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DETERMINANTS OF HEALTH STATUS AND PUBLIC POLICIES IMPLICATIONS – LESSONS FOR ROMANIA

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Abstract

The primary aim of this study is to assess the actual impact of healthcare public financing on population health status, while controlling for other non-financial health determinants. There are plenty of heterogeneous studies dealing with the negative or positive effects of different products consumption (e.g. sugar, alcohol, tobacco, fruits, vegetables, etc.) on people's health. Starting from the relevant ones, we kept for our models those non-financial variables with public available data, used as control variables. After performing variable selection, we ranked the actual impact of different public expenditures categories on health status change, using simple and multiple regression fixed-effects techniques on a panel dataset regarding the European members of OECD (ranging from 1970 to 2014).

Our results show that financing preventive care has the strongest positive impact on the health status, followed by auxiliary (ancillary) services. Administrative expenditures for the healthcare system do not have a significant influence, suggesting there is available room to enhance the effectiveness and performance of sanitary institutions management. Our results also show that life expectancy is negatively affected by the consumption of alcohol and sugar, in a decreasing order. These results were then connected with Romanian realities regarding health care financing and people's consumption habits. In strong connection with our findings and these realities, this study provides, as a final part, a set of policy recommendations useful for Romanian public authorities in designing their policies, as well as for other interested non-governmental actors.

Keywords: health status, non-medical determinants, life expectancy, health expenditures, health care policies.

1. Introduction

The insurance of a population's health status currently represents an important challenge for public authorities since its determining factors act with increased pressure. Against this backdrop, the increase in the effectiveness of health policies is a necessity and a sensitive aspect connected to the public financing of health. According to OECD (2013), the financial factor is a major drive for the population's health status alongside other social, economic or environmental factors. In order to increase the efficiency of using the public financial resources available for health it is mandatory to take into consideration the potential lessons taught by other countries' experience.

When faced with budgetary constraints, public authorities must determine the increase of overall efficiency instead of increasing the amounts allocated, thus reducing the budgetary effort without affecting the quality of the healthcare activities, especially in the context of the recent economic and financial crisis. Thus, due to the contracting of budgetary incomes during crisis, a trend to reduce the budgetary allocations for healthcare came into shape with low-income states even facing sub-financing in this field. At the same time, additional measures were taken, such as the encouragement of collateral private insurance or introduction or extension of certain user charges. The need to keep under control the budgetary deficits through the compression of public expenditure led in some cases to the adjustment through reduction of financed medical packages, which may have medium and long-term negative effects on the population's health and life quality. In this context, it is required to reshape the public healthcare policy decisions and the experience drawn by other countries may represent a favorable anchor for their validation.

In this regard, our paper aims to analyze the real impact of healthcare financing in European members of OECD on the healthcare status, characterized by life expectancy. Apart from the financial variables (HE), we used non-financial control variables (NONMDH) and we attempted to hierarchize the impact of various expenditure related to healthcare on the dependent variable. The results obtained were correlated with the situation of health financing and the consumption behaviors in Romania and offer certain valuable lessons that public decision-makers could take into consideration when shaping future public health policies. The final part of the paper presents a set of recommendations of public policy formulated in compliance with the study results.

The data used for the analysis have as a source the OECD database, which reports the size of the public health financing within the given classification. Thus, health expenditure include curative and rehabilitative care (inpatient, day and outpatient), home-based curative and rehabilitative care, long-term care, ancillary (auxiliary) services[1],

1 This category refers to supplies and laboratory tests provided under home care, audiology, durable medical equipment, ambulatory surgical centers, home infusion, hospice care, skilled nursing facility, cardiac testing, mobile lithotripsy, fitness center, radiology, pulmonary testing, sleep centers, and kidney dialyses.

medical goods, preventive care, governance, and health system and financing administration. The data used took into consideration the European OECD countries in different periods, according to the datasets' availability (ranging from 1970 to 2014, with some differences for different models used, see Table 2).

The main conclusion of the paper shows that the medical prevention financing, alongside with auxiliary services have a major impact on the improvement of population's health with a direct impact on life expectancy, suggesting the need for their consolidation. On the other hand, the sugar consumption negatively and more strongly influences life expectancy than alcohol consumption, a fact which suggests that the attention and increase in the intensity of public efforts should be focused on its decrease.

The paper is structured as follows: section 1 contains a brief introduction, section 2 includes the literature review, section 3 focuses on data and methodology, section 4 has empirical findings and discussions, section 5 analyses the pattern of healthcare financing and consumption in Romania and synthesizes some key lessons for policy-makers. The last section comprises the conclusions.

2. Literature review

The issue of the drivers of population's health is frequently tackled in the literature, mainly focusing on the causes and factors that influence its evolution in different countries or groups of countries (Or, 2000; Hollingsworth and Spinks, 2005; Mohan and Mirmirani, 2007; López-Casasnovas and Soley-Bori, 2014). According to the World Health Organization, the determining factors of population's health are distributed on three main tiers: the social and economic environment where the people live, the physical and personal environment of their life, and their features and behavior. In other words, the context in which the life of persons goes on also represents the explanatory factor of their health, including their social status, income, education, physical background, social integration, genetic aspects, gender, etc. At the same time, the structure, diversity and quality of health services constitute a major impact factor on the population's health status and their public or private financing plays a vital role.

The scientific interests in insuring and financing health services start from the premise that people inherently need these social goods and their supply is a legal obligation of public authorities. First and foremost, there is the problem of choosing between public and private financing of health services with the debate regarding the effects of coverage degree of services, equality, effectiveness or the impact on the life quality of the beneficiaries.

