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Original article

Title: Health service utilization among adults aged 50+ across eleven European countries (the SHARE study 2004/5)

Lena Borboudaki[1*], PhD(c), MPH, lena@nhmc.uoc.gr

Manolis Linardakis[1], PhD, MSc, linman@med.uoc.gr

Anna Maria Markaki[1], MPH, ammarkaki@hotmail.com

Angeliki Papadaki[2], PhD, Senior Lecturer, angeliki.papadaki@bristol.ac.uk

Anna Trichopoulou[1], PhD, Sociologist, trichopoulou.anna@gmail.com

Anastas Philalithis[1], MD, professor emeritus, philal@uoc.gr

Institutions and Affiliations:

[1] Department of Social Medicine, School of Medicine, University of Crete, Greece

[2] Centre for Exercise, Nutrition & Health Sciences, School for Policy Studies, University of Bristol, Bristol, UK

*Corresponding author:

Lena Borboudaki, PhD(c)

Department of Social Medicine, School of Medicine, University of Crete

Heraklion 71003, Crete, Greece

E-mail: lena@nhmc.uoc.gr, dioikitria@hc-crete.gr, Phone number: 0030 6977421133

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ORCID

Lena Borboudaki 0000-0003-2224-5036

Manolis Linardakis 0000-0003-3849-3907

Angeliki Papadaki 0000-0002-5728-3975

Abstract

Purpose The current study aims to examine the use of preventive and other health services among adults aged 50+ in eleven European countries.

Methods The data used derived from 16,120 adults aged 50+ years participating in the Survey of Health, Ageing and Retirement in Europe (2004/05). Preventive Health Services Utilization score (PHSUs) and Health Care Services Utilization score (HCSUs) were assessed as a composite value from answers to 12 and 16 questions respectively, on a scale ranging from 0 to 100. Estimations were based on a complex study design.

Results Participants from Central European countries were found to have significantly higher mean PHSU and HCSU scores than their counterparts in Northern and Southern regions, ($p<0.05$) and also exhibited a greater gap between the two scores (29.3, 95% CI: 28.6-30.1). Overall mean PHSU score was 39.9 (95% CI: 39.4-40.4) and mean HCSU score 12.4 (95% CI: 12.2-12.7). Women have a higher mean PHSUs and HCSUs ($p<0.001$); as age increases, PHSUs falls and HCSUs rises ($p<0.001$). Better educated participants appear to have higher mean PHSUs and HCSUs ($p<0.001$). In addition, both of the above scores increase in the presence of chronic diseases ($p<0.001$).

Conclusion Strong correlation is seen between comorbidity, increasing age, educational level and retirement on the one hand, and increased use of health services on the other hand. The use of health services is a major issue with regard to public health policy formulation.

Abbreviations

SHARE   Study of Health, Ageing and Retirement in Europe

PHSUs   Preventive Health Services Utilization score

HCSUs   Health Care Services Utilization score

NCDs   Non-communicable diseases

Title: Health services utilization among adults aged 50+ across eleven European countries (the SHARE study 2004/5)

Introduction

Population ageing is a major social challenge, and one which has led to research focusing on the elderly population and medical care (Dominguez et al. 2006). Chronic diseases and comorbidity are more prevalent in the elderly population, leading to increased use of health services and a consequent increase in health care costs (Srakar et al. 2016).

Non-communicable diseases - NCDs (cardiovascular diseases, chronic respiratory diseases, diabetes and cancers) account for approximately 70% of all deaths worldwide, i.e. around 38 million deaths per year (Malta et al. 2017). The emergence of chronic diseases is exacerbated by urbanization, sedentary lifestyles, dietary habits and rising levels of obesity (Deloitte 2019). Preventive health services contribute to reducing these harmful lifestyle habits by providing information and advice on a systematic basis, ensuring the prevention and / or treatment of such diseases (Linardakis et al. 2015). The use of preventive health services involves a variety of measures including immunization, disease tests and behavior counseling in order to prevent or diagnose the occurrence of chronic disease early on, thus reducing premature mortality and improving the quality of life (Vaidya et al. 2011).

Numerous research papers describe health service utilization models and have developed research frameworks detailing predictors for the use of health services (Babitsch et al. 2012). One widely recognized instance is the behavioral health services model developed by health sociologist and researcher Ronald M. Andersen in 1968 (Zhang et al. 2018). Global health care expenditure is currently rising at an annual growth rate of 5.4% (for the period 2017-2022), whereas the corresponding rate for the period 2013-2017 was 2.9% (Deloitte 2019; EIU 2016).

Nevertheless, various factors such as gender, age, social level and insurance are important in the use of health services (Görge et al. 2017; Rattay et al. 2013). Rattay and colleagues showed that as age increases, so does the need for in-patient and out-patient health care services (Rattay et al. 2013). Comorbidity also is associated with lower levels of functioning and quality of life (Hopman et al. 2016a; Hopman et al. 2016b), psychological burden (Fortin et al. 2006; Hopman et al. 2016a), increased mortality (Hopman et al. 2016a; Menotti et al. 2001) and higher levels of health services use compared to healthy individuals and those suffering from one chronic disease (Hopman et al. 2016a). In addition to the role played by sociodemographic and personal characteristics in the use of preventive health services, variations in geographical regions within and across different countries exist that should be taken into account when examining health care utilisation, as these variations might reflect inequalities in healthcare systems and practices (Corallo et al. 2014; de Vries et al. 2018; OECD 2014).

To our knowledge, the use of preventive health services and secondary / tertiary health care services has not been previously explored in large-scale studies, nor among adults from different European countries and geographical regions, which would be important to investigate the aforementioned variations. The aim of this study was, therefore, to examine this issue with regard to adults aged 50 + in 11 European countries, and establish any differences in healthcare utilisation among different geographical regions. We particularly focused on data obtained before the economic crisis of 2008 began, to allow comparisons across European countries and prevent the potential contamination in findings that the ongoing recession in southern European countries might introduce.

