Regional Trends in Ageing and Health for Portugal, 2011–2031

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Introduction

Educational attainment is an attribute that leads to a great distinction between the members of a population, including when considering their health and well-being, an important aspect within an aging society. In Portugal there are significantly regional differences in educational, demographic and health indicators. It is crucial to analyse, not only at the national level but also at the regional level, how these set of variables will affect the demographic structure and the population's health, particularly when we expect an ageing process with pronounced regional differences.

The aim of this work was to produce regional demographic projections for the Portuguese population by sex, age group and level of educational attainment, for the period 2011–2031. Considering fertility, mortality and migration differentials by level of education, the population was projected by NUTS II region using the multistate cohort-component method with a block Leslie matrix. Two scenarios were considered, one where educational attainment prior to 2011 remains constant and another in which educational attainment will follow the trend observed over the last decade, being the trend in the state proportion model using continuation ratio models.

The results show an increase in the proportion of individuals who complete higher educational levels in almost all age groups of both sexes. However, significant differences existed across regions. We can expect the proportion of people with higher educational levels to continue to rise, as the education of younger cohorts seems to evolve positively. Trends in health outcomes also differ between the northern and southern regions. These results will be particularly useful for planning and monitoring public health policies at the regional level in Portugal.

Methods

The study had three main objectives (1) demographic projections for the Portuguese population for the period 2011–2031 by region, gender, age group and educational level, (2) a study of the impact of age and education on the indicators of health status and health services utilization, at the regional level and (3) the subsequent projection of these outcomes for the same period, for the seven main regions in Portugal: North, Center, Lisbon, Alentejo, Algarve, RAM (Madeira) and RAA (Azores).

Demographic projections by region, gender, age group and educational level

The methodology used is similar to the one proposed for the national projections; the multistate demographic model[1] as the major instrument for demographic projections by gender, age group and educational attainment, at the region level[2]. Details on the methodology are described elsewhere[3].

Impact of age and education on health status and health services utilization at regional level

The study of current differences in health status and health services utilization by age and educational level was based on the data from the fourth edition of the National Health Survey (4th NHS), a representative survey of the Portuguese population at the regional level, conducted by Statistics Portugal and the National Institute of Health (Dr. Ricardo Jorge INSA), in collaboration with the Directorate-General of Health. The 4th NHS collected information on health status, health determinants, use of health services and socio demographic characteristics of individuals, being the first edition to cover the entire national territory, including the Autonomous Regions of Azores and Madeira. As a whole, seven NUTS II Regions are covered by this survey. The questionnaire was administered by direct interviews of a representative probability sample of the Portuguese population, between February 2005 and February 2006. The study population included individuals living in family housing

1 Frans Willekens, *Description of the multistate projection model (Multistate model for biographic analysis and projection)*. Deliverable D1 in Work Package 1. Bridging the micro-macro gap in population forecasting - MicMac Project. Netherlands Interdisciplinary Demographic Institute. (The Hague, Netherlands, 2006).

2 Robert Schoen, "Population Models With Constant Rates" pp. 1-26 in *Dynamic Population Models*. The Springer Series on Demographic Methods and Population Analysis (Springer Netherlands, 2006).

3 Martins, M.R.O., Rodrigues, I.C., Rodrigues, T. Multistate projections by level of education for Portugal, 2011–2013, *Journal of Population Research*, 31; 317–343(2014).

units (therefore excluding people living in collective accommodations). In total, 41,193 individuals living in 15,239 family housing units were interviewed, and the interview completion rate was 76% nationwide.

As outcomes of health status, we chose: *self-reported health status*, dichotomized as "very good" or "good" and "fair", "bad" or "very bad"; *chronic diseases*, determined by the presence of at least one of 19 presented chronic diseases; *long term disability*, if any difficulty or complete inability in performing at least one of a set of tasks of daily living was reported. Regarding the indicators of health services utilization, the following were considered: the existence of *at least one medical consultation in the last three months* and the *use of prescribed medicines* in the two weeks preceding the survey.

Differences in health status and health services utilization by age and educational level were analyzed by logistic regression model[4], separately estimated for each gender and region. Dummy variables referring to five-year age groups and levels of education were used as explanatory variables. Only individuals aged over 15 years were considered, since only those cases in which the answers were provided by the respondent should be included and the education level should not have a great impact on the health status and the use of health services in children. The same four categories were considered for educational attainment: *No education/Primary*; *Lower Secondary*; *Upper Secondary* and *Higher Education*. A deviation coding scheme or the variables corresponding to age and educational level were used to estimate the effect of each class, compared to the average effect of all groups[5].

