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Abstract

The study analyses the combined influence of obesity and lifestyle behaviors on health care utilization and health care costs. Therefore I analyze the interaction of obesity, nutrition and physical activity based on a community level dataset from a German city. In addition to the expected convex effects of age and chronic diseases for utilization, the results indicate that BMI and physical inactivity have an independent influence on G.P. visits as well as for hospitalization. The key finding of the cost analysis is that health care costs increase in consequence of a completely sedentary lifestyle by 505 € independent of the individual's BMI level. The results also confirm that compared to individuals of normal weight, the medical costs of the group of overweight people (by 377 €) and the group of obese people (by 565 €) are significantly increased. Even without significant weight reductions public programs against a sedentary lifestyle can be a way to reduce health care spending, and thus a sole focus on weight reduction might underestimate the additional benefits of changes in lifestyle behaviors.

***JEL*-classification:** I12, H51

Keywords: Health Care Costs; Costs of Obesity; Physical Activity

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1. Introduction

The last two decades are characterized by dramatic shifts lifestyle patterns, with increasing sedentary occupations and nutrition that is dominated by carbohydrates in most parts of the Western world (Knuth et al., 2009). As a result of these lifestyle behaviors, the share of the population that is obese is growing steadily (Mozaffarian et al., 2011), particularly in the US (Odgen et al., 2012), but also in most European countries (Berghöfer et al., 2008). In Germany, the obesity rates have increasing continuously since the 1990s and reached 23.4% for both males and females in 2011. This trend is observable over all age groups, although the rise from 10% (1990) to 15% (2011) in the age group 25 to 34 years is in particular remarkable (Mensink et al., 2013). Obesity and a sedentary lifestyle are associated with several serious diseases (Guh et al., 2009; Lee et al., 2012). For example, obese people have a higher risk for type 2 diabetes (Abdullah et al., 2010), cardiovascular disease (Wormser et al., 2011), and stroke (Strazzullo et al., 2010). Lifestyle behaviors and obesity are therefore directly and indirectly associated with enormous economic consequences (Finkelstein et al., 2005).

The economic costs of obesity, either in the form of direct costs through higher health care expenditures or indirect costs as a result of productivity losses, are quantified in numerous empirical studies (Cawley et al., 2012; Trogdon et al., 2008; Finkelstein et al., 2005; Withrow et al., 2011). In total, the costs associated with obesity are a substantial part of health care expenditures in most OECD countries. In Germany Konnopka et al. (2011) quantify the direct costs of obesity to be 4.8 billion euros or 2.1 % of total health care expenditures. Several other studies analyze the burden of physical inactivity (Katzmarzyk 2004, Oldridge 2008), and find considerably higher medical costs, particularly due to the higher risk of cardiovascular diseases. On the other hand empirical works simultaneously examining the effects of lifestyle behaviors and obesity on medical costs is scarce (Pratt et al., 2000; Wang et al., 2004; Yang et al., 2011). The studies all establish some cost-reducing impact of physical activity independent of the body-weight, while diet has no significant effects at all. For Germany, evidence on the question of how physical activity and nutrition affect the health care costs of obesity based on individual data is completely lacking. In the current paper I try to close this gap by examining the relationship between lifestyle behaviors and obesity to help to explain health care utilization and health care costs in Germany. To do so, I use a community-level panel dataset and evaluate the lifestyle consequences on inpatient services and on visits to primary care physicians.

The paper tries to assess the cost saving effect of physical activity for obese people in a small town German population. This paper is organized as follows: Section 2 provides a description of the Bad Schönborn dataset and continues with a characterization of the methods used. Section 3 first presents the results for health care utilization and then turns to the impact on health care costs. In Section 4 the results are discussed in detail, before Section 5 closes with some concluding remarks.

