Dual sensory loss and social participation in older Europeans

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Abstract

The purpose of the study was to describe the prevalence of hearing difficulties, vision difficulties and dual sensory difficulties in 11 European countries, and to study whether sensory difficulties are associated with social inactivity in older Europeans. This cross-sectional study is based on the 2004 data collection of the Survey of Health, Ageing and Retirement in Europe (SHARE) comprising 27,536 men and women aged 50 years and older. Hearing and vision difficulties, as well as participation in seven different social activities were assessed using a structured computer-assisted personal interview. Logistic regression models were used for analyses. Altogether, 5.9% of the participants reported both hearing and vision difficulties (dual sensory loss), 10.2% vision difficulties only, and 13.5% hearing difficulties only. More than two-thirds (68.6%) of the participants with dual sensory loss were socially inactive compared to half of those who reported no sensory difficulties. The participants who reported dual sensory loss had 2.18 (95% CI 1.83-2.59) times higher odds for social inactivity compared to persons without hearing or vision difficulties. In a model adjusted for age, gender, mobility, depressive symptoms, cognition, education and wealth the corresponding odds ratio (OR) was 1.21 (95% CI 1.00-1.47). According to our results, sensory difficulties were associated with social inactivity, but the higher likelihood for social inactivity among persons with sensory difficulties was attenuated by other health and socio-economic indicators. Our results suggest that various preventive and rehabilitative actions targeting older persons´ sensory functions may enhance their social activity.

Introduction

An ageing population is one of the major challenges for Europe (Christensen et al. 2009). From the societal perspective, the active involvement of older people in society may constitute an additional economic and social resource. Older people may share their resources, for example by volunteering, by providing informal help to close ones, or by participating in different clubs or activities. From the personal perspective, social participation may have considerable positive effects on an individual's health and overall quality of life (European Comission 2011). For example, social inactivity has been linked to higher rates of depression (Chiao et al. 2011), cognitive decline (Glei et al. 2005), poorer physical functioning (Avlund et al. 2004; Nilsson et al. 2011) and even mortality (Holt-Lunstad et al. 2010; Pynnönen et al. 2012). Active ageing may be achieved by promoting health and preventing health problems over the whole life-span, and by offering relevant support and opportunities for social contacts for persons who need them. From the preventive point of view, it is important to recognize factors that may lead to social inactivity.

Social participation has been variously conceptualized. In this study, social participation describes a person's involvement in activities that provide interactions with others in society or the community (Levasseur et al. 2010). According to Wilkie et al. (Wilkie et al. 2006) approximately half of those aged 50+ years reported restricted participation in at least some aspect of life. Such restrictions increased with age, and were more commonly reported by women than men.

Sensory difficulties are common health concerns in older people, and the prevalence of impairments increases with ageing. Approximately every third person aged 60-70 years has impaired hearing (Gopinath et al. 2009; Hannula et al. 2011) and every fourth (Steinman and

Allen 2012) has vision difficulties. Furthermore, approximately 1% of persons aged 60-69 years, 5% of those aged 70-79 years, and as many as 27% of those aged 80-99 years report dual sensory loss, meaning that both hearing and vision are impaired (Schneider et al. 2012). However, it should be noted, that prevalence estimates vary widely between studies according to the subpopulations, methods, and specific definition of sensory impairment used (Heine and Browning 2002; Schneider et al. 2011). In older people, the most common diagnoses behind dual sensory loss are cataract or age-related macular degeneration in combination with presbycusis (Chia et al. 2006; Wittich et al. 2012).

Hearing and vision difficulties hinder access to environmental information and may also become an obstacle to communication, in turn isolating people, and jeopardizing their independence and overall well-being (Brennan and Bally 2007). Diminished sensory capacity also affects others. Because of difficulties in communication, others may avoid people with sensory difficulties, leaving them with even fewer opportunities for an active social life. In previous studies, persons with vision loss had a two-fold higher likelihood for social restriction compared to persons without vision loss (Wallhagen et al. 2001; Wilkie et al. 2007). According to the study by Alma et al. (Alma et al. 2011), visually impaired persons aged 65 years or older participate in society, but because of vision loss, to a lesser degree than their non-impaired peers. The association between hearing and social activity has been weaker and less consistent than that for vision and activity (Wilkie et al. 2007) and not all studies support the association between poor hearing and social inactivity (Norris and Cunningham 1981; Wallhagen et al. 2001; Yamada et al. 2012).

Studies on the combined effect of vision and hearing loss on social activity are scarce. Crews and Campbell (2004) demonstrated a hierarchical pattern for the impact of sensory losses on

daily activities and social participation. Participants with only hearing loss reported more often difficulties in daily activities and social participation than participants without hearing or vision difficulties. Participants with only vision difficulties reported even greater disparities, and those with both hearing and vision difficulties the greatest disparities.

Although vision and hearing difficulties in relation to social activities are studied in some extent, the knowledge about the combined effect of vision and hearing difficulties on social activity is very limited. The purpose of this study was, first, to describe the prevalence of hearing difficulties, vision difficulties and dual sensory difficulties in older Europeans. Second, the purpose was to study whether sensory difficulties are associated with social inactivity, and whether the association is similar or different across 11 European countries. This study is built upon the World Health Organization´s International Classification of Functioning, Disability and Health –framework according to which decreased health, in this case sensory difficulties, in an interaction with different contextual factors, such as cultural or societal environment, may lead to participation restriction (World Health Organization 2001).

