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How Do Health, Care Services Consumption and Lifestyle Factors Affect the Choice of Health Insurance Plans in Switzerland?

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Abstract: In compulsory health insurance in Switzerland, policyholders can choose two main features, the level of deductible and the type of plan. Deductibles can be chosen among six levels, which range from CHF 300 to 2500. While the coverage and benefits are identical, insurers offer several plans where policyholders must first call a medical hotline, consult their family doctor, or visit a doctor from a defined network. The main benefit of higher deductibles and insurance plans with limitations is lower premiums. The insureds' decisions to opt for a specific cover depend on observed and unobserved characteristics. The aim of this research is to understand the correlation between insurance plan choices and lifestyle through the state of health and medical care consumption in the setting of Swiss mandatory health insurance. To do so, we account for individual health and medical health care consumption as unobserved variables employing structural equation modeling. Our empirical analysis is based on data from the Swiss Health Survey wherein lifestyle factors like the body mass index, diet, physical activity, and commuting mode are available. From the 9301 recorded observations, we find a positive relationship between having a "healthy" lifestyle, a low consumption of doctors' services, and choosing a high deductible, as well as an insurance plan with restrictions. Conversely, higher health care services' usage triggers the choice of lower deductibles and standard insurance plans.

Keywords: medical services' consumption; lifestyle factors; insurance plan; structural equation model

1. Introduction

Health insurers try to foster healthy lifestyles among their insureds by promoting exercise, supporting fitness center memberships, and more recently, the use of wearable connected devices. The data collected from the latter permit insurance companies to track the individual's physical activity, diet, or sleep patterns for instance. Subsequently, insureds carrying on a healthy lifestyle benefit from premium discounts or other kinds of monetary rewards. Why health insurers promote a healthy lifestyle is not unfounded. There is a strand of medical literature assessing the effect of the lifestyle on health documenting that a healthier lifestyle leads to better health, relating to lower medical costs (Johansson and Sundquist 1999; Andersen et al. 2000; Lee and Skerrett 2001; Joshipura et al. 2001; Penedo and Dahn 2005; Dauchet et al. 2006; Inyang and Okey-Orji 2015; Miller et al. 2017). However, the relationship between health and health insurance decisions has been sparsely investigated. While there is a clearly demonstrated link between lifestyle and health in the medical literature, this relation has not been used in actuarial science, leaving the field with little or no evidence of the effect of lifestyle on health insurance decisions.

In our study, using data from the Swiss Health Survey (SHS), we aim to seize the indirect effect of lifestyle—encompassed by the body mass index (BMI), diet, physical activity and commuting mode—on health insurance decisions, i.e., the choice of the plan and the level of deductible. We consider that the decisions are mediated through latent variables linked to health and health care consumption. We set up a structural equation modeling (SEM) framework that allows capturing such indirect effects. We define health as a latent variable embodied by the self-assessed health, as well as chronic and limiting daily activities health conditions. Thereby, the latter offer an objective measure. Further, health directly impacts health care consumption, our second latent variable captured by the number of doctor visits and hospital stays. Additionally, the model is able to account for the bidirectional relationship between health care consumption and the choice of the insurance plan and the deductible level.

The results from our model provide empirical support for the correlation between health insurance choice and lifestyle via health and health care consumption. Using 9301 observations obtained from the SHS dataset, we control the choice of deductible and insurance plan for socio-economic characteristics (gender, nationality, education, income, number of children in the household, importance of freedom of choice of the specialist doctor, linguistic region, and urbanization) and allow for the two endogenous variables to correlate. We show that an increase in age and BMI correlates with a decrease in health, whereas an increase in the number of portions of fruits and vegetables eaten per day, the number of physical activities performed in a week, and the usage of a bike to commute correlates with an increase in health. Further results display a negative correlation between health and health care consumption, where the latter variable is positively associated with the choice of a standard, i.e., non-restricting, health insurance plan. Similarly, an increase in health care consumption correlates positively with a low level of deductible. Linking our results, we obtain the indirect effect of lifestyle on insurance decisions. Thereby, an increase in age and BMI is associated with having a low deductible and opting for a standard insurance plan whereas, having a “healthy” lifestyle (good diet and physical activity) correlates with having a high deductible and preferring a more restrictive insurance plan at lower cost.

The remainder of this paper is organized as follows: In Section 2, we briefly review the Swiss health insurance system, as well as the literature related to the development of our research hypotheses. In Section 3, we pursue the setup of the model. Results are displayed along with a discussion in Section 4. Finally, we conclude in Section 5.

2. Background Information and Research Hypotheses

2.1. Insurance Plans and Deductibles in the Swiss Health System

Before developing our research, we expose some basic features of the Swiss health insurance system that are relevant for the matter of this study. Basic health insurance in Switzerland is mandatory and regulated by Federal law, which sets up the reimbursement policies. Under Federal law, basic health insurance coverage is compulsory for all residents and organized through private insurance companies. All insurance companies proposing basic health insurance are obliged to accept any individual independently of the health status. Premiums are calculated by the insurers, are determined by regions along cantons and urbanicity, and are validated by the Swiss government. Note that prices are the same for all individuals within the three age classes: up to 18 years, 19 to 25 years, and 26 years or more. Thus, insurers are not allowed to take into account other variables like gender, exact age, or health status. Beyond the basic plan, individuals can subscribe to private complementary health insurance. Regarding the catalog of reimbursements, on the one hand, the basic plan covers basic health risks, but does not extend to dental treatments, to alternative medicine techniques, nor to glasses or lens purchases, with exceptions made for some specific medical conditions. On the other hand, complementary health policies cover the costs that go beyond the basic insurance scheme. In this study, we focus on the decisions on basic health insurance by individuals aged 18 years and older. These individuals face several choices for their insurance plan and deductible level.

2.1.1. Insurance Plans

The insurance policies currently offered in Switzerland can be grouped into four families. The first plan is the "standard" plan, and it is chosen by most individuals. This policy offers the freedom of choice to visit any doctor or specialist and presents no specific restriction. This plan has the highest premium. The second most popular plan is the so-called "family doctor" model. Its peculiarity lies in the importance of the general practitioner (GP) that acts as a gatekeeper and centralizes information of the individual. Indeed, holders of this type of policy commit to always consulting the same GP in case of any health issues. They have to chose their doctor in advance from a list of recognized GPs provided by their health insurer. As a gatekeeper, the GP transfers the patient to a specialist if necessary. This plan typically displays premiums that are 15 to 20% lower than those of standard plans. The third most common plan is known as "CallMed". As its name suggests, this model brings the constraint of calling a medical hotline prior to physically seeking advice from a doctor. Depending on the specific policy rules, there may be an unrestricted choice of the doctor after the phone consultation. Policyholders from this scheme profit from premium reductions of up to 20%. Finally, there is the "HMO" model where the acronym stands for health maintenance organization. Under this model, the insureds commit to always pass through a doctor affiliated with the selected HMO group for a first consultation. Like in the CallMed model, if necessary, the following consultation may take place outside of the HMO medical team, depending on the health insurer. This last type of plan can come with premiums up to 25% below the standard plan.

2.1.2. Deductible Levels

In all insurance plans and on a yearly basis, policyholders chose a deductible. Here, the decision environment is less complex. With amounts regulated by the health insurance law, there exist six levels of deductibles, namely CHF 300, 500, 1000, 1500, 2000, and 2500. Once medical costs up to the chosen level are paid out-of-pocket, there only remains a co-payment of 10% up to CHF 700 on the additional costs, whereafter the health insurer entirely reimburses the spending.

2.2. Literature Review and Development of the Hypothesis

While partial insights into our research can be gained by studying descriptive statistics, we propose to structure our analyses around selected conjectures and embed the latter in the body of existing literature. A recent study conducted by Li et al. (2018) identified five health risk-reducing lifestyle factors. Among them, three characteristics are of particular interest for our study. Indeed, three lifestyle indicators are found to play a role in mortality. More specifically, life expectancy increases with a BMI ranging between 18.5 and 24.9, 30 min or more per day of exercising, and a healthy diet. In addition to these measures, we considered in our research another factor: the commuting mode. This variable has been found to be a relevant factor for health conditions in the literature (Oja et al. 1991; Pucher et al. 2010 and Riiser et al. 2018). Since these factors are relatively easily trackable and modifiable, as opposed to, for example, alcohol or tobacco consumption, we used them as determinants for lifestyle.

