Territorial health inequalities of the elderly in Italy

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Abstract

Italy displays several territorial differences: as it is well-known, the South shows less favourable conditions than the North, with respect to economic, social, and environmental aspects and also in the field of health.

The aim of our analysis is twofold. Our interest is, first, on the socioeconomic differences associated with inequalities in self-rated health of elderly people in Italy, once demographic variables and actual health status are controlled for. In particular, we intend to verify also the role of social network in the self-perception of health of older people, a component usually not considered in the literature.

Secondly, bearing in mind that in Italy the competences on health care are delegated to a sub-national level, we shall explore the presence of a *contextual effect* among Italian areas, net of individual characteristics. Furthermore, we will address the following question: is the regional breakdown sufficient in order to examine and explain differences in health performances, or we do need a more detailed territorial level of analysis?

The study makes use of a representative cross-sectional survey on health conditions carried out by the Italian National Statistical Office (ISTAT) in 2004-2005. The large sample size and the sampling design allow us to analyse health characteristics at a sub-national level. Focusing on elderly people (65 years and over), the analysis will refer both to the regional and to a sub-regional level (large areas). In order to describe the relationships among the health status of individuals, their demographic and socio-economic characteristics and the area of residence, a multilevel framework is adopted.

The first result of this study is that Italy still presents health differences depending both on gender and on individual socio-economic status. A second result is that the residential context emerges to be associated with the perception of individual health status. Individual characteristics, even representing the most important correlates of health, do not completely explain intra-regional heterogeneity, confirming the existence of a *contextual effect*. Thirdly, we found that territorial differences are present among Regions but also among large areas. However, these intra-regional differences are not so relevant and critical. The large area level of detail does not add further and improved insights to territorial heterogeneity, so the Regions seem to represent, for Italian health context, a good territorial breakdown in order to approximate the residential environment of individuals.

Keywords: Perceived health status; Old Italian people; Socio-economic inequalities; Contextual effects; Multi-level models.

1 Introduction

In last decades, a burgeoning volume of studies reported a positive association between health status and socioeconomic conditions, even with differentiated trends (Kunst *et al*., 2005). Empirical research showed consistent results about the presence and the persistence of socioeconomic inequalities in health in several developed countries (e.g. Yngwe *et al.*, 2001; Grundy and Slogget, 2003; Huisman *et al.*, 2003; Von Dem Knesebeck *et al.*, 2003 and 2006; Olsen and Dahl, 2007; Rueda *et al.*, 2008), also with high levels of public health services. Disparities have been discovered also in countries where a well-implemented welfare state and traditions of egalitarian policies (Cavelaars *et al.*, 1998; Eikemo *et al.*, 2008; Mackenbach *et al.*, 2008) should slow down mechanisms generating these inequalities. In general, people in a disadvantaged socioeconomic condition present an increased risk of *bad health*, irrespective of its measurement – self-rated health, functional impairment, presence of chronic diseases or disability and even mortality or morbidity rate. Notwithstanding recent improvements, these elements of heterogeneity characterize also Italian population (ISTAT 2007a). Also in the field of health, as with respect to economic, social, and environmental aspects, Italy displays quite a few territorial differences: as it is well known, the South still shows less favourable conditions than the North.

Using the most recent data on health conditions, in our contribution we intend to add to this state of affairs a comprehensive overview of the main socioeconomic factors associated with health status perception for the Italian population aged 65 and over, accounting for the territorial context of residence. Nowadays, in developed countries, elderly people account for the majority of those in poor health status, namely they are more likely to suffer some forms of health-related impairment or to perceive bad health. This situation may induce some consequences.

Firstly, a bad health status determines an increasing use of health services, so the ageing of population – Italy has the second oldest population in the world (United Nations, 2009) – arises concerns about the health expenditure and the economic sustainability of the national pension and social assistance system. Consequently, a major knowledge about health inequalities and social determinants of health conditions for this segment of population is urgently needed. Secondly, whether the aim is to guarantee not just an increasing life expectancy, but also a life without illness, we deem it is important dwelling upon this specific phase of life. Finally, and most generally, since previous studies verified different patterns of socioeconomic conditions on health status depending on age group (e.g. Grundy and Holt, 2001; Avlund et al., 2003; Costa-Font, 2008), we think that a specific-age focus is more fruitful in order to make results more intelligible and clear.

The aim of our analysis is twofold. Our interest is, first, on the socioeconomic differences associated with inequalities in self-rated health of elderly in Italy, once demographic variables and actual health status are controlled for. We point to add, to the existing international panorama of studies on socioeconomic inequalities in health, an up-to-date picture referring to the Italian old population. In particular, we intend to verify also the role of social network in the self-perception of health of older people, a component usually not considered in the literature, but that in our opinion is noteworthy in the Italian background.

Secondly, bearing in mind that in Italy the competences on health care are delegated to a sub-national level, we will take in hand socioeconomic inequalities in health status accounting expressly for the residential context where individuals live. Our hypothesis is that the residential context is associated with the perception of individual health status, therefore we shall explore the presence of a *contextual effect* among Italian areas, net of individual characteristics, trying to understand if the existing huge imbalances among Italian areas affect the individual perception of health status. Furthermore, we will address the following question: is the regional breakdown sufficient in order to examine and explain the differences in health performances, or we do need a more detailed territorial level of analysis?

Using cross-sectional data from the Italian Health Interview Survey carried out by the Italian National Statistical Office (ISTAT) in 2004-2005, our contribute intends to shed light on these relationships, both at individual and regional level.

