**M. Narikbayev KAZGUU University**
**Higher School of Economics**

**MASTER'S DISSERTATION (PROJECT)**

*«Health insurance-a review of key elements and economic justification»*

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**Written by Elnara Abdibekova**

**Supervisor Kuat Akizhanov**

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# Abstract

Begun in 2015, health insurance in Republic of Kazakhstan has become mandatory which led to particular changes in the health care system as a whole. This study aims to determine the positive impact of health insurance implementation to the public health economy. Specifically, it investigates if the level of health care resources allocation and spending for maximizing health benefits is effective.

In this context, the relationship between life expectancy as a main indicator of health insurance system and other important factors was estimated. In the study, the relationship was evaluated through regression analysis in combination with qualitative examination of related factors that affect to health insurance system. For the analysis, the dataset consists of 50 randomly chosen, developed and developing countries that provides the data for one dependent variable – life expectancy; and four dependent variables: total per capita health care expenditures, GDP per capita, percentage of domestic government health expenditures and density of health care professionals per 1000 people. The data was analyzed using R software. The results showed the positive correlation between health care expenditures and life expectancy. Moreover, the significance of rest variables also was identified.

These findings suggest to not focus only on expenditures, but also on factors that directly affect to the health care quality. On this basis, new regulations in the public health care sector should be taken into account in order to provide better health insurance system as well as higher life expectancy.

*Keywords—health insurance, medical insurance, life expectancy, health care expenditures, health care resource allocation.*

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## I. Introduction

In today's society, the process of evolution has made significant progress in the health care industry that these enhancements and changes demand specific solutions and innovation, as well as new regulations. Indeed, the aspiration to live longer and healthier lives often implies the use of limited resources, and this makes it part of the economic problem as well. The health care market is one of the few where government intervention has more positive influence than negative. The government regulates the provision of efficient and fair distribution of health care resources. For this reason, many countries have a policy of state intervention to govern this industry. And one of the instruments that the government uses is health insurance with a variety of options and packages for diverse populations according to their needs and demands. (Boddy et al., 2015).

By definition, health insurance is a scheme to finance medical expenditures by making contributions or taxes to a general fund to pay fully or partially for the different types of public health services. (Rogers,2019). The key features typical to most health insurance plans and packages are the prepayment of insurance fees or taxes, consolidation of funds as well as the right to receive benefits based on premiums or employment. According to the Law of the Republic of Kazakhstan from November 16, 2015 No. 405 "On Mandatory Social Health insurance", the implementation of mandatory social health insurance (MSHI) was launched on January 1, 2020 and the Kazakhstan model of MSHI system has socially oriented character. Health insurance for health-related risks is an important economic and social problem around the world. Covering these risks provides financing for health care costs which are a considerable part of the national welfare in many developed countries. World Health Organization (WHO) presented in their "Global Health Expenditure 2020" report a dataset of the budget allocation for healthcare: USA 17.1%, Germany 11.2%, most

European countries 9-12%, most of Post-Soviet Union countries 6-7% and Kazakhstan only 3.1%.

The reason of undertake a research for the topic is that the national legal and policy environment and institutional framework in the health care sector in Kazakhstan continues to change quickly, and it is far from certain in which way the system will find itself. So, the most recent implementation and project is health insurance strategy which is not studied enough to have a strong conclusion of its impact. That is why there is a broad space for conducting studies and analyzing data.

The main aim of the research study is to determine the positive impact of health insurance to the public health economy through a regression analysis. The consequent objective of this is to identify the level of effective allocation of health care resources and expenditure for maximizing health benefits.

During the data analysis and study, the following research questions «In which way/how health insurance implementation could affect to the public health economy hence to the economy in general», «What economic justification does health insurance have from the Kazakhstan's perspective » will be covered in order to succeed the primary goal of the study.

## II.  Literature Review

### A.  Importance and justification of health insurance

In the book issued by Institute of Medicine in USA (2001), the importance of the health insurance was described clearly. The few series of research studies were conducted to analyze the consequences of lacking health insurance for those part of population that could not afford the insurance or without it because of any reasons; as well as the impact for the particular country as a whole.

The authors settled a particular plan for measure these implications of not having the health insurance. The first step is to understand that the insurance serve for different groups of society with distinct purposes. Beyond performing the standard functions of risk assurance, health insurance has evolved as a funding or prepayment scheme for a wide range of medical services, inclusive of preventive services. Although a significant majority of those with health insurance make claims for their insurance coverage on an annual basis, health care costs, and hence health insurance benefits, are still clustered among the comparatively minority of claimants who make large expenditures due to serious illnesses. Moreover, 10 percent of the population represents 70 percent of health care costs, a ratio that has remained unchanged during the past thirty years. (Berk and Monheit, 2001) In this way, health insurance keeps performing a risk-sharing function, even while it increasingly funds routine treatments. On the provider side, patient insurance helps ensure a revenue flow, and the public benefits from financially sustainable and consistent health care professionals and entities.

