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Elderly Dutch citizens' individual characteristics and their impact on yearly GP visits: a baseline for an estimation model of primary healthcare utilization.

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Abstract:

This thesis examines the impact of individual characteristics on the yearly general practitioner (GP) visits of elderly Dutch citizens, aiming to establish a baseline for an estimation model of primary healthcare utilization. Using regression analyses, it identifies age, gender, current and past health conditions, and health insurance status as significant predictors of GP visits. Socioeconomic and demographic factors, such as national originality, education, and financial stability, were not significantly associated with healthcare utilization. The study suggests that understanding these determinants can aid in resource allocation, improve healthcare delivery, and inform policymaking to enhance the quality of life for the elderly.

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1. Introduction

1.1 Motivation and Theoretical Background

In January 2023, the Netherlands had a population of 17 810 000 people. On the 1st of January of the same year, 3 601 167 of these inhabitants were at least 65 years old. This age group represented 20.2% of the whole Dutch population. In the year of 1990, this number was considerably smaller, representing only 12.8% of residents in this country, and a grey pressure (the number of working age (20 to 64 years) persons per elder individual), of 20.8%, while the most recent proportion indicates a grey pressure of 34.4%, meaning that for every person aged 65 or over, three people fit in the working age group (Statistics Netherlands, 2023). Considering this trend of aging, it is currently estimated that by 2040, the Netherlands should reach an elderly population of 26%, more than a quarter of all inhabitants, according to Natalia (2021).

As people's age advances, their likelihood of suffering from chronic conditions or illness increases. This creates a strong correlation between healthcare expenditures and age groups, with average expenditures rising steeply with every year of age, especially nearing the time of death, as argued by Bakx, O'Donnell & van Doorslaer (2016). In 2011, the elderly represented 16% of the population in the Netherlands. Murakami & Morgan (2016) states that despite its dimension, this group consumed 40% of all healthcare spendings.

Considering the aforementioned ageing tendency of inhabitants of the Netherlands, and how determinant this factor is to health spending, it is crucial to prepare for these developments, in order to guarantee the Dutch healthcare system's principles of accessibility, solidarity, and high-quality services, as presented by Jimble (2023), through the promotion of efficiency and cost-effectiveness.

Besides contributing to an overall better health system, focusing on the elderly populations' healthcare utilization patterns, it is also very relevant to identify gaps in preventive care. Recognising trends of propensity to certain causes of poor health will help in more effectively engaging in prevention, with initiatives such as targeted regular screenings, vaccinations, or health promotion activities. With the improvement of these interventions' effectiveness through the present investigation, and specifically increasing its offer for older citizens, it may be possible to reduce health expenditures from the reactive use of primary care, as such necessity diminishes, considering the healthier lifestyle, more detailed and updated health status record, and increased protection against possible diseases, that preventive care beneficiaries boast. While, ideally, the entire population would benefit from this, the reality is that resources are limited, thus, being important to target those groups that are most frail and in need of healthcare, also in terms of their proportion of health spendings. This means that it is especially relevant to look at the elderly, as this group is by far the one with the highest expenditures. Hence, likely representing the most

significant investment reduction results for the health budget of any given country, when establishing policies that decrease this group's requirements of primary healthcare and making it the most efficient to focus on.

1.2 Research Question

The complexity of balancing efficiency and equitability in a healthcare system, while also tackling an unavoidable socio-demographic issue may be great. However, attempting to determine the patterns of healthcare utilization from those whose necessity of care is, on average, most significant, according to their individual characteristics, has the potential to be a sound base to initiate the response to such issues. Eventually, with further investigation, achieving a model that is able to estimate the use of healthcare from this share of the population can further enhance this response.

Hence, in the present research, I propose to investigate the impact of Dutch elderly citizens' individual characteristics, on their yearly number of visits to general practitioners (GPs) (primary healthcare), thus answering the research question:

How do socioeconomic and demographic individual characteristics of the elderly citizens of the Netherlands impact their healthcare utilization, in terms of primary care services, namely yearly GP visits?

By establishing the correlation between current health and its background, national originality, education level, economic situation, insurance status, age, and gender; and the number of yearly visits to a GP, it may be simpler to tailor care delivery to individuals, based on their specific needs; allocating resources in a more fruitful way, as healthcare systems face challenges relating to resource constraints, funding, staff, or facilities, identifying groups subject to higher risk, ensuring targeted interventions and preventing unnecessary strain on the system; addressing disparities through different characteristics and intersecting them with health disparities, thus, creating a more equitable provision, for example, responding to the necessities of migrants and refugees from outside the European Union (EU) (Lebano et al., 2020); implementing measures of prevention based on individual characteristics, leading to health outcomes' enhancement; and, ultimately, designing effective and evidence-based policies to improve healthcare delivery services, reduce costs, and increase the quality of life for our elderly population.

1.3 Results

This investigation leads me to find that the statistically significant determinants of primary healthcare utilization by the elderly, in The Netherlands, are mainly of age, gender, and health condition character. Surprisingly, this analysis does not reveal a general significant association

between the remaining exogenously decided socioeconomic and demographic factors, and the outcome, even after demonstrating how they significantly correlate with current health.

Age, while somewhat surprisingly small, gender, current and past health conditions all significantly predict primary healthcare utilization in terms of yearly GP visits, in the main regression. Health insurance is the only non-demographic or health-related factor to determine the outcome significantly.

These results also demonstrate the considerable relevance of current health, considering its immutable highly statistically significant effect, indicating the inevitability to study it in more detail, possibly, stratifying this factor by a more extensive number of variables. By doing this, it may be possible to achieve a more accurate yearly GP visits predictor.

Significant relationships between socioeconomic and exogenously determined factors, such as being non-Dutch, education or wealth, and current health are also revealed. Predictably, age and health record also significantly impact the outcome. Health insurance almost does not statistically significantly reduces the level of health, however, this relationship is dubious and will, thus, be further analysed in Section 5. Being a woman, according to this sample, does not help determine current health condition.