Methods

Participants

This study is based on the 2004 data collection of the Survey of Health, Ageing and Retirement in Europe (SHARE) comprising 27,536 men and women aged 50 years and older. SHARE data is based on representative samples drawn from population registers or from multistage sampling, i.e. regions were sampled first and then individuals selected within regions. SHARE is a multidisciplinary and cross-national longitudinal study which was conducted for the first time in 2004 in eleven European countries from Scandinavia, through Central Europe to the Mediterranean: Sweden, Denmark, Germany, the Netherlands,

Belgium, France, Switzerland, Austria, Italy, Spain and Greece. The average household response rate was 61.6%, ranging from 38.8% in Switzerland to 81.0% in France. SHARE database includes a great variety of information about health, socio-economics and social networks. The SHARE recruitment process and participation have been described in more detail elsewhere (Börsch-Supan and Jürges 2005).

Procedures

Data were collected using computer-assisted personal interviews by trained interviewers (Jürges 2005). Ethical approval for the SHARE was obtained from the University of Mannheim's internal review board, Germany, and all the participants gave their informed consent before the interview (Börsch-Supan and Jürges 2005).

Measures

Dependent variable: social activity

Social activity was assessed with the yes/no question: “Have you done any of the listed activities in the last month?”: 1) Done voluntary or charity work, 2) Cared for a sick or disabled adult, 3) Provided help to family, friends or neighbors, 4) Attended an educational or training course, 5) Gone to a sport, social or other kind of club, 6) Taken part in a religious organization (church, synagogue, mosque etc.) 7) Taken part in a political or community-related organization. A person was rated as socially active if she/he had responded affirmatively to at least one of the listed activities and inactive otherwise.

Independent variable: sensory difficulties

Hearing was assessed with the question “Is your hearing [using a hearing aid as usual] excellent/very good/good/fair/poor?” Vision was assessed with the question “Is your eyesight

[using glasses or contact lenses as usual] excellent/very good/good/ fair/poor/registered or legally blind?" Persons who rated their hearing as fair or poor were categorized as having hearing difficulties, and those who rated their vision as fair, poor or who were blind were categorized as having vision difficulties. Furthermore, all participants were categorized into one of four groups according to their hearing and vision status: 1) No hearing or vision difficulties, 2) Hearing difficulties only, 3) Vision difficulties only, and 4) Hearing and vision difficulties (dual sensory loss).

Descriptive variables

Age was determined by calculating the difference between the interview year and birth year. *Self-rated health* was measured by the question "Would you say your health is excellent/very good /good/fair/poor?" Number of self-reported *chronic diseases* was calculated as a sum of the following 13 diseases diagnosed by a doctor: heart disease, high blood pressure, high blood cholesterol, stroke, diabetes, lung disease, asthma, arthritis, osteoporosis, cancer (excluding minor skin cancers), gastro-intestinal ulcer, Parkinson's disease, and hip or femoral fracture. A person was categorized as having *depressive symptoms* if she/he scored 4 or more points in a validated 12-item Euro-depression scale (Prince et al. 1999) and as having *poor cognition* if she/he remembered 3 or fewer words in the ten word list learning test (Dewey and Prince 2005).

A person was categorized as having *limitation in activities of daily living* (ADL) if she/he reported any difficulties with six basic activities such as dressing, eating, walking across the room, and having *limitation in instrumental activities of daily living* (IADL) if any difficulties with more demanding seven instrumental activities, such as preparing a hot meal, shopping for groceries, managing, were reported. Mobility was assessed according to the yes/no

question “Because of a health problem, do you have *difficulty walking 100m*?”, and fear of falling was assessed with the yes/no question “For the past six months at least, have you been bothered by *fear of falling* down?”

Educational level describes the highest level of the participant’s completed formal education. To homogenize the country-specific educational categories, we reclassified the answers into three classes according to the 1997 International Standard Classification of Education (ISCED-97). ISCED levels 0-2 correspond to lower secondary school at the most, level 3 upper secondary school and levels 4-6 post-secondary school (Avendano et al. 2009; United Nations Educational Scientific and Cultural Organization 2006).

Total annual household *gross income* describes the total income of all the members of the participant’s household. Gross income was assessed as the sum of wages, self-employment income, capital income, pensions and other payments, rent income, and long-term insurance payments. Total household *net worth* describes the sum of all financial and real assets. Financial assets derived from bank accounts, securities, mutual funds, individual retirement´s accounts, contractual savings for housing, and life-insurance policies minus liabilities. Real assets derived from the value of primary and other residences, own business and vehicles. Both the income and net worth variables were reported in Euros for all countries and adjusted for purchasing power parity (ppp). Missing items for income and wealth were imputed with the hot-deck method (Christelis et al. 2005a; Christelis et al. 2005b).

Statistical analysis

We applied respondent-level, cross-sectional, calibrated sampling weights in all analyses to account for the complex sampling design. Weights were calculated separately for each

country and calibrated against the total national population by age and gender (De Luca and Rossetti 2011).