2. Data and Methods

Sample

The dataset analyzed in the current study is based on the Bad Schönborn Study, a health survey on the community level that is ongoing since 1992 (Woll et al., 2004). Bad Schönborn is a midsize community in southern Germany with about 12,000 inhabitants. The original participants in 1992 ($N_{\_92}$=495) depict a representative sample of the population aged 33 to 56 years, with respect to gender, socio-economic status, and health status. The survey has been conducted in five-year intervals since 1992 with the latest wave of data collected at the end of 2011. To keep an appropriate sample size in the view of panel attrition, new participants were recruited for each new wave. The present analyses are restricted to N=425 individuals that are included in the 2007 and 2011 datasets, 40% of whom were already included in the 1992 sample.

The dataset contains a broad range of variables on lifestyle, health status, and utilization of health care. All of the included medical risk indicators (blood pressure, cholesterol, blood sugar) and the obesity indicators (Body-Mass-Index (BMI), Waist-to-Hip-Ratio(WHR)) are recorded by physicians. Lifestyle information includes the frequency, strength and type of physical activity, as well as composition and frequency of nutrition. In addition the sample contains self-reported data on health status, diseases, smoking behavior, education and family background. Due to the questionnaire structure and study design I can only rely on the variables on the information pertaining to health care utilization (visits to primary care physicians, hospitalization) of the 2011 wave for the current analyses. The descriptive statistics in Table 1 provide an overview of the 2011 wave of the dataset. With a female share of 53.6% and an average BMI of 26.84 kg/m^2 the Bad Schönborn sample is representative of the general German population of the respective age group (Mensink et al., 2013). Individuals in the sample lead, in general, a more health-conscious lifestyle than the German average with an 8.8 % share of smokers (compared to 29.7 % of the general public in Germany (Lampert et al., 2013)) and 80.2% of reported physical activity once a week, while the national average lies at 50.5% (Krug et al., 2013). This healthier lifestyle is also reflected in the lower share of obese individuals (22.2% compared to 30% at the national level) in the age group above 55 years (Mensink et al., 2013). The particular lifestyle behavior in the community might be explained by an enhanced health consciousness through the repeated participation in the study and accompanying efforts by the local authorities.

Table 1: Descriptive Statistics of the Bad Schönborn Dataset

Variable	Mean	Std. Dev.	Min	Max
Gender[1]	0.536	0.499	0	1
Age	53.480	11.357	25	79
Partner[2]	0.902	0.298	0	1
Education[3]	2.807	1.576	0	5
Children	1.899	0.866	0	5
BMI-11[4]	26.844	4.386	17.3	50
BMI-07[4]	26.021	4.137	17.5	49.6
Smoker-07	0.088	0.283	0	1
Alcohol-07	0.765	0.425	0	1
Sport-07	0.802	0.399	0	1
#Sport-07[5]	3.978	2.003	0	7
Vegetarian	0.051	0.097	0	1
No Fruits	0.083	0.205	0	1
No Sweets	0.064	0.237	0	1
Chronic Disease[6]	0.053	0.180	0	1

N = 425; [1] Female=1; [2] Long-term relationship=1;
[3] Education: 0= no graduation,...5=University Degree;
[4] measured in kg/m^2; [4] Vigorous exercise per week;
[6] Diabetes, Chronic Back-pain, Cancer.

With respect to utilization of healthcare in the last 12 months the study sample differs from the representative German population (Rattay et al., 2013). The reported number of annual visits to primary care physician of 3.5 (±4.7) is relatively low compared to 6.2 in the respective national age group. On the other hand the annual share of persons with inpatient hospital treatments in the sample lies at 24.8 % (20.0 – 28.5, 95% CI), compared to 19.6 % (17.0 - 22.5, 95% CI) in the representative age group.

Methods

The dataset provides a broad range of variables on physical activity and nutrition. For the present analyses, I only choose a small number of variables which allow clear-cut interpretations. To measure physical activity, I apply the binary variable 'Sport' – asking individuals to indicate vigorous physical activity in general - and the discrete variable '#Sport' – reporting the number of days the individual is active in an average week. Accounting for many different types of nutrition schemes in general and in the dataset, I examine a subset of three different distinguishable eating behaviors. 'Vegetarian', 'No Fruits' and 'No Sweets' are the categories through which nutrition enters into the following analysis.

