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THE IMPACT OF HEALTHCARE AVAILABILITY ON THE AMENABLE MORTALITY: COUNTRY STUDY

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ABSTRACT. This study aims to provide information on the relationship between the accessibility of healthcare and avoidable mortality. Many of the general indicators such as health care expenditures, mortality, life expectancy are insufficient in comparing the national healthcare systems, because they explain only a small amount of diversity caused by socio-economic factors. The study is based on the panel data analysis for the period from 1998 to 2015 in Slovak republic. As the indicator that takes into account socio-economic factors and represents the level of provided healthcare, the depended variable is avoidable mortality. Independent variables represent the availability of healthcare in regions. Models were estimated separately for women and men. The results demonstrate differences between sexes, lower amenable mortality in case of women, correlated to availability of practitioners, dentists, specialists, pharmacies and gynecologists. For men, there is evidence of a relation between amenable mortality and the accessibility of specialists, pediatricians, practitioners and pharmacies.

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Introduction

Comparison of health care systems becomes more problematic because the variety of provided health care and health system has raised. As the countries become the members of the World Health Organization, healthcare systems of separate countries are open not only locally and nationally but also internationally. The basic models of health care systems are the Beveridge model, the Bismarck model, the National Health Insurance Model and the Out-of-Pocket model. The models differ mostly economically (by financing schemes and ownership type) and its implementation is given historically. In the Beveridge model, the hospitals and clinics are in public ownership, patients get the health care for free, financed by the state income (represented by tax revenue). Countries that based their health care system on the Beveridge model are Great Britain, Latvia, Lithuania, Denmark, New Zealand, Spain, Hungary. Austria, Germany, Japan, Slovak republic, Switzerland, Belgium and the Netherlands implemented the Bismarck model. The key element of this model is the income ceiling and the majority of private property. The National Health Insurance model, that is a combination of both previous models, was found in Canada, Taiwan and South Korea. The health expenditures are covered partially by government and private insurance companies. Out-Of-Pocket model is known mostly for developing and emerging countries such as Africa, China, India, South America.

Health systems are open and influenced by the external environment and its determinants. Determinants could be political, economic, social, technological, geographical and environmental. While political determinants of external environment are all political interventions and legislation changes to health system, technological determinants are actual capacity and capability of technologies, therefore technological progress of machinery used in health care. The development of health system is influenced by actual economic situation of country and its possibility to invest into it. Environmental determinants that influence the general health are the CO_2 emissions, change in air quality, deforestation, urbanization etc. There are gross inequalities in level of health between and within countries. To reduce disparities in health care it is necessary to do both, research the main health determinants and to incorporate the research results into the health policies and prevention.

Indicators that allow to compare the effectiveness of healthcare systems vary depending on whether the comparison is made within countries or at international level. Special indicators such as the total satisfaction of care provided, the behavior of doctors and nurses, quality of accommodation hospitals are needed in order to compare the quality of healthcare providers. Data envelopment analysis or index metrics could be conducted to benchmark the medical facilities and to compare the technical efficiency on the national and international level. The analysis of health determinants requires the correct identification of the input and output variable. Both, the explanatory variables and response variable, should contain adequate information on health and they should take into account the health determinants.

Many indicators related to health, were used in the health efficiency´s studies. According to previous studies (Lavergne & McGrail 2013; Nolte & McKee, 2003; James, Manuel, & Mao, 2006), avoidable mortality includes social-economic factors such as education, unemployment, income level and therefore, it is one of the adequate indicators for this kind of analysis. Avoidable mortality represents the information on deaths that would not occur, if effective prevention and appropriate access to health care were given. It consists of preventable and amenable mortality.

