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Risk Factors of Cardiovascular Disease and Their Related Socio-Economical, Environmental and Health Behavioral Factors: Focused on Low-Middle Income Countries- A Narrative Review Article

Li-yuan SUN, Eun-whan LEE, Aqeela ZAHRA, *Jae-hyun PARK

Dept. of Social and Preventive Medicine, Samsung Biomedical Research Institute, Sungkyunkwan University, School of Medicine, Suwon, Republic of Korea

*Corresponding Author: Email: pjaehyun@skku.edu

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Abstract

Background: In order to decrease the burden of cardiovascular disease (CVD), social determinants for CVD risk factors have been extensively studied in developed countries. However, few studies about them have been performed in low-middle-income countries. This study describes factors related to CVD risk factors in low-middle-income countries at a national level.

Methods: Data were assembled from international databases for 47 low-middle-income countries and were collected from various sources including WHO, World Bank, and previous studies. Coefficient estimates between male and female CVD risk factor prevalence and each independent variable were calculated via linear regression.

Results: Statistically significant inverse associations were observed between adult literacy rate and systolic blood pressure, blood glucose. Pump price for gasoline was negatively associated with blood glucose also. Associations for female unemployment, adult literacy rate, paved roads and urban population, alcohol and western diet were positively associated with CVD risk factors. Unemployment, urban population and alcohol were positively associated with CVD risk factors in males.

Conclusion: The effectiveness of intervention program for the prevention of cardiovascular disease in populations in developing countries should be explored, and more attention should be given to women.

Keywords: Cardiovascular disease, Health behavior, Obesity, Ecological study

Introduction

Cardiovascular disease (CVD) is becoming a leading cause of morbidity, mortality, and disability in the world. It is becoming a large global burden. Approximately one-third of all global deaths and 10% of total DALY losses were attributed to CVD (1). For the past few decades, the majority of cardiovascular disease occurred in industrialized, higher-income countries. However, the absolute burden of cardiovascular disease has been greater in developing countries. Developing countries now experience a much greater burden of cardiovascular disease than developed countries do, so will bear the greatest burden of cardiovascular disease in the future (2).

The relationship between CVD and risk factors such as high blood pressure, cholesterol, obesity, smoking, diabetes, and physical inactivity have been well known. In order to decrease the burden of disease associated with CVD, risk factors for CVD have been extensively studied in developed countries. Poorolajal estimated of NCDs risk factors in Iran (3), but to our knowledge, few studies focused on factors related to CVD risk factors in low-middle income countries. Furthermore, due to industrialization, globalization, urbanization,
and population ageing, there are also a number of underlying determinants of CVD, or "the related factors of risk factors". Therefore, more and more studies have documented social determinants such as economic situation, cultural change, health behavior, and lifestyle in high-income countries. However, previous studies rarely focused on these circumstances in low- and middle-income countries. And another problem is that, although the association between CVD and diabetes and health risk factors like diet, smoking, alcohol, physical inactivity and socioeconomic status has been studied within countries, few studies have assessed the cross-country association of CVD risk factors with national macroeconomic variables. Due to increasing urbanization and industrialization, risk factors are no more focused at individual level but are related to environmental, social and economic factors.

Therefore, our study’s aim is to identify factors related to CVD risk factors encompassing various factors, like education, health environment, health behaviors, and government policy in low-middle-income countries that have not been studied previously. We did an ecological study to identify population-level patterns and dynamics with national macroeconomic variables.

Methods

**Design and data sources**

In order to address these research aims, we used an ecological study design using data from low-middle-income countries. The prevalence of obesity, insufficient activity, systolic blood pressure, and fasting blood glucose are risk factors of cardiovascular disease, which were evaluated in relation to national indicators of the economic, education, transportation environment, health behavior, and policy. Aggregate country-level data were assembled from several databases (Table 1) including WHO (5), The World bank (6) databases, and published articles. Initially, we collected data for all low- and middle-income countries in the study, but, later, countries with missing data of any of the indicators were excluded, leaving 47 countries for analysis. At first, we choose GINI as one of the independent variables, but classification into low, middle and high income countries according to GINI was not available, so we excluded high income countries according to GNI, World bank database of 2012 (7).