2 Theoretical and empirical background

2.1 On social and economic inequalities

Socioeconomic status is unanimously recognized as a key factor in assessing a population's health status and its need for health care, but this relation may be bidirectional (Giarelli, 2009): either health status influences socioeconomic position leading to a selection of individuals in social class position, or socioeconomic disadvantage leads to illness according on different processes and mechanisms. Even if the relation is not completely unambiguous, literature agrees in considering the "causation" hypothesis as the predominant explanation with respect the "selection" one in explaining socioeconomic health inequalities (e.g. Blane *et al*., 1993), suggesting that the direction is more likely to be from socioeconomic environment to illness and not the other way round.

The relation between health and socioeconomic status has been studied through different indicators, and depending on the age group studied, the geographical area of reference or the health indicator used as outcome, different measures have been proved the most relevant in this respect. All these socioeconomic measures, even being strongly correlated, are not completely interchangeable (Grundy and Holt, 2001), each underlining a different facet of the socioeconomic status.

Income or wealth information represent direct measures of the economic differences among individuals, however they are difficult to collect in survey data; sometimes, subjective evaluation of the income situation is used. Income measures and distribution of income across occupational social classes have demonstrated to be remarkable (e.g. Yngwe *et al.* 2001), but they perform differently among countries, and may produce contradictory results depending on age, disease, context or level of aggregation. Apart a general positive association between income and health conditions, the relationship is not unambiguous and unidirectional, and one observes a different association as income brackets raise.

Education represents a proxy of individual's social capital reflecting both material and non-material resources. A higher education may open the door to more prestigious labour market positions and/or better-paid work, or may enhance the ability to save money, leading to bigger wealth in later life. As a measure of social

stratification, education has been proved to be a strong predictor of self-rated health and functional limitations when occupation and income are adjusted for (Von dem Knesebeck *et al.*, 2006), and it works well in all countries.

A number of studies (e.g. Huisman *et al.*, 2003; Volkers *et al.*, 2007) found a significant association between occupational position and both perceived general health and self-reported chronic conditions, mostly in Europe. Similar conclusions about differentials in self-assessed health, smoking and mortality have been proved for the social class (Davey Smith *et al.*, 1997; Borg and Kristensen, 2000), an indicator based on the occupation and/or education of individuals, which joints the advantages of the two.

The relationship between health and socioeconomic measures has been somewhat explained through the major presence of unhealthy or health-damaging behaviours in low socioeconomic strata (Borg and Kristensen, 2000; Molarius *et al*., 2006), that increases their exposition to some risk factors. Recent studies found a disadvantaged position of persons in lower socioeconomic strata also in the capability to use the existing health facilities and services in an optimal way, as well as in prevention behaviours (McNiece and Majeed, 1999), a result consistent also for Italian population (Voller and Buiatti, 2006; ISTAT, 2007; Pirani and Salvini, in press and 2010). Furthermore, people in disadvantaged socioeconomic conditions are more exposed to health vulnerability in the physical environment (Volkers *et al.*, 2007; Costa-Font, 2008), and experience psychosocial stressors more often.

Finally, another element has been sometime hypothesized to be correlated to the negative perception of health conditions, mostly in old age, but it has been rarely investigated and tested: the family and the social support. The marital status is often accounted for in analysis of individuals' health, however its association with mortality/morbidity is contradictory. Whether being married reduces the mortality rates among adults (Olsen and Dahl, 2007), the association is weaker, if not significant, among elderly (Grundy and Sloggett, 2003; Rueda *et al.*, 2008), so that household composition or other kinds of social support indicators should be preferred. Recently, Olsen and Dahl (2007) suggested putting attention also on elements like social networks, community life participation and social trust. In this contribution, we shall test this hypothesis for the Italian context. We think that the family structure of individuals and their relationship networks represent a factor at *meso*-level that may interact both with socioeconomic individual variables and with the *macro* context. To have someone to rely on represents an irreplaceable form of material and moral support that may help in coping with and accepting a bad health condition, particularly in its subjective component, so reducing its negative impact. We deem that this kind of relationships may be particularly relevant for the Italian context, characterized by a cultural and relational model where family cohesion and solidarity prevail.

2.2 Territorial breakdown and macro-level indicators

International comparative studies suggest that the magnitude of health inequalities according to socioeconomic status vary among countries (e.g. Yngwe *et al.*, 2001; Huisman *et al.*, 2003; Von Dem Knesebeck *et al.*, 2003; Kunst *et al.*, 2005; Olsen and Dahl, 2007). These discrepancies may be partially explained by the various measures of socioeconomic position from time to time used. However, a

socioeconomic gradient is always present. This result increased strongly the interest about the existence of a contextual effect acting on individual health (Mitchell *et al.*, 2000; Diez Roux, 2001): living in deprived areas increases the risk of health outcome, even after adjusting for personal demographic and socioeconomic circumstances.

Comparative and multilevel analysis in the field of health have grown in size over the past few years, but which are the relevant factors that engender these differences is still matter of questioning. Main explanations for area-level effect brought forward in literature are two (Ecob and Macintyre 2000; Mitchell *et al.* 2000; Macintyre *et al*. 2002). Firstly, the deprived context may be deleterious on health by itself. Beside physical environmental conditions and environment pollution – which critical role on individual health is not a matter of question in this discussion – the place where people live may be relevant in terms of lack of infrastructures, of shortage or inaccessibility of health services and other structures, and more generally in terms of poverty and scarcity of resources in the area. In this sense, one talks about *contextual effect*, that is an independent contribution of the area of living on individual health. The second explanation focuses on an indirect mechanism, and refers to the social context as sum of behaviours and attitudes of individuals living in those areas. In this case the variability among areas is due to the so-called *compositional effect*.