Hence, the studies conducted on some countries where health financing was commonly delegated to the public authorities (whole public financing of health services – Sampath and Wilson, 2012) conclude that this approach favored and supported a large coverage of services. Concurrently, this approach allowed the avoidance of inequalities in the case of low-income persons if financing had been private. These

studies suggest that health policy should firstly focus on the public financing of a basic package of medical services intended for universal access. This package may be combined with private optional health insurance, provided that inequalities between social groups with different incomes are not created or stimulated. It is admitted that the state is always able to finance entirely healthcare even if one can ascertain that the real financing base (GDP size) differs significantly among states. The difficulties faced by low-income states in the management of health services and the discrepancies compared to the states with higher revenues highlighted the need for a global approach of the healthcare issue. Thus, the possibility to finance healthcare publicly through a global fund can be discussed, especially since the European Union is aware of the need to organically and integrally tackle the social problems in general (Ooms and Hammonds, 2014). For Romania, the issue of health financing is all the more important as OECD highlighted that for 2015 there was a strong contrast with regard to this issue among its member states also belonging to the EU and the rest of the countries included in the analysis.

Even if both groups of countries registered in the years before the crisis a similar trend regarding the increase in healthcare expenditure, the EU-member OECD states (namely Greece, Portugal or Italy) turned to more consistent decreases of health financing with few possibilities to come back to the initial level in a short period of time (OECD, 2015). Romania is in a similar situation as the OECD countries since the public financing of healthcare is prevalent (an average of 75% of the total), which creates a direct relationship between the functioning of health services (and implicitly their results) and the trend of their budgetary financing.

Aside from the quantitative aspect of global financing of health services, the problem of the efficiency of the above-mentioned expenditure is still significant. In a study on the performance of health services in the USA from the perspective of their expenses, Berwick and Hackbarth (2012) noticed that at least 1/3 of the resources used represent a loss whose elimination could support both the sustainability of Medicare and Medicaid expenditure and their stabilization, given that their increase of up to 20% of GDP is forecasted for the year 2020. The questionable performance of these budgetary health allocations in different systems is considered in other studies notorious and frequent (Self and Grabowski, 2003; Medeiros and Schwierz, 2015) since it also highlights the hardships of their assessment (Anderson and Hussey, 2001). When studying the efficiency of public health expenditure, other papers extend the research to 191 states (Tandon *et al.*, 2000) and conclude that it is possible to improve the health services' performance without the increase of financial grants because all the states under analysis have usable maneuvering space. The same conclusion is also supported by the Organisation for Economic Co-operation and Development (OECD, 2010) which shows that the use of maneuvering space available in its member states in order to increase the efficiency of health expenditure would allow an average increase in life expectancy at birth by two years while the 10% increase in the financial allocations would rise this indicator with only 3 to 4 months.

On the other hand, the literature review has studies that aimed to test the intensity of the relationship between GDP and health expenses (Carrion–i–Silvestre, 2005), respectively of the relationship between health expenditure and life expectancy (Kelley, 2007; Ke, Saksenaa and Holly, 2011). These show that there are clear discrepancies between the developed countries and the developing ones, also justified by the lower efficiency of the use of financial funds in the second group of states, which questions the effects of targeted public policy measures, as is the case of Romania where there is the trend of increasing budgetary allocations. Other studies focused on the different impact of health financing on life expectancy, for instance in relation to gender, suggest that experts 'should not just use indicators such as national spending for healthcare as the share of society's total wealth (i.e. as % of GDP) or public funding as the share of (i.e. the percentage of) national spending on healthcare' (Asiskovitch, 2010). In accordance with these findings, we decided to include in the modelling both the total health financing expenditure and its components differentiated according to the goal perceived (auxiliary, preventive and so on, according to the official OECD ranking).

Apart from the study of the effects of public health financing as its economic drive, one can identify in the literature studies that focus on the social determinants of the population's healthcare status reflected in life expectancy. These prove that while the level of incomes, education and use of medical services (including the prevention ones) positively influence this indicator, an inadequate life style (which comprises of alcohol and tobacco consumption for instance) act in the opposite way, each of them having a different intensity for women and men (Joumard *et al.*, 2008).

The consumption of fruits and vegetables is promoted as a universal remedy for health status, its benefits being indisputable (Slavin and Lloyd, 2012). The studies conducted prove the dependence relationship between severe illnesses such as heart disease, stroke, and some cancers and harmful life and consumption habits such as lack of physical training, getting nutrients especially from fast-food products, fats, sugars, etc. At the same time, it is confirmed that a high consumption of fruits, vegetables and generally, 'healthy products' (i.e. whole wheat bread) positively influences health status (James *et al.*, 1997). There are also studies in the literature that present a direct relationship between morbidity and/or mortality levels and the quality of the diet according to age, sex, occupation and income level (Darmon and Drewnowski, 2008).

The non-financial variables used mainly as control variables in our study appeared constantly in research whose scientific aim was focused on health determinants. Thus, in 1972 sugar was already treated like 'pure, white and deadly' (Yudkin, 2013) while quantitative studies used as a variable its consumption (Cochrane, Leger and Moore, 1978). These scientific approaches can be found in different studies focusing on sugar supply and sugar consumption/intake.

Regarding the coverage area of these studies, it can be noticed that in most of the cases, the sample of countries targeted refers to developed economies of the OECD countries, a trend which is also fueled by the data availability needed for the study.

On the other hand, there are very few studies that deal with the less developed countries, among which we can mention those belonging to Rajkumar and Swaroop (2008), Ke, Saksenaa and Holly (2011), or Elmi and Sadeghi (2012).