Design-based tests of independence were performed to analyse differences in the proportions of socially active and inactive participants with or without different health- and wealth-related characteristics. Similarly, mean differences in age, number of chronic diseases, gross income and net worth of socially active and inactive persons were tested using the adjusted Wald test.

Univariate logistic regression models were performed to analyse whether social activity was associated with sensory difficulties, and the health- and wealth-related characteristics. Multivariate logistic regression models for social inactivity were adjusted, first for age and gender, and second for age, gender, mobility, depression, cognition, educational status and financial status. In addition, the country-adjusted model was performed. Austria was selected arbitrarily as the reference country for analyses. This selection was also useful for the interpretation of results, because the prevalence of sensory difficulties, social activities as well as the most of the descriptive characteristics were there at the average level compared to the other countries.

The modelling was performed using Stata 12.0 statistical software (Stata Corp., College Station, TX). P-values of <0.05 were considered statistically significant.

Results

Altogether 5.9% of the participants reported both hearing and vision difficulties (dual sensory-loss), 10.2% vision difficulties only, and 13.5% hearing difficulties only. The prevalence of dual sensory loss varied from 1.6% to 10.3% across the 11 European countries,

being lowest in Switzerland and highest in Italy (Table 1). According to a design-based test of independence the occurrence of sensory difficulties differed in different countries (p=.000).

The most frequently reported social activities were helping family, friends or neighbors (19.3%), and going to a sport, social or other club (19.5%). Approximately half of the participants reported at least one of the listed seven social activities. Social activity was lowest in Spain (26.2%) and Italy (27.3%) and highest in Sweden (64.1%). According to a design-based test of independence all the variables listed in table 1, except gender, differed statistically significantly by social activity. Socially inactive persons were older, had poorer health and functional status, and had lower socio-economic status than socially active persons (Table 1).

More than two-thirds (68.6%) of the participants with dual sensory loss were socially inactive compared to half of those who reported no sensory difficulties. From separate social activity domains, persons with dual sensory loss had the highest likelihood for social inactivity in attending educational or training course (OR 4.55 (95% CI 2.28-9.08), and taking part in political or community organizations (OR 4.59 (95% CI 2.62-8.03) compared to persons with no sensory difficulties. Taking part in religious organizations was approximately same among persons with or without sensory difficulties (Table 2).

Participants who reported dual sensory loss had 2.18 (95% CI 1.83-2.59) times higher unadjusted odds for social inactivity compared to persons without hearing or vision difficulties. In Model 4, adjusted for age, gender, mobility, depression, cognition, education, and net worth, the corresponding odds ratio (OR) was 1.21 (95% CI 1.00-1.47). The OR was of the same magnitude as the OR of persons who reported vision difficulties only (OR 1.28,

95% CI 1.12-1.47). The ORs between sensory difficulties and social inactivity attenuated slightly when country was entered into Model 5 together with other adjusting variables.

In Sweden, Denmark, the Netherlands, Belgium, Switzerland and Greece the country act as a protective factor for social inactivity compared to Austria. In Italy and Spain the effect was opposite (Table 3).

In Figure 1 country stratified analyses for social inactivity according to sensory difficulties are shown. The trend towards higher probability for social inactivity in age, gender, mobility, depression, cognition, education, and wealth adjusted models was most notable in Denmark and Spain, but it should be noted that the results varied widely across countries. The interactions of the country variable with sensory difficulties were non-significant (See Figure 1; data for interaction tests not shown).

Discussion

According to this study, approximately every third European aged 50+ years has difficulties either in hearing or seeing, or both. Social inactivity was most common among persons who had difficulties in both hearing and seeing, followed in order by those with vision difficulties only, hearing difficulties only, and least frequent among persons with no sensory difficulties. However, the higher likelihood for social inactivity among persons with sensory difficulties was attenuated by the other health and socio-economic indicators included in the analyses. Furthermore, it should be noted that the results varied across countries.

The prevalence of hearing, vision and dual sensory loss in this data are in accordance with the findings of Crews and Campbell (2004) among community dwelling participants aged 70 years and older (N=9,447). Of their sample, 8% self-reported both vision and hearing loss,

10% vision loss only, 24% hearing loss only and 58% neither vision nor hearing loss. Our prevalence figures are slightly lower, which is probably due to the inclusion of younger participants in the study, as the prevalence of sensory difficulties increases with ageing (Schneider et al. 2012; Schneider et al. 2011). In previous studies, poor visual acuity (Chia et al. 2006), particularly poorer vision for low contrast targets (Schneck et al. 2012) was associated with higher likelihood for audiometrically assessed hearing impairment, the results further indicating that a deficit in one sensory domain increases the likelihood of a deficit in the other. It is important that clinicians, both audiologists and eye care practitioners, take this possibility into account (Brabyn et al. 2007; Schneck et al. 2012).

