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Age and health inequality under the health paradox hypothesis

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Abstract

The effect of age on health inequality is an open field of research. We know that over time new cohorts enjoy longer life expectancies but with likely lower health levels for the additional years. If we add to this that the self-assessed levels of health status decrease with age due to a more likely medically demanding society, this composite effect will lower the effectiveness of health care over time despite the individuals' longer life expectancy. This result is the so called 'health paradox'; this is, an improvement in objective measures of health (life expectancy) seem to go hand by hand with a decrease in the reported health status of the population.

The purpose of this paper is to explore a related issue to the former paradox; whether these changes (this is, a higher prevalence of chronic conditions and a more demanding society at the time the individuals self-assess their own health) increase or decrease health inequalities.

We reply the empirical work that Garcia-Altes *et al.* (2011) did for Catalonia by comparing the changes of the mean across age cohorts over time and the evolution of the internal variance among those categories (as a proxy for perceived health inequalities over time) for the years 2001-2006. We take the Catalonia Health Interview Survey for 1994, 2000-2001 and 2006 and we decompose the longitudinal cross sectional data through a model estimation following a Bayesian approach that allows to control for heteroskedasticity and most importantly for the endogeneity of the regressors. We find that Garcia-Altes *et al.* (2011) result of increasing health inequalities over time is not confirmed. This may be due to the expanded period we have taken and to our richer estimation model that better accounts for the individual heterogeneity.

Key words: the health paradox, income related health inequalities, self assessed heath status. Catalan Health Surveys (1994-2000/2001-2006)

JEL: H51, H5, I12, I18.

Background

Based on several theories (see Mackenbach, 2012) it is hypothesized that three circumstances may help to explain the persistence of health inequalities despite attenuation of inequalities in material conditions by the welfare state: (1) inequalities in access to material and immaterial resources have not been eliminated by the welfare state, and are still substantial; (2) due to greater intergenerational mobility, the composition of lower socioeconomic groups has become more homogeneous with regard to personal characteristics associated with ill-health; and (3) due to a change in epidemiological regime, in which consumption behavior became the most important determinant of ill-health, the marginal benefits of the immaterial resources to which a higher social position gives access have increased.

The first hypothesis is that the lower social strata have become more exclusively composed of individuals with personal characteristics that increase the risks of ill-health. This is the result of decades of upward intergenerational social mobility, which may have increased opportunities for social selection and may have made the lower social groups more homogeneous with regard to personal characteristics like low cognitive ability and less favorable personality profiles. The increase of intergenerational social mobility is primarily due to changes in the economy that have led to an expansion of higher education, but to the extent that welfare policies have contributed to making the education system more merit-based, they may paradoxically have contributed to a widening of health inequalities.

To this respect, Mackenbach concludes that a substantial reduction of health inequalities can only be achieved with more radical redistribution measures, and/or a direct attack on the personal, psychosocial and cultural determinants of health inequalities. As long as there is insufficient political support for the first, and as long as the second is unfeasible because of a lack of effective interventions, those who want to reduce health inequalities will have to be satisfied with small steps forward.

It is well known that the increase in life expectancy associated to a relative compression of morbidity may be accompanied by worsening health conditions due to the fact that those infra-marginal patients that in the past did not survive and they do now, have a worse health condition. This must reflect into the overall health states of the population and in the level of health inequalities. Intuitively, a higher relative share of elderly people should reduce health inequality, being all these aged population more similar in health conditions. The underlying hypothesis here is that as health capital deteriorates the variance of self assessed health status decreases. Whether this is the result of a sigma convergence (when the dispersion of health simply falls over time) or a beta convergence (within their cohorts, those with lower health levels improve the most) may add some extra interest to the analysis.

On the top of that it is also possible to postulate that factors that create income related health inequalities diminish when people age, since despite it may be assumed to exist a larger income inequality between older versus younger age groups (ie. due to the life cycle accumulation hypothesis), the interaction between higher income and better relative health may diminish for the oldest cohorts.

Four different factors may be therefore in place in our analysis: (i) how does the distribution of health evolves over the life cycle of the individuals, (ii) whether this distribution changes across different generations, (iii) how do socioeconomic factors affect health as individuals' age and, finally, (iv) how cultural values across generations play in narrowing or widening (self-assessed) health.

Our hypotheses at any given moment of time are: a) younger cohorts are more similar in health capital (they are young!), have lower wealth differences (no yet time of earnings accumulation) and more unequal income (inherited, say) than older cohorts, but the effects of income related inequalities in health are higher for them (life styles, job risk premium and health hazards); b) older cohorts have more different health capital (accumulated over the life cycle), more equal income and despite higher average differences in wealth, income related inequalities have a lower effect in their health.

Over time our hypotheses are: c) the health capital of young cohorts improve (genes, inherited health stocks), income disparities increase (salary differences for education, technological gap in the labour markets), and this amplifies health inequalities within the group; d) the health capital of older cohorts improve other things equal for a given age, but overall morbidity prevalence and cultural demands for better health increase too, and so diminish the self-assessed health levels; finally, wealth and income disparities increase over time, but the marginal impact of this difference on health decreases; e) the composition effect (a larger share of elderly people with a more similar *within-group* poor health) offsets all those factors, by working for higher health disparities (the increase in income related inequalities *between-groups* and a more demanding society on health care) As a result, overall health inequalities should diminish. In other words: a more similar within cohorts self assessed (worse) health for older groups, given its larger share on total population, more than offsets the larger differences which otherwise would be observed between young and old cohorts. This last effect is expected to come out from greater health related income inequalities, growing over time (in a recursive influence from hypothesis 'a'). From all these hypotheses, a sigma, rather than a beta convergence, might be predicted.

Previous literature

According to our review of the existing literature, Van Kippersluis *et al.* (2009) have found that for most of the European countries, health levels change little as individual ages: this is particularly the case for the age cohort between 20 and 40 years. But beyond 65-70, health begins to deteriorate rapidly. Naturally, individuals in older generations have markedly worse health than their former counterparts but, at a given age, health differences are lower among them. The variance significantly decreases with age once the cohort effect is considered; this is, once we account for the fact that there are more aged people in the oldest cohorts. The authors analyze the relationship between health and income across the life cycle of individuals and several generations in Europe and they find in most of the southern Europe a significant fall in health inequality over time (with some northern countries and France being an exception). Age may be the explanation. In searching for the age effect, they apply age-cohort decomposition to a panel data and indentify how the mean, overall inequality and income related inequality of self-assessed health evolve over the life cycle of the individuals and how do differ across generations. They observe in general a moderate and steady decline in mean health until the age of 70 and a steep acceleration in the rate of deterioration thereafter. In southern Europe and Ireland, where economic development has been most rapid, the average health of generations born in more recent decades is significantly higher than that of older generations. This is not observed in the northern countries. Moreover, in almost all countries of the first EU-11 entrants, health is now more dispersed among older generations than in the past, and despite this Europe has experienced a reduction in overall health inequality over time. In addition, there is not overwhelming evidence that income related health inequalities (IRHI from now) are greater among younger than older generations. Indeed, in some countries the income gradient in health does peak around retirement age (as it is typically the case in USA). This is exactly the opposite effect that we expected to find. But, in general, there is no evidence that health inequality increases as a given cohort ages. Manton *et al.* (2009) find for USA that health care expenditure in a given year play the role of an investment that preserves human capital to later ages, for better health and functional status.

How health inequality changes with an ageing population is explored by Deaton and Paxson (1998) for USA. They report that within-cohort health variance and correlation between health and income increases gradually through working age. After retirement the correlation appears to weaken but the dispersion increases.

Specifically on the IRHI issue, a recent survey from Leigh *et al.* (2009) show that although there are plausible reasons for anticipating a relationship between inequality and health (in either direction), the empirical evidence for such a relationship is weak, at least in rich countries. More specifically for Sweden, Islam *et al.* (2009) explore whether IRHI change as the population ages. They find that IRHI measured by the concentration index increases over time. Good health is pro rich and increases as the cohort become older. And as in Deaton and Paxson (1998), the variation of health for different cohorts is increasing over the waves. However it is stable if we ranked according to lifetime (mean) income. Two are the drivers: retired people drop in relative income rankings and the coefficient of variation of health increases as the population ages. They analyze then how precisely aging impact on income related health inequalities. If health inequality changes as the population ages, aging itself generates unavoidable inequality consequences, not fully amenable by public policy interventions[1]. These authors conclude that the precise degree to which

[1] These authors conclude that good health (self rated by the individuals) is generally pro-rich and this bias increases as the cohorts become older. The age-gender standardization does not avert this trend. The increase in health inequality is then partly explained by the decrease in the population mean of health, which is attributable to the aging population. If the dispersion of health of different cohort increases over time, this is, elderly people in lower health states

differences in age structure contribute to the variations in health inequalities across countries should be further explored.