3. Data and methodology

3.1. The panel model – a general approach

The panel data model is described through some restrictions such as parameter homogeneity (), for all *i,t*, applied to the general model (equation 1), resulting in a linear model pooling all the data across *i* and *t* (equation 2). To model individual heterogeneity, the error term has two separate components (one of which is specific to the individual) and doesn't change over time (equation 3). In the case of fixed or random effects models: the estimation depends on the properties of the error component, which may be either uncorrelated with the regressors (random effects model) or correlated (fixed effects, within or least squares dummy variables model).

$$y_{it} = \alpha_{it} + \beta_{it}^{T} x_{it} + u_{it} \quad (1)$$

$$y_{it} = \alpha + \beta^{T} x_{it} + u_{it} \quad (2)$$

$$y_{it} = \alpha + \beta^{T} x_{it} + u_{i} + \varepsilon_{it} \quad (3)$$

Reported at our variables, x_{it} (independent variables) is delimited in two major classes: Health Expenditure (HE) and Non-Medical Determinants of Health (NMDH), while y_{it}, (the dependent variable) is represented by EVIETOTEA (Life expectancy of total population at birth).

3.2. Model definition, variable explanation and hypotheses

The aim of our study is to examine the relationship between the main determinants of population health status (e.g. health expenditures), using as control variables some non-medical determinants (such as alcohol and sugar consumption) and life expectancy of the total population at birth in European OECD countries[2]. Expenditures used in our econometric models are total expenditures (private and public) in one model or some categories of government expenditures in others, the general model being described in equation 4. Non-Medical Determinants of Health (NMDH) used in the model as control variables are: ACOLALCT – Alcohol consumption, FOODTFAT – Total fat supply, FOODPROT – Total protein supply, FOODSUCR – Sugar supply, FOODFRUI – Fruits supply, FOODVEGG – Vegetables supply.

$$y_{it} = \alpha + \beta^{T} (HE_{it} + NMDH_{it} + u_{i} + \varepsilon_{it}) \quad (4)$$

2 Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Latvia, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, and United Kingdom.

The model codification for data is presented in Table 1.

Table 1: Variable explanation and expected sign

Variable* name	Variable explanation	Measure	Expected influence on dependent variable
	Health Expenditure (HE)		
	Total Health Expenditures (private and public)		
HFTOT	Current expenditure on health, all functions, all financing schemes (Government schemes and Private expenditure), all providers	Share of GDP	positive
	Public Health Expenditures, by types		
HC1HC2	Curative and rehabilitative care, Government schemes	Share of GDP	positive
HC11HC21	Inpatient curative and rehabilitative care, Government schemes	Share of GDP	positive
HC12HC22	Day curative and rehabilitative care, Government schemes	Share of GDP	positive
HC13HC23	Outpatient curative and rehabilitative care, Government schemes	Share of GDP	positive
HC14HC24	Home-based curative and rehabilitative care, Government schemes	Share of GDP	positive
HC3	Long-term care (health), Government schemes	Share of GDP	positive
HC4	Ancillary (auxiliary) services (non-specified by function), Government schemes	Share of GDP	positive
HC5	Medical goods (non-specified by function), Government schemes	Share of GDP	positive
HC6	Preventive care, Government schemes	Share of GDP	positive
HC7	Governance and health system and financing administration, Government schemes	Share of GDP	positive
	Non-Medical Determinants of Health (NMDH)		
ACOLALCT	Alcohol consumption	Liters per capita (15+)	negative
FOODTFAT	Total fat supply	Grams per capita per day	positive/negative
FOODPROT	Total protein supply	Grams per capita per day	positive
FOODSUCR	Sugar supply	Kilos per capita per year	negative
FOODFRUI	Fruits supply	Kilos per capita per year	positive
FOODVEGG	Vegetables supply	Kilos per capita per year	positive

Note: *due to collinearity assumption, only some variables appear in the models.

Source: Authors' computations

The variables are coded in the econometric models with the codification used by the OECD.Stat Database, i.e. for the first independent variable 'current expenditure on health for all functions, financed by all financing schemes, both governmental and private, and provided by all providers' the codification is HFTOT (Table 1, column 1 – Variable name). The explanation of the variables can be found in Table 1, column 2 –

Variable explanation, for the latest example being 'Current expenditure on health, all functions, all financing schemes (Government schemes and Private expenditure), all providers'. The measurement for the variables included in the model is presented in Table 1, column 3 – Measure, for our example the measurement being 'Share of GDP'.

Starting from the well-known structure of health expenditure, as different categories of expenses appear in the official reports from OECD, we would like to rank their impact on life expectancy based on the statistical regression. As such, we developed four models.

The first model identifies the effects of 'Current expenditure on health for all functions, financed by all financing schemes, both governmental and private, and provided by all providers' (HFTOT) on 'Life expectancy of total population at birth' (EVIETOTEA). The null hypothesis is:

H0.1 (H0 for model 1) – 'Current expenditure on health for all functions, financed by all financing schemes, both governmental and private, and provided by all providers' has no influence on 'Life expectancy of total population at birth'.

For the second model, we checked the same null hypothesis, but added supplementary control variables represented by Non-Medical Determinants of Health (NMDH). The null hypothesis is:

H0.2 (H0 for model 2) – 'Current expenditure on health for all functions, financed by all financing schemes, both governmental and private, and provided by all providers' and 'Non-Medical Determinants of Health (NMDH)' have no influence on 'Life expectancy of total population at birth'.