Projection of indicators of health status and health services utilization

In order to analyze the influence of education on the health status and the use of health services in the population at the regional level, we compared the results from the projections under the constant and the trend scenarios, for the seven regions.

We also considered two projection scenarios for the differences in health status and utilization of health services by level of education: a *stable scenario*, where it was assumed that the estimated differences based on the fourth edition of the NHS will remain constant throughout the period projection, and a *variable scenario*, in which these differences follow the changes observed between different editions of the NHS. To study the evolution of the differences over time, tests for structural change of the

4 David W. Hosmer and Stanley Lemeshow, *Applied Logistic Regression* (New Jersey, John Wiley & Sons, 2004); Inez M.A. Joung , Anton E. Kunst, Evert van Imhoff and Johan P. Mackenbach, "Education, aging, and health: to what extent can the rise in educational level relieve the future health care burden associated with population aging in the Netherlands?" *Journal of Clinical Epidemiology*, 53 (2000), 955–963.

5 Joseph F. Hair, Rolph E. Anderson, Ronald L. Tatham and William C. Black. *Multivariate Data Analysis* (Upper Saddle River, New Jersey, Prentice Hall, 1998).

regression models were made related to the second and fourth editions of the NHS (conducted in 1995/1996 and 2005/2006, respectively). In cases where the variation in the impact of education was statistically significant, the corresponding coefficient at the start of the projection period (estimated using the most recent NHS) was multiplied by the same factor, to obtain the magnitude of differences observed 10 years later. Given that the sample from the 1995/1996 edition of the NHS is only representative of the population from Mainland Portugal, only these five regions were considered in such calculations. Furthermore, due to the absence of data concerning the consumption of prescribed medicines in the two weeks preceding the survey on the 1995/1996 edition, we decided to use the multiplication factors estimated for the existence of at least one medical consultation in the last three months.

The expected proportions of individuals in each category of the dependent variables, for each gender, age group and educational level, were applied to the estimated number of individuals in each of the strata defined by gender, age group and educational level, obtained from the demographic projections previously described.

Software

The methodology was executed with *Microsoft Office Excel 2010* for the demographic projections. The R software (version 2.13.1) was used to construct the necessary life tables, through the *Life Tables* library, and to model the trend for the schooling levels of the Portuguese population (VGAM library).

In the last two tasks, logistic regression models were fitted using *IBM SPSS Statistics 19* software and *Microsoft Office Excel 2010* was used to compute the estimates for proportions of ill-health and use of health services.

Results

Demographic projections by region, gender, age group and educational level

Table 1. Population structure by gender, age group and educational level, 2011 and 2031 (Trend Scenario) by NUT II

	NUT II	North		Centre		Lisbon		Alentejo	
	Year	2011	2031	2011	2031	2011	2031	2011	2031
	Total (No.)	3,741,092	3,582,068	2,375,902	2,299,854	2,839,908	2,940,893	749,055	668,539
Gender	M	48.3%	48.4%	48.3%	48.5%	48.0%	48.5%	49.1%	48.9%
	F	51.7%	51.6%	51.7%	51.5%	52.0%	51.5%	50.9%	51.1%
Age Group (years)	0-14	15.1%	12.9%	13.7%	13.1%	16.2%	15.6%	13.3%	13.1%
	15-64	68.8%	64.8%	65,5%	65.2%	65.7%	64.3%	63.6%	64.7%
	65+	16.1%	22.3%	20.9%	21.7%	18.0%	20.1%	23.1%	22.1%
Level of Education	NS/2nd Cycle BE	60.5%	44.1%	58.6%	40.5%	49.5%	35.9%	60.5%	41.5%
	Basic Ed.	16.0%	17.7%	16.4%	18.2%	17.1%	16.9%	16.4%	19.1%
	Secondary Ed.	13.2%	20.3%	14.2%	22.5%	17.4%	23.7%	14.2%	23.3%
	Higher Ed.	10.3%	18.0%	10.7%	18.9%	16.0%	23.5%	8.9%	16.1%
Population 65 and over									
Level of Education	Total (No.)	602,798	797,961	496,103	499,808	511,896	590,479	173,145	148,031
	NS/2nd Cycle BE	89.5%	67.9%	91.2%	63.0%	75.7%	43.4%	92.7%	60.3%
	Basic Ed.	4.0%	12.5%	3.7%	14.9%	9.5%	19.0%	3.3%	16.0%
	Secondary Ed.	2.6%	9.5%	2.1%	11.0%	6.7%	17.5%	1.8%	12.2%
	Higher Ed.	3.8%	10.1%	3.0%	11.1%	8.1%	20.1%	2.3%	11.4%