By moving to empirics and using lifetime income data, the authors find that the concentration index appears to be quite stable over time. Indeed the ranking of the individuals at a given moment in time is influenced strongly by the pension payments, due to the importance influence of pensions on redistribution. In Sweden, when one controls for age related income mobility over the life cycle, there is little evidence that income related health inequality increases as the population ages.

For the French case, Trannoy *et al.* (2010) use data from the Survey of Health, Ageing and Retirement in Europe (SHARE) and adopt an stochastic dominance methodology in order to prove some dynastic effects; in particular, that the mothers' social economic status (SES) have a direct effect on health status of descendants in older ages (in coherence with the so called *latency's hypothesis*), while fathers' SES only have an indirect impact through the descendant's education level and SES, in accordance with the *pathway hypothesis*. Moreover, the *hypothesis of transmission of health from one generation to the next* holds as postulated since they observe a direct effect of fathers' vital status and of mothers' relative longevity on descendants' health in adulthood. Indeed all the channels through which the family background can influence health in adulthood are involved in the explanation of inequalities in health opportunities in France. As a result, by allocating the best circumstances in both parents' SES and parents' to all the citizens, health would halve health inequality in France, being the more relevant factor the mother's social status on the health of her offspring.

Finally, for United States of America, Deaton and Paxson (1998) analyse the impact of exogenous factors to health inequalities. They argue that when health shocks are permanent, their cumulative effect will result in health being more widely dispersed at older ages. If health dispersion increases with age, ageing population would lead then to greater total inequality in health, assuming no offsetting differences across other generations. In general, however, income losses from illness related to job interruptions cease after retirement. Kunst and Mackenbach (1994) remark the case where health problems, which inevitably arise in the course of time, act as levellers and, as a result, socioeconomic disparities tend to narrow in old ages. In particular, Deaton and Paxson (1998) found that health deteriorates with age in a persistent constant rate and that health variance increases up to the age of 60 after which it remains constant. In addition, they argue, if we assume that shocks are accumulative and not random, the prediction of increasing variance with age would not hold anymore. These authors also find that the income health income gradient is greater among young cohorts and that the socioeconomics components of inequality in

remain into the poor group; this then drives the inequality upwards. On the opposite side, the 'student' effect or 'young effect' may bias the index downwards since young people are on average poor and healthy. No evidence suggests that health profiles across individual-mean income groups diverge over time. However, the observed increase in income related health inequalities may be an artifact related to the structure of the pension payments system (the 'retirement' effect) or to changes in the saving behaviour at older ages.

health have been raising while total health inequality, measured by the variance, has been falling.

Income, health, wealth and welfare

We support our assumptions on he evidence that income related health inequalities are to be more intense within young cohorts (i.e. the effect of income and education on healthy habits, better jobs, nutrition, etc) given the way that they impact on health status, and lower for those affected by a higher rate of depreciation of health capital over time, and hence the impact those socioeconomic determinants. Stoyanova *et al.* (2005) find out from the Spanish 2003 Health Survey that health and age exhibit an inverted U shape, with a maximum for the 45 to 64 cohort. As expected, with lower income related inequalities, inequalities in health are lower for young adults, and those over 74 years old (the authors believe that this may be due to a decrease in the individuals' expectations), and they pick for those age cohorts before retirement.

The Spanish National Institute for Statistics (INE) provides some data on the Life Conditions of the Spanish populations (updating former PHOGUE Survey). Data for 2010 tell that 91% of males over 65 own at least their own houses, well above the remaining groups; particularly those between 16 and 29 (just 52%). For females figures are 88% and 53.6% respectively. On quality of life, the picture is more complex: 60% of our elderly declare a type of illness, 24% of which are considered strongly limitative and 53% just limitative, with a higher ratio for females. A 36% of pensioners self assess a good or even very good health status (a 42% just for males). On social related problems INE data show that two thirds of those 65 years and over do not identify important issues; for those between 16 and 29 the share is 56.9%.

On income changes over time for age groups, from the Spanish families' household survey, Ayala (2011) find a rather stable along the years lineal relationship between family income and the age of the main income earner, this being case for the 1990 and 2008 waves. The contribution of 'age' in income inequality is small but slightly increasing over time, and statistically significant. Within aged cohorts, pensions have a strong equalitarian effect, and hence on inequality variation. Despite the fact that income distributions for the young and old cohorts seem to be similarly unequal over time, some other welfare measures may offer a different perspective (Lopez-Casasnovas and Mosterin, 2011). A measure of welfare may be the specific poverty risk[2]. Indeed, over the last two decades of the analysed period, the poverty risk has diminished for individuals below 44 years of age, as well as for those above 70. In addition, by 2001, starting at retiring age the poverty risk not only has not increased but actually decreased steadily with age so that the oldest age group suffers the smallest poverty risk of all age cohorts, in striking contrast to the 1981 scenario[3]. This is most certainly due to rigidities in the labour market, which force an unusual amount of income variance onto this age group (unionised and

[2] Poverty risk in this context is defined as the probability of income falling below 60% of the average overall personal income.

[3] Curiously the age band between 50 and 65 years, the group that has experienced the strongest income rise has seen their poverty risk to increase the most over the time frame.

public employed and the rest). Those individuals who enjoyed stable employment typically receive high salaries and enjoy better labour conditions that they accumulate over many years. On the opposite, the long-term unemployed in this age group don't find an easy way back into the labour market and are doomed until old age pensions end up 'risk protecting' them. Until that age the data displays therefore a greater variance.

This reduction in poverty risk from pre- to post-retirement age is also due to the fact that anti-poverty transfers are channelled through the social security public pension scheme. This offers non-contributive payments to the retired, poor only, rather than through a general minimum income scheme that would redistribute within all age groups. The confusion of social security's role as a contributive as well as a redistributive scheme leads to this pro-old bias. On the other front, income variance is smaller among the young[4], as labour market reform has concentrated on new entrants and young workers. So the relative risk of labour market exclusion is lower for the young, although their salaries as a group are lower.

Minimum pensions have made possible for this group to reduce drastically the poverty risk, at the same time that the group between 45 and 65 increased its probability basically due to long term unemployment. This seems to be aggravated over time since 41% (Scarpetta *et al.*, 2010) of younger cohorts (up to 24 years) are at present unemployed and elderly population are already better protected by pensions that have increased well above the Spanish GDP. A fundamental aspect is the way in which income declined from the onset of retirement in 1981 whereas in 2001 it stays almost at the level of retirement and onwards. And perhaps most noticeably, there is a stark increase in income for the group around 50 years of age. In contrast, as told, there is relatively minor improvement in income for those in their 20s and 30s[5].

The Spanish National Institute for Statistics (INE) shows that annual average income (having imputed housing rents) in 2008 was 12.009€, above the average for the remaining cohorts (i.e. 30 and 64) although that elder females are a bit below average. This implies a poverty risk, having considered the imputed rents and social transfers (a 99% are beneficiaries of one sort or another) of 13.7% (for the remaining population is 15.9%). The difference is even greater for females above 65 (13.3% against 16.4%). This rate however reduces over time (the gross index diminished 4.3 percentage points between 2004 y 2009), and increases for those 16 to 29 (almost three points and without relevant safety networks). Below the poverty line and as percentage of total, the figure was 18.8% for those over 65 and 27% for those between 16 and 65 years. Before social transfers the figure was inverted: 28.2% for elderly and 23.7% for the remaining adult population.

[4] Indeed, looking at the dynamics of income and poverty, we know from Spanish data on earnings per age group that in real terms between 1981 and 2001, population groups 15 to 44 years old have not practically increased the income, despite the fact that general economy improved a lot in that period, particularly for pensioners.

[5] The meagre improvement in income is primarily due to an increase in the employment rate for that age group. So collectively this age group has higher relative income, but only in exchange for more hours of work. In fact, looking only at the employed, there is an age range in the mid-30s, in which young workers earn less for their work in real terms in 2001 than in 1981, and it is only the population above 35 that benefits from the increase in productivity almost as an increasing function of age.

Finally, regarding wealth, the Bank of Spain Survey on the Wealth of the Families shows that average income for 65 years and more have increased during the first decade above the population average, although relative levels of inequality are still lower. Indeed, the difference between the median and the mean values indicate lower inequality for them than for the rest of the population (7.7 vs. 8.8 percentage points). However, from a wealth perspective, for those individuals above 55 and over net wealth has increased well above the rest of the cohorts, additionally in this case with an important increase of inequality: for instance among pensioners, given the differences between the mean and the median values of net wealth the previous initial difference has doubled. The net of debt wealth property, as expected, is lower for those below 35 with regard to those between 65 and 74 years old (five more times); in similar terms between the group of pensioners and the rest (almost three times higher for the former group). This difference has been moreover growing in the last period[6].