**Dependent variables**

In our study, the dependent variables included obesity prevalence, insufficient activity, blood pressure, and blood glucose. Each of the dependent variables was gender-specific. Obesity variables were self-reported prevalence rates of obesity (i.e. percentage of population with BMI≥30 kg/m2) derived from national surveys. As Table 1 shows, insufficiently active individuals were defined as attaining less than 5 times 30 minutes of moderate activity per week or less than 3 times 20 minutes of vigorous activity per week, or equivalent. Blood pressure and blood glucose is the average value by an age-standardized estimate. Countries were selected based on the availability of the four dependent variables data. The latest data of obesity and insufficient activity variable from 2008 were applied, and the data of blood pressure and blood glucose from 2009 were applied.

**Independent variables**

This study covered five dimensions: economic (GDP, unemployment), education (tertiary school enrollment, adult literacy rate), transportation environment (paved roads, passenger cars, pump price for gasoline, urban population), health behavior (western diet, alcohol, smoking rate), and health governance of the government (health expenditure), and it included 12 macro-environmental indicators. A 9-year-time frame was applied (2004–2012) to search the database. We selected the most recent data during this period. The available variables of interest are described in Table 1, along with their sources.

**Statistical method**

Linear regression models were employed to examine the association between each independent variable and the risk factors of cardiovascular data, as continuous dependent variables, for male and female groups separately.

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### Table 1: Description of dependent and independent variables in the analysis with their sources

| Indicator                          | Year       | Unit               | Description                                                                 | Source         |
|-----------------------------------|------------|--------------------|-----------------------------------------------------------------------------|----------------|
| **Dependent variables**           |            |                    |                                                                             |                |
| Obesity                           | 2008       | % of population    | Percentage of defined population with a body mass index (BMI) of 30 kg/m² or higher. | WHO            |
| Insufficiently active             | 2008       | % of population    | Percent of defined population attaining less than 5 times 30 minutes of moderate activity per week, or less than 3 times 20 minutes of vigorous activity per week, or equivalent. | WHO            |
| Mean fasting Blood glucose        | 2009       | mmol/l             | Mean fasting blood glucose (mmol/l) (age-standardized estimate)              | WHO            |
| Mean systolic Blood pressure      | 2009       | mmg                | Mean systolic blood pressure (age-standardized estimate)                    | WHO            |
| **Independent variables**         |            |                    |                                                                             |                |
| Economic                          |            |                    |                                                                             |                |
| GDP                               | 2006-2012  | US$ / capita       | GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. | THE WORLD BANK |
| Unemployment                      | 2005-2011  | % of male labor force | Unemployment refers to the share of the labor force that is without work but available for and seeking employment. Definitions of labor force and unemployment differ by country. | THE WORLD BANK |
| Education                         |            |                    |                                                                             |                |
| School enrollment, tertiary       | 2005-2011  | Per 1000 population | Gross enrolment ratio. Tertiary (ISCED 5 and 6). Total is the total enrollment in tertiary education (ISCED 5 and 6), regardless of age, expressed as a percentage of the total population of the five-year age group following on from secondary school leaving. | THE WORLD BANK |
| Adult literacy rate               | 2012       | % of population    | Adult literacy rate, both sexes (% aged 15 and above)                       | THE WORLD BANK |
| Transportation environment        |            |                    |                                                                             |                |
| Paved roads                       | 2004-2010  | % of total roads   | Paved roads are those surfaced with crushed stone (macadam) and hydrocarbon binder or bituminized agents, with concrete, or with cobblestones, as a percentage of all the country's roads, measured in length. | THE WORLD BANK |
| Passenger cars                    | 2004-2010  | Per 1000 population | Passenger cars refer to road motor vehicles, other than two-wheelers, intended for the carriage of passengers and designed to seat no more than nine people (including the driver). | THE WORLD BANK |
| Pump price For gasoline           | 2006-2012  | US$ /liter         | Fuel prices refer to the pump prices of the most widely sold grade of gasoline. Prices have been converted from the local currency to U.S. dollars. | THE WORLD BANK |
| Urban population                  | 2012       | % of total population | Urban population refers to people living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects. | THE WORLD BANK |
| Health behavior                   |            |                    |                                                                             |                |
| Western diet                      | 2008       |                   | Discussed in method section                                                 | Previous article |a |
| Alcohol                           | 2008       | Total per capita consumption | Total (recorded + unrecorded) adult (15+ years) per capita consumption, projected estimates for 2008 | WHO            |
| Smoking rate                      | 2009       | % of total population | Current smoking of any tobacco product prevalence estimates, resulting from the latest adult tobacco use survey (or survey which asks tobacco use questions), which have been adjusted according to the WHO regression method for standardizing described in the Method of Estimation below. "Tobacco smoking" includes cigarettes, cigars, pipes or any other smoked tobacco products. "Current smoking" includes both daily and non-daily or occasional smoking. | WHO            |
| The government                    |            |                    |                                                                             |                |
| Health expenditure                | 2011       | % of total expenditure | General government expenditure on health as a percentage of total government expenditure | WHO            |