2.2.1. BMI

The effect of BMI on health outcomes has been extensively studied, and the results are unambiguous. In reports published as early as 1959, the Society of Actuaries has assessed this link by studying the relationship between mortality rates and weight (Society of Actuaries 1959; Courtland C. and Edward A. 1979). It was found that as weight increases, so does the mortality rate. Following studies have confirmed and extended the negative effect of a high BMI on health. Indeed, a higher BMI is associated with a higher risk for coronary heart disease (CHD), cardiovascular disease (CVD), and for congestive health failure (Hubert et al. 1983; Jousilahti et al. 1996). An increase in BMI also increases the vulnerability to endometrial, sigmoidal, colorectal, and hormone-related cancer and type II diabetes (non-insulin dependent diabetes mellitus; see Pi-Sunyer 1991; Le Marchand et al. 1992; World Health Organization 2000; Stommel and

Schoenborn 2010). Overall, a higher BMI is associated with higher incidence rates of diseases (see also, e.g., Felson et al. 1992; Stommel and Schoenborn 2010).

2.2.2. Diet

The old adage "You are what you eat" has been proven right in multiple stances. Two literature reviews (Block et al. 1992; Steinmetz and Potter 1996) assessed the incidence of fruit and vegetable intake on several cancers, reporting their protective effect. A healthier diet composed of a greater number of fruits and vegetables decreases the likelihood of cancers like esophagus, pancreas, and breast cancer. Other studies focused on the beneficial impact of an increase of fruit and vegetable consumption on CHD or CVD and reported a lower incidence, as well as lower mortality related to heart deficiencies (Joshipura et al. 2001; Bazzano et al. 2002; Dauchet et al. 2006; Oyebode et al. 2014; Miller et al. 2017).

2.2.3. Physical Activity

Similar to the effect of the diet on health, the positive effect of physical activity on health is well established. A literature review conducted by Warburton et al. (2006) assessed 152 studies and highlighted that increased levels of physical activity were found to reduce relative risks of death by 20 to 35%; inversely, individuals in the lowest quantiles of physical activity had an increased risk of death from any cause compared to those in the top quantiles. They also accounted for a reduced incidence of type II diabetes in those individuals who reported weekly physical activity. Other studies also investigated this relationship and backed up the review of Warburton et al. (2006). Johansson and Sundquist (1999), Lee and Skerrett (2001), and Matthews et al. (2007) associated a higher frequency of physical activity to a reduced mortality rate and better overall health, while Gerhardsson et al. (1988), Thune et al. (1997), Thune and Furberg (2001), and Penedo and Dahn (2005) related a less active lifestyle to increased risks of colon, breast, prostate, and colorectal cancers.

2.2.4. Commuting Mode

The mode of commuting most frequently used to go to work, to school, for grocery shopping, or other activities is an integral part of the lifestyle definition. The medical literature has especially aimed its attention at walking and cycling as a means of transportation. Most papers pool together individuals who walk or cycle to commute; when a distinction was made, the results may present slight differences, but overall, they pointed to similar effects. For instance, Oja et al. (1991) and Riiser et al. (2018) both found a positive effect of walking or cycling on health measures such as having a high level of good cholesterol (HDL) or a decreased heart rate and systolic tension. The authors also identified an inverse relationship between walking or cycling to work and the risk of having diabetes, results that were equally found by Pucher et al. (2010). Aside from these pooled analyses, the literature review by Oja et al. (1991) focused on the effect of cycling on health. Of the 16 cycling-specific studies considered therein, all but two showed that cycling provided a health benefit and particularly for CVD and CHD risks.

Conjecture 1. An increase in BMI negatively influences health, while an increase in fruit and vegetable intake and an increase in physical activity frequency positively relate to health. Walking and cycling for commuting also enhance health.

2.2.5. Health Care Utilization

The usage of health care services is most often approximated by the number of doctor visits (GP and specialist), outpatient and inpatient hospitalization, or drug use. In the literature from the medical and economics fields, health care seeking has been studied under several perspectives, theoretically and empirically (to cite a few, Grossman 1972; Pohlmeier and Ulrich 1995; Ang 2010). Many of them addressed the demand for health care from a socio-economic, including from an insurance, point of view. However, health, as a determinant, has seldom been investigated, as the relationship may seem trivial. Fylkesnes (1993) found that self-rated health was the most important driver of health care utilization.

Another factor that could lead to the increase in health care consumption is the enrollment in health insurance. This incentive effect has been extensively studied, and the conclusion was shared among the literature reviews of Schmitz (2012) and Prinja et al. (2017): insurance take up leads to an increase in health care services' utilization. Schmitz (2012) specified that insurance plans with a deductible had lower consumption compared to plans without such a feature. Gardiol et al. (2005) performed this analysis in Switzerland and outlined that 25% of health care expenditures could be attributable to the incentive effect linked to deductibles. Further, alternative plans have been introduced in Switzerland to contain health costs by limiting doctors' visits through the primary usage of telephone hotlines and directing patients to the most efficient doctors' networks. Thus, we expected health care utilization to be negatively linked to alternative insurance plans.

Conjecture 2. Health is the most important driver of health care consumption. As health improves, health care consumption declines. Further, a low deductible and standard insurance plan should incentivize health care consumption.

2.2.6. Insurance Demand

The empirical literature on health insurance demand is relatively limited. Firstly, health as a component of the decision-making process has been less exploited, probably due to the endogeneity it may present and the difficulty to deal with it. Secondly, papers rather address the demand for complementary (private) health insurance through expected health care expenditures. In our context, we focused on the choices made in a compulsory health insurance environment. Finally, we note that other socio-economic variables have nonetheless been used as drivers of health insurance demand: e.g., gender, age, marital status, country of origin, education, occupation, or income (Van de Ven and Van Praag 1981; Cameron et al. 1988). Among these covariates, it is the effect of income that has been the most extensively estimated (see Schneider 2004 for a literature review). It is needless to emphasize the lack of empirical evidence linking health and health insurance demand, let alone the effect of lifestyle. Our research aims at providing an instance of the relationship between lifestyle and health insurance demand via the health and health care consumption channels.

Conjecture 3. The effect of socio-economic covariates, namely gender, education, and income, on decisions for the insurance plan and the deductible is significant.

Linking the arguments on health, health care utilization, and insurance demand, we further propose the following conjecture:

Conjecture 4. The effect of health through health care consumption is believed to be significant for the health insurance decisions. Higher health care usage is associated with a low deductible and a standard insurance plan.

Finally, it is interesting to consider Conjectures 2 and 4 together. When reconsidering Conjecture 2, we can state that riskier individuals, i.e., unhealthy individuals, come along with higher health care consumption, which, in line with Conjecture 4, is associated with choosing a standard insurance contract with a low insurance deductible. This is aligned with the common contributions in the insurance economics literature (Zweifel and Eisen 2012). In our model framework, we will consider the bidirectional relationship between health care consumption and insurance decisions. Indeed, while our main interest is on how one's own health and health care consumption trigger insurance decisions (deductible, insurance plan). We know from the economics literature that a given insurance coverage will also have an impact on the consumption (cf. the presence of moral hazard; see the above discussion in the section "Health Care Utilization").

3. Model Framework and Available Data

3.1. Structural Equation Model

To study the above questions and conjectures, the choice of SEM was guided by the several advantages that this technique presents. Health is a difficult concept to quantify and is oftentimes estimated by its outcomes, namely chronic disease occurrence or mortality rates. This method, however, does not provide a complete, nor a sufficient picture of the individual's state of physical and mental well-being. In view of these elements, in our SEM model, we let health be a latent variable, influenced by the lifestyle. Doing so, we avoided at the same time any reporting bias and measurement errors of health-related variables (on which Crossley and Kennedy (2002) shed light). Indeed, some authors used the self-assessed health of the individual as a proxy for the unobserved health, especially in the labor market field (see Haan and Myck 2009; Strully 2009; Böckerman and Ilmakunnas 2009, for a few examples). The issue in this procedure lies in the unobserved characteristics such as risk aversion, which may, for instance, affect both one's own health perception and health insurance demand. Solely relying on the self-reported health at face value is also prone to severe measurement biases highlighted in the literature (mostly attributed to social desirability, discussed in Huang et al. 1998 and Van de Mortel et al. 2008). In an SEM setting, on the contrary, health can be captured by several more objective measures called manifest variables and, by this means, minimize the bias. The same rationale applies to the latent variable of health care seeking. Like health, the unobservable variable of the demand of health care services is a difficult notion to grasp by a single variable or even a set (as for instance in Bourne et al. 2009) and may be subject to omitted variables' bias. Again, SEM is well suited for using several variables at once to define the concept.

Additionally, in dealing with the above issues, SEM can indicate simultaneous direct relationships called paths. These paths can be specified as well between exogenous as between endogenous variables, thus allowing for a more thorough and exhaustive analysis. Because of this convenient ability of the model to assess the simultaneous relationship between multiple unobserved variables and observed outcomes, SEM frameworks have been widely used in the sociology- and psychology-related literature (Sobel 1987; Cuttance and Ecob 2009; MacCallum and Austin 2000; Martens 2005). Moreover, we note that usual econometric methodologies like fixed effects regressions cannot be applied in our context due to the cross-sectional nature of data from surveys. In an SEM, the estimation of the parameters comes from a maximization of likelihood between the actual covariance matrices of the relationships between variables and the estimated covariance matrices of the model (for more information, see Bollen 1989).

