Combined Healthy Behaviors and Healthcare Services Use in Older Adults

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Introduction: Data on the combined impact of healthy behaviors on healthcare use in older adults are limited.

Methods: Study with community-dwelling individuals aged ≥60 years from the Spanish Seniors-ENRICA cohort, recruited in 2008–2010, followed through 2012–2013, and analyzed in 2016 (n=2,021). At baseline, the following healthy behaviors were self-reported: three traditional (never smoking, being physically active, having a healthy diet), and three emerging (sleeping 7–8 hours/day, sitting <8 hours/day, not living alone). Outcomes were: self-reported polypharmacy (five or more drugs per day), primary care physician visits (one or more per month), medical specialist visits (more than one per year), and hospitalization (one or more in the last year). The associations between baseline healthy behaviors and healthcare services used in 2012–2013 were summarized with ORs and 95% CIs from multiple logistic regression, adjusting for demographics, lifestyles, comorbidities, and baseline health services used.

Results: Most single healthy behaviors were associated with lower use of most health services. Compared with participants with zero or one healthy behavior, those with five or six healthy behaviors showed lower risk of polypharmacy (OR=0.46, 95% CI=0.24, 0.85, p-trend=0.001), visits to the primary care physician (OR=0.50, 95% CI=0.26, 0.96, p-trend=0.013), and hospitalization (OR=0.50, 95% CI=0.24, 1.01, p-trend=0.016). No association was found with visits to the medical specialist.

Conclusions: The combination of five to six healthy behaviors in older adults is associated with half the risk of polypharmacy and using several healthcare services. In an era of constrained resources in most countries, this information may help inform health policy to control healthcare spending in the future.

INTRODUCTION

Older adults are the population subgroup that has been growing the fastest in recent decades, with subsequent increasing prevalence of chronic disease and disability, and greater demand for healthcare services (www.who.int/ageing/events/world-report-2015-launch/en/).[1–4] In Spain, a recent study found that 65% of people aged ≥65 years went to primary care physicians once a month, 16.4% had been hospitalized at least once a year, and 55.7% had polypharmacy (five or more drugs per day).[2] These data are especially important considering that the Spanish National Health System provides universal health care to all its citizens under a tax-financed scheme, being free of charge at the moment of use. Primary care physicians act as gatekeepers to access to specialist care, and citizens have to pay a percentage of the cost of prescription medicines that depends on their income or pensioner state.

Many factors influence healthcare utilization,[5] including sociodemographic characteristics, health system characteristics and accessibility, and comorbidity. More recently other factors, including lifestyles, have been studied.[6]

Some studies have found a protective association of several lifestyles with mortality or cardiovascular risk in adults, including the elderly.[7–12] However, few studies have reported the association of a few isolated behaviors,[13,14] or the combination of some biological risk factors[15] with healthcare utilization.

This study is the first to examine the combined impact of a number of traditional healthy behaviors (non-smoking, physical activity, and adequate diet) and emerging healthy behaviors (adequate sleep duration, no excessive sedentary time, and cohabitation) on the use

of common healthcare services (polypharmacy, visits to the primary care physician or medical specialist, and hospitalization) in the older population in Spain. This information is of high clinical and public health relevance because (1) the proportion of older adults who adhere to the traditional healthy behaviors is low,[10,16] (2) interventions that cover multiple health behaviors may be more effective than those addressing single behaviors,[17] and (3) it could have policy implications regarding healthcare costs.

METHODS

Study Population

Data were taken from the Seniors-ENRICA (study on Nutrition and Cardiovascular Risk in Spain) cohort. Briefly, the cohort was established in 2008–2010 with 2,519 individuals selected through stratified random sampling from the non-institutionalized population aged ≥60 years in Spain.[18] At baseline, data were gathered in three stages. First, a phone interview to obtain sociodemographic factors, health status, lifestyle, morbidity, and health services used; second, a home visit to collect blood samples; and third, another home visit to perform physical examination and record habitual diet and prescribed medication.

In 2012–2013 (median follow-up 3.5 years), updated data was collected on a second wave of 2,021 participants, including healthcare utilization, physical examination, and diet.

The study protocol was approved by the Clinical Research Ethics Committee of *La Paz* University Hospital (Madrid) and patients provided written informed consent.