a: The Global Cardiovascular Risk Transition: Associations of Four Metabolic Risk Factors with National Income, Urbanization, and Western Diet in 1980 and 2008 by Goodarz Danaei.

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The GDP indicator was transformed into a categorical variable based on quartiles and entered into a linear regression with each risk factor as a continuous dependent variable. Given the exploratory nature of our study, analyses relied on an alpha-level of 0.05 to confer statistical significance. Analyses were performed using IBM SPSS Statistics 19.

### Results

**Dependent variables**

There was a wide variation in the prevalence of obesity and insufficiently active between genders (Table 2, 3).

| Country                  | GDP       | Obesity | Insufficiently active | Systolic blood pressure | Blood glucose |
|--------------------------|-----------|---------|-----------------------|-------------------------|--------------|
| Armenia                  | 3338      | 14.4    | 30.2                  | ...                     | 135.4        |
| Azerbaijan               | 7228      | 15.8    | 32.1                  | ...                     | 132.2        |
| Bangladesh               | 747       | 1.0     | 1.3                   | 2.7                     | 6.6          |
| Bolivia                  | 2576      | 10.0    | 27.1                  | ...                     | 128.6        |
| Bosnia and Herzegovina   | 4447      | 22.7    | 25.3                  | 30.3                    | 37.0         |
| Brazil                   | 11340     | 16.5    | 22.1                  | 47.2                    | 51.6         |
| Bulgaria                 | 6986      | 22.0    | 20.4                  | 24.7                    | 28.8         |
| Burkina Faso             | 634       | 1.7     | 3.0                   | 14.6                    | 16.3         |
| Cambodia                 | 946       | 1.6     | 2.8                   | 11.4                    | 11.1         |
| Cameroon                 | 1151      | 7.0     | 15.1                  | 33.0                    | 48.3         |
| Chile                    | 15363     | 24.5    | 33.6                  | ...                     | ...          |
| Costa Rica               | 9391      | 20.9    | 28.3                  | ...                     | 129.5        |
| Croatia                  | 13227     | 22.8    | 19.4                  | 26.2                    | 21.0         |
| Egypt, Arab Rep.         | 3187      | 22.5    | 46.3                  | ...                     | 126.1        |
| Ethiopia                 | 470       | 0.9     | 1.6                   | 16.5                    | 22.1         |
| Georgia                  | 3508      | 15.9    | 25.7                  | 21.1                    | 23.5         |
| Ghana                    | 1605      | 4.4     | 11.7                  | 14.9                    | 20.8         |
| Guatemala                | 3368      | 13.8    | 26.7                  | 15.3                    | 17.0         |
| India                    | 1489      | 1.3     | 2.5                   | 12.7                    | 18.4         |
| Indonesia                | 3557      | 2.5     | 6.9                   | 31.5                    | 28.1         |
| Iran, Islamic Rep.       | 6816      | 13.6    | 29.5                  | 27.1                    | 47.0         |
| Jordan                   | 4945      | 27.3    | 41.7                  | ...                     | ...          |
| Kazakhstan               | 12007     | 20.2    | 27.4                  | 32.0                    | 31.0         |
| Lao PDR                  | 1399      | 1.7     | 4.1                   | 16.7                    | 21.0         |
| Latvia                   | 14009     | 21.5    | 21.8                  | 28.1                    | 35.9         |
| Lithuania                | 14150     | 23.9    | 24.7                  | 20.3                    | 24.9         |
| Malaysia                 | 10381     | 10.4    | 17.9                  | 57.3                    | 65.6         |
| Mauritius                | 8124      | 12.9    | 23.0                  | 38.2                    | 39.1         |
| Mexico                   | 9742      | 26.7    | 38.4                  | 37.1                    | 38.4         |
| Moldova                  | 2038      | 10.0    | 28.8                  | ...                     | ...          |
| Morocco                  | 2925      | 11.1    | 23.1                  | ...                     | ...          |
| Namibia                  | 5668      | 4.3     | 16.8                  | 51.9                    | 65.1         |
| Nepal                    | 707       | 1.4     | 1.6                   | 13.9                    | 17.0         |
| Pakistan                 | 1290      | 3.5     | 8.4                   | 32.7                    | 48.1         |
| Panama                   | 9534      | 19.4    | 32.1                  | ...                     | 130.1        |
| Paraguay                 | 3813      | 16.2    | 22.3                  | 40.7                    | 42.0         |
| Peru                     | 6573      | 11.1    | 21.7                  | ...                     | 125.7        |
| Romania                  | 7943      | 16.3    | 19.0                  | 31.2                    | 46.2         |
| Saudi Arabia             | 20778     | 29.5    | 43.5                  | 61.5                    | 76.2         |
| Senegal                  | 1032      | 3.2     | 12.5                  | 20.4                    | 25.8         |
| Serbia                   | 5190      | 25.5    | 20.3                  | 63.2                    | 73.3         |
| Tanzania                 | 609       | 4.0     | 6.8                   | ...                     | ...          |
| Turkey                   | 10666     | 22.8    | 35.6                  | 49.5                    | 62.5         |
| Ukraine                  | 3867      | 15.5    | 23.6                  | 20.4                    | 16.3         |
| Uruguay                  | 14449     | 20.7    | 26.0                  | 28.0                    | 40.2         |
| Vietnam                  | 1596      | 1.2     | 2.0                   | 14.6                    | 15.9         |
| Yemen, Rep.              | 1494      | 10.5    | 22.7                  | ...                     | ...          |

