Glocalization of Social and Environmental Determinants of Health

Takashi Nakaoka[1], Ram B Singh[2]*, Toru Takahashi[3], Kuniaki Otsuka[1], Lekh Juneja[4], DW Wilson[5], Hyun Ho Shin[6], Moon-Kyu Lee[6], Sung-Rae Kim[6], Tracy Peressini[7], Germaine Cornelissen[8], and Franz Halberg[8]

[1]Department of Internal Medicine, Tokyo Women's Medical University, Medical Center East, Tokyo, Japan
[2]Halberg Hospital and Research Institute, Moradabad, India
[3]Graduate School of Human Environment Science, Fukuoka Women's University, Japan
[4]Taiyo Kagaku Co Ltd, Yokkaichi, Japan
[5]School of Medicine, Pharmacy and Health, Durham University, UK
[6]Korean Society of Lipidology and Atherosclerosis, Seoul, Korea.
[7]Department of Social Development Studies, Renison University College, University of Waterloo, USA
[8]Halberg Chronobiological Center, University of Minnesota Medical School, Minneapolis, USA

Abstract

There is evidence that various social markers of health can influence the levels of physical inactivity, dietary patterns, salt intake, alcohol consumption, tobacco use and stress. These behavioral risk factors may be also called primary risk factors of NCDs. Apart from these social determinants of health, high altitude, geomagnetic activity, and sleep disruption are other environmental factors which can predispose circadian variability in biological functions resulting in NCDs. The attributes of socioeconomic economic status, such as education, health education, occupation, household income, and availability of automobiles, are important indicators of lifestyle and food consumption patterns. These social markers can influence the levels of physical activity, dietary patterns, salt intake, alcohol consumption and tobacco use, which are important in the pathogenesis of non communicable diseases (NCDs).

Keywords: Society; Risk factors; Social attributes; Environmental; Chronic diseases

Introduction

The United Nations High-Level Meeting (UN HLM) on glocalization (glocal and local) of deaths and disability due to non communicable diseases (NCDs), was held in September, 2011 [1,2]. It may invoke some controversies and policies, because discussion on existing health promotion policies and social determinants of health in the developed countries, which are also followed by the developing countries, have been given only little consideration [1-3]. Majority of the experts attending the meeting agreed to include only four major NCDs; heart disease and stroke, diabetes mellitus, cancer, and chronic lung diseases as a target for prevention [1-3]. Apart from the health professionals, the world's Heads of States and Health Ministers attended the meeting, creating a unique opportunity to glocally advance the prevention and treatment of NCDs. However, behavioral risk factors of death and disability common among societies have not been given due consideration by the experts at this important meeting. This attitude may encourage the capitalist health promotion policies common in the developed countries [3] to focus more on these issues. Lack of health education and improper health policies may cause millions of deaths every year because people and populations living in poverty, have no opportunity for health education due to poor public health services [1-12].

Social Markers of Lifestyle and Health

Epidemiological studies indicate that various social markers of life and health; family income, housing, consumer durables, education and educational status (Appendix I), can influence the levels of physical inactivity, dietary patterns, salt intake, alcohol consumption, tobacco use and stress [4-10]. The lower social classes in developed countries have lower general education and have higher tobacco consumption and unhealthy dietary and lifestyle habits [4]. In developing countries, these social characteristics among higher social classes may be associated with greater consumption of dietary fats, tobacco and lower