In the book, Institute of Medicine (2001) represent the data from the survey which shows that the non-insured are much more likely to refuse necessary treatment. During the survey, more than 3.400 adults were interviewed about 15 serious or ill health conditions. Among those who reported any similar symptoms ,16 percent of those who responded, adjusted for demographic and economic background, health history, and regular source of care, one an uninsured individual was much less likely than an individual with insurance to

receive care for the stated disease where the ratio of chances is around 0.43. (Baker et al., 2000). Which means that health insurance is highly important to be provide by the government for both economic and demographic purposes.

### B. Cost-effectiveness of health insurance projects in high-income countries

Currently, national health insurance programs are prevalent in the majority of developed countries. This study, conducted by Nghiem et al. (2018), reviews data and summarizes information on the cost-effectiveness of national health insurance programs in high-income countries. This type of insurance is based on the principles of risk aggregation and economies of scale. In specific terms, significant resources leveraged from all or a significant portion of the population make it possible to provide health care services at affordable prices. Proponents of national health insurance systems claim that the private market is a better instrument for delivering public health services at cost-effective prices. (Friedman, 2009) But because of high inflation and the moral high risk that providers take, such as exploiting clients by using market power and suggesting they use more services than needed, market prices make these services inaccessible to a considerable segment of the community.

The method of the study was the survey for evaluating medical expenditure. The target audience were people aged from 25 to 65, who were interviewed in order to assess their impact of social, demographic characteristics and health behaviors on quality-adjusted life years and health care expenditures for the uninsured people. Estimating these parameters were used for forecasting quality-adjusted life years and insurance-related costs for the uninsured, dated by 2018 year. Then, Markov decision analysis simulations were used to calculate the cost-effectiveness parameters. As a result, studies showed that national health insurance programs and health reforms are cost-effective based on the standard threshold on a typical readiness-to-pay for quality-adjusted life years' threshold of $50.000-$100.000.

(Shiroiwa et al., 2010). Also, the results represented that the cost effectiveness correlation gets more advantageous as people approach age 65.

As the main output of the conducted study by Nghiem et al. (2018), supplemental health care acquired through health insurance delivers quality-adjusted life improvement at a rate that differs profitably from the costs of other programs and health care interventions that the community now prefers to fund.

### C. Trends in the development of health insurance economy in the system of functioning of the financial market of Kazakhstan

In Kazakhstan, on January 1, 2020, mandatory social health insurance (MSHI) was launched. The study, written by Saparova and Nurseitova (2016), defines that there are currently three main economic models of the health care system in terms of the participation of the state and the employer and the consumer of medical services:

-        Paid medicine, based on market principles using private health insurance;

-        State medicine with a budgetary system of financing;

-        Health care system, in which the principles of market regulation with a multi-channel system of financing are applied.

Therefore, the reforms in health care assume transition from the model of state medicine with the budgetary system of financing to the integrated model, which synthesizes the state participation with the responsibility of the employer and the insured himself. Such a model can be defined as a social insurance or integrated health insurance system. It can be characterized as a system based on the principle of integrated economy, where the market of medical services functions on the synthesis of state regulation and provision of social guarantees, ensuring the availability of medical care for all segments of the population. But there remain the rights to compulsory health insurance for the entire population of the country with the participation of the state in guaranteeing and financing the health insurance fund. The function of the medical services market is to cover the needs of the population beyond

the list guaranteed by the state, giving freedom of choice to consumers of medical services. This (integrated) system of health insurance financing, which consists of accumulated funds of insurance organizations, deductions from wages, state budget expenditures, creates the necessary elasticity and stability of the financial base of social insurance medicine. This model is vividly expressed in the health care system of Germany, France, the Netherlands, Austria, Belgium, Holland, Switzerland, Canada and Japan.

Since 2017, Kazakhstan has planned the introduction of social health insurance. This system is supposed to be introduced in several stages. The main idea is the introduction of the principle of health care financing from the state, employer, citizen and other sources, and thus the systematization of their solidarity participation in the preservation of health.

The planned health insurance reforms are not intended to replace traditional comprehensive health care methods and the basic set of services that provide access to health care facilities, such as doctor visits or prescriptions for medications and competent consultations, so it is too early to make judgments about how untimely these reforms are. Another question is how the system of medical insurance for the unprotected segments of the population, pensioners, military personnel, etc. will be built, if they are exempt from payment, how it will be made, in the form of quotas or social queuing, and how effectively the system will work on cases of immediate surgical intervention.

Based on the above, we believe that the creation of a fund can significantly advance not only the health care system to a higher level, but also improve the health insurance market as a whole. Thus, this preparatory stage will be aimed at forming a fund and accumulating funds that will not lie "idle", because inflation and devaluation influences may depreciate the funds in the long run.

To sum up, the studies show that in overall terms there is a positive relationship between health care expenditures and economic indicators such as labor productivity, personal income, GDP and etc. In addition, personal spending on health care has a negative effect on the time spent buying goods and services. Different governments need various investments in individual health care expenditures, even if they enjoy the same level of productivity.

