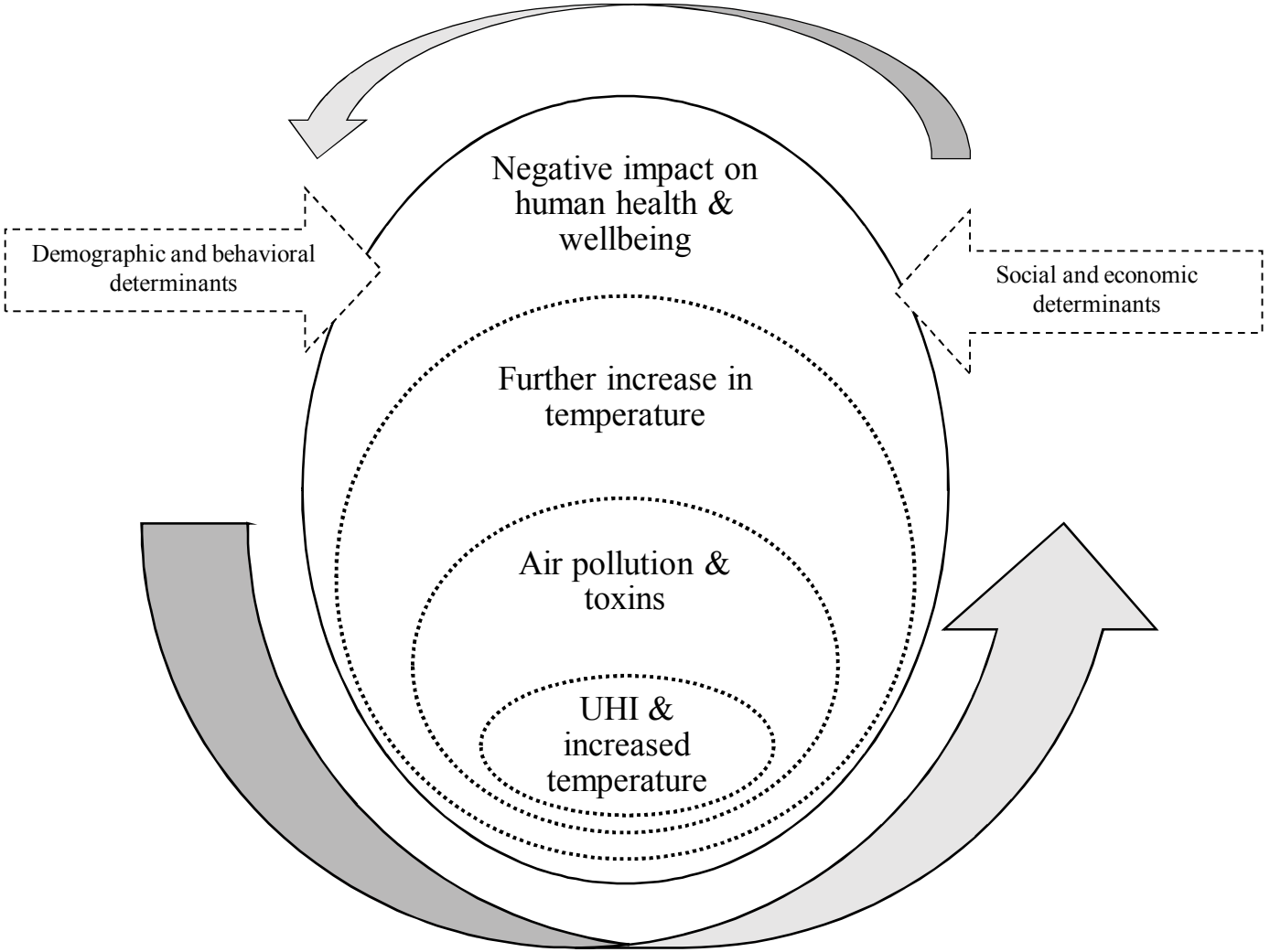
- The study has used the annual and seasonal pollution averages from 2006 to 2010.

- The results reveal that there is apparent increase in pollution levels especially for NO_2, SPM and RSPM.
- However, these pollution levels are not constant; rather, they fluctuate with the seasonal changes.
- These changes have large scale invisible impacts on the human health.