1.4 Structure

This research paper will be structured as follows. The subsequent section will provide a framework for the present investigation, analysing past literature works and other sources to motivate the selected individual characteristics, besides the main intent of this study. The hypotheses are also formulated and explained in the same section. In section 3, the process of data collection, and the methodology for the empirical analysis are provided. This segment of the paper also includes information regarding the measurement of all variables and the descriptive statistics of this sample with an accompanying table. In section 4, the results of the main regression, four additional regressions for two sets of opposing subgroups (female and male, and complementary and basic health insurance (BHI)), and a separate secondary regression showing the effect of the selected variables on current health are presented. Each hypothesis is evaluated considering such findings. The 5th and final section consists of the conclusion, discussion, limitations, and indications for succeeding research on the same topic.

2. Theoretical Framework

2.1.1 Literature Review

As expected, given the existing relevance of studying the healthcare utilization behaviours and patterns of the elderly, considering their greater, and consequently, more expensive demand of services, compared with the other age groups, there is extensive literature surrounding this subject matter.

The phenomenon of gatekeeping is exactly what makes the study of the impact of individual characteristics on yearly GP visits so relevant in countries that use this method to enhance the efficiency of the health system. This primary stage is of utmost importance, as it is necessary for those who require the use of healthcare services. And that is also the reason for such a measure to be the outcome of my research.

Eggink, Ras & Woittiez (2017) looks at the same individual characteristics of the elderly residents of the Netherlands as it is being proposed in the present research, with the exception of national originality, insurance status, and economic situation, and the addition of household type. However, it focuses on the effect of such characteristics, on long-term care.

While, according to Mueller & Morgan (2020), long-term care provides ongoing support for individuals with chronic health needs, thus representing considerable expenditures, the utilization effects on preventive and early intervention services, of individual characteristics, will likely be more informative when attempting to optimally allocate resources to and within healthcare providers, based on their pool of registered patients.

Cumming et al. (2010) attempts to find the determinants of GP visits in New Zealand, hence, not having as its final goal the creation of a prediction model for yearly GP visits, but that of identifying what are its predictors. According to the authors, gender, age, and ethnicity strongly correlate with the outcome in question, however, it is claimed that education or household income do not impact GP visits, when controlling for other confounding factors on their multivariate regression, disputing the arguments of aforementioned literature works. Furthermore, in this country, GPs function as gatekeepers, as in the Netherlands. Unsurprisingly, the authors found that older individuals were more likely to visit a GP. Females yielded the same result.

Bíró (2016) also considers individual characteristics, not of the elderly, but of the retired, then finding a relationship between this employment situation and outpatient care use. This differs from my research, as I do not take into account the individuals' professional situation.

Zayas et al. (2016) considers the high demand of healthcare by middle-aged and the elderly, in the United States of America, and highlights the importance of identifying ineffective utilization

from these high-cost users, so as to target interventions that improve the delivery of care. This research paper's objective is very similar to the present proposal, however, I am attempting to establish a link between individual characteristics of the elderly, specifically, and GP visits, in the Netherlands. This is a country where health expenditures, as a percentage of the gross domestic product (GDP), are significantly higher than the EU average, and have been increasing rapidly, according to Murakami & Morgan (2016). Hence, making it vital to design investment plans for healthcare providers that are as efficient and cost-effective as possible, providing an ideal end for this large funding of healthcare.

2.1.2 Selected Individual Characteristics

The World Health Organization declares that health is determined by a number of factors that include "the social and economic environment, the physical environment, and the person's individual characteristics and behaviours" (WHO, 2017). It is, then, the context of living that plays the biggest role in determining one's health, and directly controlling this aspect efficiently is unlikely. Intuitively, it is possible to infer the link of health status and healthcare utilization, and it would be optimal if this was, in fact, the only determinant of healthcare utilization, however, other factors also have an effect (National Academies of Sciences, Engineering, and Medicine, 2018). For such reason, it is crucial for this research to identify these factors that influence health outcomes and, consequently, primary healthcare utilization, in terms of GP visits.

Recently, there has been greater attention paid to social determinants of health, like education or economic stability (ODPHP, 2018), which are being shown to correlate with increased levels of health, by ODPHP (2017).

Race and ethnicity, age, and gender also result in differences across medical conditions (National Academies of Sciences, Engineering, and Medicine, 2017), and consequent healthcare utilization, according to Cumming et al. (2010). These demographic factors are included as predictor variables, besides serving as covariates that help control for potential confounding effects, as they also assist in better explaining variations in the outcome variable. Knowing of the strong correlation between health status and healthcare use, and how this status is worsened with age, it becomes necessary to control for such variable, as an individual who is, for example, 65 years old, will likely exhibit a distinct utilization pattern from one who is 87 years old. Gender should also impact the dependent variable, considering how women and men experience health conditions differently, as argued by Vlassoff (2007). Tong & Artiga (2021) considers that race and ethnicity, while not inherently bound to biological differences, will intersect with social, economic, and historical factors, which results in disparities in health outcomes and access to healthcare. Furthermore, there is also intersection between this factor and others like poverty, age, gender, or disability (NHS England, 2022). These explanatory variables will, thus, allow

policymakers and healthcare providers to tailor interventions, by realizing how these factors affect utilization of healthcare, and designing services accordingly.

Current health and its record should, as previously stated, have a direct impact on the utilization of healthcare, as an individual who is in a state of poor health will naturally, more likely, decide to visit a practitioner.

Unrelated with health outcomes if moral hazard is disregarded, but strongly impacting the utilization of healthcare, is health insurance status. This is why it is included as an influencing characteristic. Ekman (2007) states that individuals with insurance seek healthcare services more frequently, feeling encouraged to do more regular check-ups or early medical interventions, for example, given the reduced out-of-pocket expenses.