Overall, the research above outlines how government can spread health care spending across key parameters that can boost economic growth while also enhancing the well-being of the people. It is also crucial that policies at the macroeconomic level address health care costs and economic development. All in all, in view of the prospective economic advantages of health care, access to health care for all is an area that requires further research.

## III. Research methodology

### A. Importance of the problem

In this study the relationship between health care expenditures and life expectancy is discussed. Healthcare economics is based on the proper allocation of resources to improve the standard of living of the population. Therefore, we assume that if the government spends money on a product or service, it is allocating a necessary resource to itself. Based on this, it is reasonable to expect that spending on health care will bring some health value. In this way, we also expect that an increase in health care spending will show a better health care system quality, which in our model is measured through expectancy of life. The study of this relationship is essential because it will provide a better understanding of the efficiency of public expenditures on health care industry.

According to the strategy "Kazakhstan 2050" which is a step towards improving the health care system, government should establish a clear set of managing roles, requirements and guidelines that will bring the country closer to the top 30 most developed countries in the world. And, consequently, the main question is how the accurate implementation and application of the health insurance as a strong developing "tool" will help to improve the quality of the industry as a whole that it is covered in this study.

### B. Methodology

The estimation of health insurance costs is not restricted to a simple comparison of macroeconomic expenses without emphasizing the significant features, which are divided in two schematic areas: public/private and voluntary/compulsory. Based on this, a reasonable estimate of the future evolution of the economic significance of health insurance can be proposed. As a research method for this study, regression analysis was chosen as a part of quantitative methodology. Moreover, using the literature review and rationale techniques to

qualitatively examine the associated factors affecting the health insurance in combination with the methods of multiple and simple linear regressions to build a model, to quantitative examination of such factors will be helpful in the making clear and relevant conclusions and see the potential areas for improvement and corrections.

Regression analysis is a well-known statistical tool and a valid method of determining which variables have an influence on a particular subject of concern. The regression analysis approach provides a sure way to figure out which factors are most important, which factors can be neglected, and how these factors correlate with each other. This analysis has two essential elements, such as, dependent variable (which is the primary determinant you intend to comprehend or predict) and independent (factor/variable that, according to the researcher's hypothesis, affect the dependent variable). (Angelini, 2019)

The Regression analysis was chosen due to its comparative feature and enhanced clear results representation. By the way, the method has their own advantages and limitations which are listed below.

Advantages:

-Regression analysis is useful in forecasting and making prognoses/predictions for an industry, both, in the short and long term.

-It helps make accurate and strong decisions by giving the relevant insights and data into the dependent variable/object and the predictors.

-The analysis allows to correct mistakes by performing a good analysis of the results obtained from the decisions.

-Industries/businesses use this method to discover new opportunities in the market.

Limitations:

-Regression analysis is a very sophisticated and time-consuming process, consisting of many calculations and data analyses and evaluation.

-It could not be applied to qualitative factors such as social phenomena, honesty, taste, colors and etc.

-The assumption of a causal relationship between variables that should remain constant is not always appropriate. (Angelini, 2019)

As a model, for the chosen method, simple linear regression model (SLRM) and multiple linear regression model are in consideration. A SLRM is a model which, excluding random error, implies a straightforward relationship between the dependent variable and independent one. (Ross, 2017) Multiple linear regression model is a statistical technique that is used to forecast the effect of a variable on the basis of the value of two or more variables.

C. **Data Analysis**

For the analysis and model 51 randomly chosen countries were selected. The dataset includes countries from all continents, regions. Moreover, it provides numbers of both developed and developing countries. The data and numbers were taken from different resources, namely: 'Our World in Data', World Health Organizations The Global Health Observatory, World Bank Data base. While health insurance is a complex system which is containing a several factors that aimed to provide a better health state, longer life expectancy and well-being to the population/individual in general, which consequently affects to the economy of the country. Because of the better health care system, better resources allocation and healthier working population. Therefore the following variables/parameters were chosen for the analysis.

For this study life expectancy was chosen as a main parameter (dependent variable) of the health care system of a particular country. Moreover, it is the key indicator of a developed health insurance system of a country. This parameter is a broadly accessible statistics for many countries and is available on many resources, which provides enough and sufficient data for our analysis. The life expectancy terminology is the expected average number of

years a newborn child can live. (Deshpande *et al*.,2014) Moreover it takes into consideration mortality in all age groups and covers factors such as infant mortality and rates of infectious disease.

Total per capita health care expenditures, both public and private, was chosen as the main independent variable. We can assume that those countries that have higher expenditures on health care system are having higher/better life expectancy values. Expenditures per capita were selected to capture total general health care expenditures and to consider differences in population size across countries.

Next, the second independent variable is GDP (Gross Domestic Product) per capita. Here, we also have expectations that countries with the higher GDP per 1 person logically would have better life expectancy values. Per capita is estimation that take into account variance between population size of taken countries. Similarly, we would expect positive correlation between two mentioned variables. Because, high - income countries usually tend to spend much more for the health care necessities that the low - income ones.   In addition, countries with higher GDP per capita are likely to have a higher standard of living, which influences life expectancy.