physical activity [5-10]. These behavioral risk factors may be also called primary risk factors of NCDs [11]. Apart from these social determinants of health, high altitude, geomagnetic activity, and sleep disruption are other environmental factors which can predispose circadian variability in biological functions resulting in NCDs [13-16]. In high income countries, many experts believe that poverty is the major cause of deaths and disability due to NCDs [1-3]. However, in the hypertension cohort of the Prospective Urban Rural Epidemiology (PURE) study presented at last week's European Society of Cardiology (ESC) 2012 Congress by Dr Rafael Diaz exposed many facts about such association. The study aimed to assess the prevalence, awareness, and control of hypertension worldwide by measuring blood pressure in 153,000 individuals from 528 urban and rural communities in 17 countries from five continents. The mean age of the participants was 50.4 years, 60% were female, and 46% were from rural communities. The prevalence of hypertension was lowest in lowest-income countries (around 30%) and highest in upper-middle-income economies (around 50%), with high-income and low-middle-income economies having an intermediate level (around 40%).The study clearly shows that diet, salt, alcoholism and sedentary behavior are major determinants of hypertension rather than income. Many societies could be better health-educated despite low income and may have lower deaths and disability due to NCDs.

Recently Otsuka group [13,14] assessed, glocally (globally, to start with in India at high altitude and locally in Japan, in space but not yet

glocally in time series),1,858 Ladakhis (777 men and 1,081 women, aged from 13 to 92 years, average 51.4 years) and 25,211 Japanese (13,366 men and 11,845 women, aged from 16 to 98 years, average 48.0 years). They compared men and women in 3 groups living in Ladakh with Japanese, at different altitudes, i.e., from 2,500 to 3,000 meters (m), from 3,200 to 3,720 m, and from 3,800 to 4,590 m above sea level. Aortic stiffness was measured by finding out the cardio-ankle vascular index (CAVI) by the measurements of BP in the right and left forearms and ankles using a VaSera instrument (Fukuda Denshi, Tokyo). They reported that as compared to Japanese living at low altitude, highland people in India showed higher values of aortic stiffness of the cardio-ankle vascular index (CAVI) in both men and women (14). Differences in altitude did not statistically significantly influence BP, pulse oximetry (SpO_2), CAVI, and ECG findings in Ladakhi men. By contrast, CAVI values and BP in sitting position increased with statistical significance with increasing altitude in Ladakhi women. Incidences of first degree AV block, ST depression and abnormal Q waves in the ECG were more frequent at higher altitude in Ladakhi women. The change of SpO_2 and diastolic BP over the years were more pronounced in Ladakhi women than in Ladakhi men. Without extrapolating beyond the time and geographic site investigated, women in Ladakh, India, were found to be more sensitive to hypoxia than men who appear to be better adapted. In the BIOCOS project by Halberg et al., extended consensus on means and need to detect vascular variability disorders (VVDs) and vascular variability syndromes (VVSs) have been highlighted which are important causes of death and disability among both higher as well as lower social groups [15].

Takahashi et al., in an excellent review showed that there are 22 known amino acids, essential and nonessential, that are components of proteins, which affect a broad range of physical and mental processes [16]. The studies indicate that amino acids are cell signaling molecules as well as being regulators of gene expression and the protein phosphorylation cascade. The majorities of the neurotransmitters are composed of amino acids and can influence biological functions related to brain-body interactions. Amino acids appear to be key precursors for syntheses of hormones and low-molecular weight nitrogenous substances with each having enormous biological importance. Physiological concentrations of amino acids and their metabolites; nitric oxide, polyamines, glutathione, taurine, thyroid hormones, and serotonin are required for the biological functions in our body. These metabolites are known to be protective against cardiovascular diseases and degenerative diseases of the brain. However, increased concentrations of amino acids and their products (e.g., ammonia, homocysteine, and asymmetric dimethyl arginine) are pathogenic factors for neurological disorders, oxidative stress and cardiovascular disease. A balance between amino acids and other nutrients appears to be important for normal physiological functions without any adverse effects. Thus diet and other environmental factors appear to be important social determinants of NCDs.