Measures

Participants self-reported traditional health behaviors. First, whether they were never a smoker, former smoker, or current smoker. Physical activity was evaluated with a validated index that combines activity at work (sedentary, standing, manual, heavy manual, unemployed) and the hours spent in sports and cycling at leisure time (not active, <3.5 hours/week, 3.5 to ≤7.0 hours/week, or >7 hours/week).[19] Then the index assigns participants a score from one to four: one= inactive, two= moderately inactive, three= moderately active, and four= active.[20] Diet was assessed using a computerized dietary history validated in Spain.[21] Diet health was calculated with the Mediterranean Diet Adherence Screener (MEDAS),[22] which scores from zero to 14 depending on the food consumed, quantity, and frequency, where a higher score indicates better adherence. MEDAS was classified into sex-specific tertiles. Those in the highest tertile were considered as adherent.

Regarding non-traditional health behaviors, sleep duration was obtained by asking: *How many hours do you usually sleep per day (including both nighttime and daytime)?* Sedentary behavior was estimated by asking: *In a typical week during the past year, how many hours do you spend on each of the following activities: seated and watching video or TV, seated at the computer, seated on transport to work (as a driver or passenger in the car, subway, bus...), seated while reading or listening to music (except during transport), and seated or lying in the sun in summer and winter?* Participants were also asked: *On average, how many minutes it takes you to have breakfast, lunch at noon and dinner (seated while eating)?* Participants were then categorized according to whether they were sitting more or less than 8 hours a day.[23] Social network was assessed by asking whether participants lived alone or not.[24]

A healthy behavior score was developed where each individual was given one point for each of the following six positive behaviors: never a smoker, very or moderately physically active,

healthy diet score (highest MEDAS tertile), sleeping 7–8 hours/day, sitting time <8 hours/day, and not living alone. This categorization was in accordance with previous prospective studies and reviews.[7–10,25]

Outcome variables were the utilization of healthcare services in 2012–2013, obtained by asking and then dichotomizing the response: (1) the number of medications currently being taken (five or more drugs per day [polypharmacy][3,26] versus less); (2) frequency of visits to primary care physician (one or more per month versus less); (3) admission to a hospital at least once in the past year; and (4) visits to medical specialist (more than one per year versus less). Reported medications use was checked by asking the participants in the second home visit to show the drug packages they had. Cutoff points for health services used were based on previous studies, including the Spanish National Health Survey, took into account the frequency of healthcare use in Spain, and in the case of polypharmacy the cutoff value used was reported to be the best to identify older people at risk of harm.[2,3,26,27]

Baseline information on potential confounders of the associations was collected. Sociodemographic variables included age, sex, and educational attainment (primary or less, secondary, or university). Total energy intake (kcal/day) was estimated from the dietary history.[21] Alcohol consumption was obtained with the frequency–quantity scale used in the Spanish National Health Survey.[28] Participants were classified as excessive drinkers (>24 g/day of alcohol intake in women, and >40 g/day in men) and non-excessive drinkers (never drinker, former drinker, moderate drinker). The following self-reported chronic diseases diagnosed by the physician were considered: asthma or chronic bronchitis, arthritis, osteoarthritis, hip fracture, depression (in need of treatment), cardiovascular disease (ischemic heart disease, stroke, or heart failure), and cancer at any site.[29] Subjects were

classified into two groups: zero to one and two or more comorbidities. Weight and height were measured using standardized procedures, and BMI was weight (kg) divided by squared height (m^2).[30] Blood pressure was measured three times using standardized conditions and validated devices.[31] Hypertension was defined as current blood pressure medication or mean systolic blood pressure $\geq$140 mmHg,[31,32] hypercholesterolemia as a previous diagnosis, total cholesterol >200 mg/dL or lipid-lowering treatment, and diabetes mellitus as fasting glucose $\geq$126 mg/dL or current treatment.[15]

Statistical Analysis

This study analysis was performed in 2016. Among the 2,519 participants, 498 were excluded for having missing values for health behaviors or use of healthcare services. Therefore, the analyses were performed with 2,021 subjects. The associations between each health behavior or the behaviors score in 2008–2010 and healthcare services use in 2013 were summarized with ORs and 95% CIs, obtained from multiple logistic regression. P-values for linear trend were estimated by modeling the behaviors score as a continuous variable. Two models were built adjusting for baseline confounders. Model 1 was adjusted for age, sex, educational attainment, and baseline use of the corresponding healthcare service (as defined above). Model 2 was additionally adjusted for total energy intake, alcohol consumption, comorbidities, BMI, hypertension, diabetes, and hypercholesterolemia. Given the limited number of events, parsimonious models were built.[33] Because no significant interactions were found between study results and age and sex, results are presented for the total study sample.