	NUT II	Algarve		R.A.A.		R.A.M.[6]	
	Year	2011	2031	2011	2031	2011	2031
	Total (No.)	437,643	528,960	245,811	251,247	247,568	246,554
Gender	M	50.1%	49.5%	49.6%	49.2%	47.3%	47.6%
	F	49.9%	50.5%	50.4%	50.8%	52.7%	52.4%
Age Group (years)	0-14	15.8%	15.9%	18.3%	15.6%	17.2%	15.2%
	15-64	64.9%	65.2%	69.2%	68.4%	69.8%	69.5%
	65+	19.3%	18.9%	12.6%	16.0%	13.0%	15.3%
Level of Education	NS/2nd Cycle BE	55.5%	41.8%	64.6%	51.6%	61.0%	46.8%
	Basic Ed.	17.9%	19.9%	16.0%	18.8%	15.3%	16.3%
	Secondary Ed.	16.8%	22.9%	11.2%	16.4%	13.7%	21.8%
	Higher Ed.	9.8%	15.4%	8.1%	13.2%	10.0%	15.2%
Population 65 and over							
Level of Education	Total (No.)	84,463	99,941	30,864	40,158	32,188	37,824
	NS/2nd Cycle BE	84.9%	56.2%	88.8%	67.6%	90.0%	66.6%
	Basic Ed.	5.9%	16.7%	4.5%	12.6%	4.0%	10.9%
	Secondary Ed.	5.2%	15.3%	2.8%	9.0%	2.7%	10.9%
	Higher Ed.	4.1%	11.8%	3.8%	10.8%	3.3%	11.7%

Source: Author's calculations.

6 RAM is the Portuguese acronym for "Região Autónoma da Madeira".

Results for the Demographic Projections, by Portuguese NUTs II Regions, are shown in Table 1. The expected demographic pattern will generally be similar to the one obtained for the whole country. According to the trend scenario, the total number of residents is expected to decline in most regions, with the exception of Lisbon, the Algarve and the Azores (RAA)[7]. The proportion of young people will decline in almost all regions, with only a slight increase in the Algarve and a sharp decrease in the Autonomous Regions and the North, whilst the percentage of elderly is expected to rise in all regions, remaining at levels close to those achieved in 2011 only in Alentejo and Algarve.

Table 2. Demographic Indicators, 2011 and 2031 (Trend Scenario), by NUT II

	North		Centre		Lisbon		Alentejo		Algarve		R.A.A.		R.A.M.	
	2011	2031	2011	2031	2011	2031	2011	2031	2011	2031	2011	2031	2011	2031
Youth Ratio	93.8	58.1	65.4	60.2	90.1	77.6	57.7	59.3	81.7	83.9	145.4	97.6	132.6	99.1
Ageing Ratio	106.6	172.1	152.9	166.2	111.0	128.8	173.4	168.7	122.5	119.2	68.8	102.4	75.4	100.9
Longevity Ratio	46.6	41.1	50.1	43.0	44.2	44.2	52.2	42.7	48.8	43.8	45.6	34.7	45.9	32.7
Renewal of Working Age Population Ratio	111.9	66.5	103.4	68.9	87.6	79.5	96.6	70.6	97.4	86.7	164.7	88.2	153.7	79.8
Youth Dependency Ratio	22.0	20.0	20.9	20.1	24.7	24.2	21.0	20.3	24.3	24.3	26.4	22.8	24.7	21.9
Elderly Dependency Ratio	23.4	34.4	31.9	33.3	27.4	31.2	36.4	34.2	29.7	29.0	18.1	23.4	18.6	22.1
Total Dependency Ratio	45.4	54.4	52.8	53.4	52.1	55.4	57.4	54.5	54.0	53.3	44.5	46.2	43.4	44.0

Source: Author's calculations

Increased levels of schooling, for the general population and in particular for the elderly, is a generalized phenomenon and Lisbon will remain as the region with comparatively high levels of education. Projections obtained for crucial demographic indicators, by regions, are shown in Table 2.

Adjusted for other factors, logistic regression models based on data from the 4th INS (Table 3), suggest that there is an effect of education on health status self - perception, both among men and women, and in all NUT II regions. In general, individuals who have completed higher education tend to rate their health status more positively, and those who have not completed basic education tend to give more negative ratings.

7 RAA is the Portuguese acronym for "Região Autónoma dos Açores".

Table 3. Differences in self-rated health status as 'fair', 'poor' or 'very poor', between levels of education, by gender and NUTS II, adjusted for age (odds ratio).