The third model intends to check the influence of 'public health expenditure categories' (HC1 to HC7) on 'life expectancy of total population at birth' (EVIETOTEA). The null hypothesis is:

H0.3 (H0 for model 3) – 'Current expenditures on health' (different public expenditures by types, government schemes and compulsory contributory health care financing schemes – HC1 to HC7) have no influence on 'life expectancy of total population at birth' (EVIETOTEA).

The fourth model checks the same null hypothesis, but uses as control variables the same Non-Medical Determinants of Health, as in the second model.

H0 (for model 4) – 'Current expenditures on health' (different public expenditures by types, government schemes and compulsory contributory health care financing schemes – HC1 to HC7) and 'Non-Medical Determinants of Health' (NMDH – sugar, alcohol, fruits, vegetables) have no influence on 'Life expectancy of total population at birth' (EVIETOTEA).

3.3. Database description, model assumptions

3.3.1. Database description

The database used in our analysis is described in Table 2.

Table 2: Data description

Statistic	N	Mean	St. Dev.	Min	Median	Max
			Model no. 1			
Year	867	1,995.36	12.37	1,970	1,997	2,014
EVIETOTA	867	76.74	3.21	66.40	76.90	83.30
HFTOT	867	7.32	1.71	2.26	7.29	11.40
			Model no. 2			
Year	734	1,994.26	11.66	1,970	1,996	2,013
EVIETOTA	734	76.53	3.05	66.40	76.70	82.80
HFTOT	734	7.29	1.59	2.26	7.27	11.13
ACOLALCT	734	10.67	3.15	3.80	10.85	20.50
FOODFRUI	734	97.91	33.18	28.90	92.50	241.60
FOODPROT	732	101.20	11.14	71.00	100.15	138.10
FOODSUCR	732	41.82	8.66	19.60	42.50	62.70
FOODTFAT	732	134.34	17.60	78.20	134.55	175.50
FOODVEGG	732	97.01	48.31	9.50	85.55	302.40
			Model no. 3			
Year	512	2,002.91	7.12	1,990	2,003	2,014
EVIETOTA	512	78.03	2.94	69.40	78.30	83.30
HC11HC21	434	2.19	0.58	0.92	2.15	4.30
HC13HC23	490	1.43	0.49	0.33	1.41	2.73
HC3	395	0.91	0.68	0.0003	0.84	2.98
HC4	380	0.32	0.16	0.04	0.34	0.94
HC5	449	0.94	0.37	0.21	0.86	2.76
HC6	428	0.16	0.06	0.001	0.15	0.35
HC7	466	0.19	0.11	0.02	0.16	0.57
			Model no. 4			
Year	424	2,001.42	6.23	1,990	2,002	2,013
EVIETOTA	424	77.65	2.85	69.40	78.10	82.80
HC11HC21	358	2.21	0.58	0.92	2.17	4.30
HC13HC23	404	1.38	0.47	0.33	1.38	2.53
HC3	323	0.86	0.63	0.0003	0.83	2.60
HC4	308	0.31	0.15	0.04	0.34	0.74
HC5	374	0.93	0.38	0.21	0.85	2.76
HC6	353	0.16	0.06	0.001	0.15	0.35
HC7	388	0.19	0.11	0.02	0.16	0.57
ACOLALCT	424	10.43	2.52	4.50	10.80	16.00
FOODFRUI	424	99.83	33.78	34.50	94.25	241.60
FOODPROT	422	103.21	10.79	71.00	104.25	138.10
FOODSUCR	422	42.31	8.72	20.10	43.30	62.70
FOODTFAT	422	136.78	17.92	88.40	137.05	175.50
FOODVEGG	422	100.47	36.39	31.40	89.35	246.40

Source: Authors' computations

3.3.2. Regression diagnostics with panel data

We used {car} package (Fox and Weisberg, 2011) in Rstudio (R Development Core Team, 2011) to identify outliers, so we controlled for the unusual and influential data by removing them from datasets. We used {lmtest} package (Zeileis and Hothorn, 2002; Zeileis, 2006) to test the presence of heteroscedasticity. The Pearson's correlation matrix suggests no problems regarding correlations between dependent variables in all three models. We have found that the homoscedasticity assumption is violated in all models, so we decided to use robust standard errors for reporting the results. Using the approach suggested by Zuur, Ieno and Elphick (2010), our final VIF's suggests no problems with multicollinearity (all the VIF's are below 2). We used Hausman test from package {plm} to decide which model fits best the data (see Table 3).

Table 3: Hausman test on panel data

Model number	Test statistic	df	P-value
1	34.87	1	0.000000003527 * * *
2	24.58	7	0.0009 * * *
3	12.81	6	0.0462 *
4	39.34	11	0 * * *

Source: Authors' computations

Based on Hausman test results, we conclude that individual effects are significantly correlated with at least one of the regressors in the models and thus the random effect could be problematic. Therefore, we should choose the fixed effect model rather than the random effect.

4. Empirical findings and discussions

Table 4 shows the models' empirical results. We have found that total health expenditures (public and private) have a positive effect on life expectancy (H0 is rejected for both model no. 1 and model no. 2), our study results being in line with other studies on this topic using different data (Kim and Lane, 2013; Deshpande, Kumar and Ramaswami, 2014). An increase with one percent in 'Current expenditure on health as GDP proportion', on average per Country, raise the life expectancy with 1.732*** (± 0.006) years. Adding more independent variables (Non-Medical Determinants of Health), the life expectancy value rises, on average, with 1.3352*** (± 0.00623) units, at the .05 significance level, holding all other variables constant.