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Obesity prevalence ranged from 0.9 to 29.5% among males, from 1.3 to 46.3% among females and a median value of 13.3% for males and 20.8% for females. Insufficiently active ranged from 2.7 to 63.2% among males, from 6.6 to 76.2% among females and a median value of 29.0% for males and 34.8% for females. Through the result, we observed more prevalence of obesity and insufficiently active in females than male. But in the blood glucose and blood pressure, we did not observe obvious differences between male and female.

**Macro-environmental correlates**

The sample size and distribution of the independent variables of interest are provided in Table 3. Gender specific linear regression coefficients (b) along with the p-values are presented in Table 4. Statistically significant inverse associations were observed between adult literacy rate and systolic blood pressure, blood glucose. Pump price for gasoline was negatively associated with blood glucose also. Associations for female unemployment, paved roads and urban population, alcohol and Western diet were positively associated with CVD risk factors. Only three statistically significant findings for male CVD risk factors were associated with available unemployment, urban population (approximate value, p=0.052) and alcohol. The magnitude of the coefficient estimates suggests stronger associations for female CVD risk factors than for male CVD risk factors in all cases. Independent variables not significantly associated with CVD in any of the five groups included GDP, students in tertiary education, passenger cars, smoking, and health expenditure.

**Discussion**

We examined four risk factors of CVD data and found that, risk factors of CVD are influenced by socioeconomic factors, environment, and lifestyle. But we did not find any relationship for the four risk factors (obesity, insufficient activity, systolic blood pressure, and fasting plasma glucose) with GDP, although a study stated that GDP and obesity have a negative association in high-income European countries(8). We usually consider that higher income implies that there is more money to spend on health. Through study of previous articles, various different results were found. Goodarz studied country-level CVD risk factor estimates for 199 countries and he found that associations between national income and BMI, systolic blood pressure, total cholesterol, and their outcomes for gender changed with time(9). The study indicated that a country’s high or low GDP level does not indicate that there must be health behavior change and health improvement endeavors. It can be assumed that national income has a rather indirect relationship with health behavior or health improvement endeavors, not a direct relationship.