Subjects and Methodology

Study population and sampling

SHARE, the Survey of Health, Ageing and Retirement in Europe (SHARE), is a multidisciplinary, cross-national panel database of microdata on the health, socio-economic status and social and family networks of more than 120,000 individuals aged 50 or older (approximately 300,000 interviews) from 20 European countries and Israel (Wave 1 to 6). As Europe has the highest proportion of adults aged 65+ in any region in the world, the main task of SHARE in 2002 was to examine the role of ageing in the health of adults aged 50+ years in the diverse cultural settings of Europe. SHARE records a great variety of information, including health variables, physical measures and biomarkers, psychological, economic and social support variables plus social network information. The current article presents data from a subsample of 16,120 adults aged 50+ years, from the sum total of 27,444 adults in 11 countries (Austria, Belgium, Denmark, France, Germany, Greece, Italy, The Netherlands, Spain, Sweden and Switzerland) during the first wave (2004/05) of the study. With regard to methodology, stratified-simple random sampling from national and regional registers was used to select the sample. This involved either national population registers (stratified-simple random sampling), regional/local population registers (multistage sampling) or telephone directories (single or multistage sampling). The target population consisted of households with at least one person aged 50 and above who spoke the official language of the country where the survey was conducted. Adults were excluded if they were institutionalized or away from their homes during the investigation period (in prisons, hospitals, etc.). Weighted average household response rates ranged from 38.8% (Switzerland) to 81.0% (France), with corresponding individual response rates being higher, ranging from 73.7% (Spain) to 93.3% (France). The differences between the two response rates most likely derive from different sampling frames, but are common in large surveys (Borsch-Supan et al. 2005; Linardakis et al. 2015). Based on the 16,120 adults selected and the overall study sample, the total estimated population targeted by the study was ≈57 million adults aged 50+. Detailed information on the design of the SHARE study (multi-stage

sampling, recruitment procedures, response rates, ethical issues, etc.) has been provided in previous reports (Borsch-Supan et al. 2013; Borsch-Supan et al. 2005; Linardakis et al. 2015).

Questionnaires

Regarding completion of the main questionnaire in the present study, a personal computer interview (CAPI) consisting of 21 modules was administered to all participants (n=27,444). Modules included demographic features, physical and mental health, health services use, etc. To ensure the validity of responses, card demonstration was performed in addition to the questions in some modules (Crimmins et al. 2011; Linardakis et al. 2015).

A self-completed questionnaire was also administered to a subset of respondents (n=16,125), concerning medical examinations, mental and social well-being, etc. Response rates ranged from 70% (Sweden) to 93% (Greece) (Borsch-Supan et al. 2005).

The overall response rate in the current survey was 97%. Proxy interviews were conducted for those unable to respond due to cognitive or physical problems.

Preventive Health Services Utilization score (PHSUs)

Preventive Health Services Utilization was assessed by a composite score (PHSUs) using 12 questions. The questions assessed whether participants had: (1) had contact with a dentist/ dental hygienist for routine control and/or prevention; (2) seen a general practitioner (GP) for advice/prevention; (3) been assessed by a GP for physical activity; (4) received advice on regular exercise from a GP; (5) been assessed by a GP for body weight; (6) been asked by a GP about drug use or prescriptions; (7) had flu vaccinations in the preceding year; (8) had a mammogram in the preceding two years (this question was initially addressed to females only, but was answered by males as well); (9) ever had a sigmoidoscopy/colonoscopy; (10) been tested for hidden blood in stool in the preceding 10 years; (11) ever been referred to a physiotherapist or exercise program for joint pain; (12) ever been referred to an orthopedic surgeon for joint pain (Hallberg 2006; Linardakis et al. 2015). Some of the score's components referred to secondary or tertiary prevention. All questions were coded as a binary variable (0 =no/never, 1 =yes/at some time/every visit), and a composite score (range=0-12) was computed by summing responses (Caldwell and Kirby 2012; Linardakis et al. 2015). The score was subsequently rescaled to 0-100, with higher values indicating higher preventive health services utilization (Linardakis et al. 2015).

Health Care Services Utilization score (HCSUs)

Health Care Services Utilization was assessed by a composite score (HCSUs) using 16 questions. The questions assessed how often participants had: (1) seen or talked to a medical doctor in the last 12 months; (2) been a patient in hospital (times last year); (3) been a patient in

a nursing home or number of weeks spent in a nursing home; (4) received home care: nursing or personal care or number of weeks they had received professional nursing care; (5) received home care: domestic tasks or weeks they received help from paid professionals; (6) received home care: meals-on-wheels or weeks received meals-on-wheels; (7) received care from private providers/type of received care from private providers; (8) contacts with specialists (card 12); (9) seen a dentist/dental hygienist; (10) spent in hospital (total number of nights); (11) been in hospital (reasons): (1.inpatient surgery 2. medical tests or non-surgical treatments (except mental health) 3. mental health problems); (12) spent the night in hospital for surgery (number of nights); (13) had inpatient surgery in the last 12 months; (14) spent the night in hospital for psychiatric problems (number of nights); (15) had outpatient surgery in the last 12 months; (16) had outpatient surgery (number of times).

All answers to questions were coded as a binary variable (0 =no/never, 1 =yes/at some time/every visit), and a composite score (range = 0–16) was computed by summing responses. The score was subsequently rescaled to 0-100, with higher values indicating higher health care services utilization. The HCSU score is a new index that is used for the first time in the current study.

Socioeconomic characteristics

Social and demographic variables included in the study were gender, age, educational level and living conditions. Age was categorized into four groups (50-59, 60-69, 70-79 and 80+ years), while living conditions included two categories: "living alone" and "living with a partner / spouse". Years of education were calculated on the basis of total study time at different education levels as defined by national education systems (UNESCO 1997). Economic status was recorded as the gross household income in the previous year. Reflecting transnational differences in household income, quadrants were calculated and used by country (Caldwell and Kirby 2012; Linardakis et al. 2015).

Countries were grouped by region into Northern Europe (Denmark, Sweden), Central Europe (Austria, Belgium, France, Germany, The Netherlands, Switzerland) and Southern Europe (Greece, Italy, Spain).

Statistical analysis

Data were analyzed using the SPSS software package (IBM SPSS Statistics for Windows, version 25.0. Armonk, NY: IBM Corp.). Weights were applied according to the complex multistage stratification sampling design of the study, accounting for non-responses. The prevalence and corresponding 95% confidence intervals (95% CIs) of the PHSU and HCSU components were estimated. In addition, mean PHSUs and HCSUs were assessed and compared between European regions, using analysis of covariance (according to the complex sampling

design procedure), with gender, age, education, living status, physical health, retirement status and income as covariates. The corresponding 95% CIs were estimated according to the general linear complex sampling design. Across the 11 countries, the PHSUs and HCSUs were also illustrated as a spider gram. Finally, comparisons of PHSUs and HCSUs according to the different characteristics of participants were examined using multivariate analysis of covariance. Excluding the current characteristic each time, the covariates used were gender, age (year categories), education (year categories), living status, chronic diseases, retirement status, income and European regions (polynomial trends were assessed in ordinal characteristics).