As a result of all the descriptive statistics, as commented above, we would expect that due to the demographic effect (elderly living longer with higher income/wealth inequality but lower inequalities in health status) and the labour market conditions (less income inequalities in younger cohorts, but higher IRHI effects), the net impact on aggregate inequalities in health should decrease over time. This may be however conditioned to the fact that the criteria for grading self assessed health remain constant over time, what it may be unlikely if expectations for a better quality related health increase over periods despite decrease among elder cohorts.

Our study

We focus first on the health paradox (Barsky, 1988), this is, the dissociation between objective measures of morbi-mortality and the individual health assessed health levels. In a previous paper, Garcia Altes *et al.* (2011) show that in between 1994 and 2006 in Catalonia, as in Sweden (Burström *et al.*, 2003), the health paradox is confirmed. Their results indicate that there is an increase in the visual analogue scale (VAS) of self assessed health for men aged 15-44 and a decrease in mean VAS for women aged 65-74 and 75 and more. The increase in mean VAS in the first case may be explained, according to the authors, by a decrease in the severity effect, which offsets the increase in the prevalence effect. The decrease in mean VAS for women 65 and over may be caused by an increase in the prevalence of the chronic factors, which does not offset the decrease in the severity effect. This makes the authors highlight the

[6] This is a common feature for some other countries too. In USA, according to a recent Report led by P Taylor for an special Congressional Committee (nov 2011) find that the wealth gap between younger ans older Americans has stretched to the widest on record, worsened by a prolonged economic downturn that has wiped out job opportunities for young adults and saddled then with housing and collage debts. The typical household headed by a person age 65 or older has a net worth 47 times greater than a household headed by someone under 35. This wealth gap is now more than double what it was in 2005 and nearly five times the 10 to 1 disparity a quarter Century ago, alter adjusting for inflation. The economic crisis has indeed hit young adults. More are pursuing in USA College or advanced degrees, taking on debt as they wait for the job market to recover. Others are struggling to pay mortgage costs on homes now worth less that when they were bought in the housing boom. The elderly in fact have a comprehensive safety net in most of the developed countries that most adults, especially young adults, lack.

need to be careful when we measure health over time, as well as the usefulness to detect population perceptions as actual ‘needs’. In addition to this result, they find that the inequalities between and within cohorts increase over time. This seems to contradict our hypothesis that these inequalities should diminish due to a relatively larger weight of the aged population in downwards biasing the aggregate inequality, and due to the fact that the income related health inequality factors should reduce their marginal impact for the older cohorts over time.

By using the Catalonia Health Survey (ESCA) of 1994, 2000-2001 and 2006, we build an observational longitudinal study in order to test our hypotheses. The population analysed corresponds to non-institutionalized residents in Catalonia any of those years. The sample is composed by those respondents of the direct personal interviews which make up the ESCA, 15 years of age or older (number of individuals: 12,557 in ESCA 1994 -53.27% women-; 7,138 in ESCA 2000-2001 -51.36% women-; and 15,932 in ESCA 2006 -50.50% women-).

Estimation approach

In the definition of the variables we follow García-Altés *et al.* (2011). The dependent variable is health status, measured using the visual analogue scale (VAS) (EQ-5D) (from 0 ‘worst imaginable health state’ to 100 ‘best imaginable health state’).

As explanatory variables we include:

i) Sex (0 male, 1 female)
ii) Age (0; 15-44 years old, 1; 45-64, 2; 65-74, 3; 75 years of age or older)
iii) Chronic conditions – common of all three ESCAs (0/1 absence/presence of each of the following: hypertension, cardiac problems, varicose veins, osteoarthritis, allergy, asthma, bronchitis, diabetes, duodenal ulcer, prostate or urinary problems, high cholesterol, cataracts, skin problems, constipation, nervous problems or depression, and embolism)
iv) Number of chronic conditions – common of all three ESCAs
v) Other conditions – chronic conditions non-common to all three ESCAs or non-chronic conditions (0/1 absence/presence of each of the following: migraine, back pain, blood circulation problems, moraines, thyroid problems, neoplasm or cancer, anaemia, heart attack, cervical pain, osteoporosis, and incontinence problems)
vi) Socio-demographic variables related with health status:

- Education level (0 non studies, 1 primary, 2 secondary, 3 university, 4 others)
- Labour status (0 employed, 1 unemployed, 2 home work, 3 retired or disabled, 4 student, 5 others)
- Marital status (0 single, 2 married or living in couple, 3 divorced or separated 4 widow or widower).

vii) Smoking status (0 non-smoker, 1 smoker, 2 ex-smoker)
viii) Median per capita income of the years 1994, 2000 and 2001, and 2006 (constructed averaging the income question found also in the ESCAs)

Our proxy in adjusting for a more cultural demanding society will be the median per capita income over time, defined as a random effect for the three cross sectional data. We try in this way to neutralize the impact of those expectations on self assessed health.

All variables, both dependent and explanatory, were obtained from the answers of self-declared questions. In all the qualitative variables (i.e. all explanatory variables except iv and viii), the 0 category was taken as the reference.

A hierarchical mixed model was specified as follows,

$$VAS_{it} = \beta_{0i} + X.i\beta_{1t} + X.ii\beta_{2t} + X.iii\beta_{3t} + X.iv\beta_{4t} + X.v\beta_{5t} + X.vi\beta_6 + X.vii\beta_7 + X.viii\beta_{8t} + u_{it} \quad [1]$$

where the sub index *i* denoted individual and *t* the ESCA year (*1994, 2000-2001, 2006*); *VAS* was the dependent variable; *X.k* denoted the matrix of the corresponding *k* explanatory variable (i.e., *k=i, ii, iii,…,viii*); β were the vectors of the unknown parameters associated to the explanatory variables; and *u* a zero-mean error term normally distributed (however, we allowed a non-constant variance).

Note that in the model [1] we considered seven random effects, Only one (β_0) varied with the individual and the rest ($\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_8$) varied with the ESCA. That is to say, in the specification of the model we tried to capture individual heterogeneity (β_0) and allow that the effect of sex, age, common chronic and other conditions, and the median per capita income varied between the ESCA's (i.e. the corresponding years).

Models were built as Bayesian hierarchical models with two stages (Schrödle and Held, 2011) (see Annex). The first stage was the observational model. The second stage was given by the hyperparameters and their respective prior distribution. The posterior marginal of the hyperparameters is approached by using a Laplace approximation (Tierney and Kadane, 1986). In particular, a simplified Laplace approximation (less expensive from a computational point of view with only a slight loss of accuracy) was used (Schrödle and Held, 2011; Rue *et al.,* 2009; Martino and Rue, 2011).

According to García-Altés *et al.* (2011), the variation in mean VAS could be attributed to a 'prevalence effect', as a result of year differences in the distribution of chronic conditions, to a 'severity effect' from year differences in the impact on health status of these conditions, and to an interaction due to simultaneous differences in prevalence and severity amongst years. As them, we decomposed the change in mean VAS from 1994 to 2000-2001 and from 2000-2001 to 2006 for all individuals and stratifying by sex and age group. In particular we used the Blinder-Oaxaca decomposition (Blinder, 1973; Oaxaca, 1973) in its three-fold variant (Jahn, 2008):

$$E(VAS_i) - E(VAS_{i-1}) = (E(X_i) - E(X_{i-1}))\hat{\beta}_{i-1} + E(X_{i-1})(\hat{\beta}_i - \hat{\beta}_{i-1}) + (E(X_i) - E(X_{i-1}))(\hat{\beta}_i - \hat{\beta}_{i-1}) \quad [2]$$

where *E* denoted expectation; *E(VAS)* was the mean VAS estimated using model [1]; *X* was the matrix of explanatory variables included in model [1]; $\hat{\beta}$ the vector of the associated coefficients, also estimated in model [1]; *i* corresponded to 2000-2001 and 2006 and *i-1* to 1994 and 2000, respectively.

Two are the assumptions of such decomposition. First, the dependent variable is assumed to be continuous. Although VAS was in fact an ordered response variable, it could be assumed that, in fact, it was only an observed counter fact of an underlying continuous non-observed variable, i.e. health status. Second, the explanatory variables of the model for the different groups being compared must be identical. Note that what could vary (between the ESCA's) in our model [1] was the effect of the explanatory variables, but the explanatory variables of the VAS were identical between the three ESCAs.

All the computations were carried out using the interface called INLA (The R-INLA project, 2011), running directly in R (version R 2.13.1) (R Development Core Team 2011).

Results

Our main results are shown in Table 1 and Figures 1. We have estimated a decrease in mean VAS for men and an increase for women (see Figure 1a upper and Table 1). Without distinguishing by sex, with the exception of those individuals younger than 45 years old, we estimated an increase in mean VAS, sharper from 1994 to 2000-2001. Note also that, again with the exception of those younger than 45 years, the slope was estimated more pronounced for the higher age group (see Figure 1a bottom and Table 1).