The hierarchical pattern of the impact of sensory difficulties on social inactivity was in line with previously reported results. Crews and Campbell (2004) demonstrated that persons with hearing and vision loss were least likely to visit friends, eat out at a restaurant, attend church, attend movies, or engage in exercise, followed in order by participants with vision loss only, hearing loss only and no sensory loss. However, there were no differences between the sensory groups in visiting relatives. The same hierarchical pattern has been even clearer between sensory difficulties and daily activities (Crews and Campbell 2004). After multivariable adjustment, the hierarchical pattern of sensory functions vanished in our study, indicating that vision has a more important impact on social activity than hearing. Persons with only vision difficulties had even a slightly higher likelihood for social inactivity than persons with dual sensory loss. A similar pattern was observed in previous studies for the association between sensory functions and activities of daily living (Brennan et al. 2006; Brennan et al. 2005; Lin et al. 2004) and between sensory functions and functional activity (Harada et al. 2008), the increased risk from dual sensory loss being of the same magnitude as that reported by persons with vision loss alone, while hearing difficulties alone did not

increase the risk for difficulties in daily living compared to those who reported no sensory difficulty.

Recently, there has been growing interest in cross-national comparative ageing research (Tesch-Römer & von Kondratowitz 2006). Although age-related decreases in vision and hearing are more or less universal phenomena among older persons, there may be substantial differences across countries in treatment of possible underlying diseases or in rehabilitative actions, which may lead to differences in coping with vision or hearing difficulties in everyday life. It is also presumable that participation in separate out-of-home social activities may at least partly be culture- and society-dependent and social activity offerings, both quality and quantity, may substantially differ across and even within countries. Results of this study evinced large country-specific differences in predictor levels, and also the results about the adjusted associations between sensory difficulties and social participation differed in different countries. These country-specific differences attenuated the overall estimate of the effect of sensory difficulty on social inactivity. The trend towards higher probability for social inactivity with increasing sensory difficulties was most notable in Denmark and Spain. Country-specific differences in measures of health and socio-economic status tended to have a large effect on the social activity outcome, resulting in a lower odds estimate for sensory difficulties in the pooled-data analysis. Whether these differences are due to measurement, or study participation, or reflect cultural characteristics, requires further study.

The causality and complexity of the relations between deteriorated mental or physical health and social inactivity are currently under active debate. It has been demonstrated, for example that depression can cause social inactivity, and, conversely, that social inactivity can lead to depression (Chiao et al. 2011; Isaac et al. 2009; Wilkie et al. 2007). The cross-sectional

design did not permit the causality between sensory functions and social activity to be confirmed in this study, but it seems reasonable to assume that sensory difficulties lead to social inactivity rather than vice versa. Our results offer suggestive evidence that depressive symptoms, poor cognition and poor mobility may act as mediators between sensory difficulties and social inactivity. Previous studies have demonstrated a link between sensory difficulties and depressive symptoms (Harada et al. 2008; McDonnall 2011), cognitive decline (Lin et al. 2004) and mobility decline (Viljanen et al. 2009; Viljanen et al. 2012), all of which are also linked to social inactivity (Avlund et al. 2004; Avlund et al. 2004; Chiao et al. 2011; Glei et al. 2005; Nilsson et al. 2011). Another pathway, although not supported in our study, is that sensory difficulties lead directly to decreased participation (Crews and Campbell 2004), and that this is the reason for the decline in physical and mental capacity (Avlund et al. 2004; Chiao et al. 2011; Glei et al. 2005; Nilsson et al. 2011).

A person with a single sensory impairment may compensate for the decrement in functioning by greater reliance on the other sensory domains; but when multiple sensory impairments accumulate, such a compensatory resource will be lost (Merabet & Pascual-Leone, 2010). Consequently, while intuitively it might be presumed that dual sensory loss has an additive, or even a synergistic impact on the affected person's everyday functioning and social activity, this has not been conclusively demonstrated (Brennan et al. 2005; Crews and Campbell 2004; Lee et al. 1999; Lin et al. 2004). It is possible that persons with severe sensory problems, and particularly severe dual sensory loss, are unwilling to participate in studies because of possible communication problems. If so, this would attenuate the results on the association between dual sensory loss and social activity. It is also possible that the questions and questionnaires currently in use, which have been designed to estimate the disabling effects of a single sensory impairment only, are unable to capture the possible effects of dual sensory

loss on performance in tasks and situations which are particularly challenging for persons with both hearing and vision difficulties (Saunders and Echt 2007).

Some social activities may not be captured by the questionnaire used, and we do not know precisely what the participant's role is in an activity. Sensory impaired persons may take a more passive role in activities than non-impaired peers, or select activities which make fewer demands on communication. Our results indicate that persons with dual sensory loss had the highest likelihood for inactivity in an attending educational or training course or taking part in political or community organizations, which can be assumed to require the highest communication abilities of the activities on the list. Moreover, we do not have more specific information on the kinds of clubs people are active in. Various clubs and community groups are organized specifically for hearing and/or vision impaired persons, but their availability may vary widely across regions, which may be one reason behind the differences across countries found in this study. Our results support previous findings that persons may be socially active despite having sensory disabilities. For example, participation in religious activities was of the same magnitude whether or not the person reported sensory difficulties. This result is in line with the findings of Alma et al. (Alma et al. 2011), who demonstrated that religious activity is equally common among vision impaired and non-impaired older person. Stratified analysis according to productive social activity (voluntary work, caring for a sick or disabled adult, helping family, friends or neighbors) and collective social activity (participation in an educational or training course, sport, social or other club, religious organization, political or community-related organization) (Bukov et al. 2002) were also conducted as a part of this study (results not shown). The main results on the associations between sensory difficulties and productive or collective social activities were very similar to each other and comparable to the results presented here for combined social activity.