These mechanisms are not mutually exclusive and they may coexist, making clear the necessity to define and explain the individual level before the territorial one (Pickett and Pearl, 2001), since observed heterogeneity may be due, completely or in part, to individual differences. We shall verify, for the Italian context, the magnitude of these effects. Moreover, in the debate referring to territorial variations in health, we address two relevant issues: (1) the identification of the most relevant and meaningful spatial scale; (2) how to approximate the social and economic environment where individuals live.

Referring to the first point, while differences among countries are well acknowledged, recently different authors have hypothesized that the context may operate also at sub-national or at local level, namely regions or neighbourhoods. “Context” or “neighbourhood” are often defined using geographical and/or administrative boundaries. Sometimes this represents a forced choice, owing to the impossibility to identify other levels of “social context” and since it permits a linkage with available area-level data. However, whether the administrative units of aggregation do not match and capture to some extent the geographical distribution of the risk factors relied to health (Diez Roux, 2001; Pickett and Pearl, 2001), this may lead to meaningless and inappropriate results. On this matter, we will compare the results coming from two different geographical aggregations relevant in the domain of health from the points of view of administration, management and policies. In particular, we will refer both to the Regional level, namely the 20 Italian Nuts level-2 Regions, and to a sub-regional level, the so-called “large areas”, that correspond alternately to metropolitan areas, provinces (Nuts level-3) or groups of provinces. These large areas, that has been specifically defined in occasion of the survey, group together administrative units responsible for the management of health services, thus identifying territorial aggregates of particular interest for the health policies at local level (ISTAT, 2007b).

Considering the second issue, while at individual level correlates of health are well established, debate about the relevant socio-economic factors acting at

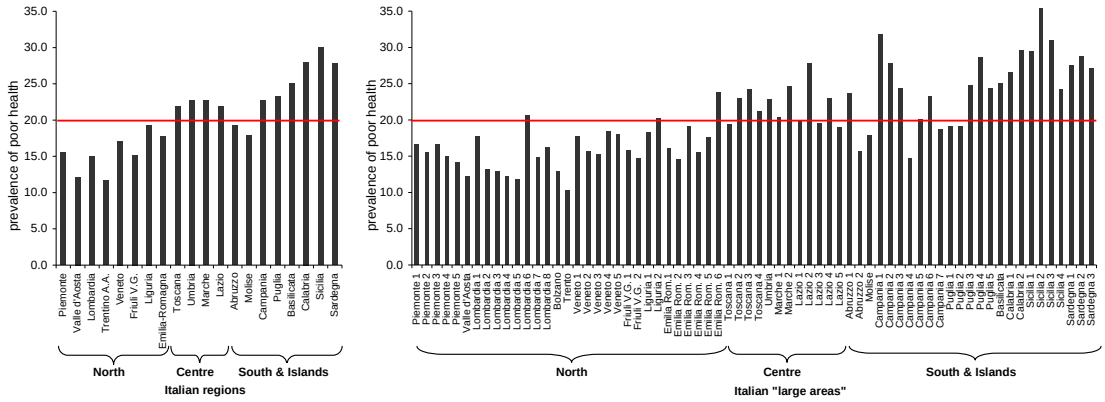
contextual level is still underway (Costa et al. 2003; Cummins *et al.*, 2005). While at theoretical level it is clear the distinction among contextual and compositional effects, once passing on empirical analysis, this distinction is not as much clear-cut. On the other hand, the lack of a formal operationalization of the context is sometimes due to a lack of available data (Diez-Roux, 2000), whenever the level of analysis is sub-national or local. The *context* is a synthetic term encompassing a number of specific social, economic, psychological and material components. Sometimes the identification and the measure of the main factors that come into play is difficult, but it is necessary to avoid the risk of a misleading interpretation of individual characteristics. This is required also from the policy point of view. Generally, most used covariates refer to composite indices of the socioeconomic situation at aggregate level (Pickett and Pearl, 2001), to different measures of wealth and public social expenditure, or to indicators of deprivation, sometimes based on occupation or of deindustrialisation of the area (Mitchell *et al.*, 2000; Basta *et al.*, 2007; Olsen and Dahl 2007). Cummins *et al.* (2005) tested a large number of "neighbourhood attributes", computed as factor scores summarizing a set of variables, founding that, for Scotland and England, elements like physical quality of residential environment, private and public transportation infrastructures, political climate and political engagement were significantly associated to self-rated health. As these authors discuss, exploiting individual level characteristics to derive area-based measures of deprivation is one of the major drawbacks of current research, preventing from capturing health promoting or health damaging features of the area itself. On the other side, these measures conceptualise different facets of the social, cultural and material local environment that contribute to define the general concept of multiple deprivation.