Overview

- The link between health and environment is composed of complex interactive elements that need systematic investigation in trans-disciplinary perspective.
- The chapter tries to explore the impact of air pollution on human health.
- The reports on cause of death for the same period have been analyzed. Correlation is established to understand the linkages between air pollution levels and number of deaths caused by it.
- To further understand the degree of association and relationship between air pollution and health, regression analysis under the systems approach is utilized.
- The regression analysis tool is helpful in identifying the major urban health challenges due to air pollution.

Urban health risk analysis due to UHI and poor air quality



Inter-relationship between temperature, air quality and human health

Air Pollution and Health

The United Nations Environment Programme has estimated that globally 1.1 billion people breathe unhealthy air (UNEP, 2002).

The World Health Organization (WHO) has estimated that urban air pollution is responsible for approximately 8,00,000 deaths and 4.6 million people lost their life in every year around the globe (WHO, 2002).

A new WHO air quality model confirms that 92% of the world's population breathe polluted air (27 SEPTEMBER 2016, Geneva)

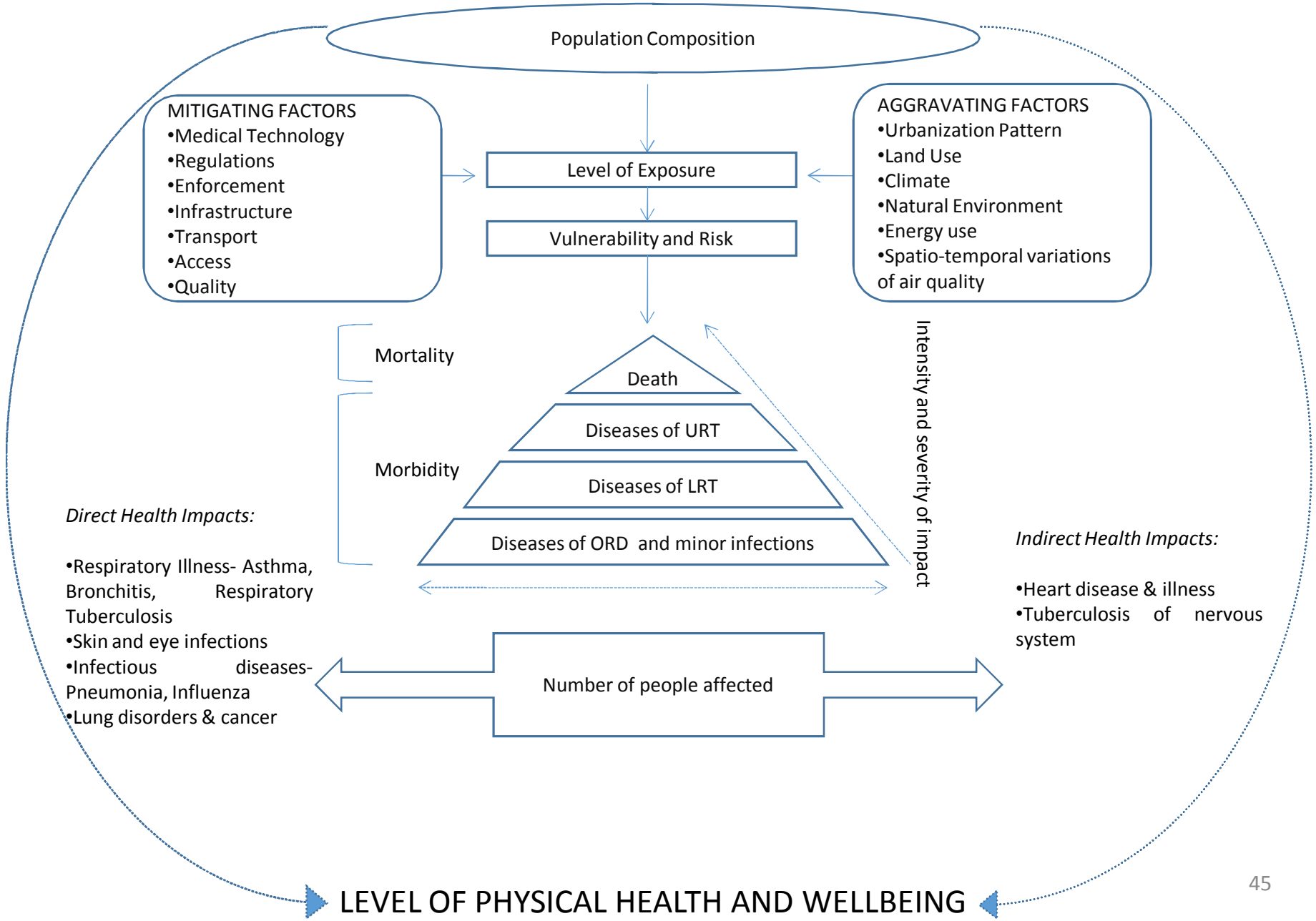
Impacts of major air pollutants (based on literature review)