The results of this study are based on self-reports of vision and hearing. Perceived and objectively assessed sensory functions are more or less related, depending on the methods used, but they may capture different dimensions of functioning, and thus should be considered complementary rather than measures of the same trait. Self-reports provide information about perceived difficulties in the everyday environment, and are thus clinically highly relevant and suitable for the analysis of the association between sensory functions and social participation (Brennan et al. 2006; Horowitz et al. 2005; Kiely et al. 2012).

Some main limitations of the present study should be acknowledged in the interest of future research. Firstly, this study is based on self-reports about hearing and vision difficulties and no objective data about sensory functions were available. Although, less feasible when used in a large study including more than 25,000 individuals, comparative objective sensory data could have reduced some possible cultural differences related to self-report data. Secondly, social activity was also based on self-reports and no specific data about the more precise nature of activities was available. It is also possible, that not all activities were captured with a seven-item question.

Conclusions

This study focused on a highly topical issue in a rapidly ageing Europe. According to our results, approximately every third older European has difficulties either in hearing or seeing, or both. Sensory difficulties were associated with social inactivity, but the higher likelihood for social inactivity among persons with sensory difficulties was attenuated by other health and socio-economic indicators. The results about the association between sensory difficulties and social inactivity differed across European countries. Further studies are needed to explore

in detail those cultural or community related features which seem to either facilitate or inhibit the social activity. Qualitative approach to sensory impaired persons perceived activity restrictions might offer an interesting perspective on the topic. From the preventive point of view, it would be important, first, to identify people who are at high risk for social inactivity, and, second, to find ways of promoting active ageing. Our results offer suggestive evidence that different preventive and rehabilitative actions targeting sensory functions in older persons may enhance their social activity, but this should be affirmed using case-control studies. Attention should be paid in particular to persons who have both hearing and vision loss, and their special needs should be recognized. Furthermore, studies are needed on whether environmental modifications, aimed especially at improving visual and acoustic factors, could enhance the social participation of sensory impaired persons.

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Table 1 Participants Characteristics According to Country and Social Activity, and Univariate Logistic Regression Models for Social Inactivity

Unweighted number of participants	ALL n= 27536	SE n= 2997	DK n= 1615	DE n= 2943	NL n= 2877	BE n= 3699	FR n= 3052	CH n= 962	AT n= 1849	IT n= 2508	ES n= 2354	GR n= 2680	Socially active[a] n= 13712	Socially inactive[a] n= 13293	
Characteristics	%	%	%	%	%	%	%	%	%	%	%	%	%	%	OR (95% CI) for inactivity[b]
Sensory difficulties															
No hearing or vision difficulties	70.4	82.8	73.9	74.6	70.2	69.8	65.6	83.6	78.4	59.5	61.1	77.0	75.5	66.6	Ref.
Hearing difficulties only	13.5	8.5	11.8	13.7	15.7	14.0	16.0	9.8	10.5	12.0	12.8	8.5	12.9	14.0	1.23 (1.10-1.37)
Vision difficulties only	10.2	6.9	9.5	6.9	10.1	10.9	11.6	5.0	7.1	18.3	16.7	9.3	7.8	12.1	1.77 (1.56-2.00)
Hearing and vision difficulties	5.9	1.7	4.8	4.8	4.0	5.4	6.9	1.6	4.0	10.3	9.4	5.2	3.8	7.3	2.18 (1.83-2.59)
Social activity[a]															
Active	46.8	64.1	63.5	47.4	61.4	54.7	48.2	60.4	49.0	27.3	26.2	56.4			
Voluntary or charity work (yes)	11.0	18.4	17.9	10.0	21.4	15.8	14.5	14.3	8.2	7.0	2.8	3.1			
Cared for a sick or disabled adult (yes)	5.7	7.7	5.4	5.8	7.2	8.5	6.5	7.5	7.1	2.9	2.6	5.4			
Provided help to family, friends or neighbors (yes)	19.3	38.9	33.5	16.1	29.3	27.8	25.1	21.3	21.6	13.9	6.0	15.3			
Attended educational or training course (yes)	5.4	12.8	10.0	5.6	7.0	9.3	4.1	16.6	4.1	1.0	2.0	4.1			
Gone to sport, social or other kind of club (yes)	19.5	25.6	31.5	24.5	29.1	21.7	18.5	32.7	14.1	6.2	6.7	6.2			
Taken part in religious organization (yes)	10.2	6.8	5.0	9.4	10.7	7.1	5.4	12.4	21.4	4.9	11.2	37.8			
Taken part in political or community organization (yes)	3.6	4.6	4.8	3.6	3.3	7.1	3.4	7.3	5.5	2.3	1.6	5.1			
Men	45.3	46.9	46.8	45.0	46.7	45.5	44.9	45.7	44.3	43.9	45.4	46.4	45.9	44.8	0.96 (0.89-1.03)
Fair or poor self-rated health	34.8	13.1	25.6	39.7	27.7	26.6	34.0	16.3	30.3	40.7	41.1	30.9	25.7	42.1	2.10 (1.94-2.28)
Symptoms of depression	26.1	20.4	17.9	20.4	20.9	25.7	33.6	19.0	19.9	33.4	34.8	24.2	20.9	30.6	1.67 (1.54-1.82)
Poor cognition	23.9	15.3	13.9	13.6	16.7	21.8	29.3	14.0	16.2	28.4	49.0	19.2	15.5	30.7	2.41 (2.21-2.64)
Difficulties in 100 m walking	10.5	6.9	8.0	10.5	9.4	10.4	10.4	3.8	7.7	11.4	13.5	10.9	4.9	14.9	3.41 (2.96-3.94)
1+ ADL limitation	10.7	10.0	10.2	10.2	8.3	12.7	12.3	7.0	9.6	10.6	11.7	8.6	6.0	14.1	2.58 (2.26-2.94)
1+ IADL limitation	17.0	16.6	16.9	14.8	15.7	18.8	17.1	8.8	17.6	14.2	23.1	18.3	10.6	21.7	2.33 (2.10-2.58)
Fear of falling	9.6	7.3	6.5	10.1	7.1	10.9	8.5	4.0	6.5	6.5	15.0	4.6	6.1	12.5	2.22 (1.93-2.55)
Educational level (ISCED)															
Post-secondary school	21.1	28.7	31.0	26.6	19.5	24.2	18.1	25.1	23.4	36.7	9.3	15.8	28.4	15.1	Ref.
Upper secondary school	33.1	17.8	43.9	53.8	23.0	24.9	27.2	22.4	45.3	32.2	8.4	20.2	35.4	31.6	1.67 (1.50-1.86)
Lower secondary school	45.8	53.5	25.1	19.6	57.6	50.9	54.7	52.5	31.3	31.1	82.3	64.0	36.2	53.3	2.77 (2.51-3.06)
Ppp-adjusted net worth quartiles															