2.3 The Italian context

Deep differences go across Italian regions in various dimensions of health (e.g. Costa et al. 2003; ISTAT 2007a; Carrieri, 2008; Mazzuco 2009; Pirani and Salvini, 2010), and Southern regions continue to register worst performances. Some recent studies investigated whether the environmental context influences autonomously the health of individuals. Ongaro and Salvini (2009) performed a logistic regression model to analyse association between socioeconomic and health inequalities, introducing macro-regions (North, Centre, South and Islands) as proxy of the context. They found a significant residential effect that, particularly, influences negatively people living in the Centre and in the South of Italy, compared with the North – without making clear factors or process that engender these discrepancies. Egidi and Spizzichino (2007) have achieved similar conclusions considering the geographical aggregation in NUTS-level 1 (North-East, North-West, Centre, South, Islands). Carrieri (2008) found that even though living in the South of Italy increases the risk of a bad self-rated health, the effects of socioeconomic inequalities on health is less strong in this area.

Figure 1 shows the presence of a certain degree of intra-national variability in the prevalence of "poor" health, both considering Italian Regions and large areas. In particular, with respect to an overall average of approximately 20% of Italian elderly declaring bad health, we depict a less favourable self-rated health condition for southern areas, and in a lower measure for the centre ones.

Figure 1 – Prevalence of people scoring "bad" or "very bad" their health status, by area of residence by Italian regions and Italian large areas (crude percentages)



Starting from these results, that confirm a regional gradient in the subjective evaluation of health, deeper analysis are requested to better understand the area level variables that come into play, using a thinner territorial detail.

In an institutional framework where policies are decentralized to a local level, the account for the *context* where individuals live is essential for the interpretation and a better understanding of the most relevant critical factors, both at individual and territorial level. The fact that individuals are nested within territorial units that are, as known, deeply dissimilar on background characteristics, represents a nuisance consideration in an effort to obtain appropriate estimates of individual relationships. We therefore propose a multilevel logistic regression approach, in order to analyse more in depth Italian regional heterogeneity in the field of health, and to disentangle individual and territorial effects on health inequalities, namely compositional and contextual ones. To the best of our knowledge, no previous study modelled contextual differences in health perception among Italian Regions, particularly attempting to explain via contextual variables these differences. Our formulation of a hierarchical model that explicitly represents the nesting structures has the ambitious aim to stimulate the discussion around this conceptual and empirical gap.

3 Data and Method

3.1 Data

Data were obtained from the representative survey on health conditions carried out by the Italian National Statistical Office (ISTAT) in 2004-2005. The large sample size and the sampling design (ISTAT, 2007b) allow to analyse health characteristics at a sub-national level. In particular, our analysis will refer both to the 20 Italian Regions and to the 68 large areas.

We point out at once the attention to the fact that the temporal sequence of events necessary for drawing causal inference is not available in the provided dataset, preventing from a proper evaluation of the causal mechanisms that determine the associations observed between health status and the various correlated investigated. Even if health literature tends to endorse predominantly the hypothesis that sees the

socioeconomic disadvantage on the origin of a bad health condition, given the cross-sectional nature of the survey, our analysis necessarily investigates just association rather than causation.

The analysis focus on elderly (namely people aged 65 years and over), so that the total sample include 10,668 men and 14,515 women, clustered in 68 large areas and in 20 Regions. It is worthwhile noting that the survey data excludes the institutionalized elderly (for instance those living in nursing homes or homes for the elderly). These people are likely to present a high burden of morbidity and bad health status, that raises the risk to underestimate the phenomenon. However, since in Italy disabled old people live primarily in their family, so they would be eventually included into the survey – an estimate proportion of over 65 institutionalized people range from 1% to 3%, for men and women respectively (ISTAT, 2004) – the magnitude of the underestimation should be negligible.

3.2 Specification of the random effect model

As described above, data have a group structure defined as individuals living in different "large areas", which are, in turns, nested in Regions. Different two-level models have been estimated, considering alternately, as second level of analysis, the 20 Italian Regions or the 68 large areas, in order to capture the role of different levels of determinants on individual health status.

The problem is to describe the relationships among the health status of individuals (the "outcome" variable), their demographic and socioeconomic characteristics, and their place of residence. From a statistical point of view, the presence of an explicit hierarchical structure – namely individual nested in geographical regions – entails a violation of the assumption of independence among observations within the same second level units (Rabe-Hesketh and Skrondal, 2008). Adding a region-specific random intercept to the predictor, random effect models introduce explicitly the hierarchical structure in the analysis, modelling the unobserved heterogeneity and producing valid standard error. The hierarchical modelling allows improving our knowledge of how individual characteristics and features of the place where these individuals live interact, rather than attempting to model these relationships with a single term.

Consider I individuals $i = 1,...,I$, for whom a set of H individual variables X_{ij} is collected, nested in J second-level units characterized by a set of M contextual variables Z_{mj}. In our case, second-level units will be, alternatively, Regions or large areas. Random effect models are composed by two parts: the lower part corresponds to a logistic regression model, where the dichotomous health outcome (poor health versus not poor health) is regressed on a certain number of individual level covariates. Considering the logit transformation of the probability that a person *i* from second-level unit j reports a poor health status, the individual level model is

$$\operatorname{logit}\left\{P\left(Y_{ij}=1\right)\right\} = \beta_{0j} + \sum_{h=1}^{H} \beta_{1hj} X_{hij} \,. \qquad [1]$$

To account for the second level of nesting, we assume the following higher level part of the model for the intercept parameter β_{0j}:

$$\beta_{0j} = \gamma + \sum_{m=1}^{M} \beta_{2m} Z_{mj} + u_j \qquad [2]$$

where γ represents the mean intercept among second level units, and β_{2m} the slope parameters for the contextual covariates. Substituting the random intercept in equation [2] with the individual level model in equation [1], the logit transformation of the combined model becomes:

$$\text{logit}\left\{P\left(Y_{ij}=1\right)\right\} = \gamma + \sum_{h=1}^{H} \beta_{1hj} X_{hij} + + \sum_{m=1}^{M} \beta_{2m} Z_{mj} + u_j . \qquad [3]$$

The u_j, with $u_j \sim N\left(0, \tau^2\right)$, are the deviations of the J second-level units from the mean intercept γ, and thus represent the residual second level-specific random effects on the response variable, "net" of the explicative covariates introduced into the model. In this sense, the random intercept represents the combined effect of all omitted group-specific covariates that cause some homogeneity among individuals within the same second level unit (Rabe-Hesketh and Skrondal, 2008).