A more detailed view of the estimated behaviour by sex and age group, in Figure 1b, shows that, for those younger than 45 years old, the decrease in mean VAS was deeper for men, particularly before 2000-2001. For those older than 44, the increase in mean VAS was more pronounced for women, for any age group, and, as explained above, more steeply with age. Note that it seems that we have estimated a turning point in the behaviour of mean VAS, at least for women older than 44 years old (see Figure 1b bottom) and men older than 64 years old (see Figure 1b upper).

With respect to the (estimated) coefficient of variation of VAS, note, in Table 1, that, in general, there was a slighter increase in the dispersion from 1994 to 2006. However, when we look at this Table in detail, we can see a very important increase in the dispersion for those younger than 45 (from 7.39% to 16.23%) and a more moderate increase in the dispersion for men (from 12.92% to 16.39%). Note also that, in general, it was estimated a decrease in the dispersion of VAS from 1994 to 2000-2001, more evident in those aged 75 or older and, without stratifying by age, in women; and an increase in the VAS dispersion 2000-2001 onwards, although only clear for women aged either 45-64 or 75 years old or older. This gives support to the central hypothesis of this paper.

As we mentioned above, the variation in mean VAS could be attributed to a ‘prevalence effect’, to a ‘severity effect’ and to an interaction. The prevalence effect can be observed in Table 2. For those younger than 45 (with a decrease in the estimated mean VAS and an important increase in VAS dispersion for both sexes) we can see an increase of the proportion of individuals with at least one condition (see Table 2a). Note, however, that, on average, the number of chronic conditions for those with at least one condition did not increase very much. An increase in the prevalence ratio was clearly seen in the most widespread conditions (those with a prevalence higher than 10%): osteoarthritis (both sexes); varicose veins (particularly women); hypertension (particularly women); allergy (only in men); nervous problems or depression (both sexes); high cholesterol (particularly men); and a few other conditions with lower prevalence: asthma (particularly women) and skin problems (only women). Note that was only one case with a clear decrease in the prevalence, prostate and urinary problems.

For those older than 44 years old, there was an increase in mean VAS from 1994 to 2000-2001 and a decrease from 2000-2001 onwards (with the exception of men aged 75 years or older, where the decrease from 2000-2001 to 2006 was not found statistically significant). Accordingly, the prevalence ratios from 1994 to 2000-2001 should have increased and, with the possible exception of men aged 75 years and old, decreased after. For those aged 45-64 years (Table 2b) this was only the case for hypertension (only women) and allergy (also only women), amongst the more prevalent conditions. In fact, the rest of the most prevalent conditions increased their prevalence ratios, with the exception of osteoarthritis with a decrease 1994 onwards. For those aged 65-74 years (Table 2c) a decrease in the first period followed by a further increase was observed (always among the most prevalent conditions) in allergy (only in women), cardiac problems (only in women) and osteoarthritis (particularly women). Finally, for those aged 75 or older (Table 2d) the prevalence ratios first decreased and then increased in only two conditions (amongst the most prevalent ones): osteoarthritis (in this case, particularly men) and cardiac problems (only women). Summing up, from the observation of the prevalence ratios of the (common) chronic conditions it is not clear that the prevalence effect has been the predominant amongst the individuals aged 45 years or older.

Another separate issue is the interpretation of the percentage of individuals with at least one chronic condition and, to a lesser extent, of the number of chronic conditions in individuals with at least one of them. They have increased from 1994 to 2000-2001 and decreased after for those individuals aged 75 or older (both sexes) (Table 2d) and those women aged 65-74 years old (Table 2c). Note that for the men in the same age group there was stabilization in the first period and a decrease thereafter. For those individuals aged 45-64 years old (Table 2b) there was an increase in the first period and a stabilization after, but only in women.

The results of the Blinder-Oaxaca decomposition are shown in Table 3. The table could be interpreted as follows. If the prevalence of chronic conditions in 1994 (for instance) would be that of 2000-2001, mean VAS would be higher

(1.255), corresponding to the decrease in prevalence of 2000-2001. Note that from 1994 to 2000-2001 there was also a decrease in the severity effect, leading to a higher VAS (1.890).

From 1994 to 2000-2001 there was a decrease in both, prevalence and severity for men and women in all age groups, with the exception of those aged from 15 to 44 years old. Note that, with that exception, the decrease was higher for women and increasing with age. The decrease in severity, at least when it was approached by the increase in the mean VAS, was higher (in absolute and relative terms) for those individuals aged 65 and older. The decrease in the prevalence was apparently more important than the severity for women aged 45 to 64 years old. For those individuals aged 15 to 44 years old, the increase in prevalence was higher than in severity.

From 2000-2001 to 2006 there was an increase in the prevalence in both sexes and in all age groups. There was also an increase in the severity with the exception of those individuals aged 75 or older. However, note that in this case the prevalence effect dominated the severity one, resulting in a decrease in mean VAS in all cases.

The importance of the ‘severity effect’ could also be observed in Table 4. Note first of all, that have a chronic condition reduced the estimated mean VAS. This negative impact was greater in 2000-2001. When considering particular chronic conditions, not all of them had an impact in the reduction of mean VAS. At any rate, note that in the conditions that (statistically) significant had it, the effect of mean VAS decreased over time. The level of exigency of the individuals, in self assessing health, measured by the (random) effect associated with median income, increased from 1994, with a clear turning point in 2000-2001.

Discussion

In order to test the hypotheses that we formulated initially in this paper, our findings should be referred not only to the estimated mean VAS behavior but to its dispersion.

For those individuals younger than 45 years old, we estimated a decrease in mean VAS, relatively deeper for men, and particularly from 1994 to 2000-2001. Although this decrease was a consequence of increases in both, the prevalence and the severity effects, being the former estimated to be more pronounced than the later. The dispersion of VAS for those younger than 45, however, had an important increase, again, more pronounced for men and from 1994 to 2000-2001.

However, as expected, for those older than 44, there was an increase in mean VAS, more pronounced for women and more steeply with age. In all cases, however, the increase was a consequence of a more important raise from 1994 to 2000-2001 followed by a relatively moderate decrease from 2000-2001 to 2006, resulting overall in a net increase. In fact, from 1994 to 2000-2001, for those older than 44 years old, there was a decrease in both, prevalence and severity for both men and women and for all age groups. The decrease in the severity factor was larger than in prevalence one for those individuals (men and women) aged 65 and older, and smaller for women aged 45 to 64 years old. From 2000-2001 to 2006 there was an increase in the prevalence for males and females and for all age groups. There was also an increase in the severity with the exception of those individuals aged 75 or older, but smaller than for the prevalence effect. In addition, we estimated a decrease in the dispersion of VAS from 1994 to 2000-2001, more evident in those aged 75 or older and, without stratifying by age, in women; and an increase in the VAS dispersion 2000-2001 onwards, although only clear for women aged either 45-64 or 75 years old and older, as expected.

In the evolution of the estimated VAS (both, mean and dispersion) we observe a turning point around 2000-2001 for those aged 45 or older. Two may be the reasons of this finding. First, a change in the ESCAs' sampling proportions of the age groups may be beyond this result. Note, in Table 1, that there was an increase in the percentage (properly weighted) of the individuals younger than 45 years old, especially in men, and in those aged 75 or older, in both sexes. However, only if these changes were not monotonous could be taken as a clear indication of the turning point. This happens in some, not all, age groups: 45-64 years old (both sexes), 65-74 years (women), 75 years or older (both sexes). Note, nevertheless, that these changes were not systematic, That is to say, the percentage of 2000-2001 was very similar to 1994 for women aged 45 years or older and for men aged 75 years or older. For men in the age group 45-64 years, the percentage of 2000-2001 was similar to that of 2006.

The second possible reason for the turning point could be a structural change. In fact, this could be closer to reality. In Table 5 we can see a profound change in the education level of the individuals from 1994 to 2000-2001, continuing slowing afterwards. In particular, we observe a decrease in the percentage of individuals with primary studies and an increase of those with university studies for all age groups. Also, the increase and the decrease were milder with increasing age group. There was also a more gradual change in the labour status in women, rising those employed and unemployed, and decreasing those doing home work. This comes as a result of a very significantly increase of women into the labour market.

In short, our findings do not confirm those of García-Altés *et al.* (2011). Three could be the reasons of the differences. First, we use a larger data set. More important, the data set we used allowed us to capture a likely structural change around 2000 and 2001. The second reason is related to the just mentioned structural change. We specify for this a different model, with a more complete number of explanatory variables (i.e. smoking status, median income) and, above all, including random effects that enabled us to capture individual heterogeneity and the change of the VAS (mean and dispersion) over the years. We believe indeed that the model we have specified adapts better to the reality. This allows for maintaining the basic assumptions on ageing related inequality and income related health inequalities as argued in this paper. Finally, it is not clear that their model fulfils the second assumption of the Blinder-Oaxaca decomposition, that is to say, the explanatory variables of the model for the different groups being compared must be identical (López-Valcárcel, 2011).