In many countries, as well as in Slovakia, the existence of social disparities increases. Avoidable mortality is more common for social groups disadvantaged because of their ethical or social-economic characteristics. Economically, Slovakia´s development was influenced by its Soviet history, that did not allow to make the same economic progress as in countries of Western Europe. Even within the country, there is a difference between the development of the Est and the West. While in the Western part, including the capital city Bratislava, economic progress is visible, the Eastern part is characteristized by higher unemployment rate and more socially disadvantaged residents with lower education. The geographical location of Slovakia as well as the climatic and weather conditions are cause of differences between the countryside of north and the south part of country. The difference between the productive and non-productive population gets more significant, meaning that the population is getting older nowadays. For the population aged below 40 years, the disease of coronary system is of less importance. The older the population is, the coronary system problems (that are the main causes of amenable mortality in Slovakia), become more evident.

The most common health system obstacles in Slovakia are low efficiency of the whole system, outdated medical facilities and high average age of general practitioners. Historically, there were many reform efforts to improve the Slovak health system. The best known have started in 2002, resulted in health legislation changes and transformation of inssurance companies. Other reforms, that are still in process, cover primary health care, health education system, implementation of e-health, diagnostic and therapeutic procedures, broadening the competences of general practitioners and integrated health care centers. All of the the reforms determine the whole health system of Slovakia and make it unique when comparing to other countries.

As it was mentioned above, avoidable mortality is an indicator that includes important social-economic aspects and therefore provide good measure to compare the health efficiency of Slovak districts. In this study, amenable mortality is calculated and used to examine the level of healthcare across all Slovak districts. In general, healthcare becomes more accessible even to socially disadvantaged when there is sufficient access to it. The number of different types of health facilities represents healthcare availability (accessibility) in this research. After the computation of amenable mortality within Slovak districts, the briefly comparison of amenable mortality across them will take place. Next part of study covers the examination of relationship between the amenable mortality and health care accessibility (represented by number of several types of health care facilities). It is examined separately for women and men in the case of Slovak republic during the period from 1998 to 2015. The results of the panel data analysis are presented in the results part, followed by the discussion, where the results are discussed, and by the conclusion. The structure of this study is as follows: introduction, literature review, methodological approach, research results, discussion and conclusion.

1. Literature review

Considering both, the specificity of provided healthcare and diversity of health systems, it is problematic to compare the health care quality and efficiency at regional and international level (Dwyer-Lindgren, et al., 2016; Dopico, 1987; Hakulinen, et al., 1986; Mackenbach, et al., 1988; Lozano, et al., 2012; Wang, et al., 2012; Rudawska, 2017; Staňková et al., 2017). Historically, general health care indicators such as healthcare spending, hospital facilities access, mortality, life expectancy, etc. were used to compare effectiveness of healthcare systems across world (Carinci, et al., 2015; Kabir, 2008; Feinstein, 1993; Simionescu et al., 2019; Dumitrescu et al., 2014). The quality of health care is the indicator that determines the health of the population (James et al., 2006). Rutstein, et al. (1976) first defined "quality" as the effect (outcome) of health care for individuals and populations. Examining geographic and socio-economic influences in healthcare outcomes is crucial for finding areas in which improvements of accessibility, quality and timeliness are needed (Lavergne & McGrail, 2013).

To analyse multiple metrics of different inputs and outputs more effectively, ratios and econometric/mathematical programming were used. DEA (data envelopment analysis) and SFA (stochastic frontier analysis) were the two of mostly used linear methods in studying the health care efficiency (Asandului et al. 2014; Benicio & Mello, 2015; French & Jones, 2006). In the study (Nolte & McKee, 2003), the authors conclude that the high level of health attained in the countries does not have to be directly related to the state of the health system as such, but rather to the coincidence caused by the geographical location of the country, the dietary habits of the population, or the implemented policies in other sectors.

Generally, mortality is used as an indicator of the quality and safety of healthcare provided. In in-depth analysis, it is necessary to pay attention not only to the overall mortality but also to its causes. Information on the causes of death in individual countries depends on historical, demographic and socio-economic developments, which directly determines the level of quality of health care (Kjellstrand et al. 1998). Analytical mortality indicators are mortality median, infant mortality, perinatal mortality, neonatal mortality, mortality rate, standardized mortality rate (Reidpath & Allotey, 2003).