Pollutant	Health Impacts
Sulphur Dioxide	Heart problem , respiratory problems including pulmonary emphysema, cancer, eye burning*, headache, damage to lungs and skin, aggravate asthma**, chest tightness, nose and throat irritation*, premature mortality*
Oxides of Nitrogen	Lung irritation, viral infection, airway resistance, chest tightness, eye irritation, diabetes[#]
SPM / $PM_{2.5}$	Pneumoconiosis, restrictive lung disease, asthma, cancer[##]
RSPM/ PM_{10}	Chronic Obstructive Airway/Pulmonary Disease (COPD), Influenza^^, dry cough, wheeze, breathlessness and chest discomfort, hypertension, lower respiratory tract illness, dry cough, wet cough, wheezing, whistling sound while breathing, pain in lungs, sinusitis, rhinitis (running or stuffy nose), sneezing, sore throat, common cold with fever,respiratory hospital admissions^, diabetes[#]

Urban areas are considered to be the world's primary sources of air pollution and hazardous waste generation. Currently the world's urban complexes, which occupy less than 5 per cent of the earth's land area, produce as much as 80 per cent of the CO_2 pollution (Ghosh and Maji, 2011).

The large metropolitan cities like Mumbai, Kolkata, Chennai and Delhi present a very depressing picture as the environment in these places becoming worse day by day (Maiti et al., 2005).

Fig. 1. System Analysis framework to conceptualize linkages between urban environment and level of physical health and wellbeing



Conceptualization of the linkages between various aspects of health and environment

- The conceptualization of the linkages between various aspects of health and environment can be well-understood under the purview of system analysis (Fig. 1).

- The level of exposure and susceptibility to health risk is dependent on individual physical and biological status.

- Further, the mitigating factors and aggravating factors assert differential impacts.

- Combinations of individual and physical environmental status determine the severity of impact that ranges from minor illness to death.