Lastly, population attributable risks (PAR)[34] were calculated using the formula: PAR = Pe (RRe-1) / [1 + (Pe (RRe-1))], where Pe is the proportion of individuals who lack an optimal

number of healthy behaviors (i.e., only having zero to four) and RRe is the relative risk (hazard ratio) of using healthcare services associated with that level of healthy behaviors.

Statistical significance was set at two-sided $p<0.05$. The analyses were conducted with Stata/SE, version 13.

RESULTS

Participants mean age at baseline was 68.6 years (52% women). Participants who use healthcare services more frequently had in general significantly higher mean age, less education, lower energy intake, higher mean BMI, and higher frequency of comorbidities and diabetes than those using services less frequently (Table 1). Also, participants with polypharmacy were more frequently physically inactive, not sleeping 7–8 hours, and living alone than those using less than five drugs per day (Appendix Table 1, available online). Those who visit the primary care physician and the medical specialist more frequently were more likely to be inactive; and those who have been hospitalized one or more times in a year had a higher percentage of sedentary behavior.

Never smoking was associated with fewer hospitalizations (fully adjusted OR=0.69, 95% CI=0.50, 0.96) (Table 2). Physical activity was associated with a reduced risk of polypharmacy (fully adjusted OR=0.72, 95% CI=0.54, 0.94), visits to the primary care physician (fully adjusted OR=0.80, 95% CI=0.60, 1.00), and visits to the medical specialist (fully adjusted OR= 0.78, 95% CI=0.61, 0.99). Non-sedentary behavior was associated with lower risk of hospitalization (OR=0.58, 95% CI=0.39, 0.86). Most of the rest of healthy behaviors also showed a tendency to lower use of most health services (Table 2). Combo of two specific behaviors on specific services was more salient for polypharmacy (e.g., physical

activity with sleeping 7–8 hours/day, physical activity with never smoking, and physical activity with cohabitation), yielded a reduced risk of this outcome (fully adjusted OR=0.50, 0.59, and 0.57, respectively, all with $p<0.01$). The combo of these three behaviors was also associated with a lower risk of polypharmacy (OR=0.41, $p<0.01$).

An increasing number of healthy behaviors was associated with a progressively lower use of health services (p-trend <0.05) except for visits to medical specialist (Table 3). In the fully adjusted model, the aggregation of five to six healthy habits (versus zero to one) was associated with lower risk of polypharmacy (OR=0.46, 95% CI=0.24, 0.85) and of visits to the primary care physician (OR=0.50, 95% CI=0.26, 0.96), and was marginally associated with fewer hospitalizations (OR=0.50, 95% CI=0.24, 1.01).

Evaluated ordinally, each additional healthy behavior was associated with a 18% lower risk of polypharmacy (OR=0.82, 95% CI=0.74, 0.92, p-trend=0.001); 13% lower risk of primary care physician visits (OR=0.87, 95% CI=0.77, 0.97, p-trend=0.019); and 15% lower risk of hospitalization (OR=0.85, 95% CI=0.74, 0.97, p-trend=0.019) (Figure 1).

Lastly, PARs indicate that 42.7% of polypharmacy, 28.9% of monthly primary care physician visits, and 21.6% of annual hospitalizations were attributable to the lack of an optimal healthy behavior profile (i.e., only having zero to four healthy behaviors).

DISCUSSION

This study carried out in a cohort of community-dwelling older adults in Spain shows for the first time that the combination of five or six healthy habits is associated with a 50% reduction of the use of several common health services. Importantly, the combination of healthy habits

impacted services used in a dose–related fashion: the more healthy habits a person follows, the fewer the healthcare services utilizations, except for visits to a medical specialist. It is possible that people who practice many healthy behaviors are more proactive or assertive in demanding specialist healthcare when they perceive it is warranted/ needed. Also, 20%–40% of the polypharmacy or the higher use of services in the older population is potentially avoidable (or may be postponed) by meeting all five to six healthy habits. This illustrates the great potential benefit of lifestyle promotion in terms of healthcare utilization and potential saving.

