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Research Article

Relationship Between Health Indicators and Educational Indicators in Iran's Provinces

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Abstract

Background: Currently, health indicators are considered an important factor in the development of countries and can be effective in raising the level of developmental indicators.

Objectives: In this regard, the present study aimed to analyze the relationship between the effect of health indicators on the developmental indices of the provinces of Iran.

Methods: The current study of an applied type was descriptive, cross-sectional, and retrospective. The data were prepared through forms designed based on experts' opinions and classified information in statistical yearbooks for the provinces of the country during 2016 - 2020. Data analysis was carried out using Stata 17 software. Moreover, panel data was used to estimate the model, and the Xtpcse test was used to obtain the results of the hypotheses.

Results: The results of the model estimation show the positive and meaningful impact of health indicators on educational indicators such as the ratio of students to teachers, the ratio of students to staff and management, the ratio of higher education students to the population of the provinces and the distribution of students in the province.

Conclusions: The country's authorities can improve and develop health by identifying and optimizing the use of effective indicators in the field of Health and education indicators such as increasing the number of medical and health students and developing educational programs in the field of Health and health and informing the community about these programs, as well as encouraging higher education in low-income areas.

Keywords: Health Indicators; Educational Indicators; Data Panel Model

1. Background

In the healthcare system, efficient resource management and allocation are of paramount importance. Accordingly, currently, it is one of the fundamental actions of developed societies toward achieving social justice and reducing regional disparities in the field of health and healthcare (1). The nature of healthcare services is not limited to a specific group of individuals. The absence or shortage of these specialized services in rural areas, small towns, and underprivileged regions has numerous negative consequences, including temporary migration to large cities, which necessitates significant expenses and time. It is possible for this temporary migration to turn into permanent migration (2).

1.1. Theoretical Principles

Health has a broad definition (3). Health is a dynamic process that will change over time (4). The oldest definition of health is the absence of illness (5). In traditional medicine, they considered four characters for humans, and they believed that when these four opposing characters are in balance, a person is healthy (6).

Health is a multifaceted process (7). The word "development" has different definitions (8). Regional development, in Morgan's view, is a series of national and international goals (9). Development involves the interests of the majority of individuals, not a limited number (10). Development with a focus on indicators of quality of life, such as poverty, income distribution, nutrition, infant

mortality, life expectancy, literacy, education, access to employment, housing, water supply, and other services, aims to compensate for these deficiencies (11). This approach to development places a greater emphasis on human reality while still emphasizing economic and social indicators (12, 13).

Between different regions of a country, there are many inequalities in many fields (14). Equitable distribution of healthcare facilities and resources is one of the fundamental prerequisites for increasing the overall level of society's access to health services and care (15). Inequality in health and healthcare among regions indicates differences in the level of development of health and medical facilities between cities, rural areas, regions, and countries (16). Based on this issue, the main goal of development is to eliminate inequalities (17).

According to Article 29 of the Constitution of the Islamic Republic of Iran, the right to a healthy, productive, and high-quality life, accompanied by an acceptable lifespan free from illness and disability, is a universal right entrusted to governments and a prerequisite for achieving sustainable development (18). One of the basic steps for regional policy-making and planning in the country's healthcare and medical services sector is to divide a country into different regions and then investigate the desired deficiencies in different sectors and subordinate provinces (19). Therefore, the development of health and health services directly and indirectly has accelerated it (20). Currently, achieving sustainable regional development in various sectors, especially the health sector, is the priority of governments (21).

Iran has taken fundamental steps toward change in this sector by approving policies of health transformation and family physicians. A necessary aspect of this change is prioritizing less developed regions in the country. One of the long-term goals of the 1404 Perspective Document plan is to achieve this. Improving health among the human workforce will lead to increased motivation for continuing education; this is because improved health conditions, on the one hand, enhance the attractiveness of investing in education and, on the other hand, by enhancing learning abilities, make individuals more inclined to pursue further education. Furthermore, increasing health and hygienic indicators in society by reducing mortality and increasing life expectancy will encourage individuals to save more (22).

1.2. Literature Review

Beraldó, Mantalio, and Torati (2009), in their study based on data from 19 organization for cooperation and development economic (OECD) countries, examined the effect of public and private health and education expenditures on economic growth through their impact on health, skills, and knowledge. The results showed that health and education expenditures have a positive impact on economic growth (23). Parouhit (2012) investigated the relationship between health and education expenditures with the Human Development Index. The research results indicated that health and education expenditures have a positive and significant effect on the Human Development Index (24). Zajacova and Lawrence (2018) demonstrated in their research that adults with higher levels of education have healthier and longer lives than their peers with lower levels of education. They observed that understanding educational and macro contexts in which this association occurs is the key to reducing health inequalities and improving population health (25). Amin et al. (2015) showed in their research that the health outcomes and behaviors of adults are generally significantly associated with their educational level (26). Savelyev et al. (2022) examined the beneficial impact of education on health and lifespan in comparison to other twin studies in the United States and showed that education has a modest effect on health (27).