In our study, unemployment was positively associated with systolic blood pressure among men, and it showed a significant positive association with obesity, insufficient activity, and systolic blood pressure among females. Previous studies in high-income countries showed there is an association between unemployment and health-related diseases. They found that health-related consequences of unemployment can be mitigated by social support (10,11). However, in low-middle-income countries, there is scarcity of social security systems that compensate for the impact of unemployment on health. There may be several reasons for unemployment that led to higher-risk factors of CVD, especially in women more than in men. Women are often needed for housekeeping, child rearing, and so on. Due to longer stays at home, females lack outdoor activities and have easy access to food that causes obesity (12). Moreover, unemployed women suffer more mental stress than men, which can lead to hypertension (13).

We found that a lower adult literacy rate has higher risk factors of BP and blood glucose among women. Education provides knowledge and life skills that allow people to gain ready access to information and health promotion resources. A study has demonstrated a consistent association between educational level and CVD risk factors (14).
Table 3: Summary statistics (median, minimum, and maximum) for independent variables by domain across 47 low-middle countries

| Indicator | Number of countries | Unit | Median | Minimum | Maximum |
|-----------|---------------------|------|--------|---------|---------|
| **Dependent variables** | | | | | |
| Obesity male | 47 | % of population | 13.3 | 0.9 | 29.5 |
| Obesity female | 47 | % of population | 20.8 | 1.3 | 46.3 |
| Insufficiently active male | 34 | % of population | 29.0 | 2.7 | 63.2 |
| Insufficiently active female | 34 | % of population | 34.8 | 6.6 | 76.2 |
| Mean fasting blood glucose male | 47 | mmol/l | 5.5 | 4.7 | 6.7 |
| Mean fasting blood glucose female | 47 | mmol/l | 5.5 | 4.7 | 6.6 |
| Mean systolic blood pressure male | 47 | mmHg | 130.7 | 123.4 | 137.5 |
| Mean systolic blood pressure female | 47 | mmHg | 126.7 | 117.8 | 133.5 |
| **Independent variables** | | | | | |
| **Economic** | | | | | |
| GDP | 47 | US$ / capita | 5878.8 | 470.2 | 20777.7 |
| Unemployment male | 47 | % of male labor force | 8.1 | 0.3 | 32.5 |
| Unemployment female | 47 | % of male labor force | 10.8 | 0.1 | 43.0 |
| **Education** | | | | | |
| School enrollment, tertiary | 47 | per 1000 population | 33.1 | 3.9 | 81.7 |
| Adult literacy rate | 47 | % of population | | | |
| **Transportation environment** | | | | | |
| Paved roads | 47 | % of total roads | 48.2 | 4.2 | 100.0 |
| Passenger cars | 47 | per 1000 population | 108.0 | 1.0 | 514.7 |
| Pump price for gasoline | 47 | US$ / liter | 1.3 | 0.2 | 2.54 |
| Urban population | 47 | % of total population | 54.9 | 17.3 | 92.6 |
| **Health Behavior** | | | | | |
| Western diet | 47 | | 0.5 | 0.04 | 0.9 |
| Alcohol | 47 | Total per capita consumption | 7.0 | 0.05 | 23.01 |
| Smoking male | 46 | | 35.7 | 8.0 | 61.0 |
| Smoking female | 43 | | 11.1 | 1.0 | 36.0 |
| **Health governance of the government** | | | | | |
| Health expenditure | 47 | % of total government expenditure | 10.9 | 3.6 | 28.0 |

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Table 4: Beta coefficients of linear regression analysis for male, female CVD risk factor prevalence and each independent variable across 47 low-middle-income countries