In the second model, alcohol consumption (the raise with one liter per capita, on average per country) and sugar consumption (the raise with one kilo per capita per year, on average per country) diminished the life expectancy with -0.0950* (± 0.0552), and -0.0439*** (0.0100) units, respectively, at the 1 and at the .05 significance level, holding all other variables constant.

The public health expenditures by type also have a positive effect on life expectancy, both null hypotheses (for the third and fourth model) being rejected. Expendi-

tures related to auxiliary (ancillary) services, coded HC4, also appear to have a high impact. The raise with one percent in this type of health expenditure services increases the life expectancy by 6.6695*** (±1.4266) units. Adding the control variables, the positive impact is estimated at 4.1325*** (±0.4738) years at the .05 significance level, holding all other variables constant.

Table 4: Empirical findings

Robust Standard Errors for Panel Regressions with Cross-Sectional Dependence				
Dependent variable: EVIETOTA				
Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**
HFTOT	1.7320*** (0.0600)	1.3352*** (0.0623)		
HC11HC21			0.3402 (0.2472)	0.5650** (0.2493)
HC13HC23			2.4026*** (0.5484)	1.1049*** (0.2814)
HC4			6.6695*** (1.4266)	4.1325*** (0.4738)
HC5			0.8383 (1.2734)	1.3481 (0.8485)
HC6			3.4630 (2.3274)	4.5085*** (1.4415)
HC7			-2.5282 (1.8993)	-0.3799 (0.9222)
ACOLALCT		-0.0950* (0.0552)		-0.6088*** (0.1690)
FOODSUCR		-0.0439*** (0.0100)		-0.0273** (0.0125)
FOODTFAT		0.0145 (0.0109)		0.0379*** (0.0092)
FOODPROT		0.0377** (0.0150)		0.0884*** (0.0218)
FOODFRUI		0.0035 (0.0036)		0.0063* (0.0036)
FOODVEGG		0.0212*** (0.0048)		0.0121* (0.0069)
Observations	867	732	366	292
R^2	0.7998	0.8272	0.4412	0.6479
Adjusted R^2	0.7939	0.8195	0.3912	0.6029
F Statistic	3,360.4190*** (df = 1; 841)	478.6823*** (df = 7; 700)	44.0868*** (df = 6; 335)	39.5616*** (df = 12; 258

Note: *p<0.1; **p<0.05; ***p<0.01, Std.Err in parenthesis

Source: Authors' computations

Another category with large positive effect on life expectancy is health expenditure on preventive care (HC6). The raise with one percent in this type of expenditure affects positively the duration of life with 4.5085*** (±1.4415), at the .05 significance level, holding all other variables constant.

Regarding the Non-Medical Determinants of Health, the alcohol consumption appears to have a higher influence when used as a control variable in the fourth model, along with public expenditures by types. The increasing of consumption with one liter per capita, on average per country, reduces the life duration by 0.6088*** (±0.1690) units. Sugar consumption (one more Kilo per capita per year) diminishes the life expectancy with 0.0273** (±0.0125). With regard to normality of the data, the usage {boot} package in R results implementing R=10000 iterations, shows very low bias in the reported results.

5. The pattern of healthcare financing and consumption in Romania. Key lessons for policy-makers

The health financing in Romania knew a sinuous evolution during the 2003-2012 period, as the Table 5 and Figure 1 show; the weight of each category analyzed in the GDP registered different changes from one category to the other.

Table 5: Health financing in Romania (2003-2012, % of GDP)

Year	HC11HC21	HC13HC23	HC3	HC4	HC5	HC6	HC7
2003	2.28	0.52	0.52	0.18	1.1	0.33	0.28
2004	1.97	0.52	0.51	0.2	1.51	0.36	0.24
2005	2.02	0.51	0.52	0.2	1.59	0.37	0.19
2006	1.87	0.42	0.53	0.17	1.44	0.27	0.32
2007	1.84	0.47	0.54	0.21	1.4	0.34	0.33
2008	1.93	0.58	0.65	0.25	1.4	0.31	0.15
2009	2.09	0.51	0.78	0.22	1.42	0.46	0.1
2010	2.35	0.54	0.76	0.23	1.47	0.36	0.12
2011	1.89	0.51	0.69	0.22	1.7	0.38	0.11
2012	1.98	0.54	0.63	0.21	1.63	0.37	0.09

Source: Authors, based on data from Eurostat (undated)

We can observe the existence of different trends by categories, respectively from one period to another, without the existence of a global financing pattern for healthcare. For example, in the case of HC11HC21 – Inpatient curative and rehabilitative care, there is a decreasing trend between 2003 and 2007, followed by an increasing trend between 2007 and 2010, while in the case of HC5 – Medical goods, there is an increasing trend between 2004 and 2006 and a constant in the financing between 2005-2010, a fact which can be explained through the lack of a legal strategy in the field.

It turns out that the highest weights belonged to the financing of HC11HC21 – Inpatient curative and rehabilitative care (with values between 1.84 and 2.35, respectively and average of 2.02), followed by HC5 – Medical goods (values between 1.10 and 1.70, respectively and average of 1.46) (Table 5 and Figure 1). The activities that refer to the performance of the medical act (care of the sick people) were mainly financed, while the prevention activities HC6 (Preventive care) benefited from reduced financing (values between 0.27 and 0.46, respectively an average of 0.35). This approach comes in contradiction with the results of our study, which confirm the existence of a strong and positive impact of prevention expenditure on life expectancy. Hence, the results obtained suggest the need for a short-time shift in health financing, with a much ample focus on this category of public expenditure.