With the realization of the effect of the abovementioned individual characteristics on the frequency of yearly GP visits, comes the knowledge of how groups with higher incidence of certain characteristics will make use of healthcare. This is especially relevant in a country like The Netherlands, where GPs are used as a method of gatekeeping, making a visit to these doctors, when in need of medical care, necessary as a first stage, except in the case of emergency, as to access the necessity to be referred to a specialist (Studentenverzekeringen, 2023).

2.2 Hypotheses

From the analysis of previous literature on the topic of healthcare utilization by the elderly, it is possible to formulate the following one-sided hypotheses, according to the selected socioeconomic and demographic characteristics of these citizens.

Hypothesis 1: *Age increases will have a positive effect on the number of yearly visits to GPs*. This hypothesis considers the effect of individuals utilizing primary healthcare services more frequently as they get older. This is supported by Cumming et al. (2010), while further research such as Bakx, O'Donnell & van Doorslaer (2016) associates such impact to the approximation of death, arguing that healthcare needs increase exponentially around this time frame.

Hypothesis 2: *Females will have a larger positive effect on the number of yearly visits to GPs, relative to males*. This means that, on average, women require more healthcare than men Cumming et al. (2010). This may be due to the fact that these individuals experience health conditions differently, or that they exhibit diverging behavioural responses to such conditions.

Hypothesis 3: *Higher financial comfort will have a negative impact on the number of yearly visits to GPs*. This hypothesis evaluates the effect of an individual's financial situation, considering their ability to respond to an unexpected significant expense, on their health, and predicting that poorer individuals will be more likely to need primary healthcare. Hence, it associates wealth

with better health, which ODPHP (2017) and Woolf et al. (2015) verify. While in a country where there are meaningful health access inequalities, this would not be enough to make such a prediction, in the Netherlands, every citizen is obliged to purchase health insurance, either through their own means or through government subsidizing, (IamExpat, 2024) which means that it is unlikely that individuals are not able to consult a GP due to their economic situation.

Hypothesis 4: *Education level will have a negative impact on yearly visits to the GP*. This implies that the more educated an individual is, the smaller the necessity for primary healthcare. ODPHP (2017) demonstrates that more educated individuals tend to be healthier, which should translate to a diminished use of healthcare services.

Hypothesis 5: *A better level of current and past health will have a negative impact on yearly visits to the GP*. The intuition behind such a claim is simple, as it is likely that individuals in a state of good health will not feel the necessity to visit the doctor. Admitting the validity of the effect of the first factor, it is also possible to estimate that people with a better health record will, on average, be more probable to enjoy a current good state of health, thus, not requiring primary healthcare.

And, due to a lack of consensus in the literature or less information available, it is also possible to formulate the following two-sided hypotheses.

Hypothesis 6: *Originally belonging to a non-Dutch group will have an impact on the number of yearly visits to GPs*. This hypothesis evaluates the effect of not being of Dutch origin, on the individual's utilization of primary healthcare. This is two-sided, given some contradictions in the literature. Cumming et al. (2010) finds that the effect of belonging to a minority ethnic group negatively impacts the yearly number of visits to a GP, however Tong & Artiga (2021) ties health disparities in terms of race, partly, to socioeconomic differences, and if minorities are associated with disadvantaged economic situations, as claimed by Stronks, Ravelli & Reijnveld (2001), then from the relationship that was previously analysed between wealth and health (positive according to Woolf et al. (2015) and ODPHP (2017)), then it may also be possible to predict that belonging to a non-Dutch group will have a positive effect on the number of yearly visits to a GP.

Hypothesis 7: *Taking up complementary health insurance will have an impact on the number of yearly visits to GPs*. Finally, hypothesis 7 considers the impact of an individual electing to purchase additional health insurance, besides what is mandatory, on their utilization of primary healthcare, in terms of GP visits. This effect is probably the least certain one, as one may consider that an individual who takes this extra deductible might be unhealthier than average, thus, requiring more healthcare and increasing the number of yearly visits to a GP, however, it has been supported by Einav et al. (2011) that this decision may simply derive from behaviours such as

risk aversion and it has even been argued that healthier individuals, which expect fewer expenses, may be more risk-averse and, thus, opt for more comprehensive coverage.

Lastly, the eventual aim of what is started with this study is that of creating a simple prediction model which may be extrapolated and used by policymakers, or healthcare providers to estimate optimal investment allocation, in terms of primary care, namely GP visits, considering the characteristics of their patients. It was nearly impossible to find this type of approach elsewhere, as research mostly focused on finding the effects of certain individual characteristics and then proceeding to take conclusions and inferring policy implications from those static results alone, except for one research paper, Marcusson et al (2020), which aims to predict the risk of hospital admission of individuals between the age of 75 and 109. The authors also make use of a multivariable regression, but a logistic one. The objective of this model is similar to mine, as it lies in the enabling of proactive intervention for older individuals who, based on their characteristics, will likely need some sort of medical attention. So, the novelty aspect of my research also lies in the design of a model, capable of estimating results, based on real-life outcomes and subsequent analysis.

3. Data and Methodology

As previously mentioned, this research, ultimately, serves to find a correlation effect between several individual characteristics of the elderly Dutch, on their primary care utilization. Such characteristics include current health and its background, national originality, education level, economic situation, insurance status, age, and gender.

3.1 Data Collection

In this paper, I make use of data of the LISS (Longitudinal Internet studies for the Social Sciences) panel administered by Centerdata (Tilburg University, The Netherlands). The data used to measure these explanatory variables is extracted from wave 16 of such a panel. A total of 5000 households and 7500 individuals over the age of 16 are comprised in this panel. This sample is drawn from the population registered on Statistics Netherlands and is based on true probability. Furthermore, Knoef & de Vos (2009) finds that although the elderly are still underrepresented in this probability sample, this degree of underrepresentation is lower, compared to an online access panel. The sixteenth wave of the LISS core study contains several dimensions of data which include, and are used in the present analysis, modules of Health, Religion and Ethnicity, Work and Schooling, and Economic Situation.