| Indicator                          | Obesity Female | Obesity Male | Insufficient activity Female | Insufficient activity Male | Systolic blood pressure Female | Systolic blood pressure Male | Blood glucose Female | Blood glucose Male |
|------------------------------------|----------------|-------------|------------------------------|---------------------------|------------------------------|------------------------------|---------------------|-------------------|
| **Economic**                       |                |             |                              |                           |                              |                              |                     |                   |
| GDP                                | -2.210         | -1.832      | -4.122                       | -4.579                    | -0.401                       | -1.235                       | -0.023              | 0.036             |
| Unemployment male                  | 0.113          | —           | 0.500                        | —                         | 0.191                        | —                            | 0.001               | —                 |
| Unemployment female                | —              | 0.309**     | 0.861*                       | —                         | —                            | 0.142*                       | —                   | 0.006             |
| **Education**                      |                |             |                              |                           |                              |                              |                     |                   |
| School enrollment, tertiary        | -0.008         | -0.020      | -0.055                       | -0.070                    | 0.016                        | 0.008                        | -0.007              | -0.006            |
| Adult literacy rate                | -0.022         | -0.080      | 0.183                        | -0.210                    | -0.044                       | -0.119*                       | -0.004              | -0.011*           |
| **Transportation environment**     |                |             |                              |                           |                              |                              |                     |                   |
| Paved roads                        | 0.037          | 0.074**     | 0.007                        | -0.028                    | 0.005                        | 0.046**                       | 0.002               | 0.003             |
| Passenger cars                     | 0.000          | -0.028      | -0.028                       | -0.043                    | 0.001                        | 0.000                        | 2.792               | 0.000             |
| Pump price for gasoline            | -1.399         | -2.490      | 4.630                        | 5.451                     | -0.159                       | -0.262                       | -0.091              | -0.242*           |
| Urban population                   | 0.144*         | 0.375**     | 0.216                        | 0.561*                    | -0.007                       | -0.025                       | 0.009*              | 0.010**           |
| **Health behavior**                |                |             |                              |                           |                              |                              |                     |                   |
| Western diet                       | 12.220         | 13.740      | 22.435                       | 21.740                    | 3.938                        | -1.675                       | 0.696               | 0.832*            |
| Alcohol                            | -0.223         | 0.135       | -1.038                       | -1.180                    | 0.352**                      | 0.510**                      | -0.011              | -0.007            |
| Smoking male                       | -0.010         | —           | -0.396                       | —                         | -0.052                       | —                            | -0.002              | —                 |
| Smoking female                     | —              | -0.180      | 0.236                        | —                         | 0.030                        | —                            | —                   | -0.005            |
| Health governance of the government|                |             |                              |                           |                              |                              |                     |                   |
| Health expenditure                 | 0.372          | 0.331       | -1.420                       | -1.720                    | -0.116                       | -0.226                       | 0.005               | 0.013             |

*P < 0.01, **P < 0.05

Nowadays, the developing world still has low education levels and greater gender disparities. The proportion of women with no schooling is consistently higher than that of men (15). For the above reasons, it can be assumed that the adult literacy rate of is a problem related with the risk of CVD in women than in men. Strategies for the prevention of cardiovascular diseases should first let people receive education on health and women need more attention in this regard.

The rate of paved roads had a positive association with obesity and systolic blood pressure, the price of gasoline had a negative association with blood glucose, and these two indicators were significant among women only. There is growing evidence that the land-use characteristics and transportation patterns affect the levels of physical activity (3) and in this way, they are related to the prevalence of CVD. In the United States, as Frank reported, obesity is associated positively with time spent in cars and negatively with mixed land-use and with walking (16). Our study showed that this effect also exists in low- and middle-income countries.
Women are more vulnerable to the transformation environment than men are. It is probably because of the difference of daily life patterns or of occupational needs and more physical activity among males than among females (3), especially housewives. In our study, among men, the urban population was positively associated with obesity and high blood glucose. Among women, urban population was associated with obesity, low physical activity and high blood glucose. A study reported results similar to our results (17). Mendez reported that, in developing countries, urbanization is associated with profound changes in diet and in exercise that in turn increase the prevalence of obesity (18). Several studies also showed that individuals living in an urban environment have increased cardiovascular risk factors such as, having hypertension, being overweight, and suffering diabetes than did people living in rural areas (19,20). Therefore, in urban areas in low-middle-income countries, more attention should be paid to socioeconomic status and changing lifestyles.

We found that western diet positively associated with blood glucose. As is well known, western diet is unhealthy diet, it is associated with increased diabetes risk and cardiovascular disease (21). With globalization and economic development, increasing urbanization accompanies higher incomes, exposure to mass media, marketing campaigns, and less leisure time which bring out rapid shifts in lifestyle habits and dietary structure of with high intake of processed meats, red meats, and high-fat dairy products in developing-country populations (22). Therefore, we now should pay more attention to the diet pattern and related media campaigns in low- and middle-income countries as well.