Social Class and Noncommunicable Diseases

Epidemiological studies indicate that social determinants of health and economic status, such as education and health education, occupation, household income, and availability of automobiles, are important indicators of lifestyle and food consumption patterns [4-6]. These social markers can influence the levels of physical activity, dietary patterns, salt intake, alcohol consumption and tobacco use, which are important in the pathogenesis of NCDs, and misuse of any substance independently could cause mortality [3-8]. In developing countries, higher social classes have been observed to have higher risk

of cardiovascular diseases (CVDs) including coronary artery disease (CAD), hypertension and type 2 diabetes mellitus [4-7]. However, in high income countries, lower social classes 3 and 4 have greater risk factors of cardiovascular and cancer mortality, as well as all-cause mortality than higher social classes [1-3,12]. It is possible that higher social classes have greater access to health education, spare time to increase physical activity and additional resources to maintain prudent diets than lower social classes. Lower social class 5, who are living with a scarcity of foods and irregular employment and physically demanding occupations are common in developing countries but do not exist in developed countries, where they have only social classes 1-4. However, urban populations have a double burden of diseases, related to overeating as well as malnutrition because occupational physical activity decreases along with greater consumption of proatherogenic foods during transition from lower social classes 4-5 (poverty) to higher social classes 1-3 [8-11].

The definition of poverty varies in developed countries compared to lower income countries which would be apparent from the appendix 1. In higher income countries, there is increased availability of energy rich foods to poor's (social classes 3 and 4) whereas in developing countries, social class 4 and 5 are considered poor (total family income insufficient to buy enough food) and may have under nutrition and related diseases. Lower social classes (poor's) in developed countries have little knowledge about health education on prevention of NCDs, which is similar with the status of health education among higher social classes 1-3, in developing countries. Therefore, lack of health education appears to be an important risk factor for NCDs in these social groups. Conversely, risk factors of NCDs are significantly more common in the urban population of India and among higher social classes compared to lower social classes 4 and5 [2-8]. Infections and malnutrition, which are more widespread among lower social classes, may be the most common cause of death in developing countries [8-11]. In India, although the population of the state of Kerala has been poor, the infant and maternal mortality rates due to rarity of infections and malnutrition have been lowest, and the life expectancy is 'maximal' because general education and health education about vaccination, malnutrition and related diseases have been as good as in developed countries [17-19]. In Kerala, health education about prevention of NCDs does not exist, leading to sedentary behavior, smoking, alcoholism and unhealthy dietary patterns, which is causing the highest prevalence of CVDs and diabetes mellitus [5,17-22]. Risk factors and death rates due to NCDs are already much higher in lower-middle-income social groups than in developed countries [11,12,21-24]. Global nutrition dynamics and the epidemiological evolution in pattern of cardiovascular diseases in blacks, indicate that the world is shifting rapidly toward a diet linked to a rapidly approaching disaster of NCDs [25,26]. Randomly selected death records of 2,222 (1,385 men and 837 women) decedents, aged 25-64 years at the time of death, were studied by verbal autopsy questionnaires by Singh and coworkers [27]. All the risk factors were assessed by questionnaires which were completed with the help of the victim's spouse and a local treating doctor practicing in the concerned field. Social classes were assessed, based on attributes of per capita income, occupation, education, housing, and ownership of consumer luxury items in the household. Poverty was considered if the total family income was <US $300 per month. Lack of knowledge on health education about the role of exercise, prudent diet, and adverse effects of tobacco use and alcoholism was studied using the validated questionnaires. This study shows that sedentary behavior, excess salt intake, and other typical Western dietary habits were significantly more common among

decedents belonging to higher social classes 1-3, compared to those within lower social classes 4 and 5. Lack of knowledge regarding health education was significantly more common among decedents in lower social classes, who died more often due to communicable diseases. The study also revealed that deaths associated with diabetes mellitus and those due to circulatory diseases were significantly more common among higher social classes 1-3, compared to lower social classes 4 and 5. However, deaths due to malignant diseases and chronic lung diseases were not associated with social class (except the social class of women with breast cancer), but total proportion of deaths due to NCDs including these causes were significantly greater among higher social classes 1-3, compared to lower social classes 4 and 5. The findings indicate that sedentary behavior, typical Western diet, and excessive salt intake, in conjunction with underlying lack of health education, may be the predisposing factors for deaths among decedents of higher social classes 1-3. Among lower social classes 4 and 5, general lack of health education may have caused more deaths due to communicable diseases, as well as injury and accidents.