Since the efforts of every country and society aim for greater prosperity and well-being, undoubtedly achieving such goals requires a development of the sustainable kind, in which attention is simultaneously paid to all dimensions and aspects of development. Based on this issue, "health" and "education" are among the most influential factors in development. In recent years, numerous studies have been conducted on indicators, such as per capita income and economic growth. However, due to the one-dimensional nature of these variables, which only encompass the economic aspect of households' lives and do not reflect other dimensions, such as health and education, it is necessary to pay sufficient attention to dimensions beyond the economy, such as health and education.

2. Objectives

The purpose of this study was to answer this question: Is there a significant relationship between health indicators and the educational development index in the provinces of Iran?

3. Methods

This study was practical in terms of purpose and analytical in terms of analysis method. The population of the study included all 31 provinces of Iran. The desired health and educational indicators for the years 2016 - 2020 were collected. Instead of sample selection, the entire set of relevant health and educational indicators for this study was examined across the entire statistical population.

By using library sources, such as books, weekly and monthly magazines, journals, publications from research centers of organizations and educational institutions, and relevant theses, and searching through electronic and informational databases, such as the internet, the theoretical and literary aspects of the subject have been incorporated into the writing. The statistics and information related to the variables used in the research

were also extracted from the statistical database (28).

3.1. Statistical Methods

The model is estimated based on panel data. Panel data is a collection of time series data that repeat for different periods over time. Time series data have autocorrelation over time, and in panel data, since data from different periods are also considered, the likelihood of correlation in this type of data is reduced.

The estimation of relationships that use panel data (time series, cross-sectional) often faces complexities. In general, the following model represents a model with mixed data:

$$y_{it} = \alpha_{1it} + \sum_{k=2}^{k} \beta_{kit} x_{kit} + e_{it}$$

where (i = 1,2,...,n) represents cross-sectional units (e.g., provinces) and (t = 1,2,...,T) refers to time. is the dependent variable for the i-th cross-sectional unit in year t, and is the k-th non-random independent variable for the ith cross-sectional unit in the tth year.

It is assumed that the disturbed sentence has a mean of zero and a constant variance . are the unknown parameters of the model that measure the response of the dependent variable to changes in the kth independent variable in the ith period at time t. In general, it is assumed that these coefficients vary across all cross-sectional and temporal units. However, in many research studies, the variability of these coefficients is limited for all periods and times. Depending on the nature of the subject being studied and other conditions, the researcher must determine the appropriate assumptions regarding the parameters.

Xtpcse is an alternative to feasible generalized least squares (FGLS)–see [XT] xtgls—for fitting linear cross-sectional time-series models when the disturbances are not assumed to be independent and identically distributed (i.i.d.). Instead, the disturbances are assumed to be either heteroskedastic across panels or heteroskedastic and contemporaneously correlated across panels. The disturbances might also be assumed to be autocorrelated within the panel, and the autocorrelation parameter might be constant across panels or different for each panel. Such models can be written as follows:

$$y_{it} = x_{it}\beta + \epsilon_{it}$$

where i = 1,…, m is the number of units (or panels); t = 1,…, Ti; Ti is the number of periods in panel i; is a disturbance that might be autocorrelated along t or contemporaneously correlated across i. This model can also be written panel by panel as follows:

$$\begin{bmatrix} y_1 \\ \vdots \\ y_m \end{bmatrix} = \begin{bmatrix} \boldsymbol{x_1} \\ \vdots \\ \boldsymbol{x_m} \end{bmatrix} \times \boldsymbol{\beta} + \begin{bmatrix} \boldsymbol{\varepsilon_1} \\ \vdots \\ \boldsymbol{\varepsilon_m} \end{bmatrix}$$

For a model with heteroskedastic disturbances and contemporaneous correlation but with no autocorrelation, the disturbance covariance matrix is assumed to be as follows:

$$E[\epsilon\, \acute{\epsilon}] = \Omega = \begin{bmatrix} \sigma_{11}\mathrm{I}_{11} & \cdots & \sigma_{1m}\mathrm{I}_{1m} \\ \vdots & \vdots & \vdots \\ \sigma_{m1}\mathrm{I}_{m1} & \cdots & \sigma_{mm}\mathrm{I}_{mm} \end{bmatrix}$$

where σii is the variance of the disturbances for panel i, σij is the covariance of the disturbances between panel i and panel j when the panels' periods are matched, and I is a Ti by Ti identity matrix with balanced panels. The panels need not be balanced for xtpcse; nevertheless, the expression for the covariance of the disturbances will be more general if they are unbalanced. This could also be written as follows:

$$E[\epsilon\, \acute{\epsilon}] = = \sum_{m\times m} \otimes \mathrm{I}_{T_{i\times T_i}}$$

where Σ is the panel-by-panel covariance matrix and I is an identity matrix.