Some studies[35] have found an increased risk among older smokers (versus never smokers) for poorer health ratings, impaired mobility, and selected medication use. This is consistent with the present findings that never smoking, along with a non-sedentary lifestyle, is associated with lower hospitalization. Also, an inverse association has been reported between levels of physical activity and multimorbidity in adults, including older individuals,[36–39] which may explain the lower level of polypharmacy and frequent visits to specialists in individuals who were physically active as found in the present study. According to one study among older adults with polypharmacy[40] those who lived with a partner were more knowledgeable of the indication of all their prescribed medications than those living alone. This is consistent with the marginally lower polypharmacy risk among older adults not living alone in the present study. Regarding sleep duration, some studies have shown that <6 hours of sleep is a risk factor for cardiovascular disease risk.[41] This could help explain the present findings that the elderly not sleeping 7–8 hours/day have more frequent polypharmacy. Although no significant association was found between diet and any particular habit (only marginally lower use of primary care physician), other studies have found that the Mediterranean diet reduces the risk of cardiovascular events,[42] which is compatible with that marginal

association. Lastly, unfortunately no similar studies are available to compare the combined impact of these healthy behaviors on health services used.

Limitations

The strengths of this study include the adjustment for many potential confounders. This study also presents some limitations. Twenty percent of the sample was lost to follow-up. Nevertheless, the baseline sociodemographic, lifestyle, and clinical characteristics of individuals lost to follow-up and those remaining in the study were similar. Thus, among the 2,021 subjects without follow-up losses, there were 52% of women, mean age was 68.7 years, 54.1% had primary or less studies, 14.5% had more than two diseases, mean BMI was 28.5, hypertension 47.9%, diabetes 15.8%, and hypercholesterolemia 70.1%. Among the 498 participants who had follow-up losses, 57% were women, average age was 68.8 years, 56% had primary studies or less, 15.3% had more than two diseases, mean BMI was 28.6, hypertension 41.7%, diabetes 15.5%, and hypercholesterolemia 70.9%. Lifestyle was self-reported, which may have led to recall bias, particularly for assessing physical activity and non-traditional health behaviors. However, similar measures of these behavior variables have shown adequate validity.[8] Diet was also self-reported so some recall bias may exist, which usually leads to underestimating the study association. Health services used was also self-reported, but it has been found to be a reliable method.[43] However, further studies using more objective and standardized measures of physician visits and utilization of other health services could strengthen results of this and similar studies. Data on long-term patterns of healthy behaviors were also lacking, and although the follow-up was rather short, some changes over time are still possible and would likely have led to underestimation of the protective effects observed. Hospitalization was significantly associated with the combination of four habits and only marginally significant with five to six habits, probably due to

insufficient sample size. Given that polypharmacy is correlated with visits to primary care

and specialists, and that access to specialist visits were controlled by primary care physicians,

sensitivity analyses were run with additional adjustment for these variables, and found that

main results presented in Table 3 did not materially change (data not shown). Although the

study entailed a prospective design, the authors have not used incident outcomes because

individuals with the study outcomes at baseline were not excluded but only adjusted for.

Thus, the study results may reflect a cross-sectional association. Also, because of short

follow-up, reverse causality cannot be completely ruled out, and future studies with longer

follow-up need to replicate these results. Nevertheless, in a sensitivity analysis excluding

cardiovascular and diabetes at baseline, the main results were practically unchanged (data not

shown). Overall, these limitations did not preclude the observation of a clear association

between combination of healthy behaviors and lower use of health care. Lastly, it is worth

noting that the authors only studied more or less frequent healthcare services used according

to commonly used criteria, and frequent attendance is not synonymous of abuse or

inappropriate delivery of services, these are problems that require specific studies.

CONCLUSIONS

This study in Spanish older adults shows that adherence to a combination of healthy

behaviors is independently associated with half the risk of polypharmacy, frequent visits to

the primary care physician, and hospitalization. This is important given that, for example,

polypharmacy affects 36% of older people in the present study, and increases the risk of

using inadequate medications, adverse reactions, and lower treatment adherence.[44] Likewise,

the decrease of primary care visits and hospitalizations associated with a healthy lifestyle

could lead to improved care due to reduced workload, shorter waiting lists,[45] and a reduction

of complications from hospitalization.[46] Hence, the information of this study may have

implications for policy to control healthcare spending and support better behavioral health.

Notwithstanding, further research with cohort studies should be done to confirm these results.

ACKNOWLEDGMENTS

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LIST OF FIGURES

Figure 1. Association between each one additional healthy behavior and selected healthcare services use in older people.

Notes: Healthy behaviors: never smoking, being physically active, having a healthy diet, sleeping 7–8 hours/day, sitting <8 hours/day, and not living alone. Polypharmacy: currently taking five or more drugs daily. Primary care physician visits: one or more time per month. Medical specialist visits: more than one time per year. ORs were obtained from fully adjusted models (Table 3 footnote).