Our research aims to assess the relationship between lifestyle and health insurance decisions. Figure 1 gives a graphical representation of the model that we employed. We measured lifestyle from four behaviors, namely BMI (BMI), diet (DIT), sports (SPT), and commuting modes (CMW, CMB, CMP, CMV), while we controlled for age (AGE). In our model, however, lifestyle was not assumed to have a direct effect on insurance decisions (insurance plan PLN and deductible DED), but rather an indirect one mediated via health (HLT) and health care consumption (HCC). Health was hypothesized to play a role in health care usage, which in turn was conjectured to drive health insurance decisions, thus creating a bridge to lifestyle. Finally, the health insurance choice was controlled by socio-demographic characteristics (gender SEX, nationality NAT, education EDU and income INC levels, number of children in the household KID, freedom of choice for specialist doctors SPE, language region LNR, and urbanicity RUR). Further, health was measured using information on self-reported health SRH, chronic health conditions CHR, and limiting health conditions LIM, while health care consumption was evaluated from GP visits (GPV), specialist and gynecologist visits (SPV), and hospital stays (HOS). In Table 1, we summarize and describe the variables that we used.

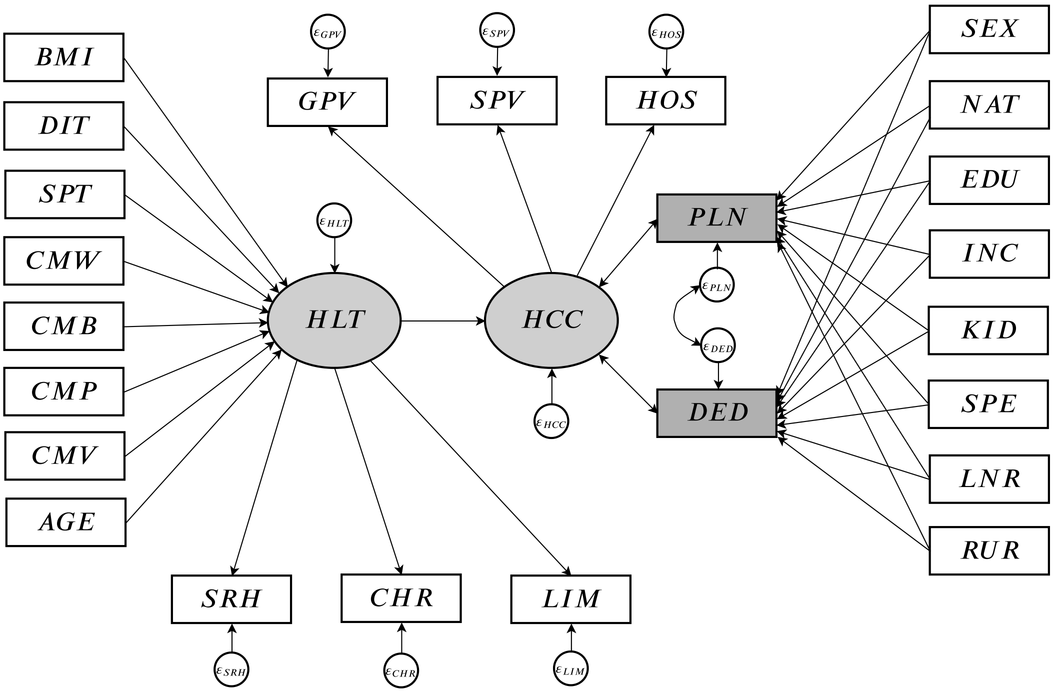

Figure 1. Illustration of the path diagram of the structural equation model.

Table 1. Description of the variables used in the model.

Variables	Type	Description	Values
AGE	Exogenous	Age	integer (19+)
BMI	Exogenous	BMI according to the WHO scale	categories: 0–18.4, 18.5–24.9, 25–29.9, 30+
DIT	Exogenous	Diet, portions of fruits and vegetables consumed on average per day	categories: 0–2, 3–4, 5+
SPT	Exogenous	Sports sessions with perspiration, per week	categories: 0, 1–2, 3+
CMW	Exogenous	Commuting mode: walking	no, yes
CMB	Exogenous	Commuting mode: biking	no, yes
CMP	Exogenous	Commuting mode: public transportation	no, yes
CMV	Exogenous	Commuting mode: motorized vehicle	no, yes
HLT	Latent	Health	–
SRH	Manifest	Self-reported health, (Likert scale)	0 (very bad), 0.25 (bad), 0.5 (average), 0.75 (good), 1 (very good)
CHR	Manifest	Chronic health conditions lasting at least 6 months	no, yes
LIM	Manifest	Limiting health conditions in everyday activities	no, yes
HCC	Latent	Health care consumption	–
GPV	Manifest	Number of general practitioner and family doctor visits in the past 12 months	integer
SPV	Manifest	Specialist and gynecologist visits in the past 12 months	integer
HOS	Manifest	Any hospital stays of at least one night	no, yes
SEX	Exogenous	Gender	male, female
NAT	Exogenous	Nationality	Swiss, other
EDU	Exogenous	Level of education	primary, secondary (professional and general), tertiary (professional and general)
INC	Exogenous	Level of income in CHF	categories: 0–3000, 3001–4500, 4501–6000, 6001+
KID	Exogenous	Number of children in household $<$ 18 y.o.	categories: 0, 1, 2, 3, 4+
SPE	Exogenous	Freedom of choice of specialist important	no, yes
LNR	Exogenous	Language region	German, French, Italian
RUR	Exogenous	Rural region	no, yes
PLN	Endogenous	Insurance plan	standard, other (HMO, family doctor, telmed, other)
DED	Endogenous	Deductible in CHF	high (2500), low (300)

3.1.1. Measurement of Health

To run the analysis, we designed our model with health (HLT) as a latent variable. This latent variable was measured by three observed variables: the self-rated health (SRH), having or having had a chronic health condition lasting at least six months (CHR), and having health conditions limiting daily activities during the past six months (LIM). These three indicators were assumed to correlate perfectly with the unobserved health variable. We considered the following set of equations:

$$\begin{aligned} SRH_i &= \kappa_{SRH} HLT_i + \varepsilon_{SRH,i} \\ CHR_i &= \kappa_{CHR} HLT_i + \varepsilon_{CHR,i} \\ LIM_i &= \kappa_{LIM} HLT_i + \varepsilon_{LIM,i} \end{aligned} \quad (1)$$

In the system of Equation (1), κ_{SRH}, κ_{CHR}, and κ_{LIM} are the loading factors. $\varepsilon_{\cdot,i}$ are the error terms for the individual i linked to each of the indicator variables. For our modeling, we assumed the error terms to be uncorrelated with each other and with the latent variable HLT, as well as having an expectation value of zero.

3.1.2. Regression Model for Health

The following Equation (2) describes the regression of health on the lifestyle variables including a control for age as depicted in the left-hand part of the graph in Figure 1.

$$\begin{aligned} HLT_i = {} & \beta_0 + \beta_{AGE} AGE_i + \beta_{BMI} BMI_i + \beta_{DIT} DIT_i + \beta_{SPT} SPT_i + \beta_{CMW} CMW_i \\ & + \beta_{CMB} CMB_i + \beta_{CMP} CMP_i + \beta_{CMV} CMV_i + \varepsilon_{HLT,i} \end{aligned} \quad (2)$$

The respective β_0 and $\beta_{\cdot}$ coefficients correspond to the baseline, respectively the regression coefficients linked to the variables. The error term $\varepsilon_{HLT,i}$ was assumed to have a zero expected value and to be uncorrelated with the error terms in the other submodels.

3.1.3. Measurement of Health Care Consumption

Our second latent variable was the individual's inherent health care consumption (HCC). Three variables were used to approximate this behavior: the number of GP or family doctor visits (GPV), the number of specialists visits (SPV), and whether the respondent had an inpatient hospitalization (HOS). All three variables were accounted for during the past 12 months and were assumed to correlate perfectly with our unobserved health variable.

$$\begin{aligned} GPV_i &= \lambda_{GPV} HCC_i + \varepsilon_{GPV,i}, \\ SPV_i &= \lambda_{SPV} HCC_i + \varepsilon_{SPV,i}, \\ HOS_i &= \lambda_{HOS} HCC_i + \varepsilon_{HOS,i} \end{aligned} \quad (3)$$

In the system of Equation (3), λ_{GPV}, λ_{SPV}, and λ_{HOS} are the loading factors. $\varepsilon_{\cdot,i}$ denote the error terms for the individual i in each indicator variable. The errors were assumed to be uncorrelated with each other and with the latent variable HCC. Errors were supposed to have an expected value of zero.