Our study also found that alcohol is positively associated with systolic blood pressure. Epidemiological and experimental investigations have established a close association between alcohol consumption and hypertension (23). There is heavy drinking in some localities and groups in the population of many developing countries, and steady rise in alcohol consumption was recorded (24). In order to decrease alcohol consumption in low-middle-income countries, limitative policy on purchase of alcohol beverages may be needed.

In the health expenditure aspect, no significant relation was found. Research in OECD countries also suggests that there is a weak positive relationship between public spending on health care and premature mortality (25). This research indicated health status attainments are multidimensional concepts that cannot be directly measured by a single set of indicators. Socioeconomic and environmental variables have more influence on health behaviors than government expenditure on health.

In our study, many CVD risk factors are associated with economic factors, education, transportation environment, and health behaviors (such as western diet, alcohol, and smoking) in women more than in men. This means that women are more influenced by these factors than men in low- and middle-income countries. Many prior studies in high-income countries showed that socioeconomic status and CVD risk accumulation were stronger in women than in men (26, 27). The studies in low-middle-income countries also reported that CVD risk factors have been consistently more strongly associated with socioeconomic status among women than in men (3, 28). Except for socioeconomic status, the reasons for these gender-based differences in CVD risk are unclear although pathophysiological factors, or treatment differences, may play a role (29).

Our conclusions are limited to country-level associations, ignoring variations within a country and individual-level associations. National, objectively measured data of macro-environmental variables in low-middle income countries are largely unavailable, due to which our sample size is small and only has 47 countries. Secondly, we had applied the WHO database from 2008-2009, which is not very new. However, the data from World Bank is relatively recent (until 2011, 2012). The small sample size may cause low reliability and low statistical power. Even though, we emphasize societal rather than individual strategies, and our study focused...
on low-middle-income countries, we obtained very useful results that are now required and could be a guideline for future research. We suggest that the effectiveness of intervention program for the prevention of cardiovascular disease in populations in developing countries should be explored. More attention should be given, and health promotion activities should be initiated in low-middle-income countries, especially for women.

Conclusion

The effectiveness of intervention program for the prevention of cardiovascular disease in populations in developing countries should be explored, and more attention should be given to women.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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References

1. World Health Organization. (WHO 2011a). Global status report on non-communicable diseases 2010. Geneva: WorldHealth Organization.
2. GazianoTA, BitonA, AnandS, Abrahams-GesselS, MurphyA. (2010). Growing Epidemic of Coronary Heart Disease in Low- and Middle-Income Countries. Current Problems in Cardiology, 35(2), 72-115.
3. Poorolajal J, Zamani R, Mir-Moeini RS, Amiri B, Majzooobi MM, Erfani H, et al. Five-year evaluation of chronic diseases in Hamadan, Iran. Iran J Public Health, 2012;41(3):71-81.
4. Cesare MD, Khang YH, Asaria P, Blakely T, Cowan MJ, Farzadfar F, et al. (2013). Inequalities in non-communicable diseases and effective responses. Lancet, 381:585–597.
5. WHO. Data. Global Health Observatory Data Repository. http://apps.who.int/gho/data/node.main.45?lang=en.
6. THE WORLD BANK. Data. Available from: http://data.worldbank.org/indicator.
7. WHO. Data. How we Classify Countries. http://data.worldbank.org/about/country-classifications.
8. Rabin BA, Boehmer TK, Brownson RC (2006). Cross-national comparison of environmental and policy correlates of obesity in Europe. Eur J Public Health, 17:53–61.
9. Danaei G, Singh GM, Paciorek CJ, Lin JK, Cowan MJ, Finucane MM, et al. (2013). The Global Cardiovascular Risk Transition Associations of Four Metabolic Risk Factors with National Income, Urbanization, and Western Diet in 1980 and 2008. Circulation, 127:1493-1502.
10. Bjarnason T, Sigurdardottir TJ (2003). Psychological distress during unemployment and beyond: social support and material deprivation among youth in six northern European countries. Soc Sci Med, 56:973–985.
11. Cooper D, McCausland WD, Theodossiou I (2006). The health hazards of unemployment and poor education: The socioeconomic determinants of health duration in the European Union. Eur J Public Health, 7985.
12. James PT, Leach R, Kalamara E, Shayeghi M (2001). The worldwide obesity epidemic. Obes Res, 9(Suppl.4):228S–233S.
13. Roudi-Fahimi F, Moghadam VM (2003). Empowering Women, Developing Society: Female Education in the Middle East and North Africa, PRB MENA Policy Brief. Available at: http://www.prb.org/pdf/EmpoweringWomeninMENA.
14. Stelmach W, Kaczmarczyk-Chalas K, Bielecki W, Stelmach I, Drygas W (2004). How income and education contribute to risk factors for cardiovascular disease in the elderly in a former communist country. Public Health, 118:439-449.
15. Report on the Gender Initiative (2011). Gender Equality in Education, Employment and Entrepreneurship. Meeting of the OECD Council at Ministerial Level Paris.25-26.
Frank LD, Andersen MA, Schmid TL (2004). Obesity relationships with community design, physical activity, and time spent in cars. *Am J Prev Med*, 27(2): 87–89.

