Abbasi-Ghahramanloo A, et al, ***J Anal Res Clin Med,*** 2014, 2(4), 171-6.
doi: 10.5681/jarcm.2014.028, *http://journals.tbzmed.ac.ir/JARCM*

Original Article

Association between demographic and health indicators among 174 countries, 2004-2011

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Article info

Article History:
Received: 05 May. 2014
Accepted: 06 Sep. 2014
ePublished: 30 Nov. 2014

Keywords:
Human Resources,
Health Indicators,
Demographic Indicators,
Panel Study

Abstract

Introduction: Human resources are one of the most important factors in developing of countries and have a considerable role in the developing status of countries. Hence, our aim in this study was to assess the relationship between health indicators and population indexes (population growth and composition).

Methods: The present study was conducted using panel data from 176 countries during 8 years from 2004 to 2011. Data were obtained from World Health Organization (WHO) and World Bank and analyzed with generalized linear square regression models using Stata version 10.

Results: Our findings showed a significant association between health indicators (life expectancy at birth and infant mortality rate) and population indexes (sex ratio, residential status, and dependent population). Life expectancy was decreased by 0.35 with one unit increase in the dependent population. Furthermore, there was inequality in life expectancy among rural an urban subjects and was higher among urban subjects.

Conclusion: There is a significant association between health indicators with age, sex, and residential status of the population. Planning and need assessment for population structure should be done by managers and policy makers.

Citation: Abbasi-Ghahramanloo A, Safiri S, Faramarzi A, Kabir MJ, Chahkoie M. **Association between demographic and health indicators among 174 countries, 2004-2011.** J Anal Res Clin Med 2014; 2(4): 171-6.

Introduction

Human resources are one of the most important factors in the development of any society. In the case of role and importance of human resource for comprehensive development, researchers believe that among physical, human and technological capacity in the course of the West developments, proper use of human capacity had the most role. According to Harbison theory, human resource constitutes the main foundation of the wealth of nations.[1,2] Therefore community health is important for all policy-makers. Hence, data collection by different health information system should be considered. Among these data, mortality rates have the most common use. Mortality rates are used not only as an indicator for the development of health system, but also as tools to assess the socio-economic development of a community.[3]

The health status of the community is measured based on health indicators. Therefore, health transition can be estimated by changes of this indicators.[4] Hence, various indicators are used to measure community health status. Among these indicators, life

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expectancy at birth and infant mortality rate are the most important, which were used in several studies.[5-8] Studies showed that most countries have made considerable progress in these indicators. For example, data from Iran indicated that life expectancy at birth among Iranian males and females were 71.2 and 68.8, respectively. Furthermore, infant mortality rate reduced from 154 to 26/1000 lived birth during 40 years (from 1964 to 2004).[9] According to World Health Organization (WHO) reports, life expectancy at birth for both genders in US were 75 and 79 year in 1990 and 2012, respectively.[10]

Nowadays, number of population and its related factors is the base and infrastructure for any planning and policy. In other word, population can be considered as an important socio-economic factor.[11] Based on united nation for population activity report, world population was 7.2 billion in 2013 and based on these estimations world population will increased to 8.1, 9.6, and 10.9 billion in 2025, 2050, and 2100, respectively.[12]

Population growth rate is one of the most important global issues that the humanity is faced with it. World's population growth rate was 1.23 in 2004 and 1.17 in 2011. According to World Bank report, population growth rate in Iran was 1.2 and 1.3 in 2009 and 2012, respectively.[13] This index is different in various part of the world and during 1980-2005 were 1.8, 63.1, 3 and 4 in Europe, Asia, North Africa and North America, respectively. According to Satterthwaite study population growth rate from 1980 to 2005 has been 52.1, 35.7, 5 and 7.2 in countries with low national income, countries with lower than average national income, countries with higher than average national income, and countries with high national income, respectively.[14]

Based on WHO reports, percent of the population below national poverty line (< 1 $/day) during 2006-2012 in the Africa and Southeast countries of Asia were 51.5% and 29.6%, respectively. As well as among low-income countries and countries with less than average income about 49.1% and 28.2% of the population were under the poverty level.[15] According to the mentioned reasons, this study was conducted to determine the association between demographic indicators (e.g., population growth and composition) and health indicators to provide appropriate solutions and strategies for health managers and policy makers for improving health status of people.