Avoidable mortality is the special type of mortality (Rutstein et al., 1980), which was applied in the 1960s for the first time. Scientists have developed the concept of avoidable mortality as a possible indicator for measuring the effectiveness of healthcare systems because it expresses a mortality rate that can be avoided by appropriate healthcare interventions and adequately implemented health policies (Gavurova & Vagašová, 2015). Using avoidable mortality is a simple and practical population-based method that monitors early and unnecessary deaths that could be avoided if effective public tools were available. Nolte & McKee (2004) investigated more than 70 studies addressing avoidable mortality. Studies have concluded that socio-economic factors (e.g. education, unemployment, socio-economic status, income level) are associated with avoidable mortality. Ramkissoon (2013) describes avoidable mortality as an indicator of quality of health care.

Social groups that are considered to be socially disadvantaged due to their ethnic origin or socio-economic characteristics are at greater risk of death that can be avoided. There is also a trend for a faster decline in avoidable mortality, such as a drop in mortality, to those causes that we consider to be irreversible. Sundmacher (2013), in his study, concluded that there is only a slight difference in the development of avoidable mortality between men and women. On the contrary, the authors (Hoffmann et al. 2014) in their study pointed out that avoidable mortality is higher in areas with social deprivation, and mortality rates also differ between genders and cities.

Between 2000 and 2015, a decrease in avoidable mortality has been recorded all over Europe. The English Ministry of Health uses avoidable mortality as one of the main indicators of health care performance. The Commonwealth Fund in the US uses avoidable mortality to compare the performance of 50 US states (Schoenbaum et al. 2011). In Norway, between 1994 and 2011, income-related inequalities in avoidable and its two components, amenable and preventable mortality, have remained relatively constant. All of them were mainly correlated with the relationship between income and avoidable mortality rather than with variations in the Gini coefficient of income inequality (Kinge et al. 2015).

Avoidable mortality is divided into amenable (curable) mortality and preventable mortality. Wheller et al. (2007) defined preventable mortality as a mortality that can be avoided by individual behavior or public health measures that limit individual exposure to harmful substances or conditions. Amenable mortality is generally defined as premature death rate that should not occur in the presence of effective and timely health care. In the case of curable mortality, early intervention can prevent death to a certain age limit (James et al., 2007). Preventable mortality is also used as one of the indicators of the effectiveness of health care (Mackenbach et al. 2017; Nolte & McKee, 2011; Charlton et al. 1983; Charlton & Velez, 1986).

The limitations of using the amenable mortality as an indicator of the performance of the health system internationally are the health care access, availability, different diagnosis pathway (Reid, 1962), regional inequalities (Charlton et al. 1983; Andreev et al. 2003) and the problem of identification of main cause of human death. Death can occur due to a number of reasons and therefore it can occur due to contraindications caused by other diseases (Bauer and Charlton, 1986; Treurniet et al. 1999). Hoffmann et al. (2014) confirm this statement by affirmation that there are significant geographical differences in the level of avoidable mortality between neighboring regions.

Differences in the availability of healthcare resources, patient and provider cooperation, affect the quality of healthcare services and patient outcomes differently. Efficient management of resources and processes influence the quality of health services (Mosadeghrad, 2014; Persona et al. 2008; Battini & Rafele 2008; Krot & Rudawska, 2017; Miguel Cruz & Guarín 2017; Gianino et al. 2017). Many studies of amenable and preventable mortality and their determinants are based on the production function of health (Nolte & McKee, 2004). While the avoidable mortality in the form of a amenable or preventable represents the output, inputs are healthcare expenditure (Poikolainen & Eskola, 1988), number of healthcare workers per capita (Poikolainen & Eskola, 1988; Kunst et al. 1988), the number of hospital beds, the number of health care facilities in the region (Pampalon, 1993) and the rate of consultations with practitioners (Humblet et al. 1987).