Conflicts of interest statement

There are no conflicts of interest for any of the authors. All authors disclose any financial and personal relationships with other people or organisations that could inappropriately influence and/or bias their work.

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Annex

Models were built as Bayesian hierarchical models with two stages (Schrödle and Held, 2011). The first stage was the observational model $p(y|x)$, where y denoted the vector of observations and x are the unknown parameters following a Gaussian Markov random field (GMRF) denoted as $p(x|\theta)$. The second stage was given by the hyperparameters θ and their respective prior distribution $p(\theta)$. The desired posterior marginals

$$p(x_i|y) = \int_\theta p(x_i|\theta, y)p(\theta|y)d\theta$$

of the GMRF were approximated using the finite sum

$$\tilde{p}(x_i|y) = \sum_k \tilde{p}(x_i|\theta_k, y)\tilde{p}(\theta_k|y)\Delta_k \tag{1}$$

where $\tilde{p}(x_i|\theta, y)$ and $\tilde{p}(\theta|y)$ denoted approximations of $p(x_i|\theta, y)$ and $p(\theta|y)$, respectively. The finite sum (1) was evaluated at support points θ_k using appropriate weights Δ_k.

The posterior marginal $p(\theta|y)$ of the hyperparameters is approximated using a Laplace approximation (Tierney and Kadane, 1986).

$$\tilde{p}(\theta|y) \propto \frac{p(x, \theta, y)}{\tilde{p}_G(x|\theta, y)}\bigg|x = x^*(\theta)$$

where the denominator $\tilde{p}_G(x|\theta, y)$ denoted the Gaussian approximation of $p(x|\theta, y)$ and $x^*(\theta)$ was the mode of the full conditional $p(x|\theta, y)$ (Rue and Held, 2005).

According to Rue *et al.* (2009), it is sufficient to 'numerically explore' this approximate posterior density using suitable support points θ_k for model (1). In this paper, these points were defined in the h-dimensional space, using the strategy called central composite design. Here, centre points were augmented with a group of star points which allowed for estimating the curvature of $\tilde{p}(\theta|y)$ (Rue *et al.*, 2009).

Here, to approximate the first component of model (1) a simplified Laplace approximation (less expensive from a computational point of view with only a slight loss of accuracy) was used (Schrödle and Held, 2011; Rue *et al.,* 2009; Martino and Rue, 2011).

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Table 1.- VAS values estimated in the model.

	ESCA 1994	ESCA 2000-2001		ESCA 2006	
	Mean (cv)	**Mean (cv)**	**p-value[1]**	**Mean (cv)**	**p-value[1]**
E(VAS)	69.6928 (15.11%)	72.0573 (14.87%)	<0.001	70.3696 (16.33%)	<0.001
E(VAS|age)					
15-44	76.5455 (7.39%)	72.0284 (15.00%)	<0.001	70.5093 (16.23%)	<0.001
45-64	66.2898 (13.76%)	71.9711 (15.24%)	<0.001	70.3040 (16.38%)	<0.001
65-74	60.3263 (13.74%)	72.1291 (14.43%)	<0.001	70.1240 (16.19%)	<0.001
≥75	54.7831 (15.16%)	72.3864 (14.24%)	<0.001	70.1345 (16.97%)	<0.001
E(VAS|men)	72.4403 (12.92%)	71.9040 (14.84%)	0.015	70.3734 (16.39%)	<0.001
E(VAS|men|age)					
15-44	78.3319 (5.90%)	72.0003 (14.83%)	<0.001	70.4606 (16.25%)	<0.001
45-64	69.5127 (11.77%)	71.6578 (15.76%)	<0.001	70.2707 (16.58%)	0.001
65-74	62.6193 (11.50%)	72.1664 (13.67%)	<0.001	70.1319 (16.34%)	<0.001
≥75	57.4004 (12.58%)	71.7591 (14.52%)	<0.001	70.5885 (16.82%)	0.169
E(VAS|women)	67.2830 (16.21%)	72.1973 (14.81%)	<0.001	70.3661 (16.28%)	<0.001
E(VAS|women|age)					
15-44	74.8692 (8.01%)	72.0560 (15.17%)	<0.001	70.5556 (16.21%)	<0.001
45-64	63.3801 (14.13%)	72.2626 (13.78%)	<0.001	70.3345 (16.21%)	<0.001
65-74	58.4439 (14.79%)	72.0966 (15.09%)	<0.001	70.1174 (16.08%)	0.008
≥75	53.2761 (15.98%)	72.7650 (14.07%)	<0.001	69.8527 (17.31%)	<0.001

[1] p-value of the contrast of the null hypothesis that the mean on the previous ESCA was equal than the mean of the current

Coefficient of variation (cv) between brackets

The meaning of E(VAS|men) is VAS values estimated for men; for E(VAS|men|age) is VAS values estimated for men and age group, etc.

Table 2a.- Prevalence of chronic conditions common to all ESCAs and descriptive of smoking status, Catalonia, 1994-2000 and 2001-2006.

	15-44 years					
	1994		2000-2001		2006	
Number of individuals	3027 (52.8%)	3226 (49.3%)	1835 (55.8%)	1824 (51.6%)	4097 (56.4%)	3797 (50.7%)
	Men	**Women**	**Men**	**Women**	**Men**	**Women**
Hypertension	4.7%	3.7%	4.3%	3.7%	5.7%	5.3%
Cardiac problems	1.6%	1.9%	2.2%	2.0%	2.1%	2.0%
Varicose veins	2.5%	13.6%	1.8%	13.8%	3.4%	17.9%
Osteoarthritis	10.5%	15.3%	13.8%	19.5%	17.1%	22.7%
Allergy	13.6%	17.3%	15.8%	13.6%	16.4%	17.8%
Asthma	3.9%	3.4%	4.6%	4.5%	4.8%	5.9%
Bronchitis	3.9%	2.8%	3.3%	2.8%	3.2%	3.8%
Diabetes	0.9%	0.7%	0.9%	1.4%	1.0%	1.1%
Duodenal ulcer	3.5%	2.0%	2.3%	1.3%	2.9%	2.4%
Prostate/urinary problems	1.9%	3.0%	1.5%	2.9%	0.4%	1,4%
High cholesterol	4.3%	3.2%	4.9%	4.2%	6.4%	4.3%
Cataracts	0.3%	0.1%	0.6%	0.6%	0.5%	0.4%
Skin problems	4.7%	5.5%	4.7%	5.1%	4.9%	7.1%
Constipation	1.4%	8.5%	1.3%	6.1%	2.0%	8.2%
Nervous problems/depression	4.6%	9.2%	5.7%	10.7%	6.9%	14.8%
Embolism	0.3%	0.3%	0.4%	0.5%	0.4%	0.4%
Number of chronic conditions						
No chronic conditions (%)	60.8%	51.2%	58.8%	49.5%	52.9%	42.0%
At least one chronic condition[1]	1.601 (0.930) 1	1.856 (1.159) 1	1.627 (0.990) 1	1.789 (1.166) 1	1.622 (0.967) 1	1.897 (1.175) 2
Smoking status						
Non smoker	35.2%	49.0%	44.4%	49.7%	44.7%	47.3%
Smoker	49.1%	36.1%	44.1%	41.2%	40.5%	36.1%
Ex smoker	15.7%	14.9%	11.5%	9.2%	14.9%	16.5%

[1] Mean (standard deviation)
Median

Prevalences were properly weighted by sex, age structure and health region of residence of the respondent of the ESCA, in order to recover sample proportions
Weights were also included in each ESCA

Table 2b.- Prevalence of chronic conditions common to all ESCAs and descriptive of smoking status, Catalonia, 1994-2000 and 2001-2006.