3.1.4. Regression Model for Health Care Consumption

The following Equation (4) is the regression of health care consumption on health (HLT) and the insurance characteristics (plan PLN and deductible DED):

$$HCC_i = \delta_0 + \delta_{HLT} HLT_i + \delta_{PLN} PLN_i + \delta_{DED} DED_i + \varepsilon_{HCC,i} \quad (4)$$

The respective δ_0 and $\delta_{\cdot}$ coefficients correspond to the baseline, respectively the variables' regression coefficients. The error term $\varepsilon_{HCC,i}$ was assumed to have a zero expected value and to be uncorrelated with other error terms.

3.1.5. Regression Models for Health Insurance Decisions

The two following regressions express the choice of the insurance plan (PLN) and deductible level (DED) according to health care consumption and socio-demographic characteristics. The variable PLN takes the value of one if the respondent chooses an alternative plan (HMO, family doctor, telmed, other) and zero for the standard plan. Concerning the deductible levels DED, if the individual has opted for a yearly deductible of CHF 300, the variable takes the value of zero. The value is one if the chosen deductible is CHF 2500. Here, we built a simple model by selecting only the two extreme values because we considered that they unveiled a clear choice towards the highest versus the lowest coverage. We disregarded all individuals with other choices. The resulting respective probit models (choices 0 and 1) were modeled through latent variables. Indeed, for our SEM, we supposed there existed auxiliary random variables PLN^* and DED^* such that:

$$\begin{aligned} PLN_i^* = \gamma_0^{PLN} + \gamma_{HCC}^{PLN} \cdot HCC_i + \gamma_{SEX}^{PLN} \cdot SEX_i + \gamma_{NAT}^{PLN} \cdot NAT_i + \gamma_{EDU}^{PLN} \cdot EDU_i + \gamma_{INC}^{PLN} \cdot INC_i \\ + \gamma_{KID}^{PLN} \cdot KID_i + \gamma_{SPE}^{PLN} \cdot SPE_i + \gamma_{LNR}^{PLN} \cdot LNR_i + \gamma_{RUR}^{PLN} \cdot RUR_i + \varepsilon_{PLN,i} \end{aligned} \tag{5}$$

and:

$$\begin{aligned} DED_i^* = \gamma_0^{DED} + \gamma_{HCC}^{DED} \cdot HCC_i + \gamma_{SEX}^{DED} \cdot SEX_i + \gamma_{NAT}^{DED} \cdot NAT_i + \gamma_{EDU}^{DED} \cdot EDU_i + \gamma_{INC}^{DED} \cdot INC_i \\ + \gamma_{KID}^{DED} \cdot KID_i + \gamma_{SPE}^{DED} \cdot SPE_i + \gamma_{LNR}^{DED} \cdot LNR_i + \gamma_{RUR}^{DED} \cdot RUR_i + \varepsilon_{DED,i} \end{aligned} \tag{6}$$

for which we had PLN and DED variables acting as indicators:

$$PLN_i = \begin{cases} 1 & \text{if } PLN_i^* > 0 \\ 0 & \text{otherwise} \end{cases} \tag{7}$$

and:

$$DED_i = \begin{cases} 1 & \text{if } DED_i^* > 0 \\ 0 & \text{otherwise} \end{cases} \tag{8}$$

The values γ_0^{PLN} and $\gamma_{\cdot}^{PLN}$, respectively γ_0^{DED} and $\gamma_{\cdot}^{DED}$, follow the standard notations for regression coefficients. Further, the error terms $\varepsilon_{PLN,i}$ and $\varepsilon_{DED,i}$ were assumed to come from a standard normal distribution and were allowed to correlate with each other.

3.2. Swiss Health Survey Data

We based our study on data obtained from the Swiss Health Survey, a cross-sectional nation-wide survey (Swiss Federal Statistical Office 2019; Swiss Federal Statistical Office 2018).[1] The survey was carried out by the Swiss Federal Statistical Office on behalf of the Federal Council every five years since 1992. In the following, we used the wave of 2017, which was the sixth and most recent one. The survey responses were firstly collected via computer-assisted telephone interviews and followed up by an additional written questionnaire available in the three official Swiss languages (German, French, and Italian). The included population was aged 15 years or over and lived in Switzerland in a private household. The total sample of 2017 included 22,134 telephone interviews and 18,832 subsequently completed and returned questionnaires. The information collected concerned the state of health of each individual (e.g., physical and mental well-being, health conditions, health limitations),

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[1] For more information, see https://www.bfs.admin.ch/bfs/fr/home/statistiques/sante/enquetes/sgb.html.

the use of health care (e.g., doctor consultations, hospitalization, use of drugs), the health insurance status (e.g., insurance plan, deductible, purchase of complementary insurance), behaviors susceptible to have an influence on health (e.g., alcohol intake, drug consumption), and socio-demographic characteristics (e.g., employment status, income, nationality).

To conduct our empirical analysis, we extracted a sample of "complete" answers comprising 9301 observations. The completeness of an observation was defined by the absence of entries that were not available (NA). We could consider that the NAs were distributed randomly across the original data since our extracted sample was not markedly different from the original one. Regrading the lifestyle indicators, our final sample had a slightly higher median age, i.e., 52 versus 49 years. As concerned the BMI, the diet (number of portions of fruits and vegetables eaten per day) or the frequency of physical activity[2], and commuting, the average values and shares were very close. Regarding the other exogenous variables, the original sample displayed the same level of self-rated health (good), and a smaller percentage had health conditions limiting daily activities, which was most probably due to a lower proportion of individuals aged over 50 years; our final sample contained a higher number of individuals with chronic health conditions. Overall, we considered that our extracted sample did not present any selection bias thanks to the sampling performed beforehand by the Swiss Federal Statistical Office and the relatively large sample size when compared to other surveys (where the number of observations is often considerably smaller).

3.3. Descriptive Statistics

3.3.1. Exogenous Characteristics Affecting Health

In Table 2, we present some descriptive statistics based on our data along with the variables appearing in our hypotheses. The lifestyle was conjectured to have an effect on health, which was defined in our model by the self-rated health (SRH), the past or ongoing existence of a chronic disease lasting for six months or more (CHR), and a health condition coming with a limitation in daily activities (LIM). Subsequently, through health, they impacted health care consumption, gauged in our model by the number of GP visits (GPV), the number of specialists visits (SPV, gynecologists excluded, to avoid pregnancy-related bias), and the individual's hospital stays of one night or over (HOS). The first column in Table 2 counts the number of observations N per category in each variable, while the second represents the corresponding share from the whole sample of 9301 observations (total N). The other six columns display the mean for each manifest variable. Over the total sample (cf. the last row of the table), the mean self-rated health was at 0.81, that is good health on average; 35% of the sample's population reported chronic, and 21% health conditions limiting daily activities. Alongside this, the average number of GP visits was 2.27, and the number of visits to specialists was 1.99. Finally, 18% of the sampled individuals stayed in a hospital for more than one night during the 12 months preceding the survey.

Concerning the lifestyle variables, when grouping individuals by BMI categories, we deciphered the pattern that was documented in the literature, i.e., respondents with a BMI comprised between 18.5 and 24.9 declared the highest self-rated health (0.84) and the lowest propensity of having a chronic or a limiting health condition (0.31 and 0.18). Additionally, as the BMI increased, the SRH decreased (from 0.84 to 0.72 for the category with highest BMI), and the proportion of individuals having chronic or limiting health conditions increased (moving from 0.31 and 0.18 to 0.50 and 0.30 for CHR, respectively LIM, in the group with the highest BMI), thus matching observations from the literature (cf. Section 2.2). An increase in BMI was also positively associated with health care services' utilization. According to our descriptive statistics, the effect of the diet on the health and health care usage proxies was mitigated. Two associations could be made: an increase in the number of fruits and vegetables

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[2] Note that we excluded individuals not being able to walk at least 200 m by themselves.

eaten on average per day came with an increase in self-rated health (0.80 to 0.83), but also with an increase of visits to specialists (1.33 to 1.66). Further analysis, including the study of significance, was performed in our SEM. When it came to physical activity, however, the relationship seemed indisputable. As the frequency of sports activities increased, the data presented a clear increase in the self-rated health variable (0.74 to 0.85), coupled with a decrease in the occurrence of health conditions (0.42 to 0.30 for CHR and 0.26 to 0.18 for LIM). This beneficial association continued on health care seeking through all indicators where we observed declining consumption. Concerning the effect on the commuting mode, we observed that it largely depended on the type. Biking as a means of transportation exhibited the most notable link to our indicators: individuals who bike reported a higher self-rated health (0.85 against 0.80) and a lower in-group propensity to have a chronic or limiting health condition (0.33 versus 0.36 for CHR and 0.19 versus 0.21 for LIM). By the same token, the number of GP visits dropped from 2.42 to 1.82 on average, the number of visits to specialists from 1.48 to 1.32, and the inpatient stays going down by three percentage points. Finally, age displayed the expected effect, that is as age increased, the self-rated health decreased, and the propensity in each category of having a chronic or a limiting health condition increased, along with the frequency of all medical visits. Finally, to supplement our descriptive statistics, we document in Table 3 the correlation coefficients between our proxy variables, as well as their standard deviations.