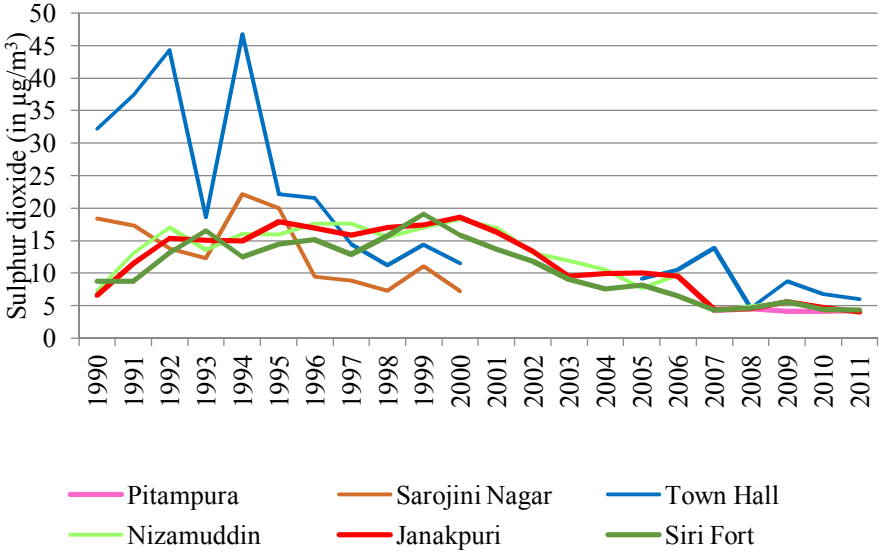
Air Quality Change in Delhi

Permissible limits and sources for selected pollutants

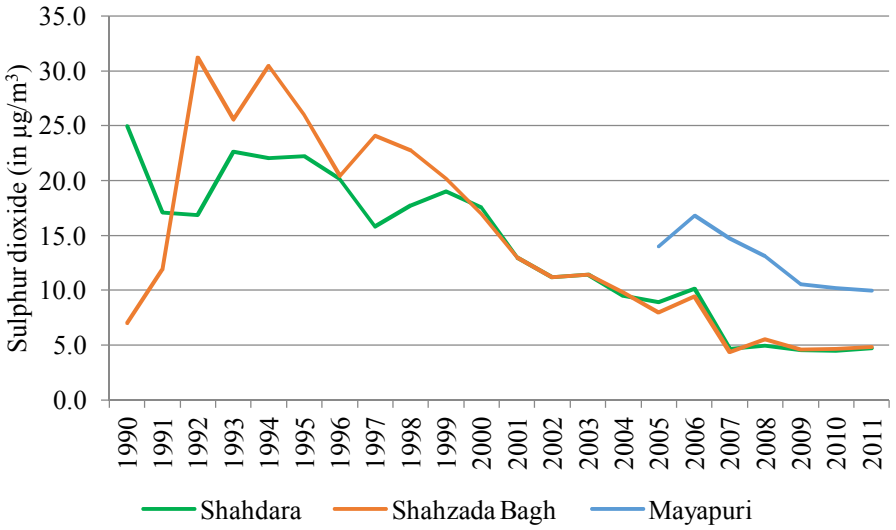
Pollutants	Annual Mean Concentration Range (micro g/m^3)	Sources*
SO_2	50	Power stations, petroleum refineries, industrial boilers
NO_2	40	Power plants, electric utility boilers, vehicle emission
RSPM/ PM_{10}	60	Industries, combustion of fossil fuels, vehicle exhaust, anthropogenic sources like agriculture, construction work, refuse burning
SPM/ $PM_{2.5}$	40	Anthropogenic sources like agriculture, construction work, refuse burning, Natural sources, windblown dust, forest fire, volcanic eruption, combustion

Sulphur dioxide: Delhi

- Main sources of SO_2 in Delhi:
  - Power sector, thermal power plants
  - Transport sector
- Permissible limit: 50 micro g/m^3
- Trend:
  - Declining trend
  - Reasons: improvement in quality of diesel fuel / stricter policy control /use of Compressed Natural Gas (CNG) /of industries from residential areas to the outskirts



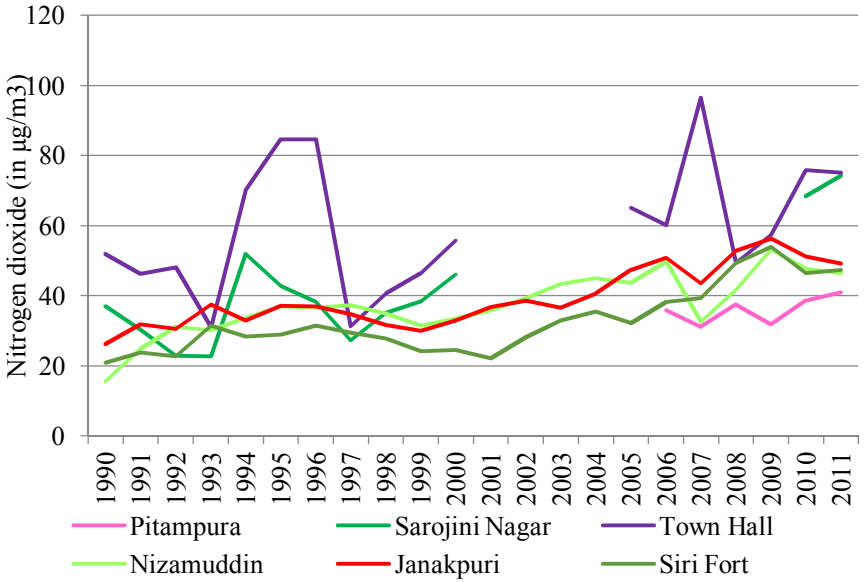
Annual trend of SO_2 in residential areas (in µg/m^3)