	45-64 years					
	1994		2000-2001		2006	
Number of individuals	1746 (29.7%)	1934 (19.1%)	1011 (27.7%)	1033 (19.4%)	2240 (27.7%)	2226 (15.7%)
	Men	**Women**	**Men**	**Women**	**Men**	**Women**
Hypertension	19.3%	27.4%	23.4%	20.6%	28.9%	25.0%
Cardiac problems	7.7%	6.7%	9.0%	5.1%	6.9%	6.2%
Varicose veins	8.0%	36.0%	10.3%	38.6%	13.5%	40.4%
Osteoarthritis	34.3%	57.2%	28.4%	39.5%	27.2%	35.2%
Allergy	8.3%	17.5%	10.5%	15.7%	13.6%	17.5%
Asthma	4.3%	4.6%	5.2%	5.4%	4.5%	5.8%
Bronchitis	9.6%	5.0%	9.6%	6.2%	7.3%	5.1%
Diabetes	6.5%	7.0%	8.0%	6.0%	7.8%	6.9%
Duodenal ulcer	10.5%	6.6%	9.8%	7.4%	9.4%	6.4%
Prostate/urinary problems	10.0%	7.8%	8.1%	6.5%	8.3%	6.7%
High cholesterol	16.7%	16.6%	18.6%	18.3%	25.6%	23.4%
Cataracts	2.9%	3.7%	3.4%	3.9%	3.6%	4.9%
Skin problems	4.7%	5.2%	5.0%	7.2%	7.1%	9.1%
Constipation	3.6%	16.2%	3.3%	14.7%	3.8%	17.3%
Nervous problems/depression	8.2%	22.2%	11.1%	23.6%	13.7%	30.6%
Embolism	1.7%	1.4%	2.1%	1.2%	1.7%	0.9%
Number of chronic conditions						
No chronic conditions (%)	32.7%	17.5%	30.1%	19.7%	26.2%	19.3%
At least one chronic condition[1]	2.234 (1.594) 2	2.920 (1.896) 2	2.259 (1.551) 2	2.530 (1.553) 2	2.391 (1.518) 2	2.717 (1.642) 2
Smoking status **Non smoker** **Smoker** **Ex smoker**	 24.6% 41.8% 33.6%	 85.7% 7.7% 6.6%	 34.6% 37.2% 28.2%	 75.4% 15.9% 8.7%	 31.7% 32.6% 35.7%	 66.1% 18.9% 15.0%

[1] Mean (standard deviation)
Median

Prevalences were properly weighted by sex, age structure and health region of residence of the respondent of the ESCA, in order to recover sample proportions
Weights were also included in each ESCA

Table 2c.- Prevalence of chronic conditions common to all ESCAs and descriptive of smoking status, Catalonia, 1994-2000 and 2001-2006.

	65-74 years					
	1994		**2000-2001**		**2006**	
Number of individuals	715 (11.4%)	870 (28.9%)	392 (10.6%)	457 (28.5%)	801 (8.8%)	902 (22.6%)
	Men	**Women**	**Men**	**Women**	**Men**	**Women**
Hypertension	30.2%	42.2%	40.4%	42.7%	46.9%	51.2%
Cardiac problems	16.6%	15.1%	19.5%	10.7%	17.3%	17.2%
Varicose veins	10.8%	38.0%	15.4%	43.5%	15.7%	45.4%
Osteoarthritis	45.8%	73.4%	36.9%	48.7%	37.6%	57.0%
Allergy	6.6%	16.1%	9.7%	14.2%	10.9%	19.8%
Asthma	7.8%	7.2%	10.3%	8.2%	7.7%	10.0%
Bronchitis	20.2%	9.8%	16.3%	8.4%	17.2%	11.2%
Diabetes	13.2%	13.0%	18.6%	16.0%	16.3%	17.2%
Duodenal ulcer	13.2%	7.7%	11.6%	9.3%	13.4%	9.4%
Prostate/urinary problems	24.2%	7.2%	22.8%	8.6%	29.9%	7.5%
High cholesterol	14.1%	24.8%	23.4%	33.0%	26.0%	30.3%
Cataracts	12.1%	16.6%	18.5%	18.3%	18.6%	26.9%
Skin problems	4.8%	8.8%	8.1%	6.3%	8.6%	8.7%
Constipation	7.2%	18.1%	8.1%	19.6%	8.5%	20.5%
Nervous problems/depression	7.7%	22.0%	12.6%	26.5%	15.2%	35.6%
Embolism	3.9%	3.4%	5.0%	2.4%	4.7%	5.1%
Number of chronic conditions						
No chronic conditions (%)	13.5%	7.9%	13.5%	9.8%	10.0%	5.0%
At least one chronic condition[1]	2.752 (1.684) 2	3.510 (1.922) 3	3.045 (1.823) 3	3.196 (1.817) 3	3.138 (1.952) 3	3.462 (1.930) 3
Smoking status						
Non smoker	19.5%	93.2%	38.1%	94.0%	33.7%	92.1%
Smoker	26.3%	2.2%	21.1%	3.8%	19.4%	2.7%
Ex smoker	54.2%	4.5%	40.8%	2.2%	46.9%	5.2%

[1] Mean (standard deviation)
Median

Prevalences were properly weighted by sex, age structure and health region of residence of the respondent of the ESCA, in order to recover sample proportions
Weights were also included in each ESCA

Table 2d.- Prevalence of chronic conditions common to all ESCAs and descriptive of smoking status, Catalonia, 1994-2000 and 2001-2006.

	≥ 75 years					
	1994		**2000-2001**		**2006**	
Number of individuals	380 (6.0%)	659 (9.3%)	234 (5.9%)	352 (9.7%)	743 (7.2%)	1120 (11.7%)
	Men	**Women**	**Men**	**Women**	**Men**	**Women**
Hypertension	28.0%	42.7%	32.5%	44.3%	40.4%	52.9%
Cardiac problems	21.4%	21.8%	21.9%	19.4%	24.8%	23.8%
Varicose veins	13.6%	25.1%	18.9%	37.8%	21.1%	42.3%
Osteoarthritis	43.0%	66.3%	33.2%	59.4%	43.5%	61.8%
Allergy	8.3%	10.8%	9.7%	13.0%	10.7%	14.9%
Asthma	7.3%	8.4%	14.7%	7.8%	12.2%	9.4%
Bronchitis	20.4%	11.9%	30.0%	9.1%	20.5%	10.1%
Diabetes	8.4%	11.2%	21.6%	17.3%	17.3%	18.1%
Duodenal ulcer	9.6%	6.5%	13.6%	8.4%	14.2%	10.1%
Prostate/urinary problems	33.1%	10.6%	37.0%	20.0%	44.9%	27.4%
High cholesterol	7.9%	14.3%	17.9%	26.4%	21.7%	30.5%
Cataracts	25.9%	38.8%	34.7%	40.4%	40.4%	52.7%
Skin problems	6.5%	8.2%	7.7%	8.9%	14.0%	11.7%
Constipation	9.0%	23.9%	15.4%	26.0%	18.1%	27.6%
Nervous problems/depression	8.8%	14.0%	14.7%	30.4%	22.0%	36.2%
Embolism	7.7%	6.3%	8.6%	4.8%	8.9%	7.5%
Number of chronic conditions						
No chronic conditions (%)	10.8%	5.6%	12.6%	7.5%	4.8%	2.5%
At least one chronic condition[1]	2.902 (1.638) 3	3.351 (2.063) 3	3.662 (2.074) 3	3.662 (1.929) 3	3.766 (2.025) 3	3.807 (1.879) 4
Smoking status						
Non smoker	28.2%	97.3%	48.1%	98.6%	37.3%	94.3%
Smoker	16.0%	0.4%	8.2%	2.1%	11.1%	1.3%
Ex smoker	55.7%	2.4%	43.7%	1.3%	51.6%	4.4%

[1] Mean (standard deviation)
Median

Prevalences were properly weighted by sex, age structure and health region of residence of the respondent of the ESCA, in order to recover sample proportions
Weights were also included in each ESCA

Table 3.- Results of the Blinder-Oaxaca decomposition

	ESCA 1994 to ESCA 2000-2001				ESCA 2000-2001 to ESCA 2006			
	Total	**Prevalence**	**Severity**	**Interaction**	**Total**	**Prevalence**	**Severity**	**Interaction**
All individuals	2.818	1.255	1.890	-0.327	-1.619	-0.934	-0.664	-0.021
15-44	-4.127	-1.727	-1.925	-0.475	-1.439	-1.316	-0.190	0.067
45-64	5.049	2.198	1.153	1.698	-1.660	-0.246	-1.218	-0.196
65-74	10.737	2.111	2.770	1.856	-2.883	-0.960	-1.953	0.030
≥75	13.442	2.789	8.014	2.639	-2.074	-2.750	0.338	-0.338
Men	-0.587	0.532	1.782	-2.901	-1.309	-0.826	-0.473	-0.010
15-44	-6.106	-3.262	-1.400	-1.444	-1.345	-0.976	-0.342	-0.027
45-64	2.098	1.088	1.085	-0.075	-1.374	-0.658	-0.821	0.105
65-74	8.071	1.153	4.178	2.740	-2.031	-0.368	-1.591	-0.072
≥75	11.509	2.762	8.398	0.349	-1.039	-2.146	1.115	-0.008
Women	4.309	1.915	1.987	0.407	-1.981	-1.100	-0.943	-0.062
15-44	-2.465	-1.495	-0.480	-0.490	-1.530	-1.465	0.036	-0.101
45-64	6.662	3.946	1.575	1.141	-1.833	-0.499	-1.612	0.278
65-74	13.467	3.016	9.256	1.195	-1.985	-0.862	-2.266	1.143
≥75	15.669	4.661	11.382	-0.374	-2.065	-1.656	0.508	-0.917

Table 4.- Estimates of the random effects, Catalonia, 1994-2000 and 2001-2006.