The third independent variable/regressor is percentage of domestic government health expenditures. This numbers were used to determine whether more public or private expenses correlated with health.  From one perspective, if the percentage of government expenditures is positively correlated with life expectancy, this might show that government intervention policy has good impact on health care system. Otherwise, if there is negative correlation it can show that the private sector is more effective to regulate health care expenditures rather than state.

The fourth regressor/variable is the professionals of health care industry (physicians, doctors) density per 1000 population of each analyzed country. This indicator provides

information of availability and accessibility of health care in countries. Logically, we assume that higher the indicator of density so the higher life expectancy, because people have better access

Life expectancy is measured on the basis of mortality data collected in civil registers or censuses. Other variables, such as health care expenditures per capita and only public health expenditures are collected from national health accounts. But unfortunately, there are countries without an updated national health database, so the numbers were taken from publicly available resources. Parameters are measured in USD$ and some in percent. As for health care physician's density is based on health workforce data collected by World Health Organization. Statistics provide data of 2018 year as its latest full covered year of all necessary information, due to latest world changes in the health care system the data not updated yet.

During the analysis, following abbreviations were used :

**life_exp** – Life Expectancy;

**expnedit_percapita** - Health Expenditure per capita in US$;

**gdp_percapita** - GDP per capita in US$;

**govern_exp** - Domestic general government health expenditure in %;

**density_hc** - Density of health care professionals per 1000 people.

### D. Model Description

R-studio software was used for creating and interpreting results of the models, because of its convenient and understandable interface.

Firstly, interpretation the main parameters of descriptive statistics of the raw data was made, in order to see the lowest and highest meaning/numbers and the fluctuations of each

variable. The subsequent functions and commands were used: *mean(), var(), range(), summary().*

Table 1 - Summary descriptive statistics for all the variables used in the regression model

```
   Country              life_exp      expnedit_percapita gdp_percapita
Length:49            Min.   :54.70    Min.   :   24.23   Min.   :  1122
Class :character     1st Qu.:71.70    1st Qu.:  165.80   1st Qu.:  9339
Mode  :character     Median :76.90    Median :  526.00   Median : 18727
                     Mean   :75.91    Mean   : 2178.49   Mean   : 29306
                     3rd Qu.:81.90    3rd Qu.: 4267.00   3rd Qu.: 43439
                     Max.   :84.60    Max.   :10624.00   Max.   :153764
 governm_exp         density_hc
Min.   : 2.81    Min.   :0.025
1st Qu.: 7.56    1st Qu.:1.110
Median :10.47    Median :1.960
Mean   :11.59    Mean   :2.066
3rd Qu.:15.28    3rd Qu.:3.155
Max.   :27.82    Max.   :4.390
```