Methods

The present study was conducted using panel data on 8 year period from 2004 to 2011. Data have been collected for 176 countries from the WHO and World Bank. The dependent variable that is an indicator of the nation's health level is life expectancy at birth that considered as the year and together for both gender. Explanatory variables can be divided into two parts, first part indicate the status of nation's population indexes including population growth rate, location of residency, population sex ratio and number of dependent population (the population under 15 and above 65 years). Population growth rate divided 5 groups with considering needed time for doubling of population: < 0.5 (fixed growth rate), 0.5-1 (average growth rate), 1-1.5 (rapid growth rate), 1.5-2 (very rapid growth rate) and higher than 2 (explosive growth rate). The second part of the explanatory variables includes the development of countries that vary based on division of the United Nations in 2011. United Nations classified countries into 4 groups: developed countries, developing countries, transition countries and countries with least developing criteria.[16] Table 1 presents study variables and their collecting resource.

In this study for analysis of sensitivity of results and also due to the importance of life expectancy at birth and infant mortality rates in the policy-making purposes, we used once life expectancy at birth (model 1) and once again the infant mortality rate (model 2) as dependent variable. To analysis of data we defined panel variable that include the name of countries. Then we defined simultaneous variable, and in order to use of panel models, we used Hausman test.

The result of this test showed that panel models with random effects are suitable. In

other word in this model, the intercept of the model is constant and randomly distributed between units and regions and error component of the model can change based on groups and time. Used model was $Y_{it} = \beta X_{it} + u_i + \varepsilon_i$ that u_i indicate error component of i^{th} unit and is constant over time. In applied studies u_i can be considered as those specific features of each stage that not include in the model. It should be noted that in this case the variances of different levels are not same and our model is affected by Heteroscedasticity. For this reason we used generalized linear square methods.[17] Statistical analysis was performed by Stata Statistical Software, Release 10.0 (Stata Corporation, College Station, TX, USA).

Results

Our results showed that from all countries 20%, 44%, 24% and 10% are developed countries, developing countries, countries with least developing criteria, and transition countries, respectively. Findings also indicated that average life expectancy from 2004 to 2011 in developed countries, developing countries, countries with least developing criteria and transition countries are 78, 69, 58 and 70 years, respectively. Our analysis also showed that average infant mortality rate in developed countries, developing countries, countries with least developing criteria and transition countries are 4.9, 26.39, 21.3, and 64.2/1000 lived birth, respectively. Population growth rate in developed countries and countries with least developing criteria were 0.53% and 2.53%, respectively. In developed countries rate of dependent population is 32%, while this rate in developing countries and countries with minimum standards is 36% and 45%, respectively. Characteristics of study population based on demographic and health indexes are shown in table 2.

Table 3 shows the result of estimation. As it can be seen in this table in model 1, the dependent variable is life expectancy at birth, which had significantly the relationship with the location of residency, sex ratio and dependent population. In model 2, the dependent variable is infant mortality rate, which had significantly the relationship with the location of residency, sex ratio, population growth rate and dependent population.

Table 1. Definition of study variables

Variable	Definition
Life expectancy at birth	The average number of years that a newborn could expect to live if he/she were to pass through life subject to the average mortality rate of a given period
Infant mortality rate	The number of deaths of children < 1 year of age per 1000 live births
Population growth rate	The rate at which the number of individuals in a population increases in a given time period as a fraction of the initial population
Residency place	Rural population as a percentage of total population
Female population	Female population as a percentage of total population
Dependent population	Population of under 15 years and over 65 years as a percentage of total population
Development	Classification of countries according to United Nation division

Table 2. Characteristics of study population based on demographic and health indexes

Variable	Developed countries		Developing countries		Transition countries		Countries with least developing criteria	
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Life expectancy at birth	78.49	78.12-78.85	69.84	69.19-70.48	70.85	70.24-71.45	58.05	57.28-58.81
Infant mortality rate	4.90	4.58-5.23	26.39	24.69-28.10	21.30	18.74-23.86	64.20	61.76-66.63
Population growth rate	0.53	0.45-0.61	1.89	1.72-2.06	0.39	0.26-0.54	2.52	2.44-2.60
Sex ratio	51.11	50.99-51.23	49.10	48.79-49.40	51.34	51.11-51.57	50.03	49.94-50.13
location of residency	25.09	23.67-26.51	41.79	40.04-43.54	46.65	44.61-48.69	69.63	68.43-70.83
Dependent population	32.30	32.09-32.51	36.28	35.79-36.78	32.46	31.95-32.97	45.83	45.43-46.22