Following the combination of all the required information for each variable into a single dataset, the elimination of individuals under the age of 65 years old, and disregarding observations with missing evidence, a sample of 1631 individuals remained for investigation.

3.2 Descriptive Statistics

Table 1 comprises the descriptive statistics of the individuals that constitute the sample in study. It reports the mean, median, standard deviation, minimum, and maximum values for each variable. The respondents in question are, on average, 73.402 years old, with the youngest being 65, and the oldest 95 years old. The majority of this sample is male, with only 46.7% being women, which signifies an underrepresentation of females in this sample, considering how this group is proportionally larger than that of men, in the actual population, in this age group (Centraal Bureau voor de Statistiek., 2023). The group reported a mean of 2.929 for current health, which translates into a general feeling of moderate to good health. Despite this, in health record, close to half, 44.8%, of the participants claimed to either suffer from a long-standing disease, affliction or handicap, or the consequences of an accident. In terms of health insurance, 72.5% of these people decided to increase their coverage besides the mandatory basic plan. A mean level of 14.583 for education reveals a group of individuals that sits just below university level. And, with an average of 2.136 for financial stability, we identify a sample that is not financially uncomfortable, given its ability to respond to high unexpected expenses. The non-Dutch group

formed the minority with 13.1% of the participants feeling this way. Finally, this sample reported a mean of 2.193 visits to a GP in the last year before this survey took place, with the lowest number reported being 0 visits, and the highest, 25 visits.

Table 1 – Descriptive Statistics

Variable	Observations	Mean	Median	Std. deviation	Minimum	Maximum
Age	1631	73.402	73	5.798	65	95
Female	761	0.467	0	0.499	0	1
Current Health	1631	2.929	3	0.728	1	5
Health Record	1631	0.448	0	0.497	0	1
Health Insurance	1182	0.725	1	0.447	0	1
GP yearly visits	1631	2.193	2	2.600	0	25
Non-Dutch	214	0.131	0	0.338	0	1
Education	1631	14.583	15	7.082	1	28
Wealth	1631	2.136	1	1.597	1	7

Notes: In this table, the number of observations, mean, median, standard deviation, minimum, and maximum are presented for each variable.

3.3 Independent Variables

Table 2 – Independent variables measurement

Independent variables	**Survey question**	**Self-reported response**
Age	No information about question.	Numeric type: Integer.
Female	Representation type: Categories.	0 for "male" 1 for "female" 2 for "other"
Current Health	"How would you describe your health, generally speaking?"	1 for "poor" 2 for "moderate" 3 for "good" 4 for "very good" 5 for "excellent"
Health Record	"Do you suffer from a long-standing disease, affliction or handicap, or do you suffer from the consequences of an accident?"	0 for "no" 1 for "yes"
Health Insurance	Did you take out a complementary health insurance in 2023?"	0 for "no" 1 for "yes"
National Originality	"To which of the following groups do you feel you belong? Choose all that applies to you: (…)"	
Dutch	"No other group"	
Non-Dutch	"Turks", "Kurds", "Moroccans", "Berbers", "Surinamese", "Hindus", "Creole groups", "Javanese", "Chinese", "Curaçaoan", "Aruban", "Antillean", "Indonesian", and "Other group, namely:".	0 for "no" 1 for "yes"
Education	"What is the highest level of education that you have completed with diploma or certificate?"	Range of 28 answer categories, respective to increasing levels of education level diploma or certificate (Appendix).
Wealth	"How easy or hard is it for you to go to unexpected essential expenses of € 500 or more without getting into debt or contracting a loan?"	A scale of 1 to 7, where 1 corresponds to "very easy", and 7 to "very hard".

Notes: This table provides detailed information regarding the independent variables used in this analysis. The first column shows the name of the variable, the second column the question posed to gain insight into the respective variable, and the third column indicates the possible answer categories, respective to the question.

3.4 Dependent Variables

The main outcome of this study, the dependent variable GP yearly visits will also be self-reported and measured from the question: "How often did you use the following health services over the past 12 months?". And the sub-question: "family physician".

The secondary outcome, current health, will be measured as indicated previously, in Table 2.

3.5 Methodology

The main multivariable regression will be used to test the effects of each explanatory variable, thus, providing a response for the sign, magnitude, and significance of each of the previously presented hypotheses. Some of these hypotheses are one-sided, as there are sufficient literature results to support such statements, however, the remaining two-sided hypotheses stem from a lack of information or consensus around these variables' effects. Thus, the expected results match this certainty for the case of the first group of hypotheses and, for the second, it is only possible, for now, to infer their effect from associations with the aforementioned variables. Such speculated relationships are presented in Section 1.

$$GP\ yearly\ visits = \beta_0 + Female * x_1 + Age * x_2 + Current\ Health * x_3 + Health\ Record * x_4$$

$$+ Health\ Insurance * x_5 + NonDutch * x_6 + Education * x_7 + Wealth * x_8 + \varepsilon$$

Possible biological or behavioural differences between females and males, or complementary and BHI holders, require the inclusion of four additional regressions in this analysis. Despite the effect of gender or complementary health insurance being controlled for as covariates in the main regression while assessing the relationships of the remaining variables with the dependent one, looking at the results of such principal regression and comparing them with gender-specific models, might accentuate whether gender or insurance act as modifiers of impact of other factors. So, adding the gender and health insurance-specific regression models may help in finding interaction effects between such factors and the other variables. If such relationships differ by gender of health insurance status, this method may reveal these nuances. This separation of analyses also allows the assessment of the effect of all predictors, for each gender and health insurance subgroup, when it is likely that their impact on the outcome for males and females, or complementary and BHI, differs, which may be the case in this sample. Furthermore, distinct models can potentially improve the model fit if the structure of data is different between each subgroup. This method may, thus, ensure the holding of the assumptions of homoscedasticity and normality of residuals. Finally, these gender and health insurance-specific, enhanced tailored insights, are especially relevant for policymaking, and to design better and more targeted interventions, which aligns with the aim of the present research.