Table 2. Descriptive statistics of the exogenous characteristics affecting health.

	N	(%)	SRH	CHR	LIM	GPV	SPV	HOS
BMI								
0–18.4	260	(2.8)	0.82	0.35	0.20	2.10	1.72	0.12
18.5–24.9	5075	(54.6)	0.84	0.31	0.18	1.99	1.37	0.10
25.0–29.9	2973	(32.0)	0.79	0.37	0.22	2.36	1.42	0.12
30.0+	993	(10.7)	0.72	0.50	0.30	3.42	1.76	0.17
Diet								
0–2 portions per day	4309	(46.3)	0.80	0.35	0.21	2.33	1.30	0.12
3–4 portions per day	3043	(32.7)	0.82	0.35	0.20	2.15	1.49	0.11
5+ portions per day	1949	(21.0)	0.83	0.35	0.21	2.30	1.66	0.11
Sports								
No activity	2947	(31.7)	0.74	0.42	0.26	2.91	1.72	0.14
1–2 times per week	3641	(39.1)	0.84	0.33	0.18	1.92	1.24	0.10
3+ times per week	2713	(29.2)	0.85	0.30	0.18	2.02	1.39	0.11
Commuting: walking								
No	4732	(50.9)	0.81	0.34	0.20	2.28	1.46	0.11
Yes	4569	(49.1)	0.81	0.36	0.21	2.25	1.42	0.11
Commuting: biking								
No	6892	(74.1)	0.80	0.36	0.21	2.42	1.48	0.12
Yes	2409	(25.9)	0.85	0.33	0.19	1.82	1.32	0.09
Commuting: public transport								
No	6000	(64.5)	0.81	0.34	0.20	2.30	1.38	0.12
Yes	3301	(35.5)	0.81	0.36	0.22	2.21	1.54	0.11
Commuting: motorized vehicle								
No	3092	(33.2)	0.81	0.35	0.21	2.23	1.50	0.11
Yes	6209	(66.8)	0.81	0.35	0.21	2.28	1.41	0.11
Age								
19–26	568	(6.1)	0.87	0.21	0.14	1.95	1.20	0.08
25–40	2117	(22.8)	0.87	0.23	0.13	1.80	1.38	0.11
41–50	1732	(18.6)	0.83	0.29	0.17	1.86	1.15	0.09
51–60	1840	(19.8)	0.79	0.38	0.21	2.28	1.71	0.10
61–70	1552	(16.7)	0.77	0.46	0.26	2.58	1.55	0.13
71–80	1173	(12.6)	0.75	0.48	0.31	3.06	1.61	0.17
81+	319	(3.4)	0.72	0.45	0.36	3.55	1.06	0.15
Total	9301	(100.0)	0.81	0.35	0.21	2.27	1.99	0.18

Table 3. Correlation coefficients and standard deviation of the indicator variables.

	SRH	*CHR*	*LIM*	*GPV*	*SPV*	*HOS*
SRH	1.00	−0.58	−0.50	−0.53	−0.46	−0.31
CHR	−0.58	1.00	0.49	0.35	0.27	0.14
LIM	−0.50	0.49	1.00	0.27	0.18	0.15
GPV	−0.53	0.35	0.27	1.00	0.51	0.39
SPV	−0.46	0.27	0.18	0.51	1.00	0.33
HOS	−0.31	0.14	0.15	0.39	0.33	1.00
Std. dev.	0.19	0.48	0.40	3.85	3.86	0.32

3.3.2. Exogenous Characteristics Affecting Health Insurance Decisions

In the following Table 4, we provide an overview of the distribution of the observations along the second set of exogenous variables, i.e., the socio-demographic characteristics, linked to insurance decisions. We provide the shares of individuals along the insurance plan and deductible choices. In addition to the control variables, we present the distribution along the health and health care utilization indicator variables.

Firstly, when comparing the statistics of health insurance decisions based on socio-demographic variables, we observed several trends. Between both genders, we noted one important difference with women being more likely to choose a lower deductible when compared to men (65.9% of the women, 52.2% of the men). Regarding the nationality, Swiss nationals tended to opt more often for an alternative plan, whereas non-Swiss individuals rather went for the standard one. Education, income, and the number of children in the household seemed to demonstrate differences. As the level of education, income, or the number of children increased, the majority switched from the low to the high level of deductible. Moreover, increasing education levels came along with a favor for alternative insurance plans. Along the two other variables, the majority already favored alternative plans with a slight increase in the share as income and number of children became higher. Finally, the last markedly different result with respect to the socio-demographic variables was the specificity of German-speaking respondents regarding the choice of the insurance plan: most individuals from the German-speaking language area tended towards alternative models, which was not the case in the French- and Italian-speaking regions.

Secondly, when focusing on health-related variables, we observed that higher levels of self-rated health went along with individuals that had chosen the high level deductible, as well as an alternative insurance plan. This observation was not at odds with economic logic as an individual with a lower self-rated health may expect to have higher yearly expenses and hence would prefer to pick a model with a higher coverage. The same observation could be drawn for individuals disclosing chronic or other limiting health conditions. The distribution of individuals who did not report having or having had any chronic health conditions was fairly even among both models (43.3% standard) and deductible levels (49.7% low). For individuals with a limiting health condition, the figures were still very similar. When focusing on people reporting any chronic or limiting health conditions, the shares regarding the model choices remained in fact relatively stable, but presented a strong increase in the share opting for the low deductible, i.e., 77.8% for CHR and 78.5% for LIM.

Finally, concerning our manifest variables accounting for health care consumption, the observations met the economic intuition. Regarding the models, the relationship was constant: as the number of visits, disregarding the type of doctor, increased, health care consumption did as well. Respondents typically favor an alternative insurance plan. Strong differences appeared with regard to the deductible. As an example, individuals not reporting any visits to a GP were 36.6% in the low deductible category; this percentage rose to 84.4% for those reporting four visits or more during the past 12 months. The same pattern could be observed throughout all three variables.

Table 4. Descriptive statistics of the exogenous characteristics affecting insurance decisions.

			Insurance Plan		Deductible	
	N	(%)	Std. (%)	Oth. (%)	Low (%)	High (%)
Gender						
Male	4343	(46.7)	43.9	56.1	52.2	47.8
Female	4958	(53.3)	43.1	56.9	65.9	34.1
Nationality (baseline: Swiss)						
Swiss	7633	(82.1)	40.7	59.3	60.3	39.7
Other	1668	(17.9)	55.8	44.2	55.6	44.4
Education						
Primary	1152	(12.4)	55.2	44.8	83.4	16.6
Secondary: professional	3384	(36.4)	44.6	55.4	68.0	32.0
Secondary: general	1213	(13.0)	43.9	56.1	57.0	43.0
Tertiary: professional	1280	(13.8)	33.8	66.2	50.9	49.1
Tertiary: general	2261	(24.3)	40.6	59.4	40.7	59.3
Income						
0–3000	3502	(37.7)	45.8	54.2	70.1	29.9
3001–4500	1949	(21.0)	45.9	54.1	64.5	35.5
4501–6000	1738	(18.7)	39.8	60.2	54.0	46.0
6001+	2112	(22.7)	40.2	59.8	41.7	58.3
Children in household						
0	6 720	(72.3)	45.6	54.4	65.9	34.1
1	354	(3.8)	42.1	57.9	56.8	43.2
2	774	(8.3)	42.4	57.6	45.1	54.9
3	220	(2.4)	43.6	56.4	47.3	52.7
4+	1233	(13.3)	32.5	67.5	36.4	63.6
Freedom of choice of specialist important						
No	2436	(26.2)	33.9	66.1	52.4	47.6
Yes	6865	(73.8)	46.8	53.2	62.0	38.0
Language region						
German	6273	(67.4)	39.0	61.0	60.1	39.9
French	2295	(24.7)	52.6	47.4	58.8	41.2
Italian	733	(7.9)	53.1	46.9	56.3	43.7
Rural region						
No	6412	(68.9)	44.6	55.4	59.5	40.5
Yes	2889	(31.1)	40.9	59.1	59.4	40.6
Self-rated health						
Very bad	32	(0.3)	46.9	53.1	87.5	12.5
Bad	212	(2.3)	57.5	42.5	93.4	6.6
Average	1020	(11.0)	51.9	48.1	90.3	9.7
Good	4218	(45.3)	43.2	56.8	66.6	33.4
Very good	3819	(41.1)	40.6	59.4	41.2	58.8
Chronic health conditions						
No	6062	(65.2)	43.3	56.7	49.7	50.3
Yes	3239	(34.8)	43.7	56.3	77.8	22.2
Limiting health conditions						
No	7385	(79.4)	43.2	56.8	54.5	45.5
Yes	1916	(20.6)	44.5	55.5	78.5	21.5
Visits to general practitioner						
0	2623	(28.2)	43.0	57.0	36.6	63.4
1	2459	(26.4)	41.7	58.3	54.0	46.0
2–3	2503	(26.9)	43.9	56.1	71.5	28.5
4+	1716	(18.4)	45.9	54.1	84.8	15.2
Visits to specialist						
0	5111	(55.0)	42.7	57.3	50.0	50.0
1	1977	(21.3)	42.1	57.9	64.9	35.1
2–3	1265	(13.6)	44.6	55.4	74.6	25.4
4+	948	(10.2)	48.6	51.4	78.7	21.3
Hospital inpatient stay						
No	8243	(88.6)	43.3	56.7	57.3	42.7
Yes	1058	(11.4)	44.3	55.7	76.5	23.5
Total	9301	(100.0)	59.5	40.5	43.4	56.6