Results

56.7% of the study sample were women, while 53.9% were seniors (60-79 years) and 8.2% were elderly (80+) (Table 1). Average participant age and years spent in education were 64.2 and 10.0 years respectively. Concerning living conditions, 25.8% said they "lived alone", while 20.4% reported having two or more chronic diseases. Almost half the sample (49.1%) said they were retired, while 24.1% reported being in the lowest country-specific quartile of income status. The majority also of the participants (53.3%) lived in Central Europe.

➜ **Table 1**

Table 2 shows the prevalence of PHSUs variables. 38.8% reported a dental visit during the last year, while the majority of the sample (90.6%) reported a visit to a GP for counseling / prevention. 49.4% were asked about physical activity and 49.7% were checked for weight, while 47.0% were asked about medication / prescription. With regard to diagnostic tests, 29.6% and 22.0% of participants had mammography and sigmoidoscopy / colonoscopy respectively and 21.4% reported referral from a physician for orthopedic surgery due to joint pain.

➜ **Table 2**

The results of Table 3 record the prevalence of HCSU score variables, where only 12.0% report no visits to a physician, whereas 14.3% report highly frequent visits. Only 13.1% report hospitalization in the last 12 months and 3.2% had home care. 9.1% report receiving services from a private health provider, while 45.2% said they had visited a qualified physician. 52.7% received care from a dentist or a dental hygienist. Of the 13.1% who reported hospitalization in a hospital unit, 4.2% reported hospitalization for 13 days or more and 12.5% gave inpatient surgery as the reason for hospitalization. Only 0.12% reported hospitalization due to a psychiatric problem.

➜ **Table 3**

Table 4 shows the mean PHSU and HCSU scores calculated for Northern, Central and Southern European. Scores range from 0 to 100, with higher scores indicating greater use of health services. Participants from Central European countries were found to have significantly higher mean PHSU and HCSU scores than their counterparts elsewhere in Europe (p<0.05), as

well as a greater gap between the two scores (29.3, 95% CI: 28.6-30.1). Overall, respective mean PHSU and HCSU scores were 39.9 (95% CI: 39.4-40.4) and 12.4 (95% CI: 12.2-12.7).

➜ **Table 4**

As shown in Figure 1, Greece has the lowest PHSU score (26.4), whereas Austria has the highest (47.0). However, Greece has the smallest gap between PHSU and HCSU (16.8), while Austria has the largest (34.4). In all 11 countries, there is a low score of 12.4 for use of healthcare services, while the score for preventive health services is 39.9.

➜ **Figure 1**

Based on the results reported in Table 5, mean PHSU and HCSU scores seem to be strongly correlated with specific variables. Among others, women had higher mean PHSU and HCSU scores (p<0.001), while increased age was associated with reduced PHSUs but greater HCSUs (p<0.001). Better educated participants have higher mean PHSU and HCSU scores (p<0.001). In addition, both PHSUs and HCSUs increase in the presence of chronic diseases (p<0.001).

➜ **Table 5**

Discussion

This study aimed to calculate HCSU and PHSU scores for the target population to carry out comparative analysis of the above scores for adults aged 50+ years from 11 different European countries in the SHARE project, and to identify correlations between socioeconomic features in the target population. It is important to emphasize that the HCSU score used in the current study is a new index and, to our knowledge, this is the first time that a comparative analysis of the HCSU with the PHSU score is made to assess the overall use of health care services.

As age increases, preventive use drops and health care access rises, whereas the inverse applies to level of education. Furthermore, the greater the number of chronic illnesses, the more health care use increases. Women and retired persons make more use of health care services than men. The overall mean PHSU score was significantly higher than the HCSU score.

The increase in the elderly population and the disproportionate cost of healthcare have been cited in relevant literature. Comorbidity is associated with a higher risk of increased hospitalization. This results in increased expenditure (Bahler et al. 2015) given that aging is by definition a process of increasing morbidity (Harman 2006).

Any increase in the age of individuals creates a greater need for healthcare, while the constant increase in the prevalence of chronic illnesses entails significant long-term health and social care costs (Prince et al. 2015), which are of great concern for European health policy (Tavares and Zantomio 2017).

The main findings of this study confirm that the use of health services is related to educational level; other studies also refer to the link between health service utilization and educational inequalities association (Stirbu et al. 2011). Our finding that visits to specialists are

associated with a higher level of education is further confirmed by other studies (Terraneo 2015). However, contrary to previous studies showing no differentiation in the use of general practitioners by educational level (Palència et al. 2013; Stirbu et al. 2011; Terraneo 2015), the present study found a positive correlation between the two, with the most educated making more use of preventive health services.

In particular, Meyerhoefer and colleagues (2014), found that education was associated with the use of all types of preventive and dental services (Meyerhoefer et al. 2014). Elsewhere, the probability of hospitalization during the previous 12 months increased among better educated people (Fernandez de la Hoz and Leon 1996). Other studies have found that the best educated are more likely to be in formal employment and hence have better access to health insurance coverage (Kaplan et al. 2015), as well as to medical visits, more positive health behaviors, and an increased ability to make healthcare payments and access (Avila et al. 2018).

The present study found no correlation between the use of health services and income status, although a significant number of studies have documented income-related inequalities (Devaux 2015; Devaux and de Looper 2012; Manderbacka et al. 2009; Masseria and Giannoni 2010; Terraneo 2015; van Doorslaer et al. 2006).

It is nonetheless noteworthy that in the current survey Greece displays the lowest levels of healthcare utilization with regard both to PHSUs and to HCSUs for secondary or tertiary care (with a low gap of 16.8 between the two). One possible explanation could be that whereas the health status of the population in Greece was traditionally one of the best in the WHO European Region, this has been overturned in recent years, even prior to the current economic crisis, and the country now has more negative health indicators than other European countries, particularly with respect to cardiovascular diseases and cancers (WHO 2016). According to the OECD, the Greek paradox involving high health self-reporting but low indicators of preventive and other health services is probably due to strong social support networks, which confirm the strong coherent ties in Greek families and society (OECD 2017); it may also be correlated with the low use of health services seen in the country in the current study.

The strong correlation found in the present study between the increasing number of chronic diseases and rising levels of healthcare use across European countries is consistent with recent research carried out in both developed and developing countries (Lee et al. 2015; Palladino et al. 2016; Rijken et al. 2013; van Oostrom et al. 2014), which have highlighted the impact mainly on the use of secondary care. Patients with comorbidity often have complications during their stay in hospital, which significantly affect the time they spend in health units (Palladino et al. 2016).