Then, to see visually the influence of some variables (GDP per capita and Expenditure per capita) to the Life Expectancy, graphs were plotted. The following scatterplots show that GDP per capita and Expenditure per capita appearing to trend exponentially of life expectancy. Exponential growth is the growth of a value when the velocity of growth is proportional to the value of the value itself.
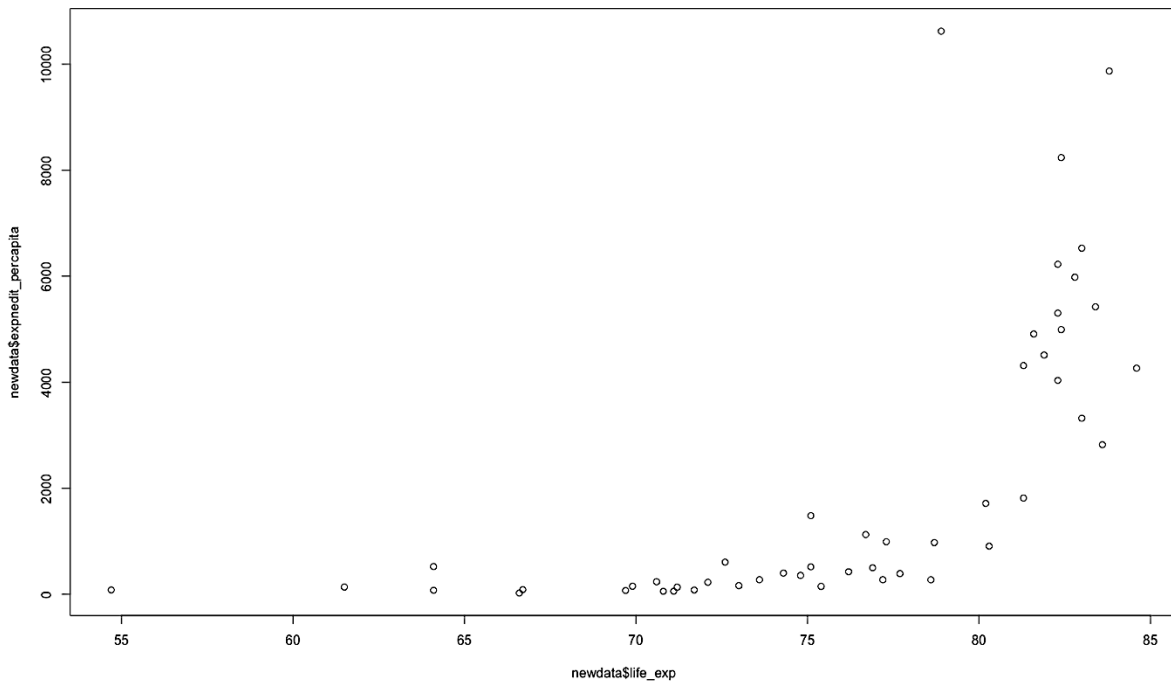
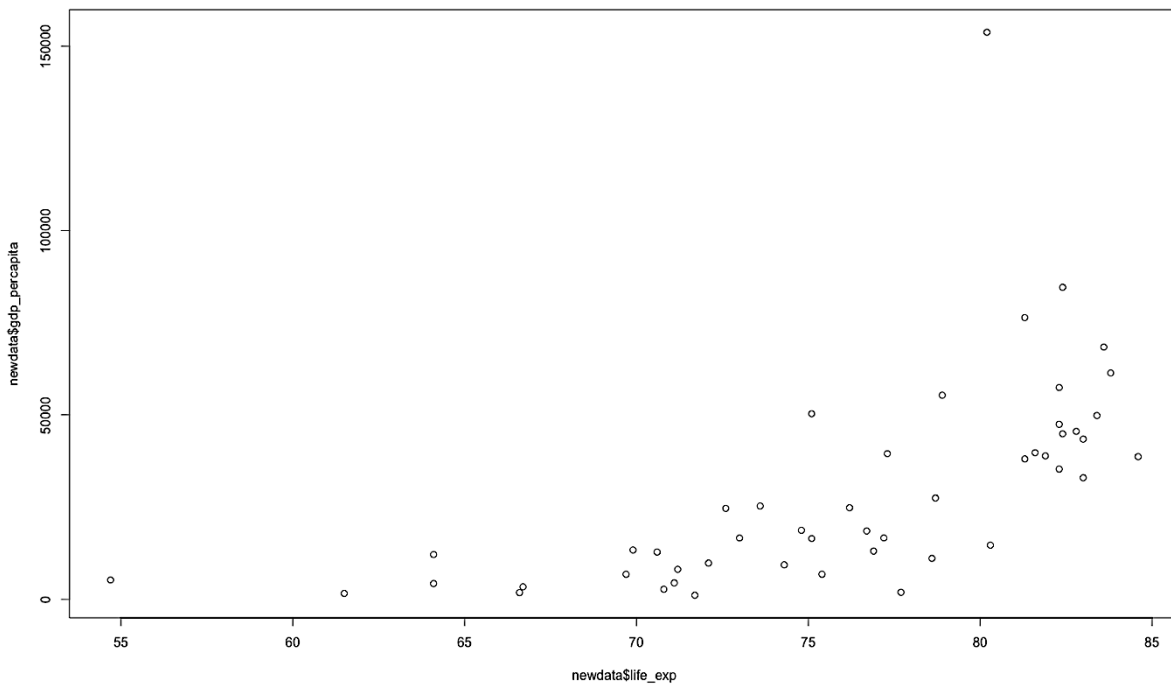Figure 1-Live expectancy vs Total Expenditure per capita



Figure 2 -Live expectancy vs GDP per capita

According to the graphs and data there are some assumptions. The first one is that model is linear in parameters. The second is that random sampling, we took randomly countries from the full list. Moreover, the authorized organizations (WHO) collect data for

each country when it is possible to find the proper data, which usually means that if there are missing information so it probably less developed countries, so the organization need to find some numbers to fill the list.

Below we provide the correlation matrix of variables to see the collinearity. For this step, *cor([supply()])* function was made.

Table 2 - Correlation matrix of variables

```
                   life_exp expnedit_percapita gdp_percapita governm_exp
life_exp           1.0000000          0.8048721     0.7276166   0.6062542
expnedit_percapita 0.8048721          1.0000000     0.8528705   0.7122211
gdp_percapita      0.7276166          0.8528705     1.0000000   0.4797160
governm_exp        0.6062542          0.7122211     0.4797160   1.0000000
density_hc         0.5518514          0.5714768     0.5523465   0.2987645
Country_numeric          NA                 NA            NA          NA
                   density_hc Country_numeric
life_exp            0.5518514              NA
expnedit_percapita  0.5714768              NA
gdp_percapita       0.5523465              NA
governm_exp         0.2987645              NA
density_hc          1.0000000              NA
Country_numeric            NA               1
>
```

According to the matrix, there is strong correlation between health expenditure per capita and GDP per capita (0.85). Which means, that it is better not to include both independent variables to the one multiple regression model, as the correlation can affect the results of the model.