4. Model Results and Discussion

In this section, we document the SEM results for our health measurement for the model defined through Equation (1), followed by the regression model for health, i.e., the coefficients of the lifestyle effects on health (see Equation (2)), the health care consumption measurement as modeled through Equation (3), succeeded by the health care consumption regression (Equation (4)). Finally, we present the results for the regression models on health insurance demand for both insurance plan (Equation (5)) and deductible (Equation (6)).

We estimated the SEM using diagonally weighted least squares, which best fits binary observed variables as it does not make any distributional assumptions, nor consider continuity contrary to the maximum likelihood method (for more information, see Muthén 1984 or Li 2016). To run our empirical analysis, we made use of the lavaan package in R (Rosseel 2012). Before presenting the model results and coefficients, we lay out the goodness-of-fit measures. The measures and indicators calculated for the overall model were the following. We obtained a comparative fit index (CFI) of 0.959 and a Tucker–Lewis index (TLI) of 0.995 for the incremental fit measures and a root mean squared error of the approximation (RMSEA) of 0.028 and a standardized root mean squared residual (SRMR) of 0.043 for the absolute fit indices. According to the cut-off values of Hooper et al. (2008), our model presented a good fit, and an RMSEA lower than 0.03, as in our case, was indicative of an excellent fit. In the following paragraphs and Tables 5–9, we display our results.

4.1. Measurement of Health

Our first results were on the establishment of the health latent variable. We set the loading factor κ_{SRH} to one as it set the scale of the HLT variable. The model results in Table 5 lay out that, expectedly, as individuals reported chronic or limiting health conditions, their health significantly decreased. Indeed, both variables CHR and LIM were highly significant at the 0.001 p-level, and the related κ coefficients were negative.

Table 5. Results for the measurement of health (Equation (1)).

	Health Measurement	
	κ	**Sig.**
$SRH_i \sim \kappa_{SRH} HLT_i$	1.000	
$CHR_i \sim \kappa_{CHR} HLT_i$	−1.760	***
$LIM_i \sim \kappa_{LIM} HLT_i$	−1.047	***

Note: *** $p < 0.001$.

4.2. Regression Model for Health

In Table 6, we report the coefficients stemming from the regression Equation (2), i.e., the results for the effect of lifestyle-defining behavior on the latent health variables. The first variable of interest was the BMI, and the displayed results were in line with the existing literature. The baseline category was a BMI ranging from 18.5 and 24.9 and showing no statistical difference with the lower category of BMI. However, when moving to higher categories, the obtained regression coefficients suggested that the negative effect on health became more salient: the value of the coefficient was multiplied by a factor of three between the third and last group, both coefficients being highly significant at the 0.001 level. Regarding the diet variable, which was characterized by the number of fruits and vegetables eaten on average per day, there was no strong effect in our sample. The only change in health may occur from an increase from 0–2 portions per day to 3–4 resulting in an increase with a 0.1 significance level. This result was somehow expected from our descriptive statistics where no striking differences between the several categories were observed. Sports activities when compared to the baseline of no activity were significantly linked to better health. When comparing individuals performing 1–2 sessions or 3+ sessions per week with the baseline, we observed very similar coefficient values. That is, an increase in the number of sessions enhanced health rather similarly between both categories with a coefficient of 0.053 (1–2 sessions), respectively 0.057 (3+ sessions). We note that our findings concerning diet and sports were found to follow the same pattern as in Blanchard et al. (2004). Indeed, they found that among cancer survivors, individuals following the five fruits and vegetables per day recommendation did not witness an increase in their health-related quality of life contrary to individuals who performed physical activities. If we classified the commuting modes according to their impact on health, biking would be the most interesting way of transportation in this regard, and walking would come second. The stronger effect of biking rather than walking was also documented by Matthews et al. (2007). Using a motorized vehicle was still linked to better health, but with a lower significance (p-value of 0.1); using public transport was linked to worse health (significance level of 0.1). Finally, with increasing age, individuals had worse health levels. Overall, having a BMI lower than 25, eating three to four portions of fruits and vegetables per day on average, exercising with perspiration at least once per week, and biking or walking as a way to commute represented a lifestyle relating to better health. In the opposite manner, having a high BMI, a greens-deprived diet, as well as a sedentary lifestyle were linked to worse health levels. These results supported and specified our first conjecture.

Table 6. Results for the regression model for health (Equation (2)).

	Health	
	β	**Sig.**
BMI category (baseline: 18.5–24.9)		
0–18.4	−0.016	
25.0–29.9	−0.032	***
30.0+	−0.090	***
Diet (baseline: 0–2 portions per day)		
3–4 portions per day	0.007	.
5+ portions per day	0.002	
Sports (baseline: No activity)		
1–2 times per week	0.053	***
3+ times per week	0.057	***
Commuting mode: walking (baseline: No)		
Yes	0.010	*
Commuting mode: biking (baseline: No)		
Yes	0.016	***
Commuting mode: public transport (baseline: No)		
Yes	−0.008	.
Commuting mode: motorized vehicle (baseline: No)		
Yes	0.008	.
Age (baseline: 25–40)		
19–24	−0.001	
41–50	−0.029	***
51–60	−0.061	***
61–70	−0.080	***
71–80	−0.103	***
81+	−0.107	***

Note: . $p < 0.1$, * $p < 0.05$, *** $p < 0.001$.

4.3. Measurement of Health Care Consumption

Moving to the second latent variable construction defined in Equation (3), we set the loading factor λ_{GPV} to one defining the scale of the health care consumption variable HCC. From the results in Table 7, one can observe a positive relationship between the number of visits to specialist doctors or inpatient stays and health care consumption (both with a p-level of 0.001).

Table 7. Results for the measurement of health care consumption (Equation (3)).

Health Care Consumption Measurement		
	λ	**Sig.**
$GPV_i \sim \lambda_{GPV} HCC_i$	1.000	
$SPV_i \sim \lambda_{SPV} HCC_i$	0.828	***
$HOS_i \sim \lambda_{HOS} HCC_i$	0.042	***

Note: *** $p < 0.001$.

Regression Model for Health Care Consumption

In Table 8, we display the results of the variables conjectured to affect health care consumption. Undoubtedly, health had the strongest impact on health care consumption. Indeed, the health variable was highly significant at the 0.001 p-value level and showed a negative sign, i.e., better health came with lower care consumption. This confirmed the first part of the second conjecture.

Table 8. Results for the regression model for health care consumption (Equation (4)).

	Health Care Consumption	
	δ	**Sig.**
Health		
	−14.109	***
Insurance plan (baseline: standard)		
Other	0.096	.
Deductible (baseline: Low)		
High	0.284	*

Note: . $p < 0.1$, * $p < 0.05$, *** $p < 0.001$.

Further, we found that the type of plan, as well as the level of deductible played some role in the amount of health care services used. Our results suggested that an alternative insurance plan and a high level of deductible were related to higher health care consumption. These results were counterintuitive since higher deductibles and alternative insurance plans were thought to diminish care service utilization (see our Conjecture 2 and Gardiol et al. 2005; Schmitz 2012; Prinja et al. 2017). First, care must be taken when concluding since significance levels for both variables were much less strong then the one for the health variable. Second, the results contradicted our findings from the "reverse" regression models in Equations (5) and (6) where health care consumption was a predictor for insurance decisions (see below). Finally, the observed relationship linking the high deductible to higher consumption might be that individuals who already experienced expenses reaching the deductible may want "to make the most out of it" and use more services that they have been postponing beforehand. Thus, individuals with a low deductible may have less incentives to "overuse" health care services. More research, beyond the data available to us, is needed to resolve this issue.

At this stage, we remained with the one conclusion that health status was probably the single primary driver for health care consumption.