Central European countries show greater use of health services than their Northern and Southern counterparts, with Austria showing the highest HCSUs. Recent research in Austria has revealed that physical inactivity rates are high in the country, representing a major risk factor

related to the occurrence of chronic diseases and comorbidity, which are in turn associated with the increased use of health services (Gomes et al. 2017). This is likely to be the major reason for the high rate of use of health care services in Austria found in the current research. The low use of preventive health services by adult Greeks, as our data show, may be due to the observed increase in socio-economic inequalities and the lack of a national primary health care policy (Lionis et al. 2009).

Finally, countries with high HCSUs tend to have high PHSUs as well, which may be due to the fact that a GP is the point of access to other health services in many health care systems (Terraneo 2015).

Access to health care system is a key element in achieving quality of life and development but also poor-quality care is a big barrier to reducing mortality (Kruk et al. 2018). Although comorbidity is strongly associated with higher rates of healthcare use in most studies, especially among the elderly population, data in the scientific literature prior to the present study remained scarce. Data on the correlation between co-morbidity and healthcare utilization in the elderly population is particularly limited with regard to Europe (Bahler et al. 2015).

This study is a major European-wide epidemiological report, investigating both the use of preventive health services and access to secondary and tertiary care. Its significance lies in the fact that it is the first study to measure preventive and healthcare services utilization in Northern, Central and Southern European countries in a particular population, (those aged 50+); this is important given that ageing is directly related to the burden placed on health systems, and has to be taken into account when developing policies if systems are to be sustainable.

Strengths and limitations

The main limitation of the study was the self-completion of the questionnaires. However, the use of cards and the drop off questionnaire reduced the risk of systematic errors by helping participants to better understand the questions (Borsch-Supan et al. 2005). PHSU score parameters were not counterparts of prevention assessment, but refer to different levels of health prevention (whether primary, secondary or tertiary) (Permpongkosol 2011). In addition, the accessibility and accessibility of 12 preventive services involving PHSUs and 16 involving HCSUs vary across countries but this study attempted to present them via country to country comparisons. Although these weaknesses limit the external validity of our findings, they can be epidemiologically compared with similar large-scale surveys or even the latest waves in the study, controlling for time effects (e.g. secular trends). In addition, the current findings refer exclusively to the first wave of the SHARE survey (2004/5). Although the development of scores a posteriori might bias the findings (AHRQ 2019; Shwartz et al. 2015), the score used to assess health service utilization in the current study was developed using the same questionnaires across the different countries, with the aim to allow between-country

comparisons in the SHARE survey, thus not hindering the study's internal validity. Finally, there is a chance that data from the 1st wave of the SHARE survey (2004/05) might be outdated, thus limiting the generalizibility of the findings to today's European populations. However, using these data ensured the comparability of findings across countries, without the economic crisis and prolonged recession, faced particularly in southern European countries (especially Greece), hindering such comparisons. Nevertheless, the present findings can be used as the basis for longitudinal comparisons and the establishment of secular trends with most recent SHARE waves.

Conclusion

This study finds a strong correlation between comorbidity, increased age, educational level and retirement on the one hand, and increased health service usage on the other. Given the burden placed on health systems by an increasingly ageing population, use of those systems is a major public health issue. It is vital that policies be formulated to strengthen and improve preventive health services, the basic aim of which should be to reduce the prevalence of chronic illnesses.

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Disclosure of potential conflicts of interest

Compliance with Ethical Standards

Research involving Human Participants

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the Ethics Committee of the University of Crete and with 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

References

AHRQ (2019) Agency for Healthcare Research and Quality - U.S. Department of Health & Human Services. Combining Healthcare Quality Measures Into Composites or Summary Scores.Content last reviewed September 2019. MD. https://www.ahrq.gov/talkingquality/translate/scores/combine-measures.html. Accessed Oct, 15 2019

Avila JC, Kaul S, Wong R (2018) Health Care Expenditures and Utilization Among Older Mexican Adults. Journal of Aging and Health:0898264318818901. doi:10.1177/0898264318818901

Babitsch B, Gohl D, von Lengerke T (2012) Re-revisiting Andersen's Behavioral Model of Health Services Use: a systematic review of studies from 1998-2011. Psychosoc Med 9:Doc11-Doc11. doi:10.3205/psm000089

Bahler C, Huber CA, Brungger B, Reich O (2015) Multimorbidity, health care utilization and costs in an elderly community-dwelling population: a claims data based observational study. BMC Health Serv Res 15:23. doi:10.1186/s12913-015-0698-2

Borsch-Supan A, Brandt M, Hunkler C, Kneip T, Korbmacher J, Malter F, Schaan B, Stuck S, Zuber S (2013) Data Resource Profile: the Survey of Health, Ageing and Retirement in Europe (SHARE). Int J Epidemiol 42 (4):992-1001

Borsch-Supan A, Brugiavini A, (eds) (2005) The Survey of Health, Ageing and Retirement in Europe – methodology. In. Mannheim Research Institute for the Economics of Ageing, Mannheim

Caldwell J, Kirby J (2012) Preventive Health Care Utilization by Adult Residents of MSAs and non-MSAs: Differences by Race/Ethnicity, 2009. http://meps.ahrq.gov/mepsweb/data_files/publications/st383/stat383.pdf. Accessed July, 16 2019

Corallo AN, Croxford R, Goodman DC, Bryan EL, Srivastava D, Stukel TA (2014) A systematic review of medical practice variation in OECD countries. Health Policy 114 (1):5-14. doi:https://doi.org/10.1016/j.healthpol.2013.08.002

Crimmins EM, Kim JK, Sole-Auro A (2011) Gender differences in health: results from SHARE, ELSA and HRS. Eur J Public Health 21 (1):81-91

de Vries EF, Heijink R, Struijs JN, Baan CA (2018) Unraveling the drivers of regional variation in healthcare spending by analyzing prevalent chronic diseases. BMC Health Serv Res 18 (1):323-323. doi:10.1186/s12913-018-3128-4

Deloitte (2019) Global health care outlook, shaping the future. https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Life-Sciences-Health-Care/gx-lshc-hc-outlook-2019.pdf. Accessed January, 27 2019

Devaux M (2015) Income-related inequalities and inequities in health care services utilisation in 18 selected OECD countries. The European Journal of Health Economics 16 (1):21-33. doi:10.1007/s10198-013-0546-4

Devaux M, de Looper M (2012) Income-Related Inequalities in Health Service Utilisation in 19 OECD Countries, 2008-2009. doi:https://doi.org/10.1787/5k95xd6stnxt-en