In general, the health systems are the objects of criticism because of their low efficiency in providing services and inefficiency in allocation of resources (Anand & Bärnighausen, 2004). There are many important indicators that partially allow to compare the effectiveness of health care and health systems in different regions within country. Many of them don´t include social and economic situation of citizens, however the amenable mortality is connected to social status of citizens (Nolte & McKee, 2004). Access to healthcare is inevitable element in improvement of health level of country (Lankila et al. 2015; Kunst et al. 1988a). Good health care accessibility is key element of lowering the avoidable mortality. Not equal health care accessibility across regions may influence the amenable mortality differently. Amenable mortality can differs across regions even when comparing men and women. There are studies, that deal with the general mortality, that doesn´t reflect the social characteristic of citizens, therefore using the amenable mortality would raise the value of research (Reidpath & Allotey, 2003; Wang et al. 2012). However, there is a lack of studies that deal with the problem of health care accessibility and amenable mortality at the same time. It´s inevitable to fill this gap and therefore to provide scientific research and study in order to get to know, whether the number of health facilities may influence the amenable mortality or not, supposing that better health care accessibility decreases the amenable mortality.

2. Methodological approach

We used data from two sources. The first source is National Health Information Centre of the Slovak republic (NHIC) from which the database of the mortality originates. This database consists of all deceased in the Slovak republic since 1995. The database of the population in Slovak regions and database of the number of healthcare facilities in Slovak regions come from the Statistical Office of the Slovak Republic (SO).

Database of healthcare facilities include number of eleven types of healthcare facilities: hospitals, health centres, paediatricians, practitioners, gynaecologists, pharmacies, emergency medical services, specialists, dentists, blood transfusion stations and medical supply store. Data are available for Slovak regions. There are eight regions in the Slovak republic: Bratislava region, Trnava region, Nitra region, Trencin region, Zilina region, Banska Bystrica region, Presov region and Kosice region. Due to the availability of healthcare facilities data, we realized analysis for years from 1998 to 2015. The database of the population consists of age-specific population in Slovak regions.

Analysis is divided into two parts. Firstly, it is necessary to compute amenable mortality. Then, we estimated a linear panel model in order to find out the impact of number of healthcare facilities on the amenable mortality in Slovak regions.

Amenable mortality belongs to the concept of the avoidable mortality. The list of causes of the amenable mortality is given by the Office for National Statistics (2013) and accepted by the European Commission. Complete list of diagnosis is presented in *Table 1*. Because of our dataset of deceased consists of ICD-10 codes of three-character, we omitted four-character diagnosis. For most of the causes of death, the age limit has been set up to 74 years for both sexes. There are several diagnoses with lower age limit because it is supposed that treatment is ineffective in case of elderly people.

The computation of the amenable mortality is based on the standardized death rate (SDR). The amenable mortality in region *i* is given as a sum of SDR for specified causes and age categories.

Table 1. Amenable mortality cause list

Cause	**ICD-10 codes**	**Age**
Tuberculosis	A15-A19, B90	0-74
Selected invasive bacterial and protozoal infections	A38-A41, A46,	0-74
Hepatitis C	B171, B182	0-74
HIV/AIDS	B20-B24	All
Malignant neoplasm of colon and rectum	C18-C21	0-74
Malignant melanoma of skin	C43	0-74
Malignant neoplasm of breast	C50	0-74
Malignant neoplasm of cervix uteri	C53	0-74
Malignant neoplasm of bladder	C67	0-74
Malignant neoplasm of thyroid gland	C73	0-74
Hodgkin's disease	C81	0-74
Leukaemia	C91, C920	0-74
Benign neoplasms	D10-D36	0-74
Diabetes mellitus	E10-E14	0-74
Epilepsy and statusepilepticus	G40-G41	0-74
Rheumatic and other valvular heart disease	I01-I09	0-74
Hypertensive diseases	I10-I15	0-74
Ischaemic heart disease	I20-I25	0-74
Cerebrovascular diseases	I60-I69	0-74
Influenza (including swineflu)	J09-J11	0-74
Pneumonia	J12-J18	0-74
Asthma	J45-J46	0-74
Gastric and duodenal ulcer	K25-K28	0-74
Acute abdomen, appendicitis,	K35-K38,K40-	0-74
Nephritis and nephrosis	N00-N07,N17-	0-74
Obstructive uropathy and prostatic hyperplasia	N13, N20-N21,	0-74
Complications of perinatal lperiod	P00-P96,A33	All
Congenital malformations,deformations andchromosomal	Q00-Q99	0-74
Misadventures to patients during surgical and medical care	Y60-Y69,Y83-Y84	All