In our analysis, we carried out first the estimation of the so-called null model, to check the existence of a certain degree of intra-regional variation. Owing to supporting evidence, secondly, we estimated a random intercept model with individual level covariates X_{hij}, in order to establish how much geographical variation remains after population composition is taken into account. Thirdly, we estimated the complete full model adding second level variables, in such a way to interpret the variability associated to the residential context.

It is worth noting that design weights should be incorporated in regression models, data coming from a complex survey involving multistage sampling and unequal selection probabilities (Grilli and Pratesi, 2004). However, publicly available data provide only a single overall level-1 weighting variable, where the pseudo-likelihood approach requires the weights corresponding to all the levels of the hierarchical sampling design (Rabe-Hesketh and Skrondal, 2006). In these situations, this confounding level-1 (individuals) and level-2 (geographical areas) design issues may result in biased estimates (Carle, 2009). Moreover, preliminary analysis with both weighted and unweighted data did not highlight a difference in the inferential conclusions across these approaches (Carle, 2009), so supporting the hypothesis of non-informative sampling design in this application. For these reasons (Grilli and Pratesi, 2004), models presented in next section have been fitted using unweighted data.

3.3 Health indicator

In this contribution, we will focus on a subjective measure of individual health– the perceived health status – measured through the question suggested by World Health Organisation (WHO) "How is your health in general?". Subjects were asked to rate their health, taken it as a whole, on a five-point Likert scale, ranging from "very good" to "good", "fair", "bad" and, finally, "very bad".

The self-reported health is a broad and inclusive multidimensional concept: it gathers physical, psychological and social aspects of health, without to be linked to any specific medical condition. The measure of self-reported health is subject to

criticisms, owing to the fact that it is – as subjective evaluation – too much susceptible to distortions and variations determined most by psychological mechanisms than by the actual health status. However, a number of reasons have been argued in favour of this indicator. Different studies proved that the self-rated health is a valid predictor of mortality (Idler and Benyamini, 1997; Egidi and Spizzichino, 2006), strictly linked to the objective health conditions (Egidi and Spizzichino, 2007). Moreover, it represents the solely measure enabling a global, complete and reliable evaluation of the individual health status and general well-being: respondents, when assessing their condition, are able to account simultaneously for all the dimensions that constitute the concept of health.

In the following analysis, we will dichotomise the indicator y_{ij} considering together the categories "very good", "good" and "fair" on the one side, and "bad" and "very bad" on the other.

3.4 Individual correlates

Socioeconomic status. No single measure is appropriate enough to portray the entire picture of socioeconomic position of an individual (Grundy and Holt, 2001). Moreover, the specific age under investigation affects the choice of the most suitable socioeconomic indicators. For elderly people wealth, more than income, represents a consistent correlate of health, as well as housing assets and housing tenure (Grundy and Holt, 2001; Avlund *et al.*, 2003; Costa-Font, 2008). In fact, one may hypothesize that present health inequalities of elderly people represent an effect of lifetime differences in socioeconomic status and exposure to risk factors during past life, even if not in childhood, mostly in adult age (Huisman *et al.* 2003). On the contrary, Von Dem Knesebeck *et al.* (2003) found that in Germany income was the best predictor for different measures of health for old age people, while in the United States weaker association among health measures and socioeconomic status indicators has been detected. Moreover, it is clear that for this age group the occupational status loses its centrality as predictor (Huisman *et al.*, 2003; Rueda *et al.*, 2008). For example in Italy, where fewer than 7% of men and 2% of women aged 65 and over is estimated to be at work, the use of a covariate referring to the current situation in the labour market would be misplaced and inappropriate. In this contribution, we shall quantify the extent of these differences distinguishing the socioeconomic status into three components – financial resources, housing conditions and social capital. Firstly, in lack of a suitable income measure, we used the subjective assessment expressed by individuals about their present financial resources: very good/adequate *vs.* scarce/insufficient. This indicator is meaningful since people's income usually decreases after retirement, but this situation not necessarily affects in an unfavourable way the financial situation perception. Secondly, using a set of six indicators concerning some characteristics of the house [1] auto-reported by respondents, an

[1] The index of housing conditions is based on the following characteristics declared by individuals about their house: lack of bathroom, lack of heating system, house too small, presence of humidity stains, house in bad conditions, less than one room per component. In case of presence of all these negative conditions, the index will take value 1, that equals to very bad conditions. The index equals 2 in case of presence of 5 out of 6 negative characteristics, and so on, till a value of 7 whether no one of the negative conditions is present (that equals to very good housing conditions).