Xtpcse and xtgls follow two different estimation schemes for this family of models. Xtpcse produces ordinary least squares (OLS) estimates of the parameters when no autocorrelation is specified, or Prais-Winsten estimates when autocorrelation is specified. If autocorrelation is specified, the estimates of the parameters are conditional on the estimates of the autocorrelation parameter(s). The estimate of the variance–covariance matrix of the parameters is asymptotically efficient under the assumed covariance structure of the disturbances and uses the FGLS estimate of the disturbance covariance matrix (29). Xtgls produces full FGLS parameter and variance–covariance estimates. These estimates are conditional on the estimates of the disturbance covariance matrix and are conditional on any autocorrelation parameters that are estimated (29-32).

Both estimators are consistent as long as the conditional mean () is correctly specified. If the assumed covariance structure is correct, FGLS estimates produced by xtgls are more efficient (34). Beck and Katz have shown, however, that the full FGLS variance–covariance estimates are typically unacceptably optimistic (anticonservative) when used with the type of data analyzed by most social scientists–10 - 20 panels with 10 - 40 periods per panel (33). They show that the OLS or Prais–Winsten estimates with panel-corrected standard errors (PCSEs) has coverage probabilities that are closer to nominal. Because the covariance matrix elements, , are estimated from panels i and j, using those observations that have common time periods, estimators for this model achieve their asymptotic behavior as the approach infinity. However, the random- and fixed-effects estimators assume a different model and are asymptotic in the number of panels m (xtreg for details of the random- and fixed-effects estimators). Although xtpcse allows other disturbance covariance structures, the term PCSE, as used in the literature,

refers specifically to models that are both heteroskedastic and contemporaneously correlated across panels, with or without autocorrelation.

3.2. Methods Tools

Data analysis was conducted using Stata 17 software utilizing the xtpcse statistical test to examine the correlation between variables. A significance level of $P < 0.05$ was considered for determining statistical significance. The results of this method are presented in Tables 1, 2, 3, and 4.

Table 1. Correlation Between Health Indicators and the Ratio of Students to Teachers Elasticity in Iranian Provinces [a]

Students to the Teacher Elasticity	Correlation Coefficient	P-Value > |z|
The number of public and private hospitals elasticity	0.08	0.000
The rate of the total number of insured individuals to the total population elasticity	0.03	0.061
The number of pharmacies elasticity	0.24	0.000
Number of published book titles elasticity	0.01	0.064
Intercept	1.56	0.000

[a] Source: Research findings.

Table 2. Correlation Between Health Indicators and the Ratio of Students to Staff and Management Indicator Elasticity in Iranian Provinces [a]

The Ratio of Students to Staff and Management Elasticity	Correlation Coefficient	P-Value > |z|
The number of public and private hospitals elasticity	0.03	0.034
The number of pharmacies elasticity	0.02	0.037
Number of active publishers elasticity	0.01	0.002
Gini coefficient of urban areas elasticity	0.31	0.000
Gini coefficient of rural areas elasticity	0.35	0.000
Intercept	4.58	0.000

[a] Source: Research findings.

Table 3. Correlation Between Health Indicators and Distribution of Students Indicator Elasticity in Iranian Provinces [a]

Distribution of Students in the Province Elasticity	Correlation Coefficient	P-Value > |z|
Number of active beds elasticity	0.54	0.000
The rate of the total number of insured individuals to the total population elasticity	0.47	0.000
Number of published book titles elasticity	0.08	0.000
The cost of education and training elasticity	-0.12	0.007
Number of general doctor elasticity	0.10	0.014
The number of public and private hospitals elasticity	0.07	0.006
Cities covered by drinking water elasticity	0.12	0.010
Intercept	-6.15	0.000

[a] Source: Research findings.

Table 4. Correlation Between Health Indicators and Distribution of the Number of Graduates Indicator Elasticity in Iranian Provinces [a]

Distribution of the Number of Graduates Elasticity	Correlation Coefficient	P-Value > |z|
Number of paramedics elasticity	0.14	0.002
Number of active beds elasticity	0.49	0.000
The rate of the total number of insured individuals to the total population elasticity	0.53	0.000
Number of published book titles elasticity	0.09	0.000
Cities covered by drinking water elasticity	0.18	0.000

Intercept	-7.65	0.000

[a] Source: Research findings.