Table 1. Baseline Characteristics of Participants in the Seniors-ENRICA Cohort, According to Healthcare Services Utilization

Baseline characteristics	Use of healthcare services in 2012–2013											
	Number of medications			Primary care physician visits			Hospitalization in the last year			Medical specialist visits		
N=2,021	≥5/ day	<5/ day	*p*-value	≥1/ month	<1/ month	*p*-value	Yes	No	*p*-value	>1/ year	≤1/ year	*p*-value
Baseline events, n	257	1,764		436	1,585		273	1,748		589	1,432	
Follow-up events, n	733	1,288		446	1,575		279	1,742		752	1,269	
Age, years (SD)	70.6 (6.7)	67.5 (5.8)	**<0.001**	69.6 (6.6)	68.3 (6.2)	**<0.001**	69.9 (7.0)	68.4 (6.2)	**0.001**	68.6 (6.2)	68.6 (6.4)	0.657
Sex, n (%)												
Women	399 (54.4)	652 (50.6)		243 (54.5)	808 (51.3)		141 (50.5)	910 (52.2)		381 (50.6)	670 (52.8)	
Men	334 (45.5)	636 (49.3)	0.099	203 (45.5)	767 (48.7)	0.235	138 (49.4)	832 (47.7)	0.597	371 (49.3)	599 (47.2)	0.354
Educational level, n (%)												
Primary or less	460 (62.7)	634 (49.2)		292 (65.4)	802 (50.9)		168 (60.2)	926 (53.1)		387 (51.5)	707 (55.1)	
Secondary	141 (19.2)	359 (27.8)		78 (17.4)	422 (26.8)		62 (22.2)	438 (25.1)		174 (23.1)	326 (25.7)	
University	132 (18.0)	295 (22.9)	**<0.001**	76 (17.04)	351 (22.3)	**<0.001**	49 (17.5)	378 (21.7)	0.082	191 (25.4)	236 (18.6)	**0.001**
Alcohol intake, n (%)												
Excessive drinkers	52 (7.2)	115 (9.0)		27 (6.1)	140 (9.0)		24 (8.9)	143 (8.3)		61 (8.2)	106 (8.5)	
Non-excessive drinkers	663 (92.7)	1,161 (90.9)	0.179	414 (93.8)	1,410 (0.9)	0.052	246 (91.1)	1,578 (91.6)	0.749	679 (91.7)	1,145 (91.5)	0.858
Energy kcal/d, (SD)	1,958.8 (638.0)	2,104.7 (748.4)	**<0.001**	1,983.0 (734.3)	2,074.5 (766.9)	**0.011**	2,044.5 (821.0)	2,054.2 (748.9)	0.819	2,018.3 (731.0)	2,075.5 (777.8)	0.068
Comorbidities, n (%)												

≥2 diseases	158 (21.5)	108 (8.3)		88 (19.7)	178 (11.3)		56 (20.0)	210 (12.0)		139 (18.5)	153 (12.1)	
<2 diseases	575 (78.4)	1,180 (91.6)	**<0.001**	358 (80.2)	1,397 (88.7)	**<0.001**	223 (79.9)	1,532 (87.9)	**<0.001**	613 (81.5)	1,116 (87.9)	**<0.001**
Risk factors, n (%)												
BMI, kg/m^2 (SD)	29.4 (4.6)	27.9 (4.0)	**<0.001**	29.3 (4.7)	28.2 (4.2)	**<0.001**	28.9 (4.2)	28.4 (4.3)	0.068	28.5 (4.2)	28.5 (4.4)	0.741
Hypertension	366 (50.2)	597 (46.6)	0.117	215 (48.5)	748 (47.8)	0.784	132 (48.0)	831 (47.9)	0.988	350 (46.9)	613 (48.6)	0.473
Diabetes mellitus	210 (28.9)	106 (8.3)	**<0.001**	90 (20.3)	226 (14.5)	**0.003**	56 (20.1)	260 (15.0)	**0.032**	141 (19.0)	175 (13.9)	**0.002**
Hypercholesterolemia	507 (69.3)	907 (70.6)	0.545	310 (69.5)	1104 (70.3)	0.727	193 (69.1)	1,221 (70.3)	0.695	529 (70.5)	885 (69.9)	0.786

Notes: Boldface indicates statistical significance (*p*<0.05).