Source: *Office for National Statistics (2013)*

According to Anderson & Rosenberg (1998) and Curtin & Klein (1995), SDR is expressed by the equation (1), where *x* represents age category 0, 1 – 4, 5 – 9, …, 90 – 95, 95+, mix is age-specific death rate and ESP denotes the European Standard Population set by the

European Commission (2013). That method is applied in order to eliminate the effect of the age variability in regions and over the time.

$$SDR_i = \frac{\sum_x m_{ix} ESP_x}{\sum_x ESP_x} 100{,}000 \quad (1)$$

The age-specific death rate mix is calculated by the equation (2), where D_{ix} signs the number of deceased in the age category x in region i and P_{ix} represents average population in the age category x in region i.

$$m_{ix} = \frac{D_{ix}}{P_{ix}} \quad (2)$$

Our analysis of the impact of healthcare facilities is related to the production function of health presented by Kamarudeen (2010). That approach is based on the assumption that health outcome dependents on the medical or healthcare variables and other non-medical variables. Production function of health is given by the equation (3), where H_{it} denotes a measure of the health outcome in region i at time t, M_{it} expresses medical or healthcare variables in region i at time t, E_{it} is a list of non-medical variables in region i at time t, α_i, β and γ are estimated regression coefficients and ε_{it} is the error term.

$$H_{it} = \alpha_i + \beta M_{it} + \gamma E_{it} + \varepsilon_{it} \quad (3)$$

Based on the production function of health, we built the linear panel model with dependent variable amenable mortality and seven explanatory variables expressing the healthcare availability. We selected these variables: (x1) paediatricians, (x2) practitioners, (x3) gynaecologists, (x4) pharmacies, (x5) emergency medical services, (x6) specialists and (x7) dentists. Other healthcare facilities were omitted because of their low number in regions, which could have negative impact on the model. Similar studies were analysed by many authors, e.g. Lankila et al. (2015), Dussault & Franceschini (2006) and Anand & Bärnighausen (2004).

We estimate three linear panel models for each sex. The first model is pooling model, which assumes parameter homogeneity (Croissant & Millo, 2008), the second model is fixed effects model and the third is random effects model. To find the most appropriate model, we apply several tests commonly used. All analysis and outputs are realized in the R Software environment (Development Core Team R., 2017).

3. Research results

The Slovak Republic is a heterogeneous country according to many indicators. The significant regional disparities are obvious in case of amenable mortality. Amenable mortality for men in 2015 in Slovak districts is depicted in Figure 1. The highest amenable mortality of men is in the south part of the country (Kosice region and Banska Bystrica region). Amenable mortality is there higher than 450 deaths per 100,000 inhabitants. On the other hand, the lowest amenable mortality is in general in the north part (Zilina region) with the amenable mortality about 250 deaths per 100,000 inhabitants.

Based on the realized tests, the most appropriate model is Fixed effects model. There are four statistically significant variables in the model. The first one is the number of paediatricians (x1) with positive value of the estimated coefficient, which mean that increase in the number of paediatricians in the region by one unit will lead to the increase in the amenable mortality in the region by 3.885 deaths per 100,000 inhabitants.