4. Results

Since all variables have been entered into the model in the form of natural logarithms, the coefficients obtained are elasticities. With an increase of 1% in the variable "the number of public and private clinics", the variable "student-to-teacher ratio" decreased by 0.08%. With an increase of one unit in the variable "number of pharmacies", the variable "student-to-teacher ratio" decreased by 0.03%. With an increase of 1% in the variable "the ratio of the total number of primary and secondary insured individuals of social security insurance to the total population," the variable "student-to-teacher ratio" decreased by 0.24%. Additionally, with an increase of 1% in the variable "the number of published books", the variable "student-to-teacher ratio" decreased by 0.01%. The results showed a significant and inverse relationship at the 0.05 significance level (Table 1).

With an increase of 1% in the variable "the number of public and private clinics", the variable "student-to-staff and management ratio" decreased by 0.03%. With an increase of 1% in the variable "number of pharmacies", the variable "student-to-staff and management ratio" decreased by 0.02%. With an increase of 1% in the variable "the number of active publishers", the variable "student-to-staff and management ratio" decreased by 0.01%. With an increase of 1% in the variable "Gini coefficient of urban areas", the variable "student-to-staff and management ratio" decreased by 0.31%. Additionally, with an increase of 1% in the variable "Gini coefficient of rural areas", the variable "student-to-staff and management ratio" decreased by 0.35%. The assessment revealed a significant and inverse relationship at the 0.05 significance level. This model demonstrates that employing all three health, economic, and cultural indicators simultaneously in the model does not diminish their effectiveness and significance in the educational development index (Table 2).

With an increase of 1% in the variable "the number of active beds", the variable "distribution of students across the province" increased by 0.54%. With an increase of 1% in the variable "number of primary and secondary insurance beneficiaries in the social security organization", the variable "distribution of students across the province" increased by 0.47%. With an increase of one unit in the variable "number of published book titles", the variable "distribution of students across the province" increased by 0.08%. With a decrease of 1% in the variable "education and training costs", the variable "distribution of students across the province" increased by 0.12%. With an increase of 1% in the variable "the number of general practitioners", the variable "distribution of students across the province" increased by 0.10%. With an increase of one unit in the variable "the number of public and private clinics", the variable "distribution of students across the province" increased by 0.07%. With an increase of 1%in the variable "cities covered by drinking water facilities", the variable "distribution of students across the province" increased by 0.12%. The results indicated a significant and direct relationship at the 0.05 significance level and a significant and inverse relationship with education and training costs. This model demonstrates that employing all three health, economic, and cultural indicators simultaneously in the model does not diminish their effectiveness and significance in the educational development index (Table 3).

With an increase of 1%in the variable "the number of specialists", the variable "distribution of graduates across the province" increased by 0.14%. With an increase of 1%in the variable "the number of active beds", the variable "distribution of graduates across the province" increased by 0.49%. With an increase of 1%in the variable "ratio of primary and secondary insurance beneficiaries in the social security organization to the population", the variable "distribution of graduates across the province" increased by 0.53%. With an increase of 1%in the variable "number of published book titles", the variable "distribution of graduates across the province" increased by 0.09%. With an increase of 1%in the variable "cities covered by drinking water facilities", the variable "distribution of graduates across the province" increased by 0.18%. The results indicated a significant and direct relationship at the 0.05 significance level. This model demonstrates that employing both health and cultural indicators simultaneously in the model is effective and significant, not diminishing their impact on the educational development index (Table 4).

5. Discussion

The findings of this study indicated- the relationship between health indicators and educational indicators in the provinces of Iran, defining the extent of the impact of each of these factors. This model discusses the relationship between health indicators and educational development indicators, where educational development indicators include the following items: student-to-teacher ratio, student-to-staff and management ratio, distribution of students across the province, and distribution of the number of graduates across the province. The results of the present study showed that health indicators significantly affect educational, cultural and economic indicators, which are in line with the results of the studies Human Development Report (34), Bajourk, Basakha (35), and Fattahi et al. (36). The results of the current study demonstrated that educational, cultural, and economic indicators significantly influence health indicators, which is in line with the results of studies by UNDP (34), Bajourk, Basakha (35), and Fatahi et al. (36).

According to the research results, it can be said that cities with a higher number of active hospital beds, general physicians, public and private clinics, a larger number of insured individuals, more published book titles, lower education and training costs, and high-quality water supply facilities are indicative of a higher level of economic and cultural development. Cities that perform well in these indicators likely have conducive conditions for growth and development, which could serve as attractive factors for students. Therefore, if health and educational development indicators improve in a society, it can lead to overall improvements in the social and economic conditions of the community.

Moreover, in a society, if health and educational development indicators improve through increasing the number of students in medical and health-related fields in low-income areas, developing educational programs to inform the community about occupational health, environmental health, and disease prevention, enhancing the educational sector in hospitals and healthcare centers, and providing scholarship programs and financial facilities for studying in medical and health-related fields, and if the government, as the largest economic entity, allocates resources to healthcare and education expenses, it will pave the way for accelerating the human development process. In this way, an overall improvement in the social and economic status of the society will follow.

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