After interpreting all basic indicators, the first model was build using *lm()* and *ggplot()* fucntions. The first model was the Simple Linear Regression model:

*life_exp ~ expnedit_percapita*

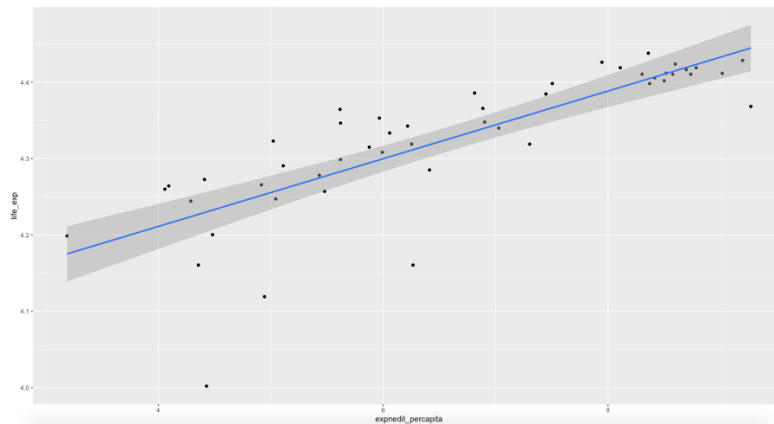**life_exp ~ 4.03379 + 0.04432 expnedit_percapita**

Figure 3 – plot *life_exp ~ expnedit_percapita*

The summary of the model below shows that the correlation between variables is moderate, the expenditure on health care positively influences on the life expectancy. R squared is 0.06478 which indicates that model is good.

Table 3 – The summary of the first SLRM

```
Call:
lm(formula = life_exp ~ expnedit_percapita, data = newdata)

Residuals:
      Min        1Q    Median        3Q       Max
-0.228170 -0.010281  0.008574  0.031110  0.081659

Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)        4.033788   0.032359 124.658  < 2e-16 ***
expnedit_percapita 0.044321   0.004767   9.298 3.18e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.0557 on 47 degrees of freedom
Multiple R-squared:  0.6478,    Adjusted R-squared:  0.6403
F-statistic: 86.45 on 1 and 47 DF,  p-value: 3.178e-12
```

Next step is to look the model where life expectancy depends on GDP per capita:

*life_exp ~ gdp_percapita*

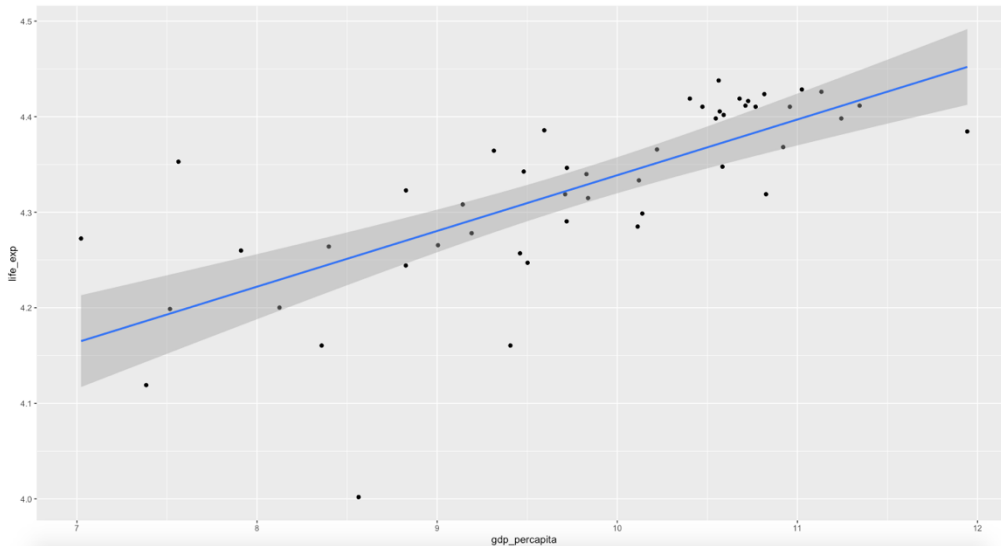**life_exp ~ 3.75556 + 0.05832 gdp_percapita**

Figure 4 – plot *life_exp ~ gdp_percapita*

Table 4 - The summary of the second SLRM

```
Call:
lm(formula = life_exp ~ gdp_percapita, data = newdata)

Residuals:
     Min       1Q    Median       3Q      Max
-0.25310 -0.02604  0.01408  0.03408  0.15621

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)     3.75556    0.07890  47.596  < 2e-16 ***
gdp_percapita   0.05832    0.00802   7.272 3.17e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.06439 on 47 degrees of freedom
Multiple R-squared:  0.5294,    Adjusted R-squared:  0.5194
F-statistic: 52.88 on 1 and 47 DF,  p-value: 3.169e-09
```

As for this model, we can see that GDP per capita affects to the life expectancy affects a little bit more to the life expectancy. But overall, the model is worse that the first one.