indicator referring to the housing conditions has been built. Based on preliminary analysis, in this paper we consider the opposition between bad housing conditions (index values from 1 to 6) and good housing conditions (index value equal to 7). Since older people spend quite a few time at home, it is reasonable to expect that they are more likely to suffer for negative housing characteristics (Costa-Font, 2008). In absence of housing assets and housing tenure indicators (Grundy and Holt, 2001), we use this indicator as a proxy of subjective perception of an aspect of the quality of life relevant for the elderly. Finally, education was selected as socioeconomic indicator measuring to some extent the individual's social capital. The covariate used in the models distinguishes a group containing the lowest education levels (no education and primary education following the International Standard Classification of Education – ISCED), the middle level (lower secondary education), and the highest ones (post secondary, tertiary and higher education). Education has a series of advantages, namely its comparability, ease of measure, stability over time, low rate of missing data and applicability to all people. Moreover, education is strictly associated to lifestyle factors relevant in triggering health inequalities. The drawback of this indicator for old aged people is the concentration in the lowest levels. For the Italian elderly cohorts, the education distribution appears skewed, with about 70% in the lowest education group; consequently, a major detail of the highest education levels would lack statistical power.

Measures of lifestyle. Three types of lifestyle have been considered: smoking, relative weight and physical activity, which represent modifiable factors that, as widely recognized, are strongly associated with certain diseases, bad health and mortality. No information about diet and alcohol abuse was available from the survey. On the basis of their answers to the questionnaire, the respondents were classified in current smokers, ex-smokers, or never smoked. Owing to lack of data we cannot consider the magnitude of the smoking habit (Borg and Kristensen, 2000; Egidi and Spizzichino, 2007). Using the responses given by individuals about their height and weight, individual Body Mass Index (BMI) was calculated as kg/m^2. Following World Health Organization standard procedure, we classified the respondents into four groups: underweight ($BMI<20$), normal weight ($20\leq BMI\leq 25$), moderate overweight ($25<BMI\leq 30$), and obesity ($BMI>30$). Finally, we exploited a composite indicator that provides information about the fact that people perform some kinds of physical activity, at least housework implying a certain level of physical strain (yes/no).

Family structure and social network. Following our hypothesis about the relevant role of the relationship and familial networks in representing an irreplaceable sustain in different phases of life, other two covariates accounting for differences in social support are considered as background factors.

The first indicator combines the marital status and the household composition of individuals, differentiating among married people, people living alone, and unmarried, separated, divorced or widowed living with other persons. This indicator crudely approximates the family structure of individuals.

The second indicator refers to the help potentially available to individuals in case of need. It has been built using the questions concerning the fact that people have (1) relatives, (2) friends or (3) neighbours that they could rely on in case of need. The modalities used in the analysis oppose people who can rely on help of both relatives,

friends and neighbours, people who can rely only to relatives, only to friends and other persons, and people who have no persons to rely on in case of problems.

Confounders. On average, health status worsens with the increasing of age, this is not at issue, this implying the need to control the analysis for age. Multivariate models are controlled also for gender. It is well known, in fact, that the life expectancy of women exceeds that of men in every country, and differentials exist with respect to certain behaviours and attitudes that may entail risk factors for health, namely smoking, alcohol abuse, alimentary habits. In line with the most recent literature, gender differences exist also in health status perception, as well as in disability and morbidity (Egidi and Spizzichino, 2007). Moreover, the specific segment of population here investigated is characterized by a high prevalence of objective health problems, such as chronic illness, disability or physician impairment, which clearly are highly correlated with bad health perception. The presence of diagnosed chronic illness and disabilities are therefore used as confounders in the regression models.

3.5 Area level variables

Although multilevel models offer the possibility to join individual information and covariates referring to the second level of analysis, contextual variables enabling to partly "control" for the milieu variability in health status perception have been rarely modelled.

As previously described, we dispose of two different levels of geographical aggregation: "large areas" and "Regions". Official macro-indicators not coming from the survey are provided by ISTAT only for the Italian Regions, while for large areas information may be just estimated from the survey. Therefore, in order to obtain coherent and consistent models, we computed the Regional and large area means of a few of individual variables collected in the survey, acknowledging that they represent just crude contextual variables.

Firstly, we considered a composite indicator of recourse to health services (ISTAT 2007b), which synthesizes various information about the average recourse to health services in the area, in different periods before the interview[2]. Secondly, we computed the proportion, for each Region and large area, of people giving a positive evaluation of the Health System (scoring from 7 to 10 on a scale from 1 to 10). These two covariates are centred on the grand mean. One could object that this area-level information represent endogenous variables since they derive from individual aggregated data, however, we consider these variables as proxies – even if indirect and subjective – respectively of the recourse to health services and of the quality of the local Health Systems. In this sense, we aim at interpreting them as contextual factors and not as compositional ones.

Thirdly, as multilevel literature recommends (Blalock 1984; Bryk and Raudenbush 1992), testing the group mean of the variables introduced at individual level is a key issue in order to disentangle "between areas" and "within areas" effects

[2] In order to compare the different services included in the indicator – e.g. use of drugs and medicines, recourse to diagnostic tests, general practitioners and specialist doctor visits, as well as territorial attendance, hospitalization and its duration, and recourse to rehabilitation services – each service is weighted using the economic value of the single performance, as a measure of its importance.

for these elements. Therefore, for the socioeconomic individual measures, we verified the presence of a meaningful "contextual" (namely area) effect, occurring when the area average of an individual-level characteristic is related to the outcome even after controlling for the effect at individual level of the same characteristic. Such effect may be interpreted as a proxy for other important contextual variables omitted from the model (Bryk and Raudenbush 1992).