The data continue to support the previous argument that NCDs are frequent problems of middle- aged and elderly men among wealthy social groups of developing countries which need glocal efforts from all agencies and governments [27]. Subject to the implementation of a scheduled health education programme, with attendant checks and balances, universal health coverage insurance should be provided free of cost, but only to those social groups who agree to alter their diet and lifestyle in accordance with the programme, and the rest should pay towards their own medical costs for their folly, depending on rules governing such payment drawn up by individual countries. Supermarket chains supplying food and beverages should also bear some responsibility as even now, with rising global food prices, relatively rich families now appear to be buying cheaper lower-cost high risk food for NCDs more of a necessity. "Global food prices have increased by 10% in the month of July, raising fears of soaring prices for the planet's poorest, the World Bank has warned. The price of grains such as corn, wheat and soybean saw the most dramatic increases, described by the World Bank president as historic [28].

In high income countries such as United States, more than half of American adults with hypertension do not have their blood pressure under control, including many of those being treated for the condition, according to the Centers for Disease Control and Prevention. Referring to uncontrolled blood pressure as "public health enemy No.2"-second only to tobacco in the number of potentially preventable deaths associated with it annually (CDC director Thomas R. Frieden). An estimated 66.9 million American adults had hypertension, defined as an average systolic blood pressure of 140 mm Hg or higher and an average diastolic blood pressure of 90 mm Hg or higher. The condition is deemed uncontrolled in approximately 35.8 million of them. Further, while an estimated 14.1 million of these adults were not aware of their hypertension, roughly 16 million were aware and receiving treatment for it; another 5.7 million were aware, but were not being treated, according to an analysis of data from the National Health and Nutrition Examination Survey 2003-2010. The results indicate that despite high income risk continues which can be modulated by health education government policies.

Recently Smith et al., proposed that doing nothing is going to cost the world $47 trillion in the next 25 years, including $500 billion a year in low- and middle-income countries, where 80% of deaths from CVD now occur [29], In contrast, estimates by the WHO of how much it will cost to implement various measures they have recommended vary between just $11 billion and $13 billion a year.

References

1. Rosenbaum L, Lamas D (2011) Facing a "Slow-Motion Disaster"—The UN Meeting on Noncommunicable Diseases. N Engl J Med 365: 2345-2348.

2. Beaglehole R, Bonita R, Alleyne G, Richard H, Liming L, et al. (2011) UN High-Level Meeting on Non-Communicable Diseases: addressing four questions. Lancet 378: 449-455.

3. Iglehart JK (2012) Primary care update--light at the end of the tunnel?. N Engl J Med 366: 2144-2146.

4. Kesteloot H (2004) Social class, all cause and cardiovascular mortality. Acta Cardiol 59: 117.

5. Singh RB, Beegom R, Mehta AS, Niaz MA, De AK, et al. (1999) Social class, coronary risk factors and undernutrition, a double burden of diseases, in women during transition, in five Indian cities. Int J Cardiol 69: 139-147.

6. Singh RB, Sharma JP, Rasogi V, Niaz MA, Ghosh S, et al. (1997) Social class and coronary disease in rural population of north India. The Indian Social Class and Heart Survey. Eur Heart J 18: 588-595.

7. Singh RB, Ghosh S, Niaz MA, Rastogi V (1997) Validation of physical activity and socioeconomic questionnaire in relation to food intakes for the five city study and a proposed classification for Indians. J Assoc Phys India 45: 603-607.

8. Pednekar MS, Gupta R, Gupta PC (2011) Illiteracy, low educational status, and cardiovascular mortality in India. BMC Public Health 11: 567.

9. Teo K, Chow CK, Vaz M, Rangarajan S, Yusuf S, et al. (2009) The Prospective Urban Rural Epidemiology (PURE) study: examining the impact of societal influences on chronic noncommunicable diseases in low-, middle-, and high-income countries. Am Heart J 158: 1-7.