In a first step I analyze the effects of current and past lifestyle (physical activity and nutrition in 2007 and 2011) and past BMI (2007) on medical care utilization in 2011. In order to disentangle the effects on outpatient and inpatient utilization I examine physician visits and hospitalization separately. In line with the literature I use a two stage hurdle model (Jones, 2000; Pohlmeier et al., 1995) to analyze general practitioner (G.P.) visits. The logistic model in the first stage reflects the binary contact decision, while the negative binomial distribution at the second stage accounts for the count data structure of the variable, as well as for over-dispersion of the variable (the standard deviation being greater than the mean). Due to the binary structure of the data on inpatient hospital treatment in the last 12 months, I use a logistic regression model for the analysis of hospital utilization, as it exhibits a better fit than the alternative Probit model. All of the cases of hospitalization that are obviously not related to sports and nutrition (accidents, pregnancy) are purged from the dataset. The covariates included in both analyses are age, gender, relationship status, education, children, health insurance status, medical risk indicators (blood pressure, cholesterol, blood sugar), smoking as well as drinking behavior and a binary measure for several chronic diseases (e.g.: Diabetes, Chronic Back-pain, Cancer).

In a second step, I turn to the investigation of the effects of the individual's current and past lifestyle (physical activity and nutrition in 2007 and 2011) and previous indicators of being overweight and obese (2007) on health care costs in 2011. Therefore, I first compute a health care cost variable containing annual outpatient and inpatient costs in 2011 based on the data regarding visits to a primary care physician and hospitalizations (accounting for readmissions in the course of the same year). For costs of visits to physician I use values for G.P. visits in 2011 (KBV 2012) which amount to 33.80€ per visit (see Appendix for the calculation). The dataset does not allow for case-specific inpatient costs, so the investigation is based on average costs of hospitalization. Therefore, I use average hospital costs per case in 2011 for Baden-Württemberg of 4,218 € (Statistisches Bundesamt 2013). All reported costs are in Euros of 2011.

Given the cost values, I analyze the effects of lifestyle and obesity in several ways. First, I use a standard ordinary least square estimator (OLS) with robust standard errors to provide an overview of the cost effects. Afterwards, I repeat the analyses using a generalized linear model (GLM) with a log link function and a gamma distribution that accounts better for the structure of the costs (share of zeros, right-skewed variables) (Jones, 2000). The choice of the GLM with log link and the gamma distribution is confirmed by a modified Park test for the choice of the gamma family after performing a modified Hosmer and Lemeshow test and a Pearson's correlation test for the choice of the link function (McCullagh & Nelder, 1991). Given the results of the gamma model, marginal health care cost effects are computed for the significant factors. The covariates included in all equations on health care costs are the same as in the utilization analyses. All statistical analyses were performed using Stata 12.

3. Results

Utilization

The results of the two-stage analysis of G.P. utilization in the year 2011 are summarized in Table 2. The first stage analyzes the decision to contact a physician, while the second stage equation represents the rate of physician visits of those with at least one visit per year. In the first stage logistic equation three variables have a significant effect on the probability to visit a physician. A higher BMI in 2007 and a diagnosed chronic disease lead to a higher visit probability in 2011. In addition, females demonstrate a significantly higher probability to see a G.P. at least once per year. None of the other control variables reaches a significant level. The negative binomial model at the second stage controls for the influence of the same control variables, though it explains the frequency of G.P. visits in 2011. In this case, gender no longer plays a significant role, while the individual's age has a convex influence on the number of visits. For young individuals the frequency declines with age, whereas it rises in age for the elderly. Some of the lifestyle variables indicate that a 'healthier' lifestyle in 2007 reduces the number of times an individual contacts a G.P. in 2011. Having had a lower BMI in the past and participating in physical activity at least once per week significantly reduce the frequency of visits. On the other hand, the effects of lifestyle are also limited. None of the nutrition patterns has an influence on the number of visits, and for those who are physically active the number of active days they exercise per week has no effect. In addition only the circumstance of a chronic disease is significant in explaining the visit frequency.