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Table 2. Association Between Each Healthy Behavior and Healthcare Utilization in the Seniors-ENRICA Cohort

Baseline healthy behaviors N=2,021	Use of health care services in 2012-2013							
	Polypharmacy		Primary care physicians visits		Hospitalization in the last year		Medical specialists visits	
	Event/n	OR (95% CI)	Event/n	OR (95% CI)	Event/n	OR (95% CI)	Event/n	OR (95% CI)
Model 1								
Never smoker	429/1,182	0.81 (0.64–1.04)	264/1,182	0.82 (0.62–1.08)	150/1,182	**0.70 (0.52–0.96)**	429/1,182	0.95 (0.76–1.18)
Physically active	114/439	**0.63 (0.48–0.82)**	76/439	0.75 (0.56–1.00)	49/439	0.81 (0.58–1.14)	142/439	**0.75 (0.59–0.95)**
Mediterranean diet	165/482	0.86 (0.68–1.10)	92/482	0.84 (0.64–1.11)	63/482	0.92 (0.67–1.25)	189/482	1.09 (0.88–1.36)
Sleeping 7–8 hours/day	236/762	**0.78 (0.63–0.97)**	152/762	0.87 (0.69–1.10)	106/762	1.07 (0.82–1.39)	279/762	0.99 (0.82–1.20)
Not sedentary behavior	646/1,807	0.77 (0.56–1.07)	397/1,807	0.85 (0.59–1.23)	236/1,807	**0.58 (0.40–0.85)**	661/1,807	0.88 (0.65–1.19)
Not living alone	590/1,693	0.84 (0.63–1.11)	374/1,693	1.19 (0.86–1.63)	228/1,693	0.89 (0.63–1.27)	631/1,693	1.01 (0.77–1.32)
Model 2								
Never smoker	429/1,182	0.77 (0.59–1.01)	264/1,182	0.76 (0.57–1.01)	150/1,182	**0.69 (0.50–0.96)**	429/1,182	0.96 (0.76–1.20)
Physically active	114/439	**0.72 (0.54–0.94)**	76/439	0.80 (0.60–1.00)	49/439	0.89 (0.64–1.26)	142/439	**0.78 (0.61–0.99)**
Mediterranean diet	165/482	0.90 (0.70–1.17)	92/482	0.78 (0.59–1.04)	63/482	0.89 (0.64–1.22)	189/482	1.10 (0.88–1.38)
Sleeping 7–8 hours/day	236/762	0.82 (0.65–1.03)	152/762	0.87 (0.68–1.11)	106/762	1.06 (0.81–1.40)	279/762	0.99 (0.82–1.22)
Not sedentary behavior	646/1,807	0.89 (0.63–1.26)	397/1,807	0.89 (0.61–1.30)	236/1,807	**0.58 (0.39–0.86)**	661/1,807	0.89 (0.66–1.23)
Not living alone	590/1,693	0.79 (0.58–1.06)	374/1,693	1.17 (0.84–1.63)	228/1,693	0.84 (0.58–1.21)	631/1,693	1.05 (0.79–1.38)