4 Results

4.1 Individual and regional factors

To describe the magnitude of the individual and contextual characteristics, odd ratios (ORs) of coefficients β_{1hj} and β_{2m} were calculated. Table 1 shows the ORs estimated for some hierarchical models with different individual level covariates and for the complete full model, considering Italian Regions as level of nesting.

Health inequalities increase with age, other things being equal. As expected, younger elderly are healthier compared to older respondents. Stepwise models show that, controlling for the presence of chronic illness and disability, reduces the age effect for all the classes, and the last age class (80 and older) loses its statistical significance. Moreover, it is likely that the oldest people who are seriously impaired live in nursing homes or homes for the elderly, thus they are not included in the analysis.

Objective negative health conditions, measured by the presence of chronic illness or disabilities, clearly are highly correlated with bad health perception, as shown by large ORs. However, it is interesting that even accounting for those pathologies, other socioeconomic factors remain significant in explaining differences in health.

Women are more likely to report poor health status, ceteris paribus, but while women have a significant 50% higher OR to perceive their health status less than good with respect to men controlling only for age, the gender ratio goes down to 16% controlling for disabilities or chronic diseases, life style indicators and socioeconomic conditions.

The association with the smoking behaviour resulted to be no statistically significant once controlled for chronic illness (and for this reason, it has been excluded from the estimation of the final model presented in Table 1). The absence of statistical significance of smoking attitude may derive from a selection-effect, for which only healthier people continue to smoke in older age, and it is not surprising in a study of health complaints (Grundy and Slogget, 2003). A level of BMI far from the norm contributes to inequalities in health. Considering a normal-weight person as reference, in elderly a weight slightly higher the norm is negatively associated with the perceived bad health status (OR equal to 0.87), a condition of underweight is related to a worst health perception (OR equal 1.74), while there is no evidence of a significant association between health perception and a situation of obesity (the OR equal to 1.04 is not statistically significant). A possible interpretation of this result is that in elderly a condition of underweight probably arises from a situation of illness so enhancing a poor health perception, while the presence of a condition of obesity is not necessarily associated to any objective health problems.

In addition, our analysis shows a positive association between a certain degree of physical activity and health conditions, with a reduction of a bad self-assessed health of about a half. Clearly, a mechanism of auto-selection may affect this result: only people who feel good are able to perform a certain degree of physical activity, to do housework and so on.

Consider now individual variables aiming to account for socioeconomic differences. Among them, the subjective assessment of the financial resource shows the largest association. Once accounted for other elements, people dissatisfied of their economic situation present an OR 76% higher to report less than fair health with respect to satisfied people. Given its character of subjective evaluation, this measure is susceptible of changes during life independently to actual condition of individuals and, most important, as the health status go worst perception assessment about other aspects of life may modify, so implying to be particular careful in interpreting this association.

Educational related inequalities in health are also large. The higher the educational level, the better the reported health, in particular, compared to people with high level of literacy, those with a medium level exhibit 24% higher probability to perceive bad health, and this percentage increases to 52% for people in the lowest education group. No significant interaction between education and age were found.

The less pronounced socioeconomic gradient is for the housing conditions indicator. In this case, as expected, people perceiving not optimal housing conditions are more likely to declare a bad self-rated health (OR equal 1.13). In this sense, net to subjective economic condition, living in a house that is evaluated less than optimal, is associated to a worst self-rated health.

It is worthwhile noting that even if the ORs of socioeconomic circumstances go down after objective health and lifestyle factors are controlled for[3], relevant effects hold over. This result suggests that socioeconomic conditions may have both a spurious association, e.g. brought by chronic diseases, disabilities and health-damaging behaviours, and a direct relationship with health status perception.

The last two covariates are the proxies of the family structure and the social networks. Considering the household composition, Table 1 shows that people living alone declare better health conditions (with an estimated risk reduction of about 25%). A straightforward interpretation is that people with some health limitations or impairments rarely live alone, however, having controlled for the presence of objective health negative conditions, this auto-selection effect should be negligible. Net of health conditions and of all elements (complete full model), also unmarried or widowed people living with other persons have a slightly lower risk to give a bad self-rated health (the OR equal to 0.90 is significant at a 10% significant level).

The fact that people declare to have someone who rely on in case of need is inversely associated to bad health perception. Considering as reference category a person who declare to be able to count on relatives, friends, and other people in case of need, a situation of lack of potentially available support determines an OR equal to 1.20 to perceive bad health conditions. Elderly declaring to be able to rely on persons inside the family present an OR equal to 1.15; the largest OR (1.36) is for people who cannot rely on family support but just on help of people outside their family,

[3] We acknowledged, however, that although we controlled for some of the most relevant dimensions of health, owing to a lack of data we did not account for the mental health.

confirming the central role of the family in the care, assistance and support of elderly people in Italy.