As for alcohol consumption, Romania ranks third in relation to the other countries studied (Figure 2), above the EU average of 9.9 liters (of pure alcohol, projected estimates, 15+ years of age), with an estimated intake of 12.9 liters (of pure alcohol, projected estimates, 15+ years of age) in 2015, being outdone only by the Czech Republic and Lithuania (14.1 liters, respectively 16.2 liters).

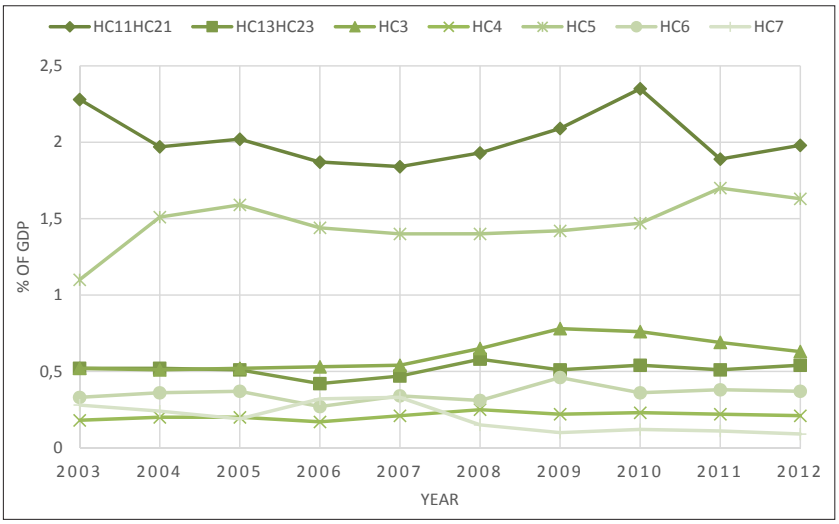

Figure 1: The evolution of health financing in Romania (2003-2012, % of GDP)

Source: Authors, based on data from Eurostat (undated)

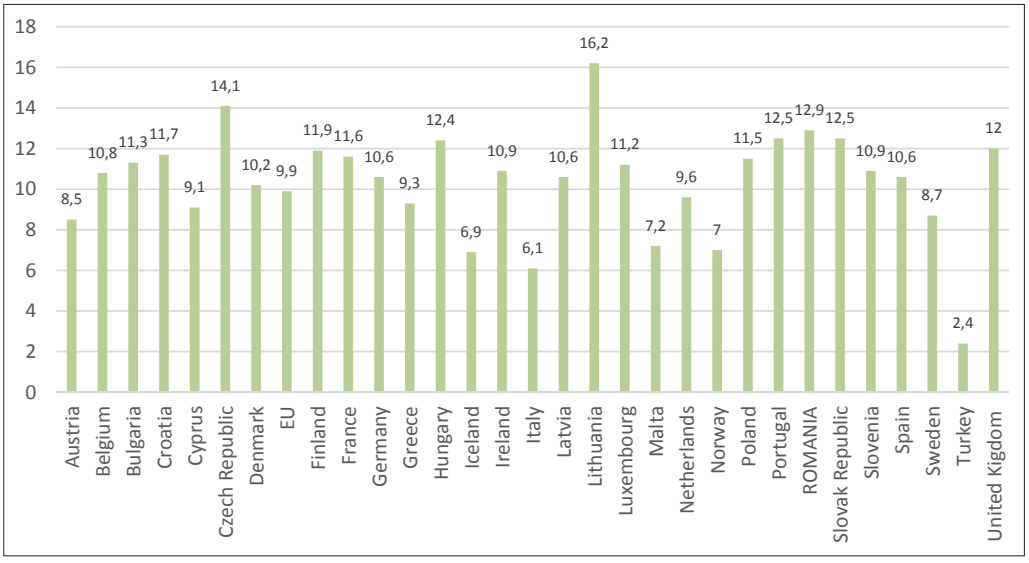

Figure 2: Alcohol consumption in selected countries and EU average (liter per capita – 2015)

Source: Authors, based on data from World Bank (undated)

In relation to the study conducted, the increase in alcohol consumption has a major impact on shortening the length of life expectancy. The negative effects are much higher in the case of countries exceeding the average, such as in the case of Romania, and emergency counteracting measures should to be adopted.

As far as vegetable consumption is concerned (quantified as a percentage of vegetables consumed at least once a day) we ascertain that Romania occupies the last

place in relation to the other countries (Figure 3), with a value of 29.6%. This percentage is smaller by 20 units than the EU average and respectively 2.68 times smaller than that in Belgium, which registers the maximum average in the UE of 78.5 units, which is worrying. In developed countries such as Italy, Greece, United Kingdom and Belgium, the percentage of people consuming fruits at least once a day is between 61.9 and 78.5.