Gender	Educational level	NUT II													
		North		Centre		Lisbon		Alentejo		Algarve		R.A.A.		R.A.M.	
		OR	p	OR	P	OR	p	OR	p	OR	p	OR	p	OR	p
Male	NS/2nd Cycle BE	2.27**	0.00	2.45**	0.00	2.51**	0.00	1.73**	0.00	2.18**	0.00	1.90**	0.00	2.58**	0.00
	Basic Ed.	0.91	0.54	1.21	0.20	1.06	0.67	1.14	0.42	1.08	0.56	1.35**	0.04	0.87	0.55
	Secondary Ed.	0.92	0.62	0.78	0.14	0.72**	0.02	0.81	0.25	0.75**	0.05	0.74*	0.08	0.88	0.63
	Higher Ed.	0.53**	0.00	0.43**	0.00	0.53**	0.00	0.63**	0.03	0.56**	0.00	0.53**	0.00	0.50**	0.02
Female	NS/2nd Cycle BE	2.28**	0.00	2.21**	0.00	2.20**	0.00	2.12**	0.00	2.29**	0.00	1.95**	0.00	2.32**	0.00
	Basic Ed.	1.21	0.16	1.29**	0.05	1.07	0.56	1.14	0.33	1.10	0.40	1.36**	0.02	1.14	0.42
	Secondary Ed.	1.35**	0.04	0.78*	0.07	0.87	0.23	0.72**	0.03	0.84	0.15	0.87	0.32	0.74*	0.07
	Higher Ed.	0.27**	0.00	0.45**	0.00	0.49**	0.00	0.57**	0.00	0.47**	0.00	0.43**	0.00	0.51**	0.00

** $p \leq 0.05$, * $p \leq 0.10$, n = 23839

Moreover, as suggested in Table 4, in general and when adjusting for age, chronic diseases do not seem to be strongly associated with the individuals' level of education. The only statistically significant differences for the prevalence of at least one chronic disease among individuals with different levels of education are found for Lisbon and Alentejo, among women in the Algarve and men in the North region. In these cases, the odds ratios indicate an increasing risk of the presence of chronic diseases among individuals with lower educational levels and a decreasing risk for those that have reached higher levels of education.

Table 4. Differences in the presence of at least one chronic disease among levels of education, by gender and NUTS II, adjusted for age (odds ratio)

Gender	Educational level	NUT II													
		North		Centre		Lisbon		Alentejo		Algarve		R.A.A.		R.A.M.	
		OR	p	OR	P	OR	p	OR	p	OR	p	OR	p	OR	p
Male	NS/2nd Cycle BE	1.45**	0.01	1.19	0.39	1.22*	0.06	1.32*	0.09	1.13	0.25	1.12	0.35	1.45	0.13
	Basic Ed.	0.85	0.26	0.88	0.41	0.95	0.67	0.88	0.41	0.92	0.52	1.10	0.44	1.03	0.90
	Secondary Ed.	0.95	0.70	1.04	0.82	0.75**	0.03	0.84	0.31	0.83	0.16	0.82	0.15	0.78	0.31
	Higher Ed.	0.86	0.37	0.91	0.57	1.15	0.28	1.03	0.89	1.14	0.40	0.99	0.93	0.86	0.57
Female	NS/2nd Cycle BE	1.24	0.11	1.28	0.13	1.15	0.12	1.41**	0.01	1.35**	0.00	1.21	0.17	1.09	0.58
	Basic Ed.	1.04	0.76	0.90	0.42	0.96	0.69	1.08	0.58	0.88	0.26	1.01	0.91	1.00	0.99
	Secondary Ed.	0.94	0.64	0.91	0.47	1.16	0.20	0.89	0.44	0.72**	0.00	0.89	0.32	0.81	0.21
	Higher Ed.	0.83	0.16	0.96	0.76	0.79**	0.04	0.74**	0.04	1.17	0.24	0.92	0.51	1.13	0.49

** $p \leq 0.05$
* $p \leq 0.10$
n = 23840

The association between schooling and the number of medical consultations is less evident. It is more evident in the Lisbon region, among men in the North and Centre and, once more, among women in the Alentejo and Azores (Table 5). In most cases, schooling is positively associated with the use of health services. Usually, individuals who have not completed basic education are less likely to have made at least one medical visit in the past three months.

Table 5. Differences in the existence of at least one medical visit in the past three months, between educational level, by gender and NUTS II, adjusted for age (odds ratio).