	1994	2000-2001	2006
Hypertension			
Cardiac problems	-3.4592 (0.9089)		
Varicose veins			
Osteoarthritis	-6.2414 (0.7471)	-3.0438 (0.8970)	-2.4890 (0.7484)
Allergy		-4.0319 (0.9579)	-1.7941 (0.7692)
Asthma			
Bronchitis	-3.8507 (0.9318)		
Diabetes	-3.8833 (0.9543)		
Duodenal ulcer			
Prostate/urinary problems			
High cholesterol		-2.1869 (0.9563)	
Cataracts		-2.8938 (1.1746)	
Skin problems			
Constipation			
Nervous problems/depression	-7.9924 (0.8377)	-6.8628 (1.0027)	-6.6741 (0.7629)
Embolism	-4.2606 (1.4470)		-3.2737 (1.1643)
Number of chronic conditions	-1.3757 (0.6187)	-3.9654 (0.7663)	-2.8483 (0.6704)
Median income		1.0699 (0.2131)	2.3789 (0.1829)
Standard error of the regression	16.9353	15.3362	16.18278

Estimated mean (standard deviation)

In empty cells the credibility interval contained the zero (that is, the mean of the distribution of the corresponding mean was non statistically different from zero, i.e. non statistically significant)

Table 5a.- Descriptive of socio-demographic variables, Catalonia, 1994-2000 and 2001-2006.

Men

	15-44 years		
	1994	**2000-2001**	**2006**
Education level (%)			
Non studies	1.5%	2.4%	2.7%
Primary	70.4%	45.3%	38.2%
Secondary	21.8%	27.1%	28.5%
University	6.2%	25.1%	30.5%
Others	0.1%	0.1%	0.1%
Labour status (%)			
Employed	61.8%	73.7%	80.3%
Unemployed	13.5%	7.5%	4.8%
Home work	0.01%	0.1%	0.1%
Retired/disabled	1.4%	1.4%	1.8%
Student	22.6%	17.0%	12.9%
Others	0.5%	0.4%	0.1%
Marital status			
Single	58.1%	58.2%	58.4%
Married/coupled	41.1%	40.2%	39.1%
Divorced/separated	0.8%	1.4%	2.4%
Widow/widower	0.01%	0.2%	0.1%

	45-64 years		
	1994	**2000-2001**	**2006**
Education level (%)			
Non studies	16.8%	15.0%	9.5%
Primary	72.4%	50.6%	48.8%
Secondary	5.8%	15.1%	17.9%
University	4.9%	19.1%	23.9%
Others	0.1%	0.2%	---
Labour status (%)			
Employed	67.7%	73.3%	77.8%
Unemployed	10.7%	6.5%	7.1%
Home work	---	0.1%	0.2%
Retired/disabled	21.1%	19.9%	14.8%
Student	---	---	0.1%
Others	0.5%	0.2%	0.1%
Marital status			
Single	7.1%	8.3%	9.2%
Married/coupled	88.8%	86.9%	82.5%
Divorced/separated	2.0%	3.3%	6.2%
Widow/widower	2.1%	1.6%	2.1%

Percentages were properly weighted by sex, age structure and health region of residence of the respondent of the ESCA, in order to recover sample proportions
Weights were also included in each ESCA

Table 5b.- Descriptive of socio-demographic variables, Catalonia, 1994-2000 and 2001-2006.

Men

	65-74 years		
	1994	**2000-2001**	**2006**
Education level (%)			
Non studies	22.7%	36.2%	31.1%
Primary	72.2%	46.5%	47.5%
Secondary	3.4%	6.3%	8.5%
University	1.7%	10.3%	13.0%
Others	0.01%	0.7%	---
Labour status (%)			
Employed	2.7%	6.3%	3.8%
Unemployed	---	---	0.7%
Home work	---	0.5%	0.2%
Retired/disabled	97.3%	93.2%	95.2%
Student	---	---	---
Others	---	0.01%	---
Marital status			
Single	4.2%	5.6%	6.4%
Married/coupled	88.3%	85.3%	86.0%
Divorced/separated	1.3%	1.6%	2.0%
Widow/widower	6.2%	7.6%	5.6%

	≥ 75 years		
	1994	**2000-2001**	**2006**
Education level (%)			
Non studies	33.6%	41.6%	43.0%
Primary	60.7%	42.7%	40.6%
Secondary	2.8%	3.8%	8.4%
University	3.0%	11.7%	8.0%
Others	---	0.2%	---
Labour status (%)			
Employed	0.5%	0.7%	0.8%
Unemployed	---	---	0.1%
Home work	---	0.5%	0.4%
Retired/disabled	99.4%	98.9%	98.6%
Student	---	--	---
Others	0.1%	---	0.01%
Marital status			
Single	3.3%	5.9%	5.7%
Married/coupled	71.1%	75.2%	76.8%
Divorced/separated	0.8%	4.1%	0.7%
Widow/widower	24.7%	14.8%	16.8%

Percentages were properly weighted by sex, age structure and health region of residence of the respondent of the ESCA, in order to recover sample proportions
Weights were also included in each ESCA

Table 5c.- Descriptive of socio-demographic variables, Catalonia, 1994-2000 and 2001-2006.

Women

	15-44 years		
	1994	**2000-2001**	**2006**
Education level (%)			
Non studies	2.2%	3.0%	2.1%
Primary	69.3%	39.3%	32.7%
Secondary	21.3%	27.7%	28.9%
University	7.0%	29.8%	36.3%
Others	0.2%	0.2%	0.01%
Labour status (%)			
Employed	43.6%	55.6&	70.0%
Unemployed	12.9%	8.8%	6.6%
Home work	20.6%	14.3%	9.7%
Retired/disabled	0.7%	1.2%	1.2%
Student	21.7%	19.8%	12.4%
Others	0.5%	0.2%	0.01%
Marital status			
Single	46.3%	50.2%	47.7%
Married/coupled	50.5%	46.5%	47.0%
Divorced/separated	2.9%	2.8%	4.9%
Widow/widower	0.3%	0.5%	0.4%

	45-64 years		
	1994	**2000-2001**	**2006**
Education level (%)			
Non studies	22.4%	21.6%	15.3%
Primary	71.3%	53.1%	51.0%
Secondary	3.3%	14.5%	16.6%
University	2.9%	10.7%	17.1%
Others	---	0.1%	---
Labour status (%)			
Employed	27.9%	39.5%	52.6%
Unemployed	3.7%	6.9%	5.3%
Home work	59.1%	46.9%	32.5%
Retired/disabled	8.9%	6.2%	9.5%
Student	---	0.2%	0.1%
Others	0.4%	0.3%	0.01%
Marital status			
Single	5.5%	6.2%	8.0%
Married/coupled	82.1%	79.2%	75.7%
Divorced/separated	4.0%	7.5%	9.7%
Widow/widower	8.5%	7.1%	6.7%

Percentages were properly weighted by sex, age structure and health region of residence of the respondent of the ESCA, in order to recover sample proportions
Weights were also included in each ESCA

Table 5d.- Descriptive of socio-demographic variables, Catalonia, 1994-2000 and 2001-2006.

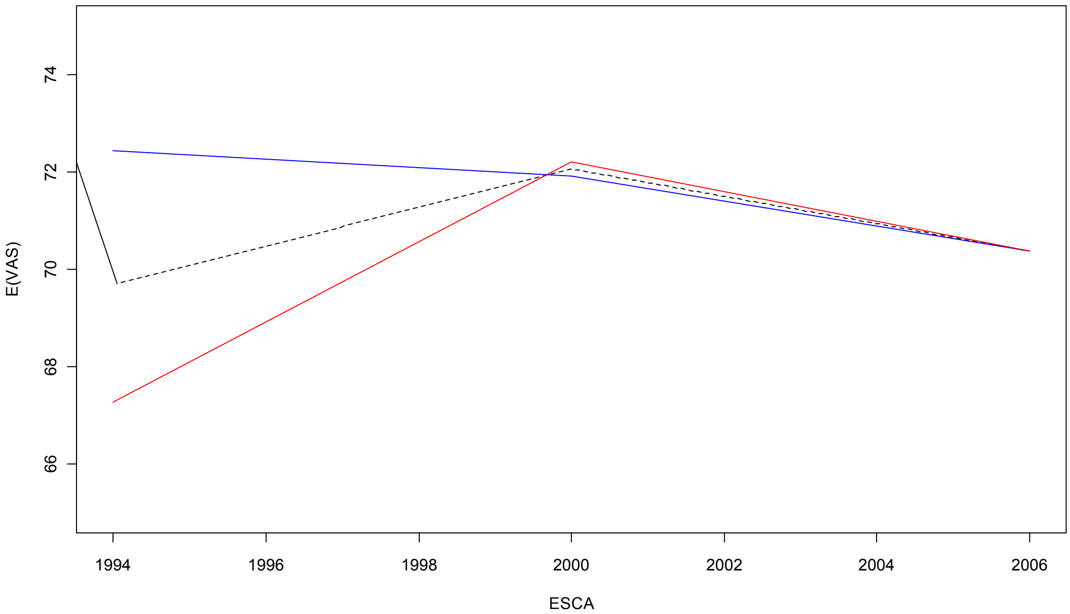
Women

	65-74 years		
	1994	**2000-2001**	**2006**
Education level (%)			
Non studies	46.5%	52.4%	45.6%
Primary	50.8%	40.2%	43.7%
Secondary	1.4%	4.4%	6.7%
University	1.2%	3.0%	4.0%
Others	---	---	---
Labour status (%)			
Employed	1.0%	2.1%	2.2%
Unemployed	0.1%	0.2%	0.5%
Home work	51.5%	49.6%	45.6%
Retired/disabled	46.7%	47.9%	51.5%
Student	---	---	---
Others	0.7%	0.2%	0.2%
Marital status			
Single	7.3%	7.0%	4.7%
Married/coupled	61.9%	63.2%	65.2%
Divorced/separated	1.3%	6.5%	3.3%
Widow/widower	29.5%	23.2%	26.8%