Dominguez LJ, Galioto A, Ferlisi A, Pineo A, Putignano E, Belvedere M, Costanza G, Barbagallo M (2006) Ageing, lifestyle modifications, and cardiovascular disease in developing countries. J Nutr Health Aging 10 (2):143-149

EIU (2016) World industry outlook. Healthcare and pharmaceuticals. The Economic Intelligence Unit. http://ftp01.economist.com.hk/GroupIT/01_FULL_REPORT-World_healthcare_and. Accessed July 16 2019

Fernandez de la Hoz K, Leon DA (1996) Self-Perceived Health Status and Inequalities in Use of Health Services in Spain. International Journal of Epidemiology 25 (3):593-603. doi:10.1093/ije/25.3.593

Fortin M, Bravo G, Hudon C, Lapointe L, Dubois MF, Almirall J (2006) Psychological distress and multimorbidity in primary care. Ann Fam Med 4 (5):417-422. doi:10.1370/afm.528

Gomes M, Figueiredo D, Teixeira L, Poveda V, Paúl C, Santos-Silva A, Costa E (2017) Physical inactivity among older adults across Europe based on the SHARE database. Age Ageing 46 (1):71-77. doi:10.1093/ageing/afw165

Görge M, Ziehm J, Farin E (2017) Health-care utilization of patients with chronic back pain before and after rehabilitation. BMC Health Serv Res 17 (1):812-812. doi:10.1186/s12913-017-2757-3

Hallberg D (2006) Cross-national differences in income poverty among Europe´s 50+. Working Paper 2006:14, ISSN 1653-6975, Uppsala - Sweden

Harman D (2006) Free Radical Theory of Aging: An Update. Annals of the New York Academy of Sciences 1067 (1):10-21. doi:10.1196/annals.1354.003

Hopman P, Heins MJ, Korevaar JC, Rijken M, Schellevis FG (2016a) Health care utilization of patients with multiple chronic diseases in the Netherlands: Differences and underlying factors. Eur J Intern Med 35:44-50. doi:10.1016/j.ejim.2016.08.025

Hopman P, Schellevis FG, Rijken M (2016b) Health-related needs of people with multiple chronic diseases: differences and underlying factors. Qual Life Res 25 (3):651-660. doi:10.1007/s11136-015-1102-8

Kaplan R, Spittel M, David D, (Eds) (2015) Population Health: Behavioral and Social Science Insights. AHRQ Publication No 15-0002, Rockville, MD

Kruk ME, Gage AD, Arsenault C, Jordan K, Leslie HH, Roder-DeWan S, Adeyi O, Barker P, Daelmans B, Doubova SV, English M, Elorrio EG, Guanais F, Gureje O, Hirschhorn LR, Jiang L, Kelley E, Lemango ET, Liljestrand J, Malata A, Marchant T, Matsoso MP, Meara

JG, Mohanan M, Ndiaye Y, Norheim OF, Reddy KS, Rowe AK, Salomon JA, Thapa G, Twum-Danso NAY, Pate M (2018) High-quality health systems in the Sustainable Development Goals era: time for a revolution. Lancet Glob Health 6 (11):e1196-e1252. doi:10.1016/S2214-109X(18)30386-3

Lee JT, Hamid F, Pati S, Atun R, Millett C (2015) Impact of Noncommunicable Disease Multimorbidity on Healthcare Utilisation and Out-Of-Pocket Expenditures in Middle-Income Countries: Cross Sectional Analysis. PLoS One 10 (7):e0127199-e0127199. doi:10.1371/journal.pone.0127199

Linardakis M, Papadaki A, Smpokos E, Micheli K, Vozikaki M, Philalithis A (2015) Relationship of behavioral risk factors for chronic diseases and preventive health services utilization among adults, aged 50+, from eleven European countries. Journal of Public Health 23 (5):257-265. doi:10.1007/s10389-015-0683-6

Lionis C, Symvoulakis EK, Markaki A, Vardavas C, Papadakaki M, Daniilidou N, Souliotis K, Kyriopoulos I (2009) Integrated primary health care in Greece, a missing issue in the current health policy agenda: a systematic review. Int J Integr Care 9:e88-e88. doi:10.5334/ijic.322

Malta DC, Bernal RTI, Lima MG, Araújo SSCd, Silva MMAd, Freitas MIdF, Barros MBdA (2017) Noncommunicable diseases and the use of health services: analysis of the National Health Survey in Brazil. Revista de Saúde Pública 51

Manderbacka K, Arffman M, Leyland A, McCallum A, Keskimäki I (2009) Change and persistence in healthcare inequities: access to elective surgery in Finland in 1992--2003. Scand J Public Health 37 (2):131-138. doi:10.1177/1403494808098505

Masseria C, Giannoni M (2010) Equity in access to health care in Italy: a disease-based approach. European Journal of Public Health 20 (5):504-510. doi:10.1093/eurpub/ckq029

Menotti A, Mulder I, Nissinen A, Giampaoli S, Feskens EJM, Kromhout D (2001) Prevalence of morbidity and multimorbidity in elderly male populations and their impact on 10-year all-cause mortality: The FINE study (Finland, Italy, Netherlands, Elderly). Journal of Clinical Epidemiology 54 (7):680-686. doi:https://doi.org/10.1016/S0895-4356(00)00368-1

Meyerhoefer CD, Zuvekas SH, Manski R (2014) The demand for preventive and restorative dental services. Health Economics 23 (1):14-32. doi:10.1002/hec.2899

OECD (2014) Geographic Variations in Health Care. doi:doi:https://doi.org/10.1787/9789264216594-en

OECD (2017) How's Life? 2017: Measuring Well-being. OECD Publishing Paris. doi:https://doi.org/10.1787/how_life-2017-en

Palència L, Espelt A, Rodríguez-Sanz M, B. Rocha K, Isabel Pasarín M, Borrell C (2013) Trends in social class inequalities in the use of health care services within the Spanish

National Health System, 1993–2006. The European Journal of Health Economics 14 (2):211-219. doi:10.1007/s10198-011-0362-7

Palladino R, Tayu Lee J, Ashworth M, Triassi M, Millett C (2016) Associations between multimorbidity, healthcare utilisation and health status: evidence from 16 European countries. Age Ageing 45 (3):431-435. doi:10.1093/ageing/afw044

Permpongkosol S (2011) Iatrogenic disease in the elderly: risk factors, consequences, and prevention. Clin Interv Aging 6:77-82. doi:10.2147/cia.s10252