Gender	Educational level	NUT II													
		North		Centre		Lisbon		Alentejo		Algarve		R.A.A.		R.A.M.	
		OR	p	OR	p	OR	p	OR	p	OR	p	OR	p	OR	p
Male	NS/2nd Cycle BE	0.99	0.12	0.90	0.20	0.76**	0.03	0.97	0.13	0.95	0.15	0.67	0.42	0.90	0.88
	Basic Ed.	0.77**	0.05	0.81	0.13	1.32**	0.02	0.92	0.56	0.90	0.35	1.22	0.10	0.81	0.31
	Secondary Ed.	1.01	0.92	0.93	0.64	0.86	0.20	1.18	0.31	0.95	0.70	1.08	0.54	1.23	0.37
	Higher Ed.	1.29*	0.10	1.49**	0.01	1.16	0.21	0.96	0.80	1.23	0.17	1.13	0.44	1.12	0.65
Female	NS/2nd Cycle BE	0.89*	0.08	1.04	0.11	0.98**	0.00	1.08*	0.10	1.05	0.14	0.91	0.06	0.87	0.43
	Basic Ed.	1.04	0.74	1.06	0.66	0.84*	0.10	0.79**	0.05	0.98	0.87	0.85	0.14	0.78	0.12
	Secondary Ed.	1.01	0.94	0.84	0.18	1.05	0.64	0.97	0.84	1.02	0.87	0.91	0.36	1.19	0.26
	Higher Ed.	1.07	0.62	1.08	0.51	1.15	0.19	1.21	0.17	0.95	0.66	1.43**	0.00	1.23	0.20

** $p \leq 0.05$
* $p \leq 0.10$
n = 23831

Table 6. Differences in the use of prescription medicines in the past two weeks, between levels of education, by gender and NUTS II, adjusted for age (odds ratio).

Gender	Educational level	NUT II													
		North		Centre		Lisbon		Alentejo		Algarve		R.A.A.		R.A.M.	
		OR	p	OR	p	OR	p	OR	p	OR	p	OR	p	OR	p
Male	NS/2nd Cycle BE	1.27	0.12	0.95	0.20	0.96**	0.03	1.04	0.13	0.83	0.15	0.92	0.42	1.26	0.88
	Basic Ed.	0.86	0.34	1.07	0.67	1.00	1.00	1.01	0.94	0.83	0.13	1.16	0.27	0.89	0.61
	Secondary Ed.	0.86	0.35	0.97	0.87	0.88	0.34	0.92	0.65	1.02	0.89	0.93	0.64	1.14	0.61
	Higher Ed.	1.07	0.71	1.01	0.96	1.18	0.20	1.03	0.88	1.42**	0.03	1.00	0.99	0.79	0.40
Female	NS/2nd Cycle BE	1.31*	0.08	1.00	0.11	1.09**	0.00	1.52*	0.10	1.16	0.14	0.96*	0.06	0.85	0.43
	Basic Ed.	0.76**	0.03	0.96	0.79	1.06	0.61	1.01	0.91	0.79**	0.02	0.85	0.17	1.08	0.63
	Secondary Ed.	1.60**	0.00	0.98	0.90	0.89	0.29	0.73**	0.02	1.03	0.76	1.04	0.75	1.19	0.28
	Higher Ed.	0.63**	0.00	1.06	0.68	0.97	0.81	0.89	0.41	1.06	0.65	1.17	0.22	0.91	0.56

** $p \leq 0.05$
* $p \leq 0.10$
n = 23837

Table 7. Prevalence projected for self-rating of health status as 'fair', 'poor' or 'very poor', 2011, 2021 and 2031, by gender and NUTS II, Constant Scenario and Trend Scenario (%).

NUT II	Year	Gender	Constant Scenario	Trend Scenario
North	2011	M	44.3%	44.3%
		F	58.8%	58.8%
	2021	M	44.6%	44.4%
		F	58.8%	58.4%
	2031	M	45.6%	45.1%
		F	59.4%	58.3%
Centre	2011	M	53.1%	53.1%
		F	63.3%	63.3%
	2021	M	51.2%	50.9%
		F	61.5%	61.2%
	2031	M	51.2%	50.3%
		F	61.2%	60.4%
Lisbon	2011	M	41.9%	41.9%
		F	55.4%	55.4%
	2021	M	40.4%	40.2%
		F	54.6%	54.3%
	2031	M	39,8%	39.1%
		F	53,9%	53.2%
Alentejo	2011	M	44.2%	44.2%
		F	60.3%	60.3%
	2021	M	42.3%	42.2%
		F	57.8%	57.7%
	2031	M	42.3%	41.9%
		F	57.1%	56.6%
Algarve	2011	M	40.8%	40.8%
		F	52.8%	52.8%
	2021	M	38.8%	38.7%
		F	50.5%	50.3%
	2031	M	37.8%	37.5%
		F	49.4%	48.8%
R.A.A.	2011	M	35.5%	35.5%
		F	48.8%	48.8%
	2021	M	36.3%	36.2%
		F	49.5%	49.3%
	2031	M	38.2%	38.0%
		F	51.5%	51.1%
R.A.M.	2011	M	42.6%	42.6%
		F	55.9%	55.9%
	2021	M	41.1%	40.9%
		F	54.8%	54.7%
	2031	M	41.3%	40.7%
		F	54.9%	54.6%

Source: Author's calculations.