A fifth and final regression is also included in this study. This is a secondary analysis that will assist in explaining the source of the association between the selected primary healthcare determinants and the main outcome, through their impact on current health. Given the tight connection between the current state of health and the utilization of these healthcare services, investigating how the remaining factors impact health, and comparing such effects with their relationship with yearly GP visits, may provide valuable information as to the why certain independent variables affect yearly GP visits and, consequently, help determine whether it is

necessary to look for more confounding factors that are missing from this model. For example, if the effect of a certain factor on current health is significant, however this is not verified for its correlation with the outcome, in the main model, then this might indicate the necessity to deconstruct this variable and find the dimension which will impact primary healthcare utilization.

$$Current\ health = \beta_0 + Female * x_1 + Age * x_2 + Health\ Record * x_3 + Health\ Insurance * x_4 + NonDutch * x_5 + Education * x_6 + Wealth * x_7 + \varepsilon$$

The relationships between the explanatory and dependent variables will be established through multivariable regressions, yielding correlation effects, which should suffice to distinguish how different individual characteristics impact the utilization of this type of primary healthcare, relative to each other, enabling the creation of a prediction model and, thus, making causal inference unnecessary for the aim of this study. This econometric method assists in identifying associations between predictors and outcome so, while it is true that it does not denote causality, it provides important and relevant information about relationships. Furthermore, this is also particularly useful to control for confounders, improving the accuracy of the estimates and, given it is a multivariable regression, it demonstrates how multiple factors impact the outcome, hence, accommodating complex relationships between influencing aspects.

The results of this investigation will demonstrate the association between multiple socioeconomic and demographic characteristics of elderly citizens of the Netherlands, and their utilization of primary healthcare, measured in yearly visits to a GP. Each of the established relationships between explanatory and outcome variables will be determinant in understanding the needs and requirements of these patients. Such information may then be used by healthcare providers and policymakers to optimally allocate resources, generating the most monetary and non-monetary profits possible out of their investments, ultimately, resulting in a more efficient, cost-effective health system, and, consequently, creating the conditions for a more equitable and fair delivery of healthcare services.

4. Results

In the present section, the results of the regression analysis that serves to estimate the effect of each of the selected individual socioeconomic and demographic characteristics of this sample of elderly citizens of The Netherlands will be presented in Table 3. The provided output will, therefore, inform the reader about the way in which these factors impact the number of visits that a person in this age group will pay to a GP, in a year, contributing to the knowledge base of what determines the utilization of primary healthcare more significantly, in what direction, and to what extent.

Considering how the future aim of this study will be that of creating a prediction model for the yearly GP visits of the elderly in The Netherlands, based on their individual characteristics, all the proposed hypotheses are initially tested in a single multivariable regression, as mentioned in Section 3, and each hypotheses will be analysed, in order to thoroughly scrutinize the effect of all variables, on the outcome.

4.1 Main Regression Analysis

Table 3 – Linear regression analysis of the relationship between the selected individual characteristics of the elderly citizens of The Netherlands and the number of yearly GP visits

		GP yearly visits			
		Female	Male	Comp. HI	BHI
Female	0.354***			0.387**	0.208
	(0.122)			(0.152)	(0.178)
Age	0.024**	0.006	0.040***	0.022	0.025
	(0.011)	(0.018)	(0.013)	(0.014)	(0.017)
Current Health	-0.971***	-1.260***	-0.733***	-1.037***	-0.768***
	(0.102)	(0.178)	(0.115)	(0.131)	(0.129)
Health Record	0.665***	0.698***	0.653***	0.812***	0.258
	(0.131)	(0.207)	(0.169)	(0.164)	(0.209)
Health Insurance	0.447***	0.466***	0.417***		
	(0.113)	(0.172)	(0.149)		
Non-Dutch	-0.005	-0.197	0.095	0.043	-0.224
	(0.184)	(0.377)	(0.185)	(0.239)	(0.237)
Education	-0.004	-0.000	-0.007	-0.002	-0.012
	(0.009)	(0.015)	(0.012)	(0.012)	(0.012)
Wealth	0.046	0.069	0.028	0.074	-0.038
	(0.053)	(0.089)	(0.063)	(0.070)	(0.053)
Constant	2.435***	4.881***	0.653	3.031***	2.336
	(0.853)	(1.357)	(1.073)	(1.059)	(1.430)
Observations	1631	761	870	1182	449
Adjusted R^2	0.144	0.161	0.125	0.145	0.114

Notes: The presented values are the coefficients of each variable and represent its effect on the dependent variable. Within brackets, the standard errors of the respective variables are presented. The subgroup with complementary health insurance is identified as "Comp. HI", and the subgroup without it is identified as "BHI". The significance of these coefficients is displayed as * for $p < 0.10$, ** for $p < 0.05$, and *** for $p < 0.01$.

The effect of age on the yearly number of visits to a GP is, as predicted, positive, meaning that ageing, or proximity to death, contributes to an increase in the necessity to utilize this scheme of

primary care. Every year of age increases by 0.024, on average, the number of visits per year, with such effect being statistically significant for an alpha of 5% (p-value < 0.05).

Considering that the effect of age and, therefore, death proximity is controlled for, it becomes clear from the examination of this coefficient, that females respond to health conditions in a considerably different manner than males, at least behaviourally. This effect has a large magnitude of 0.354, positively increasing the number of GP visits, and being highly significant for an alpha of 1% (p-value < 0.01).

Despite the verified association between increased financial discomfort and the utilization of these primary healthcare services being as hypothesised, with a positive effect of 0.046 extra visits to a GP for every level increase on the scale used to measure financial stability, such a relationship is not statistically significant for an alpha of 10% (p-value > 0.1).

A higher level of education also has an effect that is coincidental with the hypothesis, decreasing the number of yearly GP visits, with a negative effect of 0.004, however, this is not significant for an alpha of 10% (p-value > 0.1).