Allender S, Lacey B, Webster P, Rayner M, Deepa M, Scarborough P, et al. (2010). Level of urbanization and non-communicable disease risk factors in Tamil Nadu, India. *Bull World Health Organ*, 88:297–304.

Mendez MA, Monteiro CA, Popkin BM (2005). Overweight exceeds underweight among women in most developing countries. *Am J Clin Nutr*, 81:714–721.

Arambepola C, Allender S, Ekanayake R, Fernando D (2008). Urban living and obesity: is it independent of its population and lifestyle characteristics? *Trnp Med Int Health*, 13:448–457.

Niakara A, Fournet F, Gary J, Harang M, Nebie LV, Salem G (2007). Hypertension, urbanization, social and spatial disparities: A cross-sectional population-based survey in a West African urban environment (Ouagadougou, Burkina Faso). *T Roy Soc Trnp Med H*, 101(11), 1136–1142.

Malik VS, Popkin BM, Bray GA, Despres JP, Willett WC, Hu FB (2010). Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes: a meta-analysis. *Diabetes Care*, 33:2477–2483.

Popkin BM (2006). Global nutrition dynamics: the world is shifting rapidly toward a diet linked with non-communicable diseases. *Am J Clin Nutr*, 84:289–298.

Briasoulis A, Agarwal V, Messerli FH (2012). Alcohol Consumption and the Risk of Hypertension in Men and Women: A Systematic Review and Meta-Analysis. *J Clin Hypertens*, 14:792–798.

Rehm J, Chisholm D, Room R, Lopez A. Alcohol. In: Jamison DT, Breman JG, Measham AR, et al, editors. *Disease Control Priorities in Developing Countries*. 2nd edition. Washington (DC): World Bank; 2006. Chapter 47. Available from: http://www.ncbi.nlm.nih.gov/books/NBK11720/

Oz Z (2000). Determinants of health outcomes in industrialized countries: a pooled, cross-country,time-series analysis. *OECD Economic Studies*, 30: Paris.

Strand B, Tverdal A (2006). Trends in educational inequalities in cardiovascular risk factors: A longitudinal study among 48,000 middle-aged Norwegian men and women. *Eur J Epidemiol*, 21:731–739.

Lyratzopoulos G, Heller RF, Meelduff P, Hanily M, Levy P (2006). Deprivation and trends in blood pressure, cholesterol, body mass index and smoking among participants of a UK primary care-based cardiovascular risk factor screening programme: both narrowing and widening in cardiovascular risk factor inequalities. *Heart*, 92:1198-1206.

Mahfouz AA, Shatoor AS, Hassanein MA, Mohamed A, Farheen A (2012). Gender differences in cardiovascular risk factors among adolescents in Aseer Region, southwestern Saudi Arabia. *Saudi Heart Assoc*, 24:61–67.

Balagopal P, Ferranti SD, Cook S, Daniels SR, Gidding SS, Hayman LL, et al. (2011). Non-traditional Risk Factors and Biomarkers for Cardiovascular Disease: Mechanistic, Research, and Clinical Considerations for Youth: A Scientific Statement from the American Heart Association.*Circulation*, 123:2749-2769.
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