So, to analyze the data better we will include other regressors to the model to see the output and the difference.

The first multiple regression model :

*life_exp ~ 4.05+0.035 expnedit_percapita+0.0016 governm_exp+0.01 density_hc*

Table 5 - The summary of the first Multiple Regression Model

```
Call:
lm(formula = life_exp ~ expnedit_percapita + governm_exp + density_hc,
    data = newdata)

Residuals:
     Min       1Q    Median       3Q      Max
-0.216865 -0.016294  0.004024  0.029486  0.086761

Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)        4.049512   0.034191 118.437  < 2e-16 ***
expnedit_percapita 0.035577   0.008012   4.440 5.77e-05 ***
governm_exp        0.001661   0.002068   0.803    0.426
density_hc         0.010922   0.007660   1.426    0.161
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.05551 on 45 degrees of freedom
Multiple R-squared:  0.6652,    Adjusted R-squared:  0.6428
F-statistic:  29.8 on 3 and 45 DF,  p-value: 9.133e-11
```

There is a clear positive relationship between variables, moreover there is also positive but weak relationship between life expectancy and government spending. This multiple regression model indicates that healthcare expenditure, government expenditure in percent, and density all have a positive relationship with life expectancy and are all significant. We believe that a country's expenditure on healthcare, its percent government spending on healthcare and density of physicians per capita would all have a positive correlation with average life expectancy.

We then conducted a second multiple regression model between life expectancy and the independent variables; however, GDP per capita was used in this model instead of healthcare expenditure. The results:

Second multiple linear regression:

*life_exp ~ 3.872+0.037 gdp_percapita+0.005 governm_exp+0.014 density_hc*

Table 6 - The summary of the second Multiple Regression Model

```
Call:
lm(formula = life_exp ~ gdp_percapita + governm_exp + density_hc,
    data = newdata)

Residuals:
      Min        1Q    Median        3Q       Max
-0.216551 -0.022548  0.008123  0.029705  0.126435

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.872412   0.078466  49.351  < 2e-16 ***
gdp_percapita 0.036956   0.009323   3.964 0.000261 ***
governm_exp   0.005376   0.001679   3.202 0.002509 **
density_hc    0.014312   0.007654   1.870 0.068031 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.05731 on 45 degrees of freedom
Multiple R-squared:  0.6431,    Adjusted R-squared:  0.6193
F-statistic: 27.03 on 3 and 45 DF,  p-value: 3.781e-10
```

Interesting, there is no significant difference between two models. Moreover, the variables (GDP per capita and health expenditure) have almost the same values of the slopes. So, the equally affect to the life expectancy.

According to the data we can assume that density of physicians per 1000 population have a good impact to the life expectancy, while the government spending is not so significant. To check it we can test variables with VIF in Rstudio to understand if we need to drop/eliminate some of the variables. As we know, meaning from 1-5 is fine, under 10 is acceptable, but if we have bigger than 10 we strongly eliminate the regressor from the model, because it affects to the results.

Table 7 – VIF of the model3 and model4

```
> vif(model3)
expnedit_percapita          governm_exp          density_hc
          2.845172             2.103762            1.539334
> vif(model4)
gdp_percapita    governm_exp    density_hc
     1.705976       1.301695      1.442107
```

We see that in both model's density of physicians variable has good numbers. As for other indicators, they are also in the acceptable values but varies in two models.

So, in the analysis, we tried to identify the impact of health care expenditures on life expectancy. We assumed that there was a positive correlation between health care expenditures and life expectancy, showing that an expansion of spending would lead to an increase in life expectancy. The significance of having a health care professional available close by becomes more critical.

This could also point to other fields for potential research on health care outcomes. In future, it could be useful for further studies the effect of healthcare professional physicians density on life expectancy, it could also be valuable to construct a model with variables that are related to the density. From our findings, it may be useful to look more closely at the variables that directly affect health care quality, rather than concentrating on expenditures. This will provide insight into how significant this variable is to a country's health care system and what regulations or research recommendations are needed in this case.

## IV.  Conclusion

Health care industry is one of the most important global issues of the modern world. Health care distinguishes itself from other sectors of the economy. Firstly, the high cost of services, and secondly, the prevalence of the so-called moral risk in the work of medical staff and employees of insurance and other organizations involved in the process. Economic instability primarily affects health care. During any economic crisis the attention of the state to insurance of citizens against diseases and accidents usually weakens. The level of public and private financing of medical services decreases. And in the end the number of diseases, temporary disability, disability, mortality increases, which in turn is also reflected in the economy.

In these circumstances, it is the health insurance that can act as a qualified intermediary between the state, private clinics and patients.

To sum up, both, quantitative and qualitative research determines the correlation between health insurance and economy in general. Our analysis showed the positive impact of governmental interventions and resources spending to the health care system (life expectancy which leads to the health insurance development in the country).