The variable current health negatively impacts the outcome with a large effect of 0.971 and is highly statistically significant for an alpha of 1% (p-value < 0.01). This hypothesis cannot, thus, be rejected and implies that the intuition behind the formulation of it is correct, hence, that a healthier individual will not require the utilization of primary healthcare as frequently, on average. The considerable magnitude and significance of this factor reveals its importance as a determinant for the utilization of healthcare services and deserves a more detailed reflection, which will be provided in Section 5. The health record of the elderly seems to be of similar relevance to that of current health, also showing a statistically significant and considerable positive effect of 0.665, for an alpha of 1% (p-value < 0.01). This demonstrates that exhibiting some sort of health condition or the consequences of it will contribute to a higher number of visits to the hospital per year. This determinant of primary healthcare utilization will, thus, also be further analysed ahead.

Hypothesis 6 anticipated a significant effect of not being of Dutch origin, on the number of yearly GP visits, even if its sign was undetermined. Contrary to the expectations, this effect was not found to impact the outcome significantly.

The effect of taking complementary health insurance is significant for an alpha of 1% (p-value < 0.01), and positively increases the outcome by 0.447 visits. This establishes the importance of including this factor in a possible prediction model, as it seems to point to a relationship between such decision and an individuals' health, which results, as seen from the testing of hypothesis 5, in a more frequent utilization of primary healthcare services.

4.2 Linear Regressions' Analysis for Male and Female Subgroups

The linear regressions for the subgroups male and female are also presented in Table 3.

For females, a sample of 761 observations is verified. The first result to stand out due to its loss of statistical significance, for an alpha of 10% (p-value > 0.10), is age. This coefficient's magnitude is also reduced to 0.006, however its sign is kept constant. Current and past health remain highly statistically significant for an alpha of 1% (p-value < 0.01), their magnitudes increase to -1.260 and 0.698, respectively, maintaining their sign. Complementary health insurance does not suffer considerable changes, showing a magnitude of 0.466 and a positive sign. The effect of being non-Dutch increases in magnitude to -0.197 but it remains not statistically significant. Education and financial stability's signs still match the predictions, however, these are not significant.

The subgroup of males consists of 870 observations. Contrary to the trend verified for the majority of the other variables' effect, age plays a more meaningful role when compared with the previously analysed regressions, besides being statistically significant for an alpha of 1% (p-value < 0.01). Males pay an extra 0.040 GP visits, on average, as they get one year older. The factors of current health and health record remain highly statistically significant for an alpha of 1% (p-value < 0.01), and their magnitudes are still considerable, despite less than for females, with an impact of -0.733 and 0.653, respectively. Having a complementary health insurance plan is also highly significant, for males, for the same level, and its effect of 0.417 does not deviate notably from the opposing subgroup. The most recognizable difference from females lies in the effect of national originality, which sees its sign inverted, however still not significant. Education and financial stability also remain not significant.

4.3 Linear Regressions' Analysis for Complementary and BHI Subgroups

The possibility of disparate effects between the subgroup with complementary health insurance, and the one who settled for the basic, mandatory plan, also demands a more detailed analysis. Two additional linear multivariable regressions are, thus, provided in Table 3. The first will consist of 1182 observations and the second of 449.

Elderly female individuals who decided to purchase the incremented insurance plan will visit the GP an extra 0.387 times, on average, per year. This is statistically significant for an alpha of 5% (p-value < 0.05), and it has a larger effect than that of the main regression. The effect of age is, again, small, and not even significant for an alpha of 10% (p-value < 0.01), with a magnitude of 0.022. Current health is still highly significant for an alpha of 1% (p-value < 0.01), with a size that does not deviate considerably from the previous analyses, namely, -1.037. Past health loses

its statistical significance. Non-Dutch, education, and financial stability maintain their lack of significance.

For the subgroup who did not opt to purchase health insurance besides what they were obliged to, the results are the following. Being a woman, ageing and suffering from a health condition, does not seem to significantly impact the number of yearly GP visits. Current health, on the other hand, remains significant for an alpha of 1% (p-value < 0.01), with a magnitude of -0.768. The effect of being of non-Dutch origin is the largest so far, but still not significant, just as education. Financial stability is also not significant, and its sign is negative, which is surprising. Such irregular results may be due to the smaller sample size used for this regression analysis, which may be affecting the quality of the representativeness.

4.4 Linear Regression of Current Health Analysis

Table 4 - Linear regression analysis of the relationship between the selected individual characteristics of the elderly citizens of The Netherlands and their self-reported level of current health

	Current Health
Female	-0.023
	(0.033)
Age	-0.006**
	(0.003)
Health Record	-0.571***
	(0.033)
Health Insurance	-0.071*
	(0.036)
Non-Dutch	-0.133***
	(0.049)
Education	0.009***
	(0.002)
Wealth	-0.054***
	(0.011)
Constant	3.727***
	(0.225)
Observations	1631
Adjusted R^2	0.196

Notes: The presented values are the coefficients of each variable and represent its effect on the dependent variable. Within brackets, the standard errors of the respective variables are presented. The significance of these coefficients is displayed as * for p < 0.10, ** for p < 0.05, and *** for p < 0.01.

A final regression analysis, presented in Table 4, is incorporated in this results section. That is the effect of the selected individual characteristics on that which has been verified to be the most consistent and highly significant determinant of yearly GP visits, current health.

The first significant and logical effect is the negative impact of ageing on current health. This is significant for an alpha of 5% (p-value < 0.05), and it decreases the level of health by 0.006 points. Being a woman does not seem to significantly impact the level of current health, in this sample. Unsurprisingly, health record, suffering from a health condition or the consequences of an accident, contributes to a deterioration of current health by 0.571 on the scale introduced in Table

2 (Section 3.4). This effect is highly significant for an alpha of 1% (p-value < 0.01). Complementary health insurance also has an effect, significant for an alpha of 10% (p-value < 0.10), of -0.066. This may indicate the presence of ex-post moral hazard, however, it may also be due to reverse causality. Such will be more carefully investigated in Section 5. National originality significantly impacts the outcome for an alpha of 1% (p-value < 0.01) and with a magnitude of -0.133. Education, as previously argued, shows a highly statistically significant effect for an alpha of 1% (p-value < 0.01). Being more educated increases current health by 0.009 points. Contrary to the expectations, financial stability decreases the outcome by 0.054, for the same significance level.