Notes: Boldface indicates statistical significance ($p<0.05$). Model 1: Logistic regression model adjusted for age, sex, level of education, and baseline use of the corresponding healthcare service. Model 2: Logistic regression model adjusted as Model 1 plus energy, alcohol consumption, comorbidities, BMI, hypertension, diabetes mellitus, and hypercholesterolemia. Event indicates the number of participants with the higher use category of the corresponding health service (polypharmacy, one or more primary-care visits per month, hospitalization in the last year, or more than one specialist visits per year), and n indicates the number of participants who fulfill the corresponding healthy behavior.
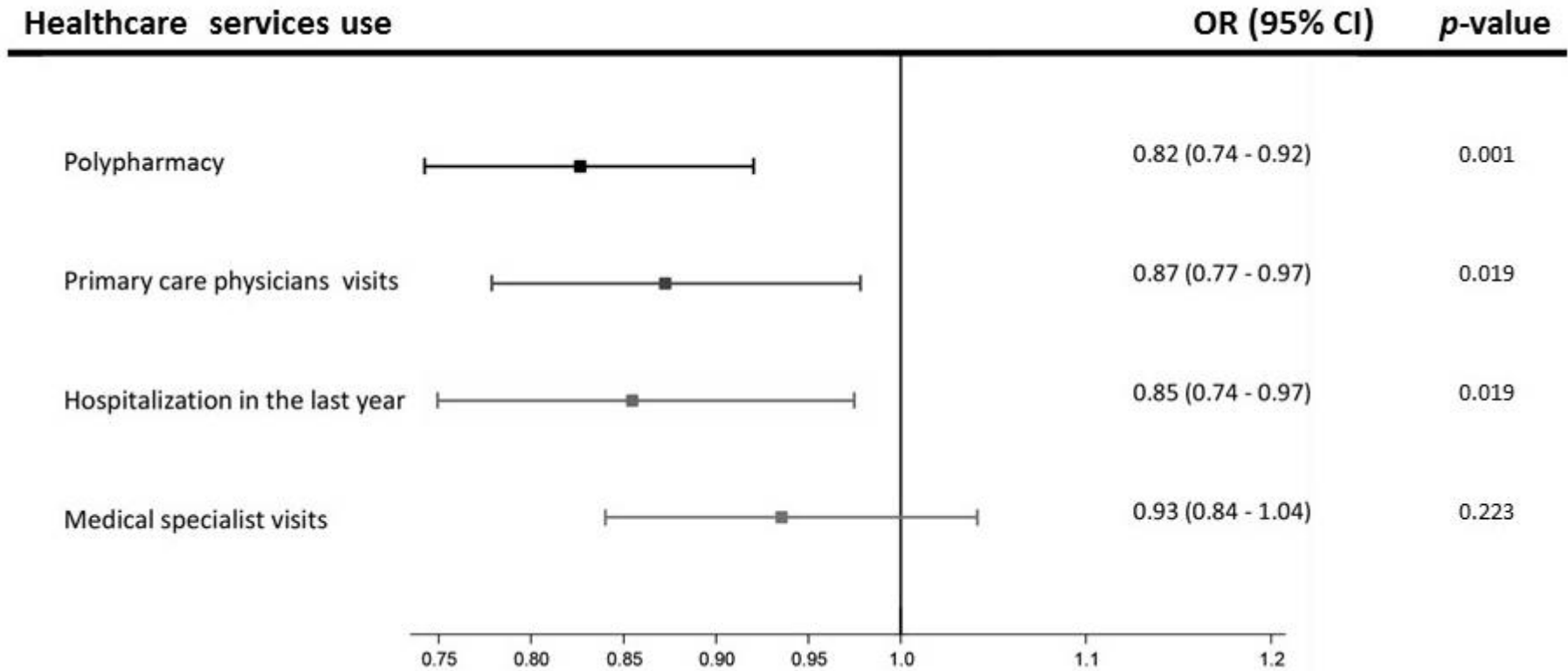
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Table 3. Association Between Number of Healthy Behaviors and Healthcare Services Utilization Seniors-ENRICA Cohort

Baseline number of healthy behaviors N=2,021	n (%)	Use of healthcare services in 2012–2013							
		Polypharmacy		Primary care physicians visits		Hospitalization in the last year		Medical specialists visits	
		Event	OR (95% CI)	Event	OR (95% CI)	Event	OR (95% CI)	Event	OR (95% CI)
Model 1									
0–1	101 (5.00)	45	1 (ref)	26	1 (ref)	21	1 (ref)	43	1 (ref)
2	415 (20.53)	170	0.84 (0.51–1.36)	99	0.76 (0.44–1.29)	63	0.72 (0.41–1.26)	153	0.89 (0.56–1.41)
3	787 (38.94)	321	0.82 (0.52–1.31)	187	0.79 (0.48–1.31)	115	0.68 (0.40–1.16)	310	1.02 (0.66–1.58)
4	533 (26.37)	156	**0.52 (0.32–0.85)**	103	0.61 (0.36–1.04)	61	**0.54 (0.30–0.94)**	183	0.83 (0.53–1.30)
5–6	185 (9.15)	41	**0.39 (0.22–0.69)**	31	0.53 (0.28–1.00)	19	**0.50 (0.25–0.99)**	63	0.82 (0.49–1.39)
p for trend			**<0.001**		0.020		0.016		0.096
Model 2									
0–1	101 (5.00)	45	1 (ref)	26	1 (ref)	21	1 (ref)	43	1 (ref)
2	415 (20.53)	170	0.95 (0.56–1.60)	99	0.78 (0.46–1.35)	63	0.75 (0.42–1.34)	153	0.94 (0.59–1.51)
3	787 (38.94)	321	0.93 (0.56–1.54)	187	0.76 (0.45–1.28)	115	0.64 (0.37–1.12)	310	1.06 (0.67–1.66)
4	533 (26.37)	156	0.63 (0.37–1.07)	103	0.61 (0.36–1.06)	61	**0.54 (0.30–0.98)**	183	0.88 (0.55–1.41)
5–6	185 (9.15)	41	**0.46 (0.24–0.85)**	31	**0.50 (0.26–0.96)**	19	0.50 (0.24–1.01)	63	0.89 (0.52–1.52)
p for trend			0.001		0.013		0.016		0.463