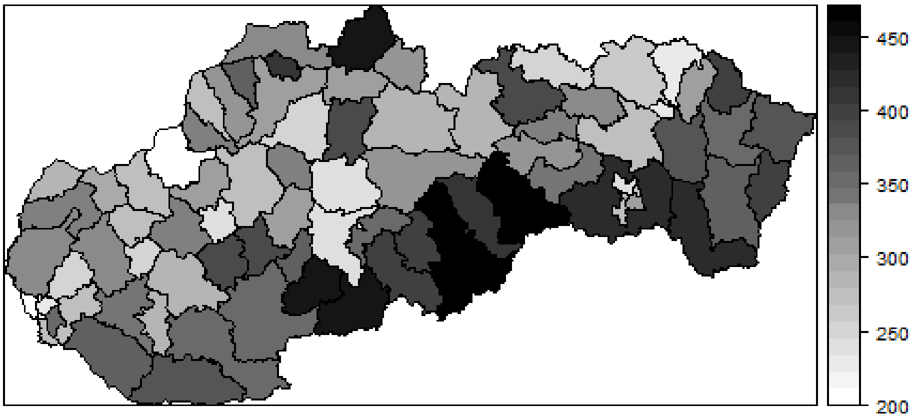

Figure 1. Amenable mortality of men in Slovak districts in 2015
Source: *own compilation*

In case of women, the amenable mortality is lower than the amenable mortality of men. The maximal amenable mortality is about 240 deaths per 100,000 inhabitants in the east part of the country. This part of the country represents the Kosice region. The lowest amenable mortality of women is in the northwest, representing the Bratislava and Trencin region.

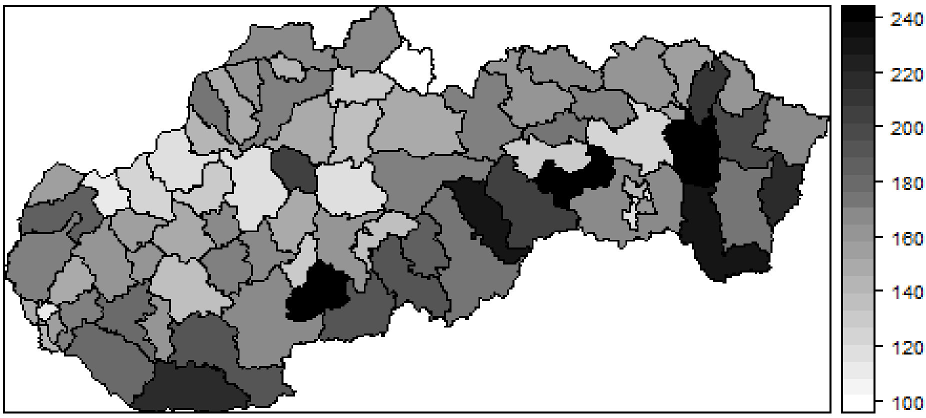

Figure 2. Amenable mortality of women in Slovak districts in 2015
Source: *own compilation*

We estimated linear panel models that express the relationship between amenable mortality and availability of healthcare facilities. We estimated three panel models: fixed effect model, random effect model and pooling model. Due to the fact that there are cross-sectional dependence and serial autocorrelation in the model, so we used estimation based on the robust covariance matrix. The estimated regression coefficients for men are shown in *Table 2.*

Table 2. Estimated coefficients of panel models for men

	Fixed effects model		Random effects model		Pooling model	
Variables	(1)		(2)		(3)	
Constant			448.437	***	455.250	***
x1	3.885	*	2.514	*	0.486	
x2	1.482	*	1.941	*	3.364	**
x3	-1.734		-0.815		2.482	
x4	-3.904	***	-4.274	***	-4.747	***
x5	-1.843		-1.632		0.102	
x6	-0.377	**	-0.424	**	-0.594	***
x7	0.251		-0.127		-1.006	
R-Squared	0.228		0.226		0.245	