Table 2: Negbin Hurdle Model for G.P. Utilization

	1. Stage: Logit		2. Stage: NegBin	
Variable	Coef.	t-value	Coef.	t-value
Gender	0.852*	1.99	0.036	0.12
Age	-0.096	-0.47	−0.191*	-2.06
Age2	0.001	0.53	0.002*	1.99
Partner	-	-	-0.420	-0.87
Education	0.085	0.51	0.122	1.37
Children	0.373	1.31	0.256	1.76
BMI-07	0.145**	2.68	0.072**	2.45
Smoker-07	0.570	0.53	0.320	0.73
Alcohol-07	0.098	0.16	-0.498	-1.63
Sport-07	-1.315	-1.24	−0.707*	-2.21
# Sport-07	-	-	0.004	0.05
Chronic Disease[1]	0.182**	2.16	0.102*	2.16
Nutrition-07[2]	no		yes	
Log Likelihood	-1,773		-1,742	
n	425		403	

[1] Diabetes, Chronic Back-pain, Cancer;
[2] Controls for 'Vegetarian', 'No Fruits', 'No Sweets'.
* significant at the 5 % level.** significant at the 1 % level.

Table 3 contains the results of the logistic model for hospitalization in the year 2011. The reduced form equation only includes past BMI, smoking and drinking behavior, and some general background covariates. The richer model shows the influence of taking the additional lifestyle variables into account. In both specifications age has a convex effect on hospitalization, meaning that the probability of an inpatient stay in hospital first declines with age and then rises again. The magnitude of the positive effect of past BMI on hospital utilization is not affected by model specification, indicating that a higher probability of hospitalization is associated with the presence of obesity, independent of other lifestyle variables. Past alcohol consumption (binary variable) reduces the probability of hospitalization in the reduced model significantly, while this effect can no longer be established in the extended form. Except for the binary variable for a chronic disease, all other control variables in the reduced form equation are insignificant. From the lifestyle indicators added in the extended equation, only the binary variable for weekly physical activity in 2007 has a positive effect on hospitalization in 2011.

Table 3: Logit Model for Hospitalization

Variable	Coef.	Std. Div.	t-value	Coef.	Std. Div.	t-value
Gender	-0.076	0.279	-0.27	0.036	0.289	0.12
Age	−0.236*	0.104	-2.29	−0.191*	0.109	-1.86
Age2	0.002**	0.001	2.56	0.002*	0.001	1.99
Partner	-0.218	0.475	-0.46	-0.419	0.482	-0.87
Education	0.090	0.086	1.05	0.122	0.089	1.37
Children	0.231	0.142	1.64	0.256	0.145	1.76
BMI-07	0.076**	0.028	2.66	0.072**	0.030	2.40
Smoker-07	0.411	0.433	0.95	0.319	0.439	0.73
Alcohol-07	−0.577*	0.295	-1.96	-0.498	0.305	-1.63
Sport-07	–	-	-	−0.707*	0.320	-2.21
# Sport-07	-	-	-	0.004	0.068	0.05
Chronic Disease [1]	0.033*	0.153	2.31	0.023*	0.103	2.07
Nutrition-07[2]	no	-	-	yes	-	-
Log Likelihood		-1,195			-1,186	

n = 425;
[1] Diabetes, Chronic Back-pain, Cancer;
[2] Controls for 'Vegetarian', 'No Fruits', 'No Sweets'.
* significant at the 5 % level.** significant at the 1 % level.

Neither the intensity of weekly physical activity nor the various nutrition patterns are significant. Additional medical risk indicators (blood pressure, cholesterol, blood sugar) are all insignificant for both utilization decisions above when the equations control for past BMI and the diagnosis of a chronic disease.