1. The first, richest, quartile	24.6	14.2	16.9	20.0	29.9	32.7	32.6	36.0	19.2	22.8	22.7	19.0	30.1	19.4	Ref.
2. quartile	24.3	19.3	21.1	22.4	20.0	30.3	26.2	21.2	24.5	27.0	27.9	23.0	25.8	23.3	1.40 (1.26-1.54)
3. quartile	22.6	32.0	27.0	17.9	14.8	19.8	19.6	17.4	22.4	29.0	33.6	38.6	21.0	24.0	1.77 (1.60-1.96)
4. The fourth, poorest, quartile	28.5	34.5	35.0	39.7	35.3	17.2	21.7	25.3	34.0	21.2	15.8	19.5	23.1	33.2	2.22 (2.00-2.46)
	mean (SE)	mean (SE)	mean (SE)	mean (SE)	mean (SE)	mean (SE)	mean (SE)	mean (SE)	mean (SE)	mean (SE)	mean (SE)	mean (SE)	mean (95% CI)	mean (95% CI)	OR (95%CI)
Age	65.2 (0.10)	65.4 (0.24)	64.2 (0.26)	65.1 (0.22)	63.9 (0.23)	65.9 (0.19)	65.5 (0.21)	64.8 (0.37)	65.2 (0.26)	65.0 (0.25)	65.7 (0.26)	65.0 (0.20)	63.4 (0.13)	66.6 (0.15)	1.031 (1.027-1.034)
Number of chronic diseases[c]	1.3 (0.01)	1.1 (0.03)	1.3 (0.03)	1.2 (0.03)	1.1 (0.02)	1.5 (0.03)	1.4 (0.03)	0.9 (0.04)	1.1 (0.03)	1.5 (0.04)	1.4 (0.03)	1.3 (0.03)	1.2 (0.02)	1.4 (0.02)	1.132 (1.101-1.164)
Gross income (1000 €)	47.8 (0.5)	45.9 (0.9)	46.9 (1.0)	54.3 (1.2)	55.5 (1.2)	43.8 (1.2)	49.9 (1.2)	65.0 (2.2)	50.4 (1.2)	36.4 (1.0)	32.5 (1.0)	27.6 (0.6)	54.9 (0.8)	41.2 (0.7)	0.995 (0.994-0.996)
Net worth (1000 €)	320.4 (7.1)	186.7 (6.9)	246.5 (13.6)	232.2 (9.3)	327.9 (17.6)	383.0 (14.1)	428.4 (18.5)	591.1 (42.9)	207.0 (8.8)	298.7 (18.6)	373.2 (26.6)	227.9 (7.9)	360.8 (9.5)	282.8 (10.6)	0.99988 (0.99981-0.99995)

[a]Active=Took part at least one out of the following activities: voluntary or charity work; cared for a sick or disabled adult; provided help to family, friends or neighbors; attended educational or training course; gone to sport, social or other kind of club; taken part in religious organization; taken part in political or community organization; Inactive=Did not take part any of the listed activities

[b]Univariate logistic regression models for social inactivity

[c]Number of the listed disease (min 0 - max13):