Prince MJ, Wu F, Guo Y, Gutierrez Robledo LM, O'Donnell M, Sullivan R, Yusuf S (2015) The burden of disease in older people and implications for health policy and practice. The Lancet 385 (9967):549-562. doi:10.1016/s0140-6736(14)61347-7

Rattay P, Butschalowsky H, Rommel A, Prütz F, Jordan S, Nowossadeck E, Domanska O, Kamtsiuris P (2013) ---Inanspruchnahme der ambulanten und stationären medizinischen Versorgung in Deutschland. Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz 56 (5):832-844. doi:10.1007/s00103-013-1665-x

Rijken M, Struckmann V, Dyakova M, Melchiorre M, Rissanen S, van Ginneken E (2013) ICARE4EU: improving care for people with multiple chronic conditions in Europe. Eurohealth 19 (3):29-31

Shwartz M, Restuccia JD, Rosen AK (2015) Composite Measures of Health Care Provider Performance: A Description of Approaches. Milbank Q 93 (4):788-825. doi:10.1111/1468-0009.12165

Srakar A, Hren R, Prevolnik Rupnik V (2016) Health Services Utilization in Older Europeans: an Empirical Study. 2016.

Stirbu I, Kunst AE, Mielck A, Mackenbach JP (2011) Inequalities in utilisation of general practitioner and specialist services in 9 European countries. BMC Health Serv Res 11 (1):288. doi:10.1186/1472-6963-11-288

Tavares LP, Zantomio F (2017) Inequity in healthcare use among older people after 2008: The case of southern European countries. Health Policy 121 (10):1063-1071. doi:https://doi.org/10.1016/j.healthpol.2017.08.011

Terraneo M (2015) Inequities in health care utilization by people aged 50+: Evidence from 12 European countries. Social Science & Medicine 126:154-163. doi:https://doi.org/10.1016/j.socscimed.2014.12.028

UNESCO (1997) International Standard Classification of Education - ISCED. http://www.uis.unesco.org/Education/Pages/international-standard-classification-of-education.aspx.

Vaidya V, Partha G, Howe J (2011) Utilization of preventive care services and their effect on cardiovascular outcomes in the United States. Risk Manag Healthc Policy 4:1-7. doi:10.2147/rmhp.s15777

van Doorslaer E, Masseria C, Koolman X, Group OHER (2006) Inequalities in access to medical care by income in developed countries. CMAJ 174 (2):177-183. doi:10.1503/cmaj.050584

van Oostrom SH, Picavet HSJ, de Bruin SR, Stirbu I, Korevaar JC, Schellevis FG, Baan CA (2014) Multimorbidity of chronic diseases and health care utilization in general practice. BMC Fam Pract 15:61-61. doi:10.1186/1471-2296-15-61

WHO (2016) Greece. Highlights on health and well-being (2016). http://www.euro.who.int/__data/assets/pdf_file/0009/308835/Highlights-Health-Well-being-Greece.pdf. Accessed July, 16 2019

Zhang X, Yu B, He T, Wang P (2018) Status and determinants of health services utilization among elderly migrants in China. Glob Health Res Policy 3:8-8. doi:10.1186/s41256-018-0064-0

Figure 1. Preventive Health Services Utilization score (PHSUs) and Health Care Services Utilization score (HCSUs) in the sample of 16,120 European adults, aged 50+ years, across eleven European countries.
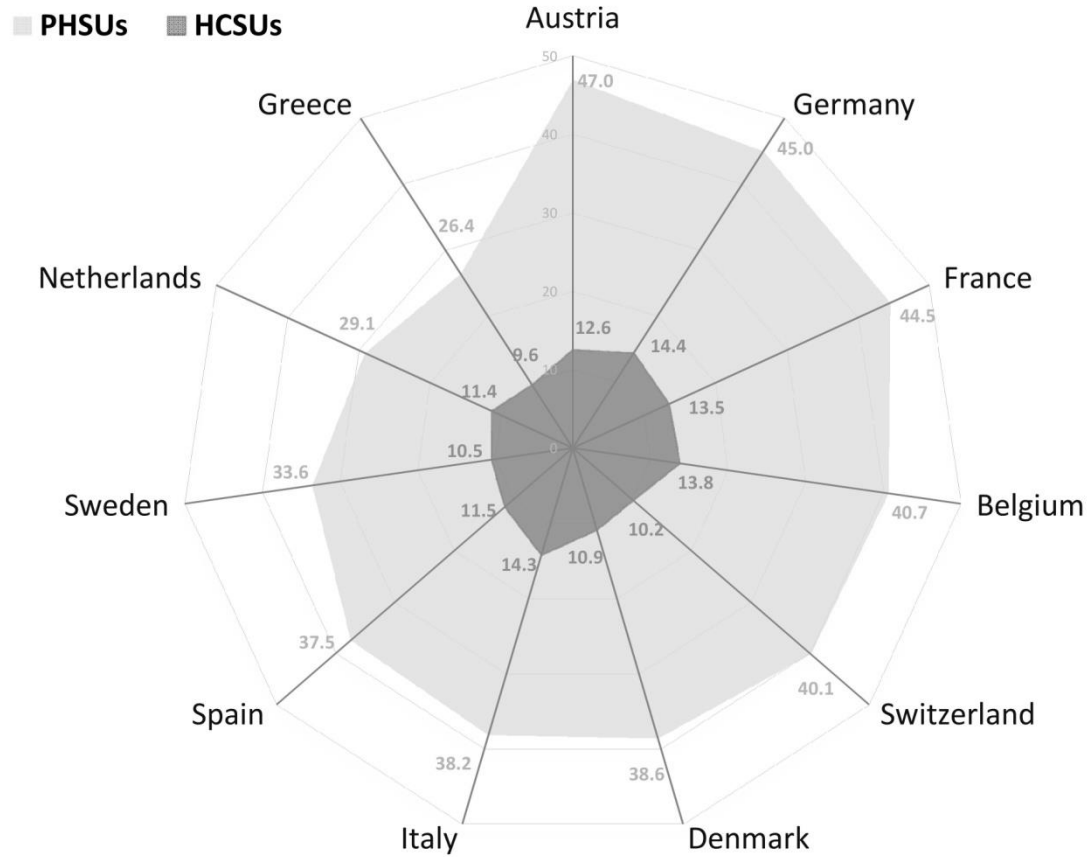
Footnote to Figure 1:
PHSUs: Preventive Health Services Utilization score; HCSUs: Health Care Services Utilization score.
The overall mean PHSU score was 39.9 (95%CI: 39.4-40.4) and in HCSU score 12.4 (95%CI: 12.2-12.7). Estimations were based on complex samples.