Health Care Costs

The results of the OLS regressions presented in Table 5 in the Appendix provide a first overview of the direction and magnitude of the estimated effects of lifestyle on annual direct health care costs (hospitalization and G.P. expenditures). The reduced form equation in the first column OLS (1) does not include past physical activity and nutritional measures and only quantifies the effect of previously being overweight by BMI (2007) on 2011 health care costs. An increase in one BMI point raises health care costs by 78.52€. The large reduction in cost (476.12 €) induced by drinking alcohol is no longer significant when I control for other lifestyle factors in the general specification of OLS (2). Age has a convex effect on health care costs, with minimal costs at the age of 49 years. The model OLS (2) includes additional lifestyle measures and also controls for several chronic-diseases. The magnitude of the effect of being overweight is hardly affected by the additional control variables and still lies at 77.47 € per BMI point. Those who are not physically active at all in 2007 have 479.40 € higher health care costs in 2011 than the group that is active at least once per week. The intensity of physical activity has no influence on the costs nor does the individual's nutrition. Having a diagnosed chronic disease increases health care costs by 280.69 €. The established age effect is unaffected by the model speciation, with minimum costs in OLS (2) at the age of 48.5 years. OLS models have well known problems in the analysis of health care cost data (Jones 2000), which is confirmed by the Pregibon test for linearity that suggests dropping the OLS model. Nevertheless, for the present dataset the OLS specification at least passes Ramsey's RESET test.

The results of the GLM estimation with log link, gamma distribution, and bootstrapped standard errors contained in Table 6 (in the Appendix) are the foundation for the marginal cost effects reported in the following. As with the OLS equations above, the reduced form equation Gamma (1) only controls for BMI in 2007, while Gamma (2) includes all the other lifestyle variables. Comparing the results of Gamma (1) and (2) indicates that health care costs in 2011 are increasing with age, though introducing the quadratic age term has no significant effect. Per year of life the annual health care costs increase by 21.21€ (±9.94) under the model specification of Gamma (2). A high BMI significantly increases health care costs in both model specifications, with a per BMI point cost increase of 71.69 € (±27.55) in Gamma (1) and 61.16 € (±29.58) when controlling for the other lifestyle factors. For physical activity at least once per week in Gamma (2), I establish a large cost reduction of 505.73 € (±242.58) per year. Having a diagnosed chronic disease induces additional costs of 322.13 € (±160.37). The intensity of physical activity, as well as the different controls for nutrition and all other control variables do not have a significant influence on health care costs in both GLM estimations with the gamma distribution. Including additional 2011 medical risk indicators has no significant influence on health care costs when the equations control for 2007 BMI and the diagnosis of a chronic disease. The choice of the gamma distribution is confirmed by a Park test, and Pregibon's link test confirms the model fit, with p-values above 0.872 for all above specifications.

Table 4: Lifestyle Behaviour and Marginal Effects on Health Care Costs

Cost difference from / to	Normal Weight	No Physical Activity
Overweight	377.59	-
	(198.98)	-
Obese	565.90	-
	(255.9)	-
Physical Activity All	-	-505.73
		(242.58)
Physical Activity Overweight	-	-619.43
		(306.16)

All costs in 2011 Euros. Bootstrapped standard errors in parenthesis.
All effects significant at least at the 5 % level.

Controlling for subgroup effects for overweight and obese individuals in the rich Gamma (2) specification identifies some additional cost effects. Compared to individuals with normal weight in 2007 (BMI < 25 kg/m^2) health care costs in the overweight group (25 ≤ BMI ≤ 30) are 377.59 € (±198.98) higher. The costs incurred by the obese (BMI > 30) are 565.90 € (±255.9) above the level of individuals with normal weight. For the subgroup of overweight individuals, physical activity reduces health care costs by 619.43 € (±306.16) compared to the inactive. However, this cost-reducing property of physical activity cannot be identified for obese people. All of the significant marginal effects of lifestyle behaviors on health care costs in the GLM model with gamma distribution are summarized in Table 4.