4.4. Regression Models for Health Insurance Decisions

Finally, we now turn to the probit regression models defined in Equations (5) and (6) linking the previously discussed variables and results to health insurance decisions. The results are presented in Table 9. We considered two insurance decisions. The first column of the table reports the coefficients of the model related to the decision of choosing an alternative or "other" insurance plan (versus the baseline of the standard plan). The second part of the table relates to choosing the high deductible (versus the baseline of the low deductible). The first and foremost result concerned health care consumption. For both the alternative insurance plan and the high level of deductible choices, *HCC* displayed a negative sign with statistical significance above 0.001. This meant that higher care utilization went along with the choice of the standard insurance plan and the low deductible. This confirmed our fourth conjecture. It is noteworthy that both coefficients were statistically very strong (as was for example the case of health on health care consumption in Table 8). Assembling the results from the entire model, we could put forward the following reasoning: when we defined a healthy lifestyle as having a low BMI, a diet of 3+ portions of fruits and vegetables per day, practicing sports or commuting by bike or walking, such a lifestyle enhanced health; higher levels of health were associated with lower health care consumption, which in turn correlated with the choice of an alternative insurance model and a high deductible.

Table 9. Results for regression models for health insurance demand (Equations (5) and (6)).

	"Other" Insurance Plan		**"High" Deductible**	
	γ	**Sig.**	γ	**Sig.**
Health care consumption	−0.030	***	−0.308	***
Gender (baseline: Male)				
Female	0.059	.	−0.405	***
Nationality (baseline: Swiss)				
Other	−0.362	***	−0.060	
Education (baseline: primary)				
Secondary: professional	0.198	***	0.462	***
Secondary: general	0.105	*	0.271	***
Tertiary: professional	0.314	***	0.486	***
Tertiary: general	0.191	***	0.627	***
Income (baseline: 0–3000)				
3001–4500	0.003		−0.001	
4501–6000	0.064		0.052	
6001+	−0.004		0.229	***
Children in household (baseline: 0)				
1	0.067		-0.108	
2	0.058		0.021	
3	−0.005		0.039	
4+	0.201	***	0.115	*
Freedom of choice of specialist important (baseline: No)				
Yes	−0.317	***	−0.268	***
Language region (baseline: German)				
French	−0.284	***	0.064	.
Italian	−0.235	***	0.258	***
Rural region (baseline: No)				
Yes	0.059	.	0.099	**

Note: . $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Regarding the further control variables, we found several significant relationships that supported Conjecture 3. For example, we observed that women rather tended to prefer a low level of deductible when compared to men. Another notable difference lied in the choice of the insurance plan regarding the nationality: non-Swiss individuals rather selected a standard insurance plan while Swiss individuals, who might be more knowledgeable about the system and have a family doctor, rather went for other plans (*p*-value of 0.001). Next, an increase in the level of education correlated with the choice of an alternative insurance plan and a higher level of deductible. This might correlate with better system understanding or potentially an interaction with better health. Similarly, individuals from very high income classes rather selected a higher deductible. This somewhat unexpected observation about wealthier families opting for the higher level of deductible may be explained by two factors. Firstly, in Switzerland, health insurance subsidies are commonplace, and they may incentivize the uptake of a lower deductible. The second element could be the diminishing level of risk aversion with wealth. As highlighted by, e.g., Schneider (2004), less wealthy households may be more risk averse than wealthier ones as unexpected medical expenses could push them into financial distress. Concerning the number of children in the household, only the last category was markedly different with larger households going for the less expensive alternative plan and the high deductible. Further, we found that respondents for whom the freedom of choice for the specialist doctor was important preferred the standard insurance plan and a low level of deductible. This was intuitive. Finally, our model included geographical control variables, as well as a variable controlling for urbanicity. We observed regional differences between German-speaking respondents and French- or Italian-speaking ones. The latter rather chose a standard insurance plan, but a high deductible (as seen already from the descriptive statistics). Regarding rural regions, individuals were more prone to choose an alternative insurance plan coupled with a high deductible.

5. Concluding Remarks

Using data from the Swiss Health Survey, we successfully established the relationship between lifestyle-defining behavior and decisions in a compulsory health insurance environment. Employing a structural equation model with health and health care consumption characterized by latent variables, we gave proof for the following conjectures. Firstly, we empirically demonstrated that an increase in BMI was negatively correlated with health, whereas an increase in fruit and vegetable intake, as well as an increase in the number of sports sessions with perspiration were linked to better health. Additionally, we found that biking and walking for commuting were also related to better health. Secondly, our results indicated health as being the most significant driver of health care consumption. In a third step, we confirmed that socio-economic, as well as geographic covariates played a role in health insurance decisions. Finally, we were able to document the positive relationship between the choice of an alternative health insurance plan coupled with a high deductible in the case where health care consumption was lower. Bridging the different findings, we understood that health-enhancing behavior correlated with decreased health care services' consumption, the choice of an alternative health insurance plan, and a high level of deductible.

Our research bound medical and actuarial aspects to provide a better understanding of health insurance. Most of the results were intuitive, but have not been researched so far for significance in a regression framework. Our results, although, were very specific to the Swiss health insurance scheme, and conclusions have to be drawn carefully. For further comprehension of the decision process, it may be interesting to perform analyses under other insurance environments, as well as make use of panel data, where available, for the implementation of other econometric techniques.

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References

Andersen, Lars Bo, Peter Schnohr, Marianne Schroll, and Hans Ole Hein. 2000. All-cause mortality associated with physical activity during leisure time, work, sports, and cycling to work. *Archives of Internal Medicine* 160: 1621–28.

Ang, James B. 2010. The determinants of health care expenditure in Australia. *Applied Economics Letters* 17: 639–44.

Bazzano, Lydia A., Jiang He, Lorraine G. Ogden, Catherine M. Loria, Suma Vupputuri, Leann Myers, and Paul K. Whelton. 2002. Fruit and vegetable intake and risk of cardiovascular disease in US adults: The first National Health and Nutrition Examination Survey Epidemiologic Follow-up Study. *The American Journal of Clinical Nutrition* 76: 93–99.

Blanchard, Chris M., Kevin D. Stein, Frank Baker, Mary F. Dent, Maxine M. Denniston, Kerry S. Courneya, and Eric Nehl. 2004. Association between current lifestyle behaviors and health-related quality of life in breast, colorectal, and prostate cancer survivors. *Psychology & Health* 19: 1–13.

Block, Gladys, Blossom Patterson, and Amy Subar. 1992. Fruit, vegetables, and cancer prevention: A review of the epidemiological evidence. *Nutrition and Cancer* 18: 1–29.

Böckerman, Petri, and Pekka Ilmakunnas. 2009. Unemployment and self-assessed health: Evidence from panel data. *Health Economics* 18: 161–79.

Bollen, Kenneth A. 1989. *Structural Equations with Latent Variables*. New York: Wiley.

Bourne, Paul Andrew. 2009. Socio-demographic determinants of health care-seeking behaviour, self-reported illness and self-evaluated health status in Jamaica. *International Journal of Collaborative Research on Internal Medicine & Public Health* 1: 101–30.

Cameron, A. Colin, Pravin K. Trivedi, Frank Milne, and John Piggott. 1988. A microeconometric model of the demand for health care and health insurance in Australia. *The Review of Economic Studies* 55: 85–106.

Courtland C., Smith, and Lew Edward A. 1979. New investigation of build and blood pressure. *The Actuary* 13: 7–8.

Crossley, Thomas F., and Steven Kennedy. 2002. The reliability of self-assessed health status. *Journal of Health Economics* 21: 643–58.

Cuttance, Peter, and Russell Ecob. 2009. *Structural Modeling by Example: Applications in Educational, Sociological, and Behavioral Research*. Cambridge: Cambridge University Press.

Dauchet, Luc, Philippe Amouyel, Serge Hercberg, and Jean Dallongeville. 2006. Fruit and vegetable consumption and risk of coronary heart disease: A meta-analysis of cohort studies. *The Journal of Nutrition* 136: 2588–93.

Felson, David T., Yuqing Zhang, John M. Anthony, Allan Naimark, and Jennifer J. Anderson. 1992. Weight loss reduces the risk for symptomatic knee osteoarthritis in women: the Framingham Study. *Annals of Internal Medicine* 116: 535–39.

Fylkesnes, Knut. 1993. Determinants of health care utilization—Visits and referrals. *Scandinavian Journal of Social Medicine* 21: 40–50.

Gardiol, Lucien, Pierre-Yves Geoffard, and Chantal Grandchamp. 2005. *Separating Selection and Incentive Effects in Health Insurance*. Working Paper No. 2005-5380. London: Centre for Economic Policy Research.

Gerhardsson, Maria, Birgitta Floderus, and Staffan E. Norell. 1988. Physical activity and colon cancer risk. *International Journal of Epidemiology* 17: 743–46.