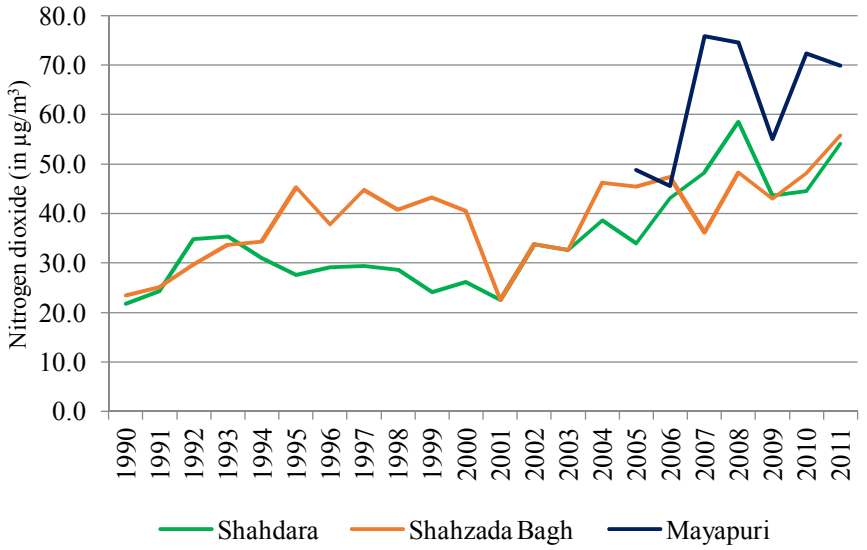
Annual trend of SO_2 in industrial areas (in µg/m^3)

Nitrogen dioxide: Delhi

- Main sources of NO_2 in Delhi:
  - Vehicular traffic
- Permissible limit: 40 micro g/m^3
- Trend:
  - Steep rise in industrial observatories (upto 75 micro g/m^3)
  - Minor increase in residential areas
  - Reasons: Increase in vehicles



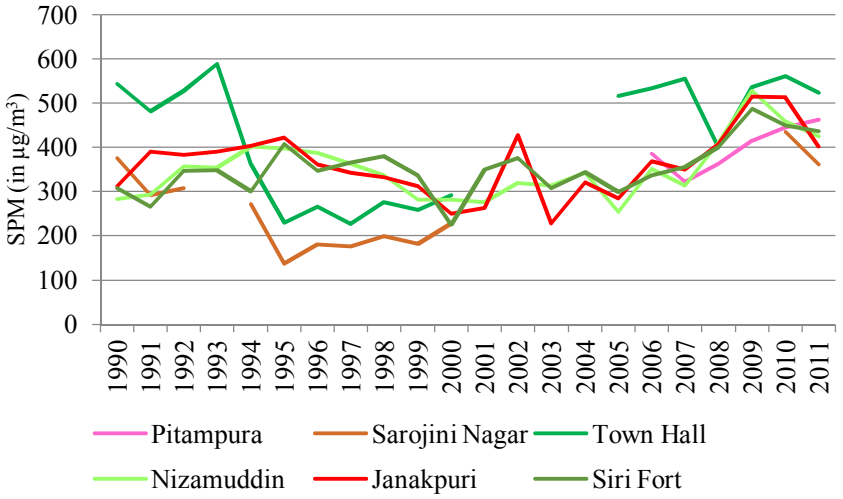
Annual trend of NO_2 in residential areas (in µg/m^3)



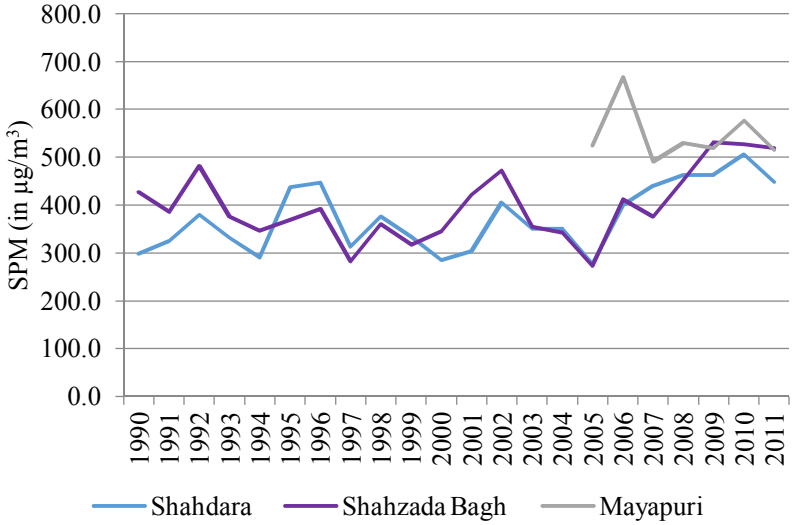
Annual trend of NO_2 in industrial areas (in µg/m^3)