4. Discussion

Overall, I find that age, overweight and obesity, a diagnosed chronic disease and physical inactivity are all associated with higher utilization of medical services and increased health care costs. These results confirm effects that have been established separately in previous studies on the impact of physical activity and obesity on medical expenditures for different countries (Pratt et al., 2000; Wang et al., 2004; Yang et al., 2011). The advantage of this study is the use of lagged lifestyle variables and reliable present diagnoses of chronic diseases to preclude the possibility of reverse causality, i.e. health status affecting current lifestyle behaviors.

The reported positive influence of physical activity on the health care costs of overweight individuals emphasizes the importance of a minimum amount of physical activity for individual health and wellbeing. Thus some of the negative health effects of being overweight can be offset by the positive consequences of lifestyle behavior. Nevertheless, I do not find this positive influence of physical activity for the subgroup of obese individuals. One can think of two explanations for this finding: either there physical activity has a positive effect but it cannot compensate for the health care costs of obesity, or due to a higher risk of injuries physical activity comes with additional costs for the obese. For other subgroups (age, gender), I also checked possible interaction effects with physical activity but; however, as for the obese, no significant effect on health care costs can be established for any of them. Comparing the magnitude of medical costs of physical inactivity of 505.73 € with the results of previous studies for the US is difficult due to differences in health care provision. On the other hand the level between $330 (Pratt et al., 2000) and $459 (Wang et al., 2004) is close to the present findings and confirms similar consequences resulting from a sedentary lifestyle. Regarding the subgroups of overweight and obese individuals, the present findings are partly contradictory to the findings by Wang et al. (2004). While these authors state that physical activity only has a cost-reducing effect for the obese, I can only find this effect for the overweight subgroup. This might be explained by country-specific factors as well as by the fact that they do not use lagged lifestyle variables.

The dataset has some characteristics that limit the generalization of the results of this paper. As mentioned in Section 2, the individuals in the community of Bad Schönborn are on average more health conscious than the general German population. Consequently, projections of the overall burden of lifestyle behaviors and obesity for the health care system based on the results of the present analysis would not be meaningful. In addition, the fact that the sample only includes inhabitants of one small city neglects possible structural differences that determine the utilization of health care services (Carlsen et al., 1998). Nevertheless with the representative gender structure and an average BMI level for the age group the findings are generally applicable for individuals with an above-average health consciousness.

The finding that the individual diet influences neither utilization nor health care costs is in line with previous results (Wang et al., 2005). The reasons for these results can be twofold: Either medical care costs are really independent of nutrition, or the variables measuring nutrition behavior (‘Vegetarian’, ‘No Fruits’, ‘No Sweets’) are not precise enough. Apart from that, the share of ‘normal’ eaters (89.4%) in the sample might simply be too high to find significant effects for deviating eating behavior.

The low number of 22 individuals (5.2%) who did not visit a G.P. in 2011 can be explained by the age structure of the sample that only includes 12.7 % younger than 40 years. The small variance in the decision to contact a physician in the analysis of G.P. utilization leads to lower significance levels of the explanatory variables (age and sport) in the first stage logit equation of the hurdle model compared to second stage negative binomial model.

The decision to measure the utilization and cost impacts of obesity and lifestyle behaviors four years ago might not be obvious at a first glance. However, regarding current health as a stock variable in the tradition of Grossman's Human Capital model (Grossman, 1972) indicates that current health can mainly be explained by past investments in health (Wagstaff, 1993). According to this theory the concentration on past health and lifestyle decisions is the right choice for the determination of today's demand for medical services. Moreover, the concentration on past lifestyle variables also has methodological advantages, as it rules out possible autocorrelation effects of medical care utilization on the present lifestyle choices. The choice is also confirmed by the simple Gamma (3) model in Table 6 (Appendix), in which the BMI in 2011 is included as covariate in the equation. As expected by theory, the current BMI does not establish a significant effect on health care expenditures.