There is a positive association between educational level and prescribed medicines for women in the North region. As can be seen in Table 6, those who have not completed basic education and those who have attained secondary education have a higher rate of consumption of medicines. However, the relationship between schooling and use of medicines is not obvious or similar in different regions. Thus, among women in Lisbon and Alentejo, education seems to be negatively associated with the prescription of medicines, but the opposite occurs among men in Lisbon, Algarve and the Azores.

Projections for Indicators of Health Status and Use of Health Services, 2011–2031, by NUT II

Self-Perception of Health Status

Table 7 shows the projected proportions of individuals who evaluate their health status as 'fair', 'poor' or 'very poor' for each region and gender in the years 2011, 2012 and 2031, comparing the constant scenario with the trend scenario. Differences between the estimated proportions according to the two scenarios depend on the level of education, previously analysed as the odds ratio of logistic regression models.

Individuals with a higher education tend to rank their health status more positively (for the same age) compared with less educated persons. The same table also reveals that in all regions the proportions of women with a negative self-reported health status outweigh the proportions recorded for the opposite gender. The Centre region is projected to have a less favourable health status, in contrast to the Azores, where these proportions reach lower values.

Chronic Diseases

Table 8 compares the prevalence of at least one chronic disease with the two scenarios. As can be seen, the most favourable results correspond to the variable scenario. Moreover, although the differences between the constant scenario and the trend scenario are small, they become more evident when we assume that the differences between the levels of education are accentuated (variable scenario). The projected prevalence is higher in the North region in contrast to the Autonomous Region of Madeira with minimum values. Women always have higher prevalence than men, regardless of the region and the scenario considered.

Table 8. Prevalence projected for the presence of at least one chronic disease, 2011, 2021 and 2031, by gender and NUTS II, Constant Scenario and Trend Scenario (%).

			Stable Scenario		Variable Scenario	
NUT II	**Year**	**Gender**	**Constant Scenario**	**Trend Scenario**	**Constant Scenario**	**Trend Scenario**
North	2011	M	60.1%	60.1%	60.1%	60.1%
		F	73.2%	73.2%	73.2%	73.2%
	2021	M	61,7%	61.6%	40.7%	40.5%
		F	75.1%	75.0%	75.1%	75.0%
	2031	M	63.9%	63.6%	59.7%	61.0%
		F	77.0%	76.8%	76.4%	74.7%
Centre	2011	M	62.8%	62.8%	62.8%	62.8%
		F	72.8%	72.8%	72.8%	72.8%
	2021	M	63.0%	62.9%	46.2%	46.0%
		F	73.2%	73.1%	73.1%	73.0%
	2031	M	64.5%	64.4%	59.8%	61.3%
		F	74.3%	74.1%	72.6%	72.2%
Lisbon	2011	M	63.2%	63.2%	63.2%	63.2%
		F	73.4%	73.4%	73.4%	73.4%
	2021	M	64.5%	64.4%	60.5%	60.7%
		F	74.2%	74.1%	74.3%	74.2%
	2031	M	65.0%	64.6%	52.3%	52.3%
		F	74.5%	74.2%	74.1%	73.2%
Alentejo	2011	M	57.8%	57.8%	57.8%	57.8%
		F	69.7%	69.7%	69.7%	69.7%
	2021	M	57.4%	57.3%	42.6%	42.5%
		F	69.2%	69.0%	69.1%	69.0%
	2031	M	58.1%	57.9%	53.4%	56.1%
		F	69.6%	69.3%	67.9%	68.3%
Algarve	2011	M	53.0%	53.0%	53.0%	53.0%
		F	67.2%	67.2%	67.2%	67.2%
	2021	M	52.8%	52.7%	45.8%	45.8%
		F	67.0%	67.0%	66.3%	66.3%
	2031	M	52.9%	52.8%	50.8%	52.6%
		F	67.0%	67.1%	60.9%	62.7%
R.A.A.	2011	M	50.1%	50.1%	50.1%	50.1%
		F	64.6%	64.6%	64.6%	64.6%
	2021	M	51.8%	51.7%	62.6%	62.5%
		F	66.6%	66.5%	67.1%	67.0%
	2031	M	54.4%	54.3%	36.1%	31.7%
		F	69.4%	69.3%	69.9%	67.9%
R.A.M.	2011	M	45.2%	45.2%	45.2%	45.2%
		F	57.9%	57.9%	57.9%	57.9%
	2021	M	45.9%	45.7%	45.5%	45.7%
		F	59.7%	59.6%	60.6%	60.4%
	2031	M	47.7%	47.5%	33.8%	30.4%
		F	62.3%	62.1%	62.1%	61.4%

Source: Author's calculations.