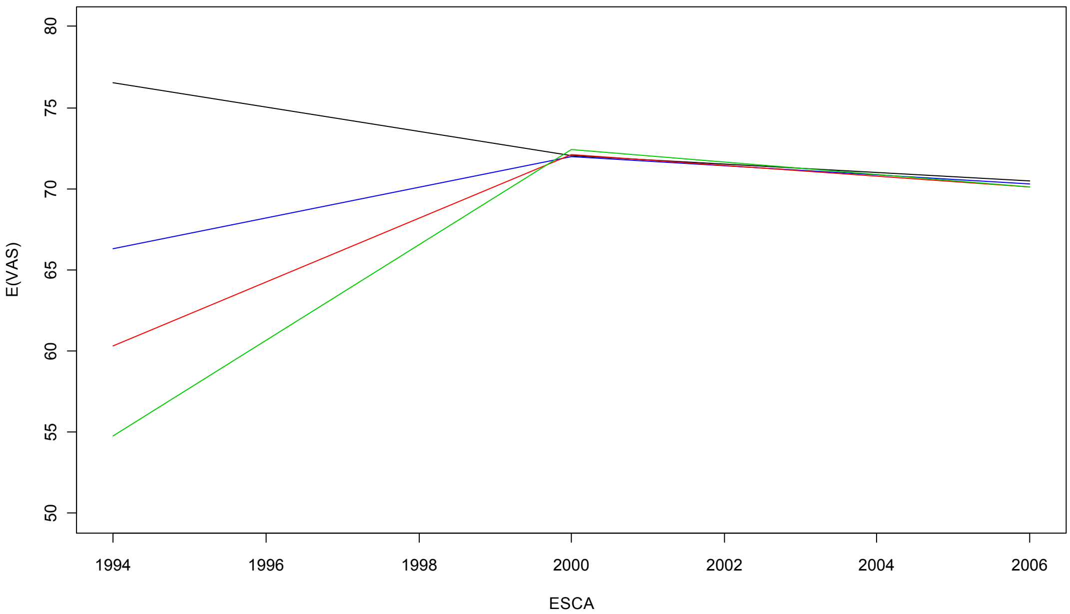
	≥ 75 years		
	1994	**2000-2001**	**2006**
Number of individuals	659 (9.3%)	352 (9.7%)	1120 (11.7%)
Education level (%)			
Non studies	46.5%	54.0%	59.2%
Primary	50.8%	40.8%	33.1%
Secondary	1.4%	3.6%	3.5%
University	1.2%	1.6%	4.0%
Others	0.1%	---	0.1%
Labour status (%)			
Employed	0.1%	---	0.5%
Unemployed	---	---	0.7%
Home work	42.1%	43.8%	42.0%
Retired/disabled	55.8%	55.7%	56.1%
Student	---	---	---
Others	2.0%	0.5%	0.8%
Marital status			
Single	7.8%	6.3%	8.3%
Married/coupled	20.4%	30.6%	30.4%
Divorced/separated	1.3%	12.4%	0.7%
Widow/widower	70.6%	50.7%	60.6%

Percentages were properly weighted by sex, age structure and health region of residence of the respondent of the ESCA, in order to recover sample proportions
Weights were also included in each ESCA

Figure 1a.- VAS values estimated in the model

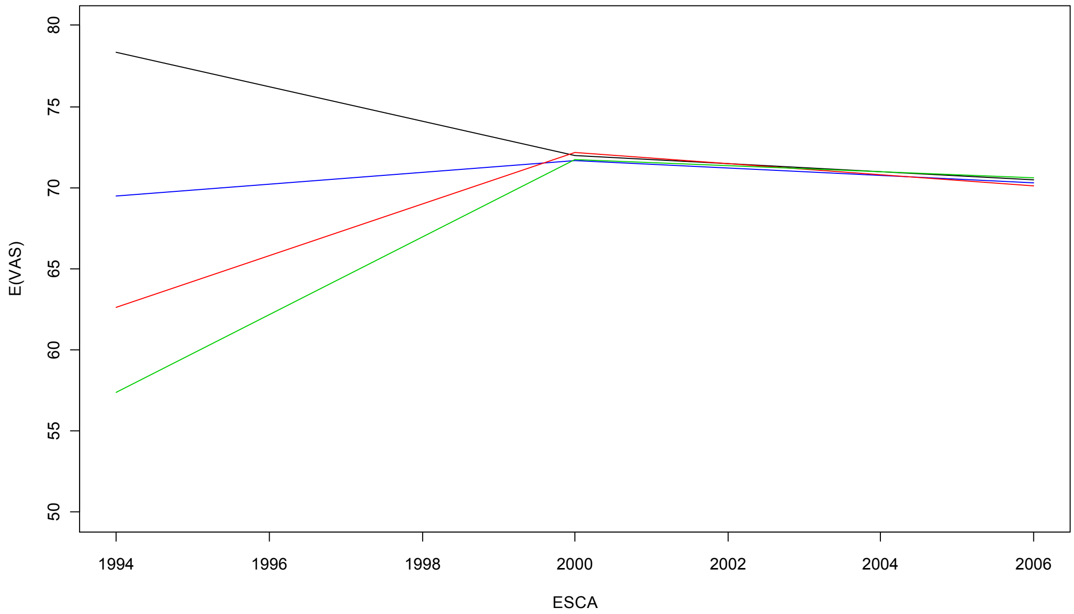


Dashed line: all subjects; Blue line: men; Red line: women

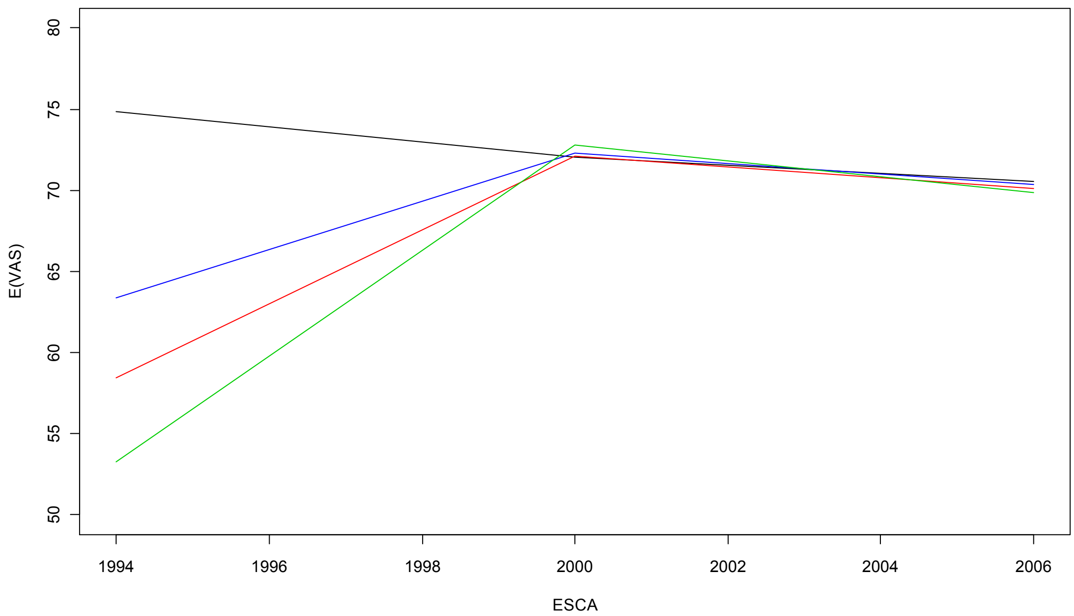


Black line: 15-44 y; Blue line: 45-64; Red line: 65-74; Green line: ≥75 y

Figure 1b.- VAS values estimated in the model



Men. Black line: 15-44 y; Blue line: 45-64; Red line: 65-74; Green line: ≥75 y



Women. Black line: 15-44 y; Blue line: 45-64; Red line: 65-74; Green line: ≥75 y

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