10. Singh RB, Singh V, Kulshrestha SK, Singh S, Gupta P, et al. (2005) Social class and all-cause mortality in an urban population of North India. Acta Cardiol 60: 611-617.

11. Singh RB, Fedacko J, Vargova V, Kumar A, Mohan V, et al. (2011) Singh's verbal autopsy questionnaire for the assessment of causes of death, social autopsy, tobacco autopsy and dietary autopsy, based on medical records and interview. Acta Cardiol 66: 471-481.

12. WHO (2010) Mortality and burden of disease estimate for WHO Member States in 2008. Geneva: World Health Organization.

13. Nakaoka T, Kawasaki T, Okumiya K, Norboo T, Otsuka K, et al. (2012) Chronoecological "glocal" (global and local) health-watch: Men better adapted to ambient hypoxia than women. World Heart J 4: (in press).

14. Otsuka K, Norboo T, Otsuka Y, Higuchi H, Hayajiri M, et al. (2005) Chronoecological health watch of arterial stiffness and neuro-cardio-pulmonary function in elderly community at high altitude (3524 m), compared with Japanese town. Biomed Pharmacother 59:S58-S67.

15. Takahashi T, Toda E, Singh RB, De Meester F, Wilczynska A, et al. (2011) Essential and non-essential amino acids in relation to glutamate. The Open Nutra J 4: 205-212.

16. Halberg F, Cornélissen G, Otsuka K, et al. (2009) BIOCOS project. Extended consensus on means and need to detect vascular variability disorders (VVDs) and vascular variability syndromes (VVSs). Leibniz-Online Nr.5, (http://www.leibniz-soziataet.de/journal).

17. Census of India, Govt. of India (2009) Report on Causes of Death in India 2001-2003. New Delhi: Registrar General of India, Ministry of Home Affairs.

18. Banerjee K (2011) Social development index 2010. Mohanty M, editor. India Social Development Report 2010. New Delhi: Oxford University Press 259-293.

19. Singh RB, Pella D, Mechirova V, Kartikey K, DeMeester F, et al. (2007) Prevalence of obesity, physical inactivity and undernutrition, a triple burden of diseases during transition in a developing economy. The Five City Study Group.Acta Cardiol 62: 119-127.

20. Singh RB, Fedacko J, Pella D, Macejova Z, Ghosh S, et al. (2011) Prevalence

and risk factors for prehypertension and hypertension in five Indian cities. Acta Cardiol 66: 29-37.

21. World Health Organization (2011) Global Status Report of NCD 2010. Geneva: World Health Organization.

22. Fuster V, Kelly BB (2010) Promoting cardiovascular health in developing world: a critical challenge to achieve global health. Washington: Institute of Medicine.

23. Finucane MM, Stevens GA, Cowan MJ, Danaei G, John K Lin, et al. (2011) National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9·1 million participants. Lancet 377: 557-567.

24. Danaei G, Finucane MM, Lin JK, Singh GM, Paciorek CJ, et al. (2011) National, regional, and global trends in systolic blood pressure since 1980: systematic analysis of health examination surveys and epidemiological studies with 786 country-years and 5·4 million participants. Lancet 377: 568-577.

25. Singh RB, Anjum B, Takahashi T, Martirosyan D, Pella D, et al. (2012) Poverty is the absolute cause of deaths due to noncommunicable diseases. World Heart J (in press).

26. Gillum RF (1996) The epidemiological evolution in pattern of cardiovascular diseases in blacks. N Engl J Med 335:1597-99.

27. Popkin BM (2006) Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases. Am J Clin Nutr 83: 289-298.

28. Economic shock: global food prices jump 10%. BBC report posted August 31, 2012.

29. Smith SC, Collins A, Ferrari R, Holmes DR, Logstrup S, et al. (2012) Our time: A call to save preventable death from cardiovascular disease (heart disease and stroke). J Am Coll Cardiol 60: 2343-2348.