Table 9. Prevalence projected for the presence of at least one long-term disability, in 2011, 2021 and 2031, by gender and NUTS II, Constant Scenario and Trend Scenario (%).

			Stable Scenario		Variable Scenario	
NUT II	**Year**	**Gender**	**Constant Scenario**	**Trend Scenario**	**Constant Scenario**	**Trend Scenario**
North	2011	M	6.0%	6.0%	6.0%	6.0%
		F	8.1%	8.1%	8.1%	8.1%
	2021	M	6.1%	6.1%	6.1%	6.1%
		F	8.1%	8.1%	7.8%	7.8%
	2031	M	6.3%	6.2%	6.3%	6.1%
		F	8.2%	8.2%	7.8%	7.7%
Centre	2011	M	6.1%	6.1%	6.1%	6.1%
		F	7.1%	7.1%	7.1%	7.1%
	2021	M	5.6%	5.6%	5.6%	5.6%
		F	6.6%	6.6%	7.8%	7.8%
	2031	M	5.5%	5.4%	5.5%	5.6%
		F	6.3%	6.3%	7.7%	8.6%
Lisbon	2011	M	5.4%	5.4%	5.4%	5.4%
		F	7.7%	7.7%	7.7%	7.7%
	2021	M	5.1%	5.1%	5.1%	5.1%
		F	7.3%	7.2%	6.3%	6.3%
	2031	M	5.1%	5.1%	5.1%	5.1%
		F	6.7%	6.7%	6.0%	5.9%
Alentejo	2011	M	6.0%	6.0%	6.0%	6.0%
		F	9.2%	9.2%	9.2%	9.2%
	2021	M	5.0%	5.0%	5.0%	5.0%
		F	8.4%	8.4%	5.6%	5.5%
	2031	M	4.4%	4.4%	4.4%	5.0%
		F	8.0%	7.9%	5.4%	4.7%
Algarve	2011	M	5.4%	5.4%	5.4%	5.4%
		F	7.3%	7.3%	7.3%	7.3%
	2021	M	4.9%	4.9%	4.9%	4.9%
		F	6.8%	6.8%	6.8%	6.8%
	2031	M	4.8%	4.7%	4.8%	4.9%
		F	6.4%	6.4%	6.5%	6.9%
R.A.A.	2011	M	3.8%	3.8%	3.8%	3.8%
		F	6.9%	6.9%	6.9%	6.9%
	2021	M	3.9%	3.9%	3.9%	3.9%
		F	7.1%	7.1%	5.6%	5.6%
	2031	M	4.3%	4.3%	4.3%	3.9%
		F	7.6%	7.5%	5.9%	5.1%
R.A.M.	2011	M	3.0%	3.0%	3.0%	3.0%
		F	5.2%	5.2%	5.2%	5.2%
	2021	M	2.6%	2.6%	2.6%	2.6%
		F	5.0%	5.0%	4.5%	4.5%
	2031	M	2.4%	2.4%	2.4%	2.6%
		F	5.1%	5.1%	4.5%	4.3%

Source: Author's calculations.

Table 10. Prevalence projected for the existence of at least one medical appointment in the last three months 2011, 2021 and 2031, by gender and NUTS II, Constant Scenario and Trend Scenario (%).