Table 1. Descriptive characteristics of 16,120 adults, aged 50+ years in the SHARE study (wave I, 2004/5).

		n	%
Gender	*men*	6,981	43.3
	women	9,139	56.7
Age, *years*	*50-59*	6,110	37.9
	60-69	5,297	32.9
	70-79	3,391	21.0
	80+	1,322	8.2
mean ± standard deviation (min-max)		64.2±9.8 (50-100)	
Education, *years*	*0-7*	5,029	31.5
	8-12	5,986	37.4
	13+	4,975	31.1
mean ± standard deviation (min-max)		10.0±4.4 (0-21)	
Living status	*alone*	4,148	25.8
Chronic diseases	*3+*	3,294	20.4
Retirement status	*retired*	7,912	49.1
Household income [a]	*lower quartile*	3,886	24.1
European region	*north*	2,872	17.8
	central	8,590	53.3
	south	4,658	28.9

[a] Income was classified using country-specific quartiles for all participants in SHARE survey in 2004/5.

Table 2. Components and their frequency of Preventive Health Services Utilization score (PHSUs) in 16,120 European adults, aged 50+ years.

12 PHSUs Components	Relevant questions	n	Estimated population	
			N	weight % (95%CIs)
Seeing dentist/dental hygienist	*During the last twelve months, have you seen a dentist or a dental hygienist? Was that for routine control or prevention, for treatment, or for both?*	6,919	21,620,009	38.8 (37.6-40.1)
Having a general practitioner (GP) for advice and prevention	*For medical advice and prevention: Do you have a "general practitioner" (i.e. a doctor you usually turn to for your common health problems)?*	12,982	50,602,874	90.6 (90.1-91.2)
GP assesses physical activity	*How often does your general practitioner: 1) ask how much physical activity you do?*	7,428	27,566,310	49.4 (48.1-50.7)
GP advises on regular exercise	*2) tell you that you should get regular exercise?*	6,462	24,855,170	44.4 (43.1-45.9)
GP assesses body weight	*3) check your weight?*	7,370	27,773,204	49.7 (48.5-51.1)
GP asks about drug use or prescription	*4) ask you about any drugs you take, either bought over-the-counter or drugs prescribed by another doctor?*	7,060	26,162,925	47.0 (45.6-48.3)
Having flu vaccination	*In the last year, have you had a flu vaccination?*	5,544	20,342,670	36.4 (35.1-37.8)
Having a mammogram	*If you are a woman: In the last two years, have you had a mammogram (x-ray of the breast)?*	5,021	16,446,066	29.6 (28.3-30.9)
Having sigmoidoscopy or colonoscopy	*Have you ever had a sigmoidoscopy or colonoscopy?*	3,283	12,355,771	22.0 (21.0-23.4)
Tested for hidden blood in stool	*In the last ten years, have you had a test that detects blood in your stool?*	3,139	13,890,034	24.8 (23.8-25.9)
Referral to a physiotherapy or exercise program for joint pain	*Have you ever been ... ... sent to physiotherapy or an exercise program for your joint pain?*	3,633	13,348,239	23.8 (22.7-25.1)
Referral to an orthopedic surgeon for joint pain	*Have you ever been ... ... sent by a doctor to an orthopedic surgeon for the joint pain that you presently have?*	2,788	11,980,170	21.4 (20.2-22.6)

GP: General Practitioner; 95% CIs: 95% confidence intervals.

Table 3. Components and their frequency of Health Care Services Utilization score (HCSUs) in the sample of 16,120 European adults, aged 50+ years.

16 HCSUs Components	Relevant questions	scoring	n	N	weight % (95%CIs)
				Estimated population	
Seeing medical doctor	*How often seen or talked to medical doctor last 12 months?*	*0: 0 times*	2,247	6,680,276	12.0 (11.2-12.8)
		1: 1-2	3,806	11,414,469	20.5 (19.4-21.5)
		2: 3-6	5,326	19,021,370	34.1 (32.8-35.4)
		3: 7-12	2,632	10,682,171	19.1 (18.1-20.3)
		4: 13+	1,755	7,994,301	14.3 (13.4-15.4)
Patient in hospital	*How often have you been a patient in a hospital overnight during the last twelve months? (times last year)*	*0: 0 times*	13,799	48,477,918	86.9 (85.9-87.8)
		1: 1	1,406	5,361,998	9.6 (8.8-10.5)
		2: 2+	561	1,952,670	3.5 (3.0-4.0)
Patient in a nursing home	*In a nursing home or weeks stayed in a nursing home*	*0: 5 ή no*	15,663	55,277,074	99.1 (98.7-99.3)
		1: yes temporarily or up to 25 weeks	41	145,614	0.3 (0.1-0.5)
		2: yes or 26+ weeks	62	369,898	0.7 (0.4-1.0)
Received home care	*received home care: nursing or personal care or weeks received professional nursing care*	*0: not selected*	15,297	54,031,343	96.8 (96.3-97.3)
		1: selected or up to 25 weeks	350	1,349,650	2.4 (2.0-2.9)
		2: selected or 26+ weeks	119	411,593	0.8 (0.5-1.1)
	received home care: domestic tasks or weeks received help from paid professionals	*0: not selected*	15,153	53,868,400	96.6 (96.0-97.0)
		1: selected or up to 25 weeks	237	632,806	1.1 (0.9-1.4)
		2: selected or 26+ weeks	376	1,291,381	2.3 (1.9-2.8)
	received home care: meals-on-wheels or weeks received meals-on-wheels	*0: not selected*	15,630	55,251,352	99.0 (98.7-99.3)
		1: selected or up to 25 weeks	53	229,305	0.4 (0.2-0.7)
		2: selected or 26+ weeks	83	311,930	0.6 (0.4-0.9)
	received care from private providers type of received care from private providers	*0: 5 ή no*	14,170	50,693,080	90.9 (90.1-91.5)
		1: yes or up to 1-2 providers	1,432	4,558,929	8.1 (7.5-8.9)
		2: yes ή 3-8	164	540,577	1.0 (0.8-1.2)
Seeing Specialists	*During the last twelve months, have you / consulted any of the specialists mentioned on card 12? (card12)*	*0: no*	9,338	30,588,030	54.8 (53.5-56.2)
		1: yes	6,428	25,204,556	45.2 (43.8-46.5)
Seeing dentist / dental hygienist	*During the last twelve months, have you seen a dentist or a dental hygienist?*	*0: no*	6,813	26,372,885	47.3 (46.0-48.5)
		1: yes	8,953	29,419,701	52.7 (51.5-54.0)
Total nights stayed in hospital	*How many nights altogether have you spent in hospitals during the last twelve months?*	*0: 0*	13,805	48,501,258	86.9 (86.0-87.8)
		1: 1-2	479	1,541,861	2.8 (2.4-3.2)
		2: 3-6	547	1,782,929	3.2 (2.8-3.7)
		3: 7-12	406	1,638,852	2.9 (2.5-3.5)
		4: 13+	529	2,327,685	4.2 (3.6-4.8)
Reasons for having stayed in hospital	*reasons for having stayed in hospital 1. inpatient surgery/ 2. medical tests or non-surgical treatments (except mental health)/ 3. mental health problems*	*0: 0*	13,800	48,482,815	86.9 (85.9-87.8)
		1: 1	1,857	6,950,190	12.5 (11.6-13.4)
		2: 2	105	343,409	0.6 (0.4-0.8)
		3: 3	4	16,172	0.03 (0.02-0.11)
Times overnight in hospital for surgery	*How often have you stayed overnight in a hospital for a surgery during the last twelve months?*	*0: 0*	15,426	54,648,566	97.9 (97.6-98.3)
		1: 1	163	599,974	1.1 (0.8-1.4)
		2: 2+	177	544,046	1.0 (0.8-1.2)
Had inpatient surgery last 12 months	*During the last twelve months, have you had any of these surgeries as an inpatient?(card 14)*	*0: no*	14,762	52,069,729	93.3 (92.6-94.0)
		1: yes	1,004	3,722,858	6.7 (6.0-7.4)
Times overnight in hospital for psychiatric problems	*How often have you stayed overnight in a hospital for mental health problems during the last twelve months?*	*0: 0*	15,753	55,750,205	99.9 (99.8-100.0)
		1: 1	9	31,091	0.1 (0.02-0.14)
		2: 2+	4	11,290	0.02 (0.01-0.11)
Outpatient surgery last 12 months	*During the last twelve months, have you had outpatient surgery?*	*0: no*	14,909	52,912,051	94.8 (94.2-95.4)
		1: yes	857	2,880,535	5.2 (4.6-5.8)
Times had outpatient surgery	*How often have you had outpatient surgery during the last twelve months?*	*0: 0*	14,909	52,912,051	94.8 (94.2-95.4)
		1: 1	709	2,431,007	4.4 (3.9-4.9)
		2: 2+	148	449,528	0.8 (0.6-1.1)