Source: *own compilation*

Note to the table: ***, **, * denote significance level on 1, 5 and 10 % respectively.Variables are denoted as follows: (x1) paediatricians, (x2) practitioners, (x3) gynaecologists, (x4) pharmacies, (x5) emergency medical services, (x6) specialists and (x7) dentists. According to the Poolability test, panel model is appropriate for individual effects (F=2.118***) but not for time effects (F=1.192). F test confirmed the existence of the individual effects (F=9.477***) as well as for time effects (F=30.864**). Based on the Pesaran CD test, cross-sectional dependence is confirmed in our model (Z=52.476***). Breusch-Godfrey test for serial autocorrelation affirms the existence of the serial correlation (Chisq=620.86***). Hausman test prefers the fixed effects model.

The same situation is in the case of the number of practitioners (x2), when the growth by 1 unit in the region will increase the amenable mortality in the region by 1.482 deaths per 100,000 inhabitants. On the other hand, if the number of pharmacies (x4) rise by one unit in the region, the amenable mortality will decline by the 3.904 deaths per 100,000 inhabitants. It is also the case of the number of specialists (x6), when the increase in the region by one unit leads to the decrease of the amenable mortality by 0.377 deaths per 100,000 inhabitants.

Table 3. Estimated coefficients of panel models for women

	Fixed effects model		Random effects model		Pooling model	
Variables	(1)		(2)		(3)	
Constant			256,243	***	244.006	***
x1	-0.680		-0,538		-0.547	
x2	0,422		0.724	*	1.339	**
x3	-2,152	**	-1.573	*	0,226	
x4	-1.912	***	-1.684	***	-1.506	***
x5	-1,121		-0.932		-0.071	
x6	-0.252	***	-0,299	***	-0.391	***
x7	0.855	**	0.557	*	-0.014	
R-Squared	0.281		0.264		0.238	

Source: *own compilation*

Note to the table: ***, **, * denote significance level on 1, 5 and 10 % respectively. Variables are denoted as follows: (x1) paediatricians, (x2) practitioners, (x3) gynaecologists, (x4) pharmacies, (x5) emergency medical services, (x6) specialists and (x7) dentists. According to the Poolability test, panel model is appropriate for individual effects (F=2.158***) but not for time effects (F=0.716). F test confirmed the existence of the individual effects (F=8.566**) as well as for time effects (F=36.718**). Based on the Pesaran CD test, cross-sectional dependence is confirmed in our model (Z=64.933***). Breusch-Godfrey test for serial autocorrelation affirms the existence of the serial correlation (Chisq=579.06***). Hausman test prefers the random effects model.

Estimated regression coefficients for women are shown in *Table 3*. According to the Hausman test, we chose the random effects model. There are five statistically significant variables in the model. The first one is the number of practitioners (x2). The estimated coefficient is 0.724, which means that if the number of practitioners in the region rise by one unit, the number of deaths will increase by 0.724 per 100,000 inhabitants. The same impact has the number of dentists (x7) with estimated regression coefficient 0.557. Negative estimated coefficients have the number of gynaecologists (x3), the number of pharmacies (x4) and specialists (x6). The increase of these healthcare facilities in the region will leads to decrease of the amenable mortality of women in the region.

4. Discussion

Term avoidable mortality with its two main indicators (amenable and preventable mortality) provides information on deaths that would not occur, if better health care were provided. Both indicators of avoidable mortality are widely used to examine the health care efficiency and to compare health care efficiency across the regions. Slovakia is the country that isn´t developed uniformly. While there are regions with high economic progress, the other parts of Slovakia are known for the higher unemployment and their progress is not evident. Amenable mortality differs from West to East of the country. In general, higher the accessibility of health care is, the more efficient it should become. However, the evidence of relationship between the number of health care facilities and amenable mortality stays unclear.