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# Appendix: The Dataset of Countries used in Regression Analysis

| Country | Life Expectancy | Health Expenditure per capita in US$ | GDP per capita in US$ | Domestic general government health expenditure in % | Density of health care professionals per 1000 people |
|---|---|---|---|---|---|
| Albania | 78.6 | 274.9 | 11104,000 | 9,71 | 1,11 |
| Argentina | 76.7 | 1128 | 18556,000 | 15,19 | 3,16 |
| Australia | 83.4 | 5425 | 49831,000 | 17,94 | 3,85 |
| Azerbaijan | 73.0 | 165.8 | 16628,000 | 2,81 | 3,38 |
| Bahrain | 77.3 | 994.2 | 39499,000 | 7,21 | 1,49 |
| Belarus | 74.8 | 356.3 | 18727,000 | 10,61 | 3,76 |
| Belgium | 81.6 | 4913 | 39756,000 | 15 | 3,78 |
| Cameroon | 59.3 | 54.14 | 2888,000 | | 0,08 |
| Canada | 82.4 | 4995 | 44869,000 | 19,55 | 2,07 |
| China | 76.9 | 501.1 | 13102,000 | 8,85 | 1,81 |
| Costa Rica | 80.3 | 909.7 | 14686,000 | 27,82 | 1,32 |
| Ethiopia | 66.6 | 24.23 | 1838,000 | 4,79 | 0,03 |
| Finland | 81.9 | 4516 | 38897,000 | 13,33 | 3,20 |
| Ghana | 64.1 | 77.91 | 4267,000 | 6,42 | 0,09 |
| Iceland | 83.0 | 6531 | 43439,000 | 16,62 | 3,46 |
| India | 69.7 | 72.83 | 6807,000 | 3,39 | 0,65 |
| Iraq | 70.6 | 239.4 | 12836,000 | 6,19 | 0,61 |
| Israel | 83.0 | 3324 | 32955,000 | 12,06 | 3,11 |
| Japan | 84.6 | 4267 | 38674,000 | 23,65 | 2,14 |
| Kazakhstan | 73.6 | 275.9 | 25308,000 | 9,1 | 3,84 |
| Kenya | 66.7 | 88.39 | 3377,000 | 8,55 | 0,18 |
| Luxembourg | 82.3 | 6227 | 57428,000 | 10,47 | 2,78 |
| Malaysia | 76.2 | 427.2 | 24842,000 | 8,47 | 1,20 |
| Mexico | 75.1 | 519.6 | 16494,000 | 10,47 | 1,96 |
| Mongolia | 69.9 | 155.1 | 13383,000 | 7,73 | 2,76 |
| Nepal | 70.8 | 57.85 | 2727,000 | 4,58 | 0,21 |
| Netherlands | 82.3 | 5307 | 47474,000 | 15,4 | 0,60 |
| New Zeland | 82.3 | 4037 | 35336,000 | 19,27 | 2,74 |
| Nigeria | 54.7 | 83.75 | 5238,000 | 4,44 | 0,40 |
| Norway | 82.4 | 8239 | 84580,000 | 17,44 | 4,39 |
| Paraguay | 74.3 | 400.4 | 9339,000 | 15,3 | 1,11 |
| Philippines | 71.2 | 136.5 | 8139,000 | 6,6 | 1,15 |
| Poland | 78.7 | 978.7 | 27455,000 | 10,83 | 2,07 |
| Qatar | 80.2 | 1716 | 153764,000 | 6,29 | 2,76 |
| Russia | 72.6 | 609 | 24669,000 | 9,76 | 4,31 |
| Saudia Arabia | 75.1 | 1485 | 50305,000 | 10,86 | 0,94 |
| Singapore | 83.6 | 2824 | 68402,000 | 15,28 | 1,92 |

| South Africa | 64.1 | 526 | 12166,000 | 13,34 | 0,76 |
|---|---|---|---|---|---|
| Sweden | 82.8 | 5982 | 45542,000 | 18,6 | 3,69 |
| Switzerland | 83.8 | 9871 | 61373,000 | 10,99 | 4,08 |
| Thailand | 77.2 | 275.9 | 16649,000 | 15,03 | 0,30 |
| Tajikistan | 71.1 | 59.84 | 4440,000 | 6,14 | 1,90 |
| Turkey | 77.7 | 389.9 | 1927,000 | 9,3 | 1,71 |
| Ukraine | 72.1 | 228.4 | 9813,000 | 8,87 | 3,52 |
| United Arab Emirates | 81.3 | 1817 | 76398,000 | 7,25 | 1,93 |
| United States of America | 78.9 | 10624 | 55335,000 | 22,5 | 2,42 |
| United Kingdom | 81.3 | 4315 | 38058,000 | 19,2 | 2,77 |
| Uzbekistan | 71.7 | 82.27 | 1122,000 | 7,87 | 2,54 |
| Vietnam | 75.4 | 151.7 | 6814,000 | 9,35 | 1,22 |
| Zimbabwe | 61.5 | 140.3 | 1611,000 | 7,56 | 0,08 |