Suspended Particulate Matter : Delhi

- Main sources of SPM in Delhi:
  - Incomplete fuel combustion process from industries
  - **V**ehicles
  - Road dust and metrological conditions
- Permissible limit: 40 micro g/m^3
- Trend:
  - SPM level were always much higher than the prescribed limit
  - The industrial areas observed SPM between 350-480 micro g/m^3 during 1990-2000, which was very high during 2000-2011
  - The level of SPM was recorded highest at Nizamuddin station (526) in 2009 and Mayapuri (575) in 2010



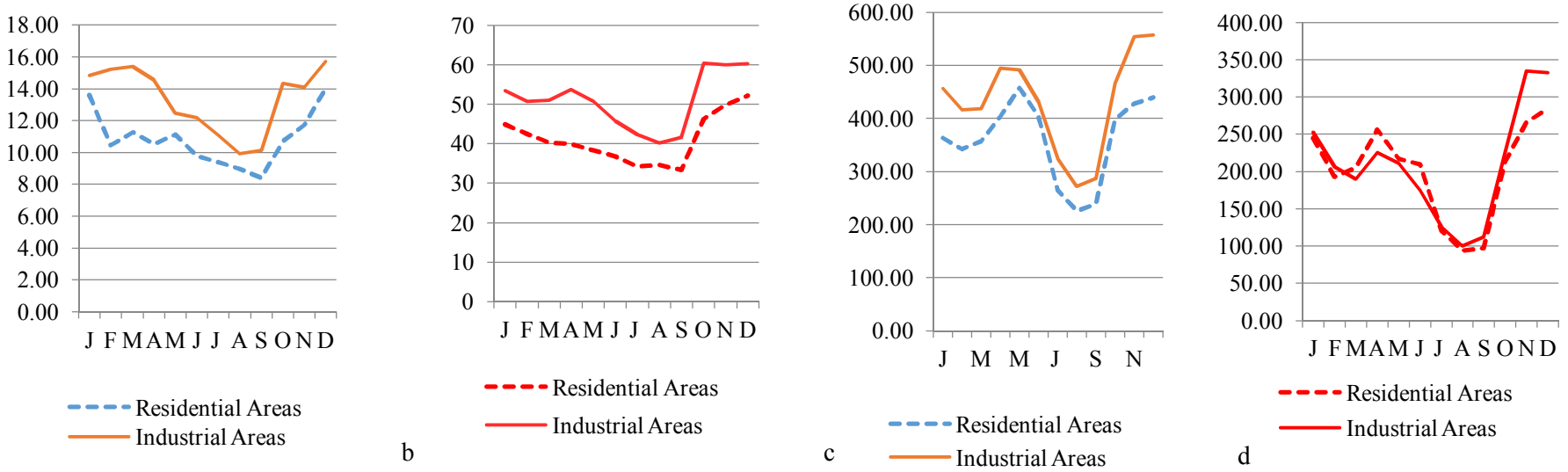
Annual trend of SPM in residential areas (in µg/m^3)



Annual trend of SPM in industrial areas (in µg/m^3)

Monthly Average of Air Pollution in Delhi

Months/ Pollutant	J	F	M	A	M	J	J	A	S	O	N	D
SO_2	Stagnant Air mass, Dry season							High humidity content				
NO_2							High humidity content					
RSPM				Dry season, pollenization			Settling of minute particles due to heavy rainfall				Stable air, less mixing	
SPM										Stable air, less mixing		



Monthly average of (a) SO_2, (b) NO_2, (c) RSPM, and (d) SPM for residential and industrial areas (1990-2011)