As a sensitivity analysis, I checked the main findings of the paper with the Waist-to-Hip-Ratio (WHR) as an alternative measure of obesity. All the results presented above remain qualitatively unchanged when the past WHR is used as a substitute for the BMI. I decided to retain the more common measure BMI despite its downsides (Burckhauser et al., 2007), to attain results which are comparable to other studies on the costs of obesity that predominantly rely on BMI.

5. Conclusion

The present study highlights the importance of a sportive lifestyle for the containment of health care costs. Exercising at least once per week significantly decreases medical care expenditures for normal weight and overweight individuals. The intensity and frequency of physical activity have no additional influence on health care costs. These findings suggest that policies aiming reducing physical inactivity might have long-run benefits even if they do not reduce the weight of the respective persons. In other words, evaluating public obesity prevention with a sole focus on weight reduction might underestimate the additional benefits of changes in lifestyle behaviors. Nevertheless, the results confirm the large excess cost caused by overweight and obesity compared to the normal weight individuals, independent of the positive effect of physical activity. For an improved understanding of the interaction of lifestyle behaviors and obesity in the determination of health care costs, further research based on panel data for health care utilization seems appropriate.

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Appendix

Table 5: Determinants of Health Care Cost 1

Variable	OLS (1)	OLS (2)
Gender	-105.95	-26.12
	(211.03)	(213.12)
Age	−206.65*	−170.70*
	(81.83)	(83.53)
Age2	2.11**	1.76*
	(0.74)	(0.76)
Partner	-103.09	-274.53
	(383.26)	(394.11)
Education	67.76	97.49
	(65.66)	(69.54)
Children	155.38	169.37
	(108.78)	(117.04)
Smoker-07	223.10	176.97
	(349.42)	(109.55)
Alcohol-07	−476.12*	-412.78
	(238.42)	(240.68)
BMI-07	78.52**	77.47**
	(23.32)	(24.21)
Sport-07	-	−479.40*
		(206.97)
#Sport-07	-	22.77
		(52.50)
Nutrition-07 [1]	no	yes
Chronic-diseases [2]	-	208.69*
		(89.53)
Const.	1865.75	904.73
	(221.46)	(218.56)
Rsquared	0.298	0.4032

n = 425, Robust Standard errors in parenthesis.
[1] Controls for 'Vegetarian', 'No Fruits', 'No Sweets'.;
[2] Diabetes, Chronic Back-pain, Cancer.
* significant at the 5 % level.** significant at the 1 % level.

Table 6: Determinants of Health Care Cost 2

Variable	Gamma (1)	Gamma (2)	Gamma (3)
Gender	-0.082	0.068	0.20
	(0.214)	(0.238)	(0.258)
Age	0.021*	−0.078*	0.027*
	(0.009)	(0.031)	(0.013)
Age2	-	0.001	-
		(0.000)	
Partner	0.238	0.087	0.294
	(0.332)	(0.346)	(0.385)
Education	0.055	0.067	0.043
	(0.063)	(0.075)	(0.068)
Children	0.195	0.223	0.200
	(0.127)	(0.159)	0.157
BMI-07	0.066**	0.058**	-
	(0.026)	(0.029)	
Smoker-07	0.116	0.097	0.070
	(0.404)	(0.461)	(0.404)
Alcohol-07	-0.439	-0.284	-0.316
	(0.288)	(0.303)	(0.286)
Sport-07	-	−0.424*	-
		(.206)	
#Sport-07	-	0.024	-
		(0.057)	
Chronic Disease [1]	0.452*	0.480*	0.461*
	0.229	(0.230)	(0.204)
Nutrition-07[2]	no	yes	no
BMI-11	-	-	0.046
			(0.084)
Const.	2.921	2.669	3.829
	(0.888)	(0.692)	(0.994)
Log Likelihood	-2,834	-2,745	-2,629

n = 425, Bootstrapped standard errors in parenthesis.
[1] Diabetes, Chronic Back-pain, Cancer.;
[2] Controls for 'Vegetarian', 'No Fruits', 'No Sweets'.
* significant at the 5 % level.** significant at the 1 % level.