CI: Confidence interval

Table 3. Associations between measured variables and health indexes

Variable	Model 1	Model 2
	Regression coefficient (SE)	Regression coefficient (SE)
Constant value	81.87* (3.12)	19.05* (10.88)
location of residency	-0.28* (0.01)	0.71* (0.05)
Sex ratio	0.30* (0.06)	-1.65* (0.22)
Dependent population	-0.35* (0.02)	1.55* (0.10)
Population growth rate		
Constant	-0.21 (0.20)	2.06* (0.77)
Average	-0.34 (0.18)	2.42* (0.69)
Rapid	-0.26 (0.16)	1.95* (0.61)
Very rapid	-0.21 (0.14)	1.49* (0.55)
Development of countries		
Developing countries	-1.97 (0.14)	0.63 (3.49)
Transition countries	-1.61 (1.76)	1.24 (4.88)
Countries with least developing criteria	-2.92 (1.54)	6.09 (4.48)
R^2	Within = 0.38	Within = 0.35
	Between = 0.55	Between = 0.59
	Overall = 0.55	Overall = 0.59
χ^2	953*	915*

*Association is statistically significant; SE: Standard error

According to table 3, R^2 is above 50% in both models and considering the combination nature of data, model fitting is good and explaining the variability of dependent variable by included variables is acceptable.

Discussion

This study was conducted to assess the relationship between health and demographic indexes in 176 countries. Findings found that average life expectancy were 78, 69, 58, and 70 in developed countries, developing countries, countries with least developing criteria, and transition countries, respectively. Average population growth rate in these countries were 0.53, 1.89, 0.39 and 2.52, respectively. As key findings of this study, it could be said that, health indexes was shown a significant relationship with population ratios and age and sex composition of the population. Also, a significant relationship was not found between health indexes and population growth rate. So that in countries that have 1% more rural population, life expectancy is less as much as 0.28. In other word, there is inequality between location of residency and life expectancy, and this inequality is more beneficial to the urban population. These findings have been confirmed by some other studies.[18-21]

However, this result was obtained in model 2 and hence that with one percent increasing in the rural population, infant mortality rate is increased as much as 0.71. This inequality could be due to several reasons. First, provision of health services is further in urban centers. Several studies have shown that people access in urban areas is more than rural areas. A study has been done by Shafii et al. in Tehran, Iran, found that the intensive care beds is unequally distributed and the beds were more focused in centers of Tehran.[22] Second, as most of the studies, cultural level and people utilization in urban areas is more than rural ones and usually educated people migrate from rural to urban areas.[23] Third, the nature of health indexes that were chosen in this study could be the origin of this inequality. As it is obvious, life expectancy at birth does not measure the level of disability and using DALE can remove this problem.

Our results showed that health indexes (life expectancy and infant mortality rate) were significantly associated with age and sex composition. In other word if females rate increase 1%, life expectancy will increase 0.3 year. Also, if dependent population rate increases 1%, life expectancy will increase 0.35 year. Other studies confirm the findings of the present study. Jagger et al. conducted a study

in 25 countries of Europe for detection of effecting factors on life satisfaction. They concluded that sex, costs of elder population and unemployment was significantly associated with healthy life years at 50 age.[24] A study has been done by Bjornskov et al. on 9000 subject in 70 countries to detect effective factors on life satisfaction, found that older age groups were less satisfied than younger ones.[25]

Conclusion

In any population, there is an essential need to information about health indexes to assess the public health system programs and determining priorities for intervention in order to control various diseases and injuries. Such information could even effective for judgments about changes in health. Our study indicated that health indexes are significantly associated with age and sex composition and location of residency. Therefore, health managers and policy makers need to planning and assessment for structure of the population (age and sex composition and residential status).

Conflict of Interests

Authors have no conflict of interest.

Acknowledgments

We extracted data from WHO and World Bank. Anyone or any university had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or a decision to submit a paper for publication except authors. So, authors would like to acknowledge the publication of the WHO and World Bank.

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