1. A heart attack including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure
2. High blood pressure or hypertension
3. High blood cholesterol
4. A stroke or cerebral vascular disease
5. Diabetes or high blood sugar
6. Chronic lung disease such as chronic bronchitis or emphysema
7. Asthma
8. Arthritis, including osteoarthritis, or rheumatism
9. Osteoporosis
10. Cancer or malignant tumor, including leukemia or lymphoma, but excluding minor skin cancers
11. Stomach or duodenal ulcer, peptic ulcer
12. Parkinson's disease
13. Hip fracture or femoral fracture

Countries from north to south: SE=Sweden, DK=Denmark, DE=Germany, NL=Netherlands, BE=Belgium, FR=France, CH=Switzerland, AT=Austria, IT=Italy, ES=Spain, GR=Greece

Ref=Reference group; OR=Odds ratio; CI=Confidence interval

Table 2 Social Activity According to Sensory Difficulties, and Univariate Logistic Regression Models for Social Inactivity

	Total	No sensory difficulties	Hearing difficulties only	Vision difficulties only	Hearing and vision difficulties	
	%	% Ref.	% OR (95% CI)	% OR (95% CI)	% OR (95% CI)	Design-based test of independence
Social activity[a], n=26696						
Active	46.8	49.9	44.8	36.1	31.4	.000
Inactive	53.2	50.1 Ref.	55.2 1.23 (1.10-1.37)	63.9 1.77 (1.56-2.00)	68.6 2.18 (1.83-2.59)	
Voluntary or charity work (yes)	11.0	11.9 Ref.	11.1 1.09 (0.92-1.27)	7.6 1.65 (1.34-2.03)	5.4 2.36 (1.67-3.33)	.000
Cared for a sick or disabled adult (yes)	5.7	6.3 Ref.	4.4 1.44 (1.12-1.85)	5.3 1.20 (0.93-1.54)	3.1 2.06 (1.38-3.07)	.001
Provided help to family, friends or neighbors (yes)	19.3	20.3 Ref.	19.2 1.07 (0.94-1.22)	15.7 1.36 (1.17-1.59)	13.3 1.66 (1.31-2.10)	.000
Attended educational or training course (yes)	5.4	6.4 Ref.	3.8 1.71 (1.33-2.20)	2.8 2.38 (1.73-3.29)	1.5 4.55 (2.28-9.08)	.000
Gone to sport, social or other kind of club (yes)	19.5	21.0 Ref.	19.4 1.11 (0.97-1.27)	12.7 1.83 (1.53-2.20)	12.5 1.87 (1.46-2.40)	.000
Taken part in religious organization (yes)	10.2	10.5 Ref.	10.4 1.01 (0.85-1.20)	8.8 1.21 (0.99-1.48)	8.8 1.21 (0.90-1.63)	.195
Taken part in political or community organization (yes)	3.6	4.1 Ref.	3.3 1.23 (0.91-1.67)	2.2 1.94 (1.37-2.74)	0.9 4.59 (2.62-8.03)	.000

[a]Active=Took part at least one out of the following seven activities; Inactive=Did not take part any of the following activities
Ref=Reference group, OR=Odds ratio, CI=Confidence interval