5. Conclusion and Discussion

5.1 Conclusion and Discussion

The aim of this research paper is that of investigating the effect of several socioeconomic and demographic individual characteristics, on the utilization of primary healthcare services, namely the number of yearly visits to a general practitioner. The target population for this study consisted of elderly citizens of The Netherlands. The ultimate goal of this analysis was that of laying the stepping stones for an estimation model, based on the aforementioned individual characteristics, that would provide a general prediction of the way in which this older part of the population would make use of primary services. Such a model would, then, be used by healthcare providers and the government to more efficiently allocate monetary resources, according to the needs of these individuals.

The focus on the elderly population allows for a more accurate model, considering the unique specificities of this age group, such as a higher propensity to health defects, caused by proximity to death. As a consequence of such fact, this group represents the highest healthcare spendings, which also supports the necessity to prevent severe inefficiencies in the distribution of assets through and within healthcare services providers, by creating models that are capable of anticipating the healthcare needs of the elderly.

Furthermore, in The Netherlands, the healthcare system is designed to be affordable and solidary, but also efficient, which leads to the implementation of gatekeeping doctors who are responsible for assessing all patients and deciding whether they will be eligible for secondary or tertiary services. Except for emergency care, this practice is mandatory for every citizen of the country. Hence, assessing primary healthcare utilization is crucial to understanding the patterns of healthcare utilization of any citizen.

This study is still insufficient for the creation of the desired final model, however, it serves as a definite stepping stone, with an initial determination of the most relevant individual characteristics to be included, besides providing advice for further research, based on its results.

Using data extracted from the LISS panel, a main regression, an example of what a final model might look like, and, additionally, four linear regressions were included in this study. These secondary analyses provide further information regarding subgroups in this sample but also assist in understanding if the selected variables affect the outcome through current health, independently, or not at all significantly.

The multivariable regressions presented in Table 3 reveal that the level of current health is consistently significant and with a considerable magnitude. Health record also demonstrates similar results. Considering how these measures may be somewhat subjective, especially, when

self-reported, it could be valuable to stratify these factors into, for example, independent variables for multiple categories of health conditions, or including a variable of different healthcare utilization methods, even a lag for yearly GP visits, during the last relevant time period, as this may indirectly show an individual's health status.

In the main regression, it is verified that females seem to significantly impact healthcare utilization relative to males. Since, in such analysis, both subgroups are examined simultaneously, the effects of male and female individuals are averaged out, consequently, cancelling each other's effects, in the case that they observe opposite directions. The same uncertainty applies to complementary health insurance, relative to BHI. Linear regressions are, thus, independently provided for each subgroup, in order to more accurately determine the coefficients of every variable, as if they differ considerably, it may be less deceiving to use more than a single model for the estimation of the outcome.

The male and female subgroups' regression results do not seem to differ considerably or present opposing outcomes. The only worth noting difference lies in the magnitude of the effects of age and current health. The first variable is highly significant for men, and not at all statistically significant for women. And the factor regarding current health impacts the outcome for females to a greater degree. This variation indicates that health conditions and their associated reactions may be experienced differently between males and females. The regression analysis presented in Table 4 demonstrates that being a woman does not significantly impact the level of current health, which supports the notion that more frequent utilization of primary healthcare does not reflect, in this case, a higher propensity or more intense manifestation of any given disease. It may, however, denote variations in behavioural responses to health defects.

The effects for the complementary and BHI subgroups' regression results also do not profile varying coefficient signs. Female and health record only significantly impact the dependent variable when individuals opt for additional insurance, and their current health has a larger effect on such outcome. It is observed that having compulsory health insurance decreases the level of current health (Table 4), however, this may be due to reverse causality as people who suffer from a health condition are then more likely to seek health insurance. Furthermore, admitting the infeasibility of such an effect to be significant, even if only for an alpha of 10% (p-value < 0.10), selection bias should be considered.

Realizing how the aforementioned subgroups do not confound the results, it would be expected that an eventual complete estimation model would include such factors in the same regression.

Further analysing the secondary regression depicted in Table 4, it is noticeable that health record has a large effect on these elderly individuals' current health, which is intuitive and not surprising. Age, on the other hand, within this sample of older people, seems to not be very impactful,

although statistically significant. The correlation of this factor with yearly GP visits was also not particularly sizeable, however it did represent a greater effect. Hence, it is probable that other motivations, besides the deterioration of health, may be present and should be determined and accounted for, eliminating selection bias, and achieving a more concise final model.

Education and wealth are also found to determine current health significantly. Education has a positive effect, which goes according to the expectations. This effect is small and that should be the reason for non-significant results, in the main regression, regarding this coefficient, as its impact likely occurs almost fully through current health. This may also indicate that educational differences in the elderly population of The Netherlands do not seem to affect behavioural responses to health conditions. Wealthier people, however, are shown to be less healthy. Given the contrary consensus, found in the literature, this result should probably be attributed to a statistical error, rather than be used to make inferences.

Being of non-Dutch originality has a substantial and significant negative effect on the level of current health. Considering how these non-native individuals seem to exhibit poorer levels of health, but how belonging to such a group does not significantly impact the number of yearly visits to a GP, as it may be verified in Table 3, it should be investigated whether this effect is completely captured by the level of current health, in the main regression, or if this is not the case. If the conclusion is reached that this health level disparity's effect is nearly fully nullified by current health, then it is unlikely that the root of this issue lies directly with the Dutch healthcare system. The encountered difference would still, however, be worrying and require a solution, considering how the literature, for example, Tong & Artiga (2021), states that biological differences among races have been invalidated and, thus, rejecting differences in illnesses prevalence and outcomes. Hence non-Dutch groups would for some reason, be exposed to conditions and environments that would be causing them to suffer more from health conditions. If, on the other hand, it is shown that the level of current health is not the only instrument through which non-nativity affects primary healthcare utilization, then this would imply inequality problems in the healthcare system. Either by distrust or access barriers to these services, for example, this non-Dutch group could be led to utilize healthcare services less than its actual necessity, as the main regression shows that despite their worse health, non-natives utilization does not significantly differ from the opposite group. This scenario would require a reform to the Dutch healthcare system towards national originality and ethnic access equity.