Grossman, Michael. 1972. On the concept of health capital and the demand for health. *Journal of Political Economy* 80: 223–55.

Haan, Peter, and Michal Myck. 2009. Dynamics of health and labor market risks. *Journal of Health Economics* 28: 1116–25.

Hooper, Daire, Joseph Coughlan, and Michael R. Mullen. 2008. Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods* 6: 53–60.

Huang, Chiou-Yan, Hsin-Ya Liao, and Sue-Hwang Chang. 1998. Social desirability and the Clinical Self-Report Inventory: Methodological reconsideration. *Journal of Clinical Psychology* 54: 517–28.

Hubert, Helen B., Manning Feinleib, Patricia M. McNamara, and William P. Castelli. 1983. Obesity as an independent risk factor for cardiovascular disease: A 26-year follow-up of participants in the Framingham Heart Study. *Circulation* 67: 968–77.

Inyang, Mfrekemfon P., and Stella Okey-Orji. 2015. Sedentary Lifestyle: Health Implications. *IOSR Journal of Nursing and Health Science Ver. I* 4: 20–25. doi:10.9790/1959-04212025.

Johansson, Sven-Erik, and Jan Sundquist. 1999. Change in lifestyle factors and their influence on health status and all-cause mortality. *International Journal of Epidemiology* 28: 1073–80.

Joshipura, Kaumudi J., Frank B. Hu, JoAnn E. Manson, Meir J. Stampfer, Eric B. Rimm, Frank E. Speizer, Graham Colditz, Alberto Ascherio, Bernard Rosner, Donna Spiegelman, and et al. 2001. The effect of fruit and vegetable intake on risk for coronary heart disease. *Annals of Internal Medicine* 134: 1106–14.

Jousilahti, Pekka, Jaakko Tuomilehto, Erkki Vartiainen, Juha Pekkanen, and Pekka Puska. 1996. Body weight, cardiovascular risk factors, and coronary mortality: 15-year follow-up of middle-aged men and women in eastern Finland. *Circulation* 93: 1372–79.

Le Marchand, Loïc, Lynne R. Wilkens, and Ming-Pi Mi. 1992. Obesity in youth and middle age and risk of colorectal cancer in men. *Cancer Causes & Control* 3: 349–54.

Lee, I-Min, and Patrick J. Skerrett. 2001. Physical activity and all-cause mortality: What is the dose-response relation? *Medicine and Science in Sports and Exercise* 33 (Suppl. 6): S459–71.

Li, Cheng-Hsien. 2016. Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods* 48: 936–49.

Li, Yanping, An Pan, Dong D. Wang, Xiaoran Liu, Klodian Dhana, Oscar H. Franco, Stephen Kaptoge, Emanuele Di Angelantonio, Meir Stampfer, Walter C. Willett, and et al. 2018. Impact of healthy lifestyle factors on life expectancies in the US population. *Circulation* 138: 345–55.

MacCallum, Robert C., and James T. Austin. 2000. Applications of structural equation modeling in psychological research. *Annual Review of Psychology* 51: 201–26.

Martens, Matthew P. 2005. The use of structural equation modeling in counseling psychology research. *The Counseling Psychologist* 33: 269–98.

Matthews, Charles E., Adriana L. Jurj, Xiao-ou Shu, Hong-Lan Li, Gong Yang, Qi Li, Yu-Tang Gao, and Wei Zheng. 2007. Influence of exercise, walking, cycling, and overall nonexercise physical activity on mortality in Chinese women. *American Journal of Epidemiology* 165: 1343–50.

Miller, Victoria, Andrew Mente, Mahshid Dehghan, Sumathy Rangarajan, Xiaohe Zhang, Sumathi Swaminathan, Gilles Dagenais, Rajeev Gupta, Viswanathan Mohan, Scott Lear, and et al. 2017. Fruit, vegetable, and legume intake, and cardiovascular disease and deaths in 18 countries (pure): A prospective cohort study. *The Lancet* 390: 2037–49.

Muthén, Bengt. 1984. A general structural equation model with dichotomous, ordered categorical, and continuous latent variable indicators. *Psychometrika* 49: 115–32.

Oja, Pekka, Ari Tapio Mänttäri, Ari Heinonen, K. Kukkonen-Harjula, Raija Laukkanen, M. Pasanen, and Ilkka Vuori. 1991. Physiological effects of walking and cycling to work. *Scandinavian Journal of Medicine & Science in Sports* 1: 151–57.

Oyebode, Oyinlola, Vanessa Gordon-Dseagu, Alice Walker, and Jennifer S. Mindell. 2014. Fruit and vegetable consumption and all-cause, cancer and CVD mortality: Analysis of Health Survey for England data. *Journal Epidemiology Community Health* 68: 856–62.

Penedo, Frank J., and Jason R. Dahn. 2005. Exercise and well-being: A review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry* 18: 189–93.

Pi-Sunyer, F. Xavier. 1991. Health implications of obesity. *The American Journal of Clinical Nutrition* 53: 1595S–603S.

Pohlmeier, Winfried, and Volker Ulrich. 1995. An econometric model of the two-part decisionmaking process in the demand for health care. *Journal of Human Resources* 30: 339–61.

Prinja, Shankar, Akashdeep Singh Chauhan, Anup Karan, Gunjeet Kaur, and Rajesh Kumar. 2017. Impact of publicly financed health insurance schemes on healthcare utilization and financial risk protection in India: A systematic review. *PLoS ONE* 12: e0170996.

Pucher, John, Ralph Buehler, David R. Bassett, and Andrew L. Dannenberg. 2010. Walking and cycling to health: A comparative analysis of city, state, and international data. *American Journal of Public Health* 100: 1986–92.

Riiser, Amund, Ane Solbraa, Anne Karen Jenum, Kåre I. Birkeland, and Lars Bo Andersen. 2018. Cycling and walking for transport and their associations with diabetes and risk factors for cardiovascular disease. *Journal of Transport & Health* 11: 193–201.

Rosseel, Yves. 2012. Lavaan: An R package for structural equation modeling and more. Version 0.5–12 (BETA). *Journal of Statistical Software* 48: 1–36.

Schmitz, Hendrik. 2012. More health care utilization with more insurance coverage? Evidence from a latent class model with german data. *Applied Economics* 44: 4455–68.

Schneider, Pia. 2004. Why should the poor insure? Theories of decision-making in the context of health insurance. *Health Policy and Planning* 19: 349–55.

Sobel, Michael E. 1987. Direct and indirect effects in linear structural equation models. *Sociological Methods & Research* 16: 155–76.

Society of Actuaries. 1959. *Build and Blood Pressure Study*. Schaumburg: Society of Actuaries, vol. 1.

Steinmetz, Kristi A., and John D. Potter. 1996. Vegetables, fruit, and cancer prevention: A review. *Journal of the American Dietetic Association* 96: 1027–39.

Stommel, Manfred, and Charlotte A. Schoenborn. 2010. Variations in BMI and prevalence of health risks in diverse racial and ethnic populations. *Obesity* 18: 1821–26.

Strully, Kate W. 2009. Job loss and health in the US labor market. *Demography* 46: 221–46.

Swiss Federal Statistical Office. 2018. *Enquête Suisse sur la Santé 2017. Vue d'ensemble*. Neuchâtel: Swiss Federal Statistical Office.

Swiss Federal Statistical Office. 2019. *L'enquête Suisse sur la Santé 2017 en Bref. Conception, Méthode, Réalisation*. Neuchâtel: Swiss Federal Statistical Office.

Thune, Inger, Tormod Brenn, Eiliv Lund, and Maria Gaard. 1997. Physical activity and the risk of breast cancer. *New England Journal of Medicine* 336: 1269–75.

Thune, Inger, and Anne-Sofie Furberg. 2001. Physical activity and cancer risk: Dose-response and cancer, all sites and site-specific. *Medicine and Science in Sports and Exercise* 33 (Suppl. 6): S530–50.

Van de Mortel, Thea F. 2008. Faking it: Social desirability response bias in self-report research. *The Australian Journal of Advanced Nursing* 25: 40.

Van de Ven, Wynand P. M. M., and Bernard M. S. Van Praag. 1981. The demand for deductibles in private health insurance: A probit model with sample selection. *Journal of Econometrics* 17: 229–52.

Warburton, Darren E. R., Crystal Whitney Nicol, and Shannon S. D. Bredin. 2006. Health benefits of physical activity: The evidence. *CMAJ* 174: 801–9.

World Health Organization. 2000. *Obesity: Preventing and Managing the Global Epidemic*. Number 894. Geneva: World Health Organization.

Zweifel, Peter, and Roland Eisen. 2012. *Insurance Economics*. Springer Texts in Business and Economics. Berlin/Heidelberg: Springer. doi:10.1007/978-3-642-20548-4.