Table 3 Logistic Regression Models for Social Inactivity

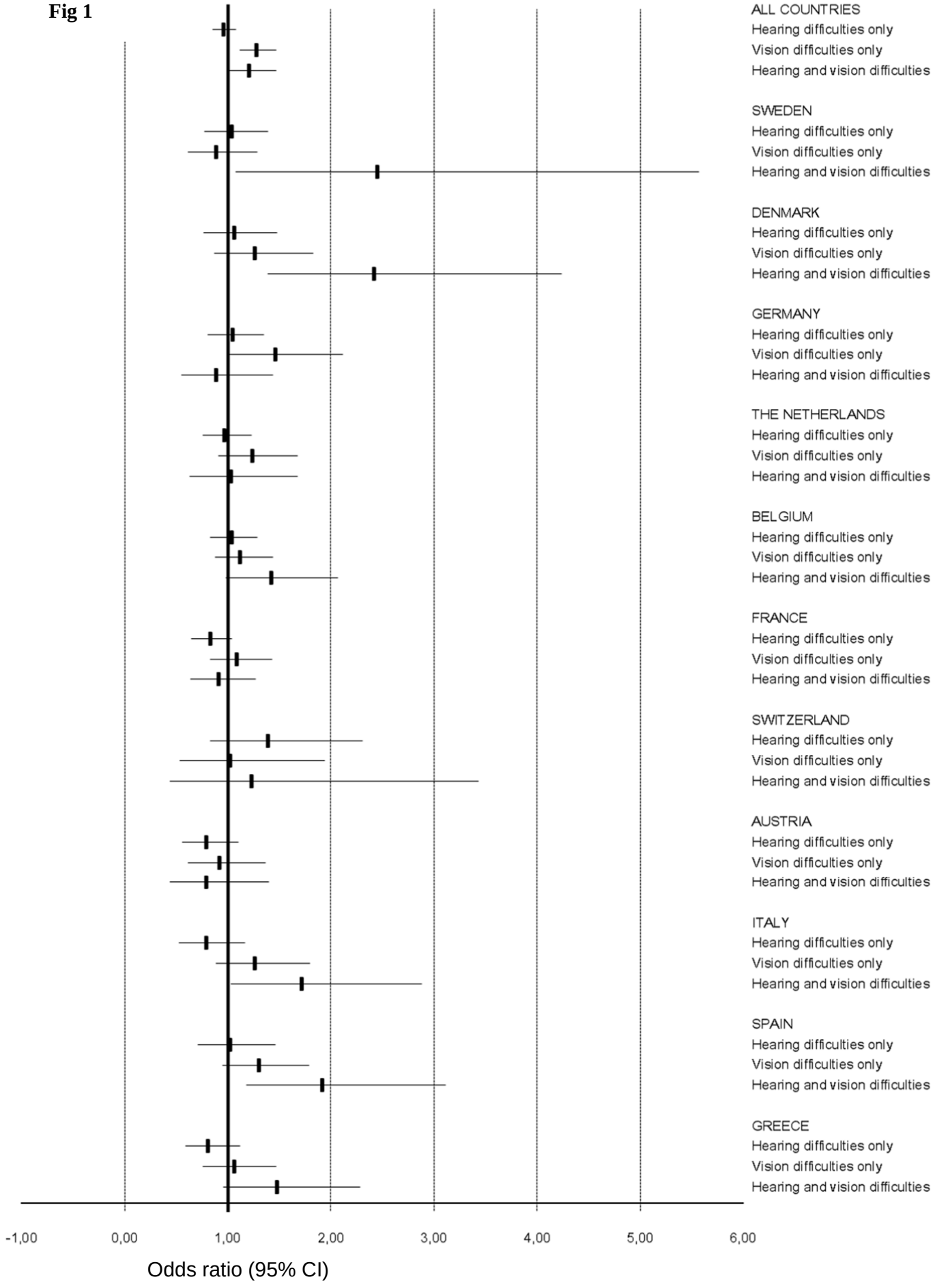
Characteristics	Model 1	Model 2	Model 3	Model 4	Model 5
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Sensory difficulties					
No hearing or vision difficulties	Ref.	Ref.	Ref.	Ref.	Ref.
Hearing difficulties only	1.23 (1.10-1.37)	1.06 (0.95-1.19)	0.97 (0.87-1.09)	0.96 (0.86-1.08)	0.96 (0.85-1.08)
Vision difficulties only	1.77 (1.56-2.00	1.61 (1.42-1.82)	1.35 (1.19-1.54)	1.28 (1.12-1.47)	1.20 (1.04-1.37)
Hearing and vision difficulties	2.18 (1.83-2.59)	1.69 (1.42-2.02)	1.26 (1.04-1.51)	1.21 (1.00-1.47)	1.10 (0.91-1.34)
Age (years)		1.03 (1.02-1.03)	1.02 (1.01-1.02)	1.01 (1.006-1.015)	1.01 (1.01-1.02)
Male		1.03 (0.96-1.11)	1.08 (1.00-1.16)	1.17 (1.08-1.26)	1.17 (1.08-1.27)
Difficulties in 100 m walking			2.18 (1.86-2.54)	2.00 (1.71-2.34)	2.00 (1.71-2.35)
Symptoms of depression			1.32 (1.20-1.45)	1.25 (1.14-1.38)	1.22 (1.11-1.34)
Poor cognition			1.82 (1.65-2.00)	1.57 (1.42-1.74)	1.33 (1.20-1.47)
Education (ISCED)					
Post-secondary school				Ref.	Ref.
Upper secondary school				1.52 (1.36-1.69)	1.52 (1.36-1.70)
Lower secondary school				1.97 (1.77-2.18)	1.91 (1.70-2.14)
Ppp-adjusted net worth quartiles					
The first, richest, quartile				Ref.	Ref.
The second quartile				1.21 (1.09-1.34)	1.18 (1.06-1.31)
The third quartile				1.38 (1.24-1.54)	1.36 (1.22-1.53)
The fourth, poorest, quartile				1.69 (1.52-1.89)	1.82 (1.62-2.03)
Country					
Austria					Ref.
Sweden					0.49 (0.43-0.56)
Denmark					0.55 (0.47-0.63)
Germany					1.08 (0.95-1.22)
Netherlands					0.54 (0.48-0.62)
Belgium					0.77 (0.67-0.87)
France					0.94 (0.82-1.07)
Switzerland					0.66 (0.56-0.78)
Italy					2.68 (2.28-3.15)
Spain					2.15 (1.83-2.53)
Greece					0.65 (0.57-0.75)

Ref=Reference group, OR=Odds ratio, CI=Confidence interval

Figure captions

Fig 1 Odds ratios and their 95% confidence intervals for social inactivity according to sensory difficulties by country. Logistic regression models are adjusted for age, gender, difficulties in walking 100 m, depressive symptoms, poor cognition, education and wealth.

Fig 1


ALL COUNTRIES
Hearing difficulties only
Vision difficulties only
Hearing and vision difficulties
SWEDEN
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Vision difficulties only
Hearing and vision difficulties
DENMARK
Hearing difficulties only
Vision difficulties only
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GERMANY
Hearing difficulties only
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THE NETHERLANDS
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BELGIUM
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FRANCE
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SWITZERLAND
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AUSTRIA
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ITALY
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GREECE
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Vision difficulties only
Hearing and vision difficulties
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0,00
1,00
2,00
3,00
4,00
5,00
6,00
Odds ratio (95% CI)