In sum, this research investigates how socioeconomic and demographic factors affect yearly GP visits among the elderly in The Netherlands. The goal is to develop a model to help healthcare providers and the government allocate resources efficiently. Findings show that age, current health status and gender significantly influence GP visits, while complementary health insurance also

affects utilization. Addressing disparities in healthcare access among non-Dutch individuals is crucial for equity. It is important that policymakers assess whether the encountered discrepancies between the necessity and utilization of healthcare services from non-Dutch individuals stem from surrounding environments that more likely affect the health of these groups, or if other inequity-related barriers provoke this issue. Once the root of these differences is determined, it will be possible to design policy solutions that guarantee all groups have equal access to healthcare services.

5.2 Limitations and Future Research

This research is, as already demonstrated, very important as a mechanism to comprehend the utilization of healthcare services from individuals belonging to the above-mentioned age group. However, being limited to this more indirect outcome may trouble the accuracy of the desired final model. Perhaps, it could be valuable to find a more direct, non-self-reported measure, such as actual expenditures to serve as the main dependent variable. The recurring limitation of self-reported data also applies to the remaining estimators.

Some potentially influential variables, such as the type and severity of chronic conditions, lifestyle factors, for example, diet or exercise, and mental health status, are not included. Their inclusion could provide a more comprehensive understanding of healthcare utilization patterns.

Additionally, this research focuses only on the elderly population of the Netherlands. While this provides specific insights, it limits the generalizability of the findings to other age groups.

The preliminary character of this research requires further investigative efforts in order to achieve a concise estimation model of primary healthcare utilization from the elderly, in The Netherlands, in terms of yearly GP visits. Further research should focus on building on what was found by this analysis and study, in more detail, the identified most relevant factors of prediction, as was noted in the previous subsection 5.1.

It could also be investigated how different health policies and interventions impact healthcare utilization among the elderly.

Finally, further exploring healthcare disparities among different socioeconomic and demographic groups and recognizing the origin of these differences may help design targeted interventions to ensure equitable access to healthcare services.

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Appendix

The variables age and gender are objective and measured directly, with the latter taking the value of 1 when the individual is female, and 0 otherwise. Current health is measured from a self-reported answer to the question: “How would you describe your health, generally speaking?”. The answer categories take the value of 1 for “poor”, 2 for “moderate”, 3 for “good”, 4 for “very good”, and 5 for “excellent”. Health background is measured by a self-reported answer to the question: “Do you suffer from a long-standing disease, affliction or handicap, or do you suffer from the consequences of an accident?”. The answer categories take the value of 1 for “yes”, and 0 for “no”. National originality is obtained from the question: “To which of the following groups do you feel you belong?”. The answers to this include, and will yield the value of 1 if chosen, and 0 otherwise, “No other group” (in case one feels Dutch), “Turks”, “Kurds”, “Moroccans”, “Berbers”, “Surinamese”, “Hindus”, “Creole groups”, “Javanese”, “Chinese”, “Curaçaoan”, “Aruban”, “Antilliean”, “Indonesian”, and “Other group, namely:”. The education level is obtained from the question: “What is the highest level of education that you have completed with diploma or certificate?”. And the answer categories take the value of 1 for “did not complete any education”, 2 for “did not complete primary school”, 3 for “primary school”, 4 for “lower and continued special education”, 5 for “vglo (continued lower education)”, 6 for “lbo (lower professional education)”, 7 for “lower technical school, household school”, 8 for “mulo, ulo, mavo (lower/intermediate secondary education; US: junior high school)”, 9 for “vmbo vocational training program (preparatory intermediate vocational school)”, 10 for “vmbo theoretical or combined program (preparatory intermediate vocational school)”, 11 for “mms (intermediate girls' school)”, 12 for “hbs (former pre-university education, US: senior high school)”, 13 for “havo (higher general secondary education; US: junior high school)”, 14 for “vwo (pre-university education, US: senior high school)”, 15 for “gymnasium, atheneum, lyceum (types of pre-university education programs)”, 16 for “kmbo (short intermediate professional education), vhbo (preparatory higher professional education)”, 17 for mbo professional training program (intermediate professional education) (BOL), 18 for “mbo professional training program (intermediate professional education) (BBL)”, 19 for “mbo-plus to access hbo, short hbo education (less than two years) (higher professional education)”, 20 for “hbo (higher professional education), institutes of higher education, new style”, 21 for “teacher training school”, 22 for “conservatory and art academy”, 23 for “academic education (including technical and economic colleges, former style) bachelor's degree (kandidaats)”, 24 for “academic education (including technical and economic colleges, former style) master's degree (doctoraal)”, 25 for “academic education, bachelor”, 26 for “academic education, master”, 27 for “doctor's degree (Ph.D, including doctoral research program to obtain Ph.D)”, and 28 for “other”. The economic situation of each individual is measured indirectly with the question: “How easy or hard is it for you to go to unexpected essential expenses of € 500 or more without getting into debt or contracting a

loan?", given the fact that the elderly often have different employment situations, as a lot of them may already be retired, which would make the use of variables such as income, deceiving. This is measured with a scale from 1 to 7, where 1 ("very easy") implies that the individual is considerably financially comfortable, and 7 ("very hard"), which reveals someone in financial distress. And, finally, insurance status is obtained from asking: "Did you take out a complementary health insurance in 2023?". The positive answer of "yes" takes the value of 1, and "no" takes the value of 0.