			Stable Scenario		Variable Scenario	
NUT II	**Year**	**Gender**	**Constant Scenario**	**Trend Scenario**	**Constant Scenario**	**Trend Scenario**
North	2011	M	51.9%	51.9%	51.9%	51.9%
		F	64.4%	64.4%	64.4%	64.4%
	2021	M	52.9%	53.0%	50.5%	50.6%
		F	65.9%	66.0%	66.8%	66.7%
	2031	M	54.2%	54.4%	53.6%	52.3%
		F	67.6%	67.7%	66.8%	64.8%
Centre	2011	M	52.6%	52.6%	52.6%	52.6%
		F	64.7%	64.7%	64.7%	64.7%
	2021	M	52.7%	52.8%	51.3%	51.4%
		F	64.5%	64.6%	65.4%	65.4%
	2031	M	54.2%	54.4%	54.0%	52.4%
		F	65.1%	65.2%	64.4%	63.2%
Lisbon	2011	M	56.8%	56.8%	56.8%	56.8%
		F	66.0%	66.0%	66.0%	66.0%
	2021	M	57.7%	57.7%	58.4%	58.4%
		F	66.6%	66.6%	66.7%	66.5%
	2031	M	57.9%	57.9%	58.1%	58.0%
		F	67.2%	67.3%	67.0%	65.7%
Alentejo	2011	M	47.2%	47.2%	47.2%	47.2%
		F	59.4%	59.4%	59.4%	59.4%
	2021	M	47.4%	47.4%	46.7%	46.7%
		F	59.4%	59.4%	62.2%	61.9%
	2031	M	48.1%	48.2%	48.0%	47.2%
		F	59.8%	59.9%	57.2%	55.1%
Algarve	2011	M	44.3%	44.3%	44.3%	44.3%
		F	58.3%	58.3%	58.3%	58.3%
	2021	M	44.5%	44.6%	43.9%	43.9%
		F	58.2%	58.1%	57.5%	57.5%
	2031	M	44.8%	44.9%	44.7%	44.4%
		F	58.3%	58.3%	58.7%	58.8%
R.A.A.	2011	M	38.9%	38.9%	38.9%	38.9%
		F	52.7%	52.7%	52.7%	52.7%
	2021	M	40.7%	40.8%	42.9%	43.0%
		F	53.8%	53.9%	60.5%	60.1%
	2031	M	43.3%	43.4%	43.8%	41.4%
		F	55.4%	55.6%	47.0%	43.9%
R.A.M.	2011	M	40.4%	40.4%	40.4%	40.4%
		F	49.6%	49.6%	49.6%	49.6%
	2021	M	41.1%	41.2%	39.2%	39.3%
		F	51.1%	51.1%	54.7%	54.7%
	2031	M	42.6%	42.8%	42.0%	40.6%
		F	53.2%	53.3%	50.4%	46.7%

Source: Author's calculations

Long-term disability

The projected prevalence for long-term disability (Table 9) tends to decrease in the various scenarios and for the different regions. The exception is in the Azores and in the North region as well as for women in the Centre. In 2031, and according to regional diversity, the North is expected to be the region with higher proportions of individuals with long-term disability in both genders. This happens even though the values in this region were lower than those of the Alentejo region in 2011, particularly among women. The Autonomous Region of Madeira will continue to report the lowest prevalence of disability.

Medical visits

The expected proportions of individuals who will attend a medical appointment (Table 10) the results for 2031 are relatively similar to those of 2011 in most regions. In 2031, the lowest percentage of use of this service is expected in the variable scenario, where an increasing level of education is assumed with the exception of Lisbon and Algarve. Once again, the lower prevalence rates are those projected by the trend scenario and Lisbon reports the highest levels. On the contrary, the lowest values are found in the Autonomous Regions. In all areas of Portugal, women have higher values for this indicator.

Conclusions

The estimation results of the logistic regression based on data from the 4th INS suggest that there is an association between education (adjusted for age) and self-perception of health status for both genders and in all regions. In general, individuals with higher education also tend to have a higher perceived health status. Those who have not completed a basic education are more likely to report more negative ratings. For the remaining indicators, the association with educational levels does not seem to be so clear. In regions where these effects are statistically significant, individuals without basic education are more likely to have at least one chronic disease or a long-term disability. However, this risk is reduced among ageing persons with higher education, particularly among women in all regions. In general, the associations between health indicators and educational levels seem to be more visible and significant among women.

For each of the five indicators used, self-perception of health status showed the most obvious improvements. A substantial increase will be expected in the proportion

of residents who rate their health as 'good' or 'very good' in all scenarios and both genders.

For this indicator, the increased levels of education (trend scenario) seem to have a great impact compared with the constant scenario. The same is true for the use of prescription medicines among men and for medical visits by women. This impact is always expected to be positive, since the trend scenario results suggest a lower prevalence of individuals who rate their health status negatively, with fewer medical appointments and less use of prescription medicines.

Projections on the health status of the population is a complex and challenging task, given the difficulties to estimate changes in morbidity and health[8]. The projections have followed an approach of 'what if', based on the definition of different scenarios for the projections of educational levels and the differences between educational levels versus health status and the use of health services. Thus, the uncertainty associated with the results is evident. Nevertheless, in our opinion such projections will be valuable for planning and policy decision-making.

We can thus assume that if increased longevity is accompanied by an increase in the number of years lived in good health, the ageing of the Portuguese population may not necessarily translate itself into an increase in health expenditures. A better health status will contribute to a lower use of health services and can consequently can lead to reduced costs[9].

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