Notes: Boldface indicates statistical significance (*p*<0.05). Model 1: Logistic regression model adjusted for age, sex, level of education, and baseline use of the corresponding healthcare service. Model 2: Logistic regression model adjusted as Model 1 plus energy, alcohol consumption, comorbidities, BMI, hypertension, diabetes mellitus, and hypercholesterolemia. n indicates the absolute number of participants who fulfill the corresponding combination of healthy behaviors, in parenthesis the percentage of each number of habits is represented with respect to the total score. Event indicates the number of participants with the higher use category of the corresponding health service (polypharmacy, one or more primary-care visits per month, hospitalization in the last year, or more than one specialist visits per year).

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Healthcare services use	OR (95% CI)	*p*-value
Polypharmacy	0.82 (0.74 - 0.92)	0.001
Primary care physicians visits	0.87 (0.77 - 0.97)	0.019
Hospitalization in the last year	0.85 (0.74 - 0.97)	0.019
Medical specialist visits	0.93 (0.84 - 1.04)	0.223

Appendix Table 1. Baseline Behaviors According to Healthcare Services Utilization in the Seniors-ENRICA Cohort

Health behaviors N=2021	Use of health care services in 2012-2013											
	Number of medications			**Primary care physicians visits**			**Hospitalization in the last year**			**Medical specialist visits**		
	≥5/ day	<5/ day	*p-value*	≥1/ month	<1/ month	*p-value*	Yes	No	*p-value*	>1/ year	≤1/ year	*p-value*
Tobacco consumption, n (%)												
Smoker	304 (41.4)	535 (41.5)		182 (40.8)	657 (41.7)		129 (46.2)	710 (40.7)		323 (42.9)	516 (40.6)	
Never smoker	429 (58.5)	753 (58.4)	0.978	264 (59.1)	918 (58.2)	0.731	150 (53.7)	1032 (59.2)	0.085	429 (57.1)	753 (59.3)	0.313
Physical activity, n (%)												
Inactive	619 (84.4)	963 (74.7)		370 (82.9)	1,212 (76.9)		230 (82.4)	1,352 (77.6)		610 (81.1)	972 (76.6)	
Active	114 (15.5)	325 (25.2)	**<0.001**	76 (17.0)	363 (23.0)	**0.007**	49 (17.5)	390 (22.3)	0.070	142 (18.9)	297 (23.4)	**0.017**
Mediterranean diet, n (%)												
No	568 (77.4)	971 (75.3)		354 (79.3)	1,185 (75.2)		216 (77.4)	1,323 (75.9)		563 (74.9)	976 (76.9)	
Yes	165 (22.5)	317 (24.6)	0.286	92 (20.6)	390 (24.7)	0.071	63 (22.5)	419 (24.0)	0.592	189 (25.1)	293 (23.1)	0.297
Sleeping 7–8 hours/day, n (%)												
No	497 (67.8)	762 (59.1)		294 (65.9)	965 (61.2)		173 (62.0)	1,086 (62.3)		473 (62.9)	786 (61.9)	
Yes	236 (32.2)	526 (40.8)	**<0.001**	152 (34.0)	610 (38.7)	0.074	106 (37.9)	656 (37.6)	0.915	279 (37.1)	483 (38.1)	0.667
Sedentary behavior, n (%)												

Yes	87 (11.8)	127 (9.8)		49 (10.9)	165 (10.4)		43 (15.4)	171 (9.8)		91 (12.1)	123 (9.7)	
No	646 (88.1)	1,161 (90.1)	0.158	397 (89.0)	1,410 (89.5)	0.757	236 (84.5)	1,571 (90.1)	**0.005**	661 (87.9)	1,146 (90.3)	0.089
Living alone, n (%)												
Yes	143 (19.5)	185 (14.3)		72 (16.1)	256 (16.2)		51 (18.2)	277 (15.9)		121 (16.1)	207 (16.3)	
No	590 (80.4)	1,103 (85.6)	**0.003**	374 (83.8)	1,319 (83.7)	0.955	228 (81.7)	1,465 (84.1)	0.317	631 (83.9)	1,062 (83.7)	0.896

Notes: Boldface indicates statistically significant comparisons (*p*<0.05).

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