Table 4. Preventive Health Services Utilization score (PHSUs) and Health Care Services Utilization score (HCSUs) in the sample of 16,120 European adults, aged 50+ years, between European regions.

European region	n	Estimated population	Preventive Health Services Utilization score (PHSUs) [a]		Health Care Services Utilization score (HCSUs) [a]		Δ-difference	
			weighted mean	95% CI	weighted mean	95% CI	weighted mean	95% CI
North	2,829	3,149,044	35.4	34.5-36.3	10.6	10.2-11.0	24.7	23.8-25.6
Central	8,433	29,759,673	42.9	42.1-43.6	15.6	13.2-13.9	29.3	28.6-30.1
South	4,504	22,883,670	36.6	35.7-37.4	11.2	10.8-11.6	25.4	24.5-26.2

PHSUs: Preventive Health Services Utilization score; HCSUs: Health Care Services Utilization score; 95%CI: 95% confidence interval.

[a] Scores range from 0 to 100, with a higher score indicating greater use of health services. The overall mean PHSU score was 39.9 (95%CI: 39.4-40.4), in HCSU score 12.4 (95%CI: 12.2-12.7) and in Δ-difference 27.4 (95%CI: 26.9-27.9). Estimations were based on complex samples (ancova).

Table 5. Preventive Health Services Utilization score (PHSUs) and Health Care Services Utilization score (HCSUs) in the sample of 16,120 European adults, aged 50+ years, according to their characteristics.

		Preventive Health Services Utilization score (PHSUs)[a]		Health Care Services Utilization score (HCSUs)[a]		Δ-difference	
		Mean (stand. error)	*p*-value	Mean (stand. error)	*p*-value	Mean (stand. error)	*p*-value
Gender	*men*	34.02 (0.24)	<0.001	11.27 (0.11)	<0.001	22.75 (0.23)	<0.001
	women	40.84 (0.21)		12.22 (0.09)		28.62 (0.21)	
Age, *years*	*50-59*	37.77 (0.30)	<0.001 [b]	11.46 (0.14)	<0.001 [b]	26.30 (0.29)	<0.001 [b]
	60-69	38.67 (0.27)		11.51 (0.13)		27.16 (0.27)	
	70-79	37.82 (0.36)		12.30 (0.17)		25.52 (0.36)	
	80+	35.44 (0.57)		13.38 (0.26)		22.07 (0.57)	
Education, *years*	*0-7*	35.53 (0.29)	<0.001 [b]	10.96 (0.13)	<0.001 [b]	24.57 (0.29)	<0.001 [b]
	8-12	38.29 (0.25)		11.90 (0.11)		26.38 (0.25)	
	13+	39.79 (0.28)		12.56 (0.13)		27.23 (0.28)	
Living status	*alone*	37.22 (0.32)	0.020	12.19 (0.15)	0.004	25.03 (0.32)	<0.001
	with partner/spouse	38.12 (0.18)		11.68 (0.08)		26.44 (0.18)	
Chronic diseases	*0*	29.76 (0.30)	<0.001 [b]	7.47 (0.14)	<0.001 [b]	22.29 (0.31)	<0.001 [b]
	1-2	38.72 (0.21)		11.91 (0.09)		26.81 (0.21)	
	3+	46.19 (0.35)		17.15 (0.16)		29.04 (0.35)	
Retirement status	*not retired*	35.38 (0.24)	<0.001	11.74 (0.11)	0.396	23.64 (0.24)	<0.001
	retired	40.49 (0.24)		11.89 (0.11)		28.61 (0.24)	
Household income	*low*	36.82 (0.34)	0.003 [b]	11.61 (0.15)	0.074 [b]	25.21 (0.33)	0.030 [b]
	average	38.21 (0.21)		11.81 (0.09)		26.40 (0.21)	
	high	38.27 (0.32)		12.00 (0.15)		26.26 (0.32)	

[a] Scores range from 0 to 100, with a higher score indicating greater use of health services.
Comparisons were examined using multivariate analysis of covariance. Excluding each time the current characteristic, as covariates were used gender, age (year categories), education (year categories), living status chronic diseases, retirement status, income and European regions.
[b] Polynomial (linear) trend analysis.