In this study we calculated the amenable mortality based on the standardized death rate (SDR) to identify the regions that may have the higher mortality rate. Analysis of panel data was conducted in order to detect the relationship between number of several types of health facilities and amenable mortality. As the analysis shows, for men, the fixed effects model was identified as the most appropriate to model the relationship between amenable mortality and availability of healthcare facilities. In case of women the most suitable model for intended analysis was the random effects model.

Lankila et al. (2015) stated that the longer distance to health centre services may be the obstacle in health care use. It may affect the decision of ill patients negatively, so they will not visit the doctor even they´re not in good health condition. Factors that are associated with the negative health outcomes are lack of resources (Dussault & Franceschini, 2006). Study (Pampalon, 1993) suggests that deaths ought to be related to health facilities as they provide the health services. Their results are partly consistent with our finding, for men, number of specialists and pharmacies are negatively correlated to amenable mortality. If the numbers of specialists or pharmacies raises the amenable mortality decreases. In case of women, negative relationship exists between amenable mortality and number of specialists, gynaecologists and pharmacies.

On the other hand, our analysis shows the evidence of positive relationship between amenable mortality and some types of health facilities. For men, positive relationship is between amenable mortality and number of paediatricians and practitioners. For women, positive relationship is only between amenable mortality and the number of practitioners. In both cases, if higher number of health facilities represented better accessibility to health care, the interpretation of this positive relationship would be confusing. However, the positive relationship may reside from the fact, that there is an excess of practitioners in Slovak districts and the additional practitioners will not ameliorate the efficiency of health care (the amenable mortality will not decrease). Before further analysis it is necessary to define what does the health efficiency means in relation to health accessibility. When analysing the positive and negative relationships between variables it is necessary to take into account the similarities between both sexes. These similarities support the accuracy of our results.

One of the recommendations that resides from our study is to decrease the number of practitioners in Slovakia. As we were limited by many factors such as the lack of more detailed data and data on preventable mortality, other factors that influence the amenable mortality, to support our results and recommendations, the future studies in this field are needed.

Conclusion

Many of the health indicators such as health care expenditures, life expectancy, infant mortality are insufficient to explain differences caused by the diversity of health systems across the world. They do not even explain diversity caused by socio-economic factors. Examining geographic and socio-economic variations in healthcare service use and outcomes has the potential to highlight areas where improvements in availability, quality or timeliness of health care are needed. Following the results, amenable mortality of Slovakia is higher in the south part of the country. In most districts, amenable mortality is in case of both sexes over the average. In the eastern part of the country, the amenable mortality is the highest. The regions with the highest amenable mortality are Kosice region following by Banska Bystrica region. Based on the general knowledge of socio-economic situation in Slovakia, in these regions there are the least developed districts with the highest unemployment.

The main focus of this study is on modelling the relationship between the number of health facilities and amenable mortality. To examine this relationship, panel data analysis was conducted. The results are presented separately for women and men. As the research demonstrated, there exist some statistically significant differences between genders. We can see that for men, there are four statistically significant variables: number of paediatricians, practitioners, pharmacies and specialists. For women, statistically significant are the number of practitioners, gynaecologists, pharmacies, specialists and dentists.

For men, the evidence of negative relationship is between amenable mortality and the number of pharmacies and specialists, while other statistically significant variables are in positive relation explained variable. For women, the results show that the number of practitioners is positively correlated with amenable mortality. Number of the gynaecologists, pharmacies, specialists and dentists are correlated negatively.

The positive correlation between response and explained variable in our case may be caused by several reasons and might be the object of future studies. Even results show that there is an evidence of a relationship between the variables, the further research is needed. The limitation of this study is a lack of more detailed data and data on preventable mortality. The avoidable mortality covers not only the amenable mortality but also the preventable mortality. The statistical evidence of preventable mortality doesn´t exist in Slovakia. As preventable mortality is not covered in this study, it will be the object of future studies. The accessibility of healthcare in this study was represented by the number of health care facilities. Health production function allows to use other indicators that may influence the amenable mortality. Current study is focused on the Slovak districts; however next study may be conducted on more detailed geographic areas.

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