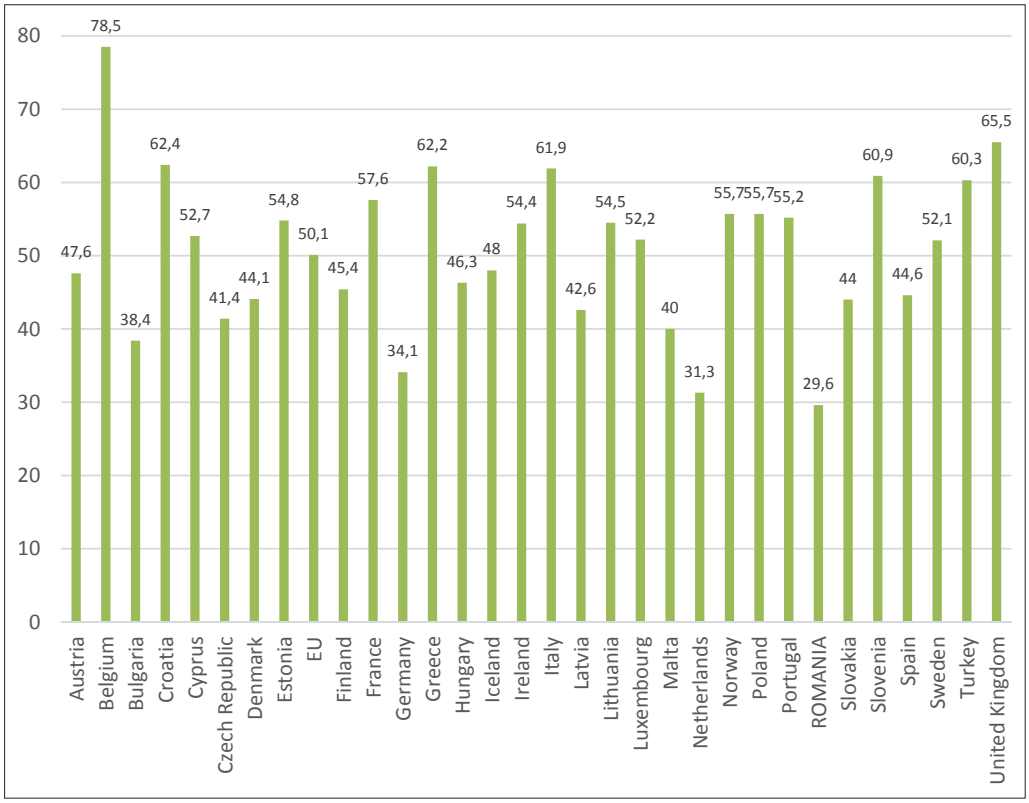

Figure 3: Vegetables consumption (at least once a day) in selected EU countries and average (2014)

Source: Authors, based on data from Eurostat (undated)

Related to the non-financial variable percentage of fruits consumed at least once a day (Figure 4), we notice that for the year 2014, Romania also ranks last in the EU, with a value of only 28.8, in comparison with the average of 52.68. In developed countries such as the United Kingdom, Spain, Italy, and Portugal, the percentage of persons consuming fruits at least once a day is up to 2.5 higher, reaching 60-70%.

Our study attests the importance of fruits and vegetables consumption as having a significant positive impact on the population's health state, respectively on the increase in life expectancy. When associated with the fact that usually a low consumption of fruits and vegetables is linked to an unhealthy consumption of fast-food products (Darmon and Drewnosky, 2008), we believe that the authorities' intervention in the support of 'healthy' consumption habits is urgent.

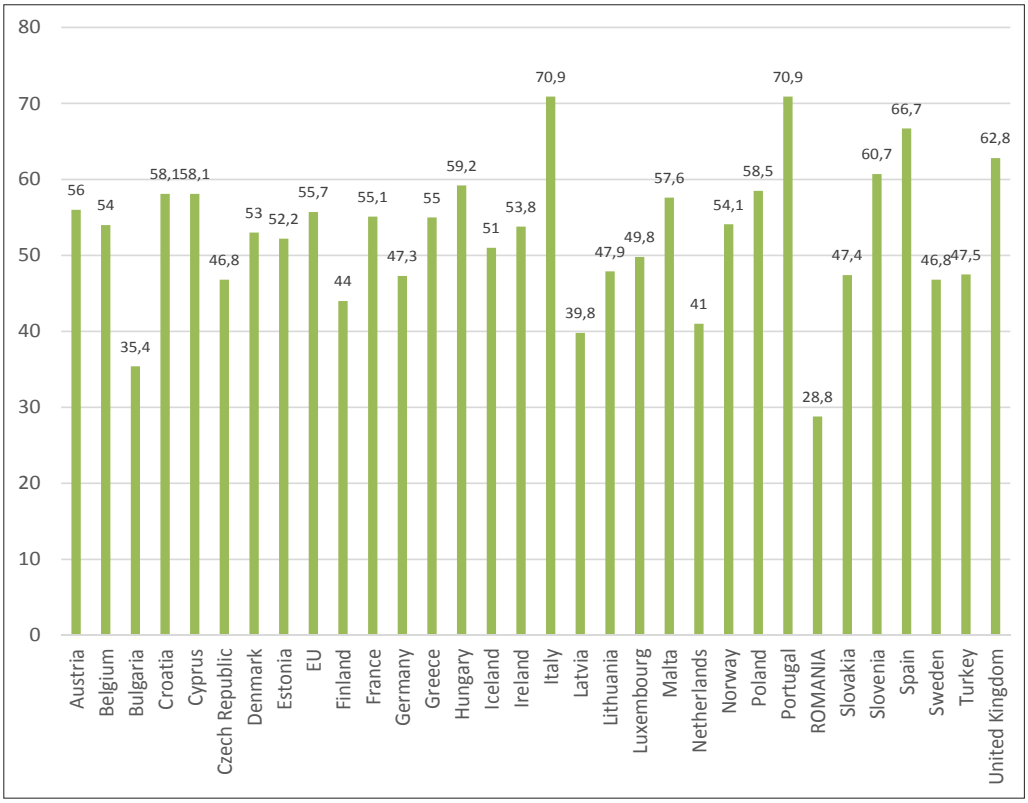

Figure 4: Fruits consumption (at least once a day) in selected EU countries and average (2014)

Source: Authors, based on data from Eurostat (undated)

Our study attests the importance of fruits and vegetables consumption as having a significant positive impact on the population's health state, respectively on the increase in life expectancy. When associated with the fact that usually a low consumption of fruits and vegetables is linked to an unhealthy consumption of fast-food products (Darmon and Drewnosky, 2008), we believe that the authorities' intervention in the support of 'healthy' consumption habits is urgent.

From the perspective of shifts in public policies, as the results of our study also indicate, the financing of healthcare positively influences the population's health status and the increase in the amount of resources granted is associated to the increase in life expectancy. For Romania, many studies mention both a precarious financing and deficiencies in the allocation technique, all of these against the backdrop of a vicious management (Vlădescu and Astărăstoae, 2012; Vlădescu *et al.*, 2016). In line with our evidence and findings, the main recommendations of public policy are:

– stabilization of health financing by legally enforcing a minimal level, taking into account that in Romania healthcare is chronically under-financed, with expenditure 3 times smaller than the EU average (according to Vlădescu *et al.*, 2016, Romania allocates 988 USD/capita unlike the EU average of 3,379 USD/capita);

- rethinking the prioritization of healthcare expenditure categories, by increasing the weight of those regarding preventive care;
- a rigorous monitoring of public procurement, as a basis for increasing the allocative efficiency of resources used;
- introducing user charges to increase the patients' responsibility;
- financing public campaigns to assess the population's health status and early health education programs;
- encouraging, through public campaigns of promotion and events, the direct meetings between farmers and consumers or the temporary subsidizing (to create healthy habits) of the consumption of biological, ecological produce or super foods;
- stimulating the consumption of products beneficial for health (fruits and vegetables) through state-financed campaigns, fiscal incentives or other financial instruments.

Secondly, by taking into account the results of our study regarding the impact of non-financial variables and realities in Romania on the life and consumption habits of people, the main fields and additional measures that policy-makers in Romania should take into consideration are:

- strengthening the campaigns directed towards alcohol/tobacco consumption and the limitation of their consumption in various locations/spaces, without any exception;
- providing specialized assistance to the persons addicted to alcohol/tobacco consumption;
- initiating public campaigns of awareness of the negative consequences of sugar or added sugar products consumption;
- improving the product labelling so that the information immediately available to the potential client/consumer should signal the presence of risk factors;
- stimulating the shift towards the 'green', environmentally friendly infrastructure.

Finally, other additional public policy measures may have in view the organization of the medical system and its specific activities, mainly through:

- stimulating the competition between public sanitary units or between these and the private ones;
- making the sanitary institutional system responsible for the beneficiary of services by introducing the evaluation of the physician and the medical institution by the patient;
- continuing the decentralization of medical services.

6. Conclusions

The main conclusion of this paper is that population health status and life expectancy strongly depend primarily on financing health care (the null hypotheses for model no. 1 to model no. 4 are rejected) and people's consumption habits (the null hypotheses for model no. 2 and model no. 4 are rejected).

It is important to underline that an increase in both health expenditures on preventive care and on auxiliary services determine an increase of life expectancy at birth. We find that the highest impact on life expectancy has HC7 – preventive care expenditures, which increases the explained variable on average with 4.5085*** (±1.4415) units and is statistically significant at a 0.01 level. We also found that an increase with one unit in HC4 (auxiliary services), increases the dependent variable with 4.1325 *** (±0.4378) units and is statistically significant at a 0.01 level. According to this result, we proposed a change of prioritization regarding public health expenditures, by focusing on preventive care financing.

The actual impact of alcohol supply and consumption in EU countries from our sample in the considered period is negative, an increase with one unit supplied to individuals decreasing life expectancy, on average, with 0.6088*** (±0.1690) and being statistically significant at a 0.01 level. The effect of sugar supply and consumption in EU countries from our sample in the period under consideration is negative, an increase with one unit decreasing life expectancy, on average, with 0.0273** (±0.0125), being statistically significant at a 0.01 level.

The consumption of vegetables and fruits also has a positive effect, an increase with one unit in vegetables consumption increasing the life expectancy, on average with 0.0121 (±0.0069), while an increase with one unit in fruits consumption increases life expectancy, on average with 0.0063 (±0.0036), being statistically significant at a 0.1 level. In line with this evidence we made the appropriate recommendations for public policies to be promoted in Romania.

Based on these findings and in close connection with the Romanian realities concerning health financing and consumption habits, we stated that public policies should stabilize healthcare financing and encourage preventive actions through educational programs, governmental advertising, local campaigns for healthy life style focused on nutrition and fitness. It is also necessary to increase the public efforts at different levels (central government, local authorities, NGO's and so on) to perform actions that could make the population aware about the consequences of consuming alcohol and sugar.

Regarding the results of model no. 4, the influence of expenditures on the health system and financing administration (HC7) appears to be negative i.e. -0.3799 (±0.0922), but the result is not statistically representative at the .05 significance level, holding all other variables constant. We consider that currently public policies should focus on the hospital management quality and effectiveness. In this respect, the policy makers should reconsider the mechanism of funds allocation, by including in the budgeting process clearly defined performance indicators for the administration of sanitary institutions. Regarding the case of Romania, we consider that future research should be oriented on identifying the sources of inefficiencies of the healthcare system (e.g. the questionable procurement system being notorious) and on quantifying their financial impact, in order to propose some basic guidelines for a healthcare reform package.

The limitation of our study is determined by the exclusion of other non-financial variables (due to data availability constraints). Thus, some interesting variables (such as tobacco or drugs consumption) were not available for our sample of countries, as consistent data series. As these will be consistently available, we intend to extent our study in future research.

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