Table 1 –Results of stepwise multilevel logistic regression models: OR for the self-rated health (bad vs. good), individual and Regional level covariates and model information (loglikelihood, degree of freedom and information criteria)

		OR sig.	**OR** sig.	**OR** sig.	**OR** sig.	**OR** sig.
Individual covariates						
gender	*male*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
	female	1.50 **	1.16 **	1.10 **	1.43 **	1.15 **
age	*65-69*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
	70-74	1.45 **	1.18 **	1.14 **	1.40 **	1.14 **
	75-79	2.13 **	1.38 **	1.30 **	2.09 **	1.35 **
	80 and more	3.30 **	1.02	0.91 *	3.22 **	0.98
disability	*no disabilities*		*1.00*	*1.00*		*1.00*
	disable		9.11 **	7.94 **		7.80 **
chronic	*0, 1 or 2 chronic diseases*		*1.00*	*1.00*		*1.00*
diseases	3 or more chronic diseases		4.20 **	4.28 **		4.13 **
physical	*no physical activity*			*1.00*		*1.00*
activity	some physical activity			0.51 **		0.52 **
BMI	under weight			1.68 **		1.74 **
	normal weight			*1.00*		*1.00*
	moderate overweight			0.89 **		0.87 **
	obesity			1.10 *		1.04
education	low				1.73 **	1.52 **
	medium				1.37 **	1.24 **
	high				*1.00*	*1.00*
satisf. financial	*very good/adequate*				*1.00*	*1.00*
resources	scarce/inadequate				1.98 **	1.76 **
housing	*very good*				*1.00*	*1.00*
conditions	not very good				1.26 **	1.13 *
household	*married/cohabitant*				*1.00*	*1.00*
composition	unmar./sep./widow living alone				0.89 **	0.75 **
	other family typologies				1.20 **	0.90 *
availability of	no help				1.30 **	1.20 **
help	help from relatives				1.23 **	1.15 **
	help from friends and others				1.41 **	1.36 **
	help from relatives, friends, others				*1.00*	*1.00*
Regional covariates						
Percentage of people giving a positive evalutation of the Health System in the region						0.988 **
Regional average indicator of the recourse to health services						0.638 **
Percentage of people evaluating their financial resource as good or adequate in the region						0.992
Log Likelihood		-12079.6	-9486.9	-9339.5	-11712.6	-9149.9
Degree of Freedom		6	8	12	15	24
BIC		24220.8	19055.0	18800.6	23577.4	18542.9
AIC		24172.0	18989.9	18703.0	23455.4	18347.7

Estimated coefficients significant at 5% significance level (**) and at 10% significance level (*).

OR of the β_{2m} coefficients estimated for the contextual covariates attempting to explain territorial heterogeneity, are reported in the bottom of the Table 1.

As for the proxy of Health System's quality, we found that Regions in which a large amount of people gives a positive evaluation of the Health System are more likely to report lower percentages of elderly people in bad health perceived conditions. Clearly, the subjective evaluation of one's own health and the subjective evaluation of Health System were expected to be strictly relied, also at area level.

The health care recourse indicator registers the largest association (OR equal to 0.638) among the contextual variables, that is, the higher the recourse to health services in the Region, the less the proportion of people who perceive their health bad or very bad.

These results are consistent also for the Italian large areas, without relevant differences in the magnitude of the effect (data not reported but available on request).

As previously mentioned, we tested, as macro-level variables, the group means for independent individual-level variables referring to socio-economic status, namely the level of education, the satisfaction of financial resources, the housing conditions. In the end, due to a lack of statistical power for other variables in models both for Regions and for large areas, we retained in the complete full model only the percentage of people that for each area evaluated their financial resources as good or adequate. It serves to verify whether a relationship between individual satisfaction of income and health exists, controlling for the effects of the proportion of individuals unsatisfied about this aspect in the area. We found that the percentage of people evaluating their financial resources as good is not statistically significant considering the Regions, while it matters for large areas, even if the relationship is of weak intensity. In this case, it may be that heterogeneity among large areas is greater than heterogeneity among Regions. While for the other socioeconomic individual covariates we found no group level effect, neither for Regions or large areas, for this covariate this result suggests the presence, for large areas, of a contextual effect that does not simply derive from the aggregation of the characteristics of individuals living in that area (compositional effect), but that represents, instead, an autonomous effect. Therefore, interpreting this covariate as a proxy of economic difficulties in the area, it suggests that the less the area is deprived, the higher individuals perceive bad health conditions. In such a model, both individual and group level variables are necessary to fully describe the relationship of interest.

In order to verify whether health inequalities due to socioeconomic differences operate differently depending on the area of residence, we estimated also a random coefficient model for each of the indicators used to approximate the socioeconomic status of individuals, that is, we allowed the regression coefficient of these indicators to vary across areas. We did not find statistically significant effects, suggesting no evidence for cross-area variations in the relationship between socioeconomic position and perceived health. This means that the context – in terms of Regions and large areas – does not influences the way through which the individual socioeconomic status affects health status.

4.2 The territorial variability

The random part of the models (Table 2) adds further insights about the territorial variability. Above all, it is worthwhile to note that the second level variability, although statistically significant, is marginal with respect to the individual-level one. In fact, the estimated intra-class correlation coefficient (ICC) – that is percentage of total unexplained variation in health perception among Italian elderly due to the different area of residence – amounts to 2.7% for the regional null model (a value slightly higher is estimated for the model using large areas instead of Regions). This implies that the remaining 97.3% is due to individual characteristics. Passing from the two-level null model to the two-level model adjusted for individual level covariates, the area-level variance τ^2 reduces (from 0.092 to 0.043 in the model considering the residential context approximated using the individual's Region of residence, and from 0.101 to 0.069 in the model using large areas as level of nesting, Table 2), so that the ICCs become 1.28% and 2.06 respectively for Regions and large areas. This decrease shows that a big part of this low geographical variability is actually due to a different social profile of the resident population: failing to account for population composition would lead to true contextual effects being overestimated. Nevertheless, some unexplained variability in perceived health status remains, advocating the existence of a contextual effect as well as a personal-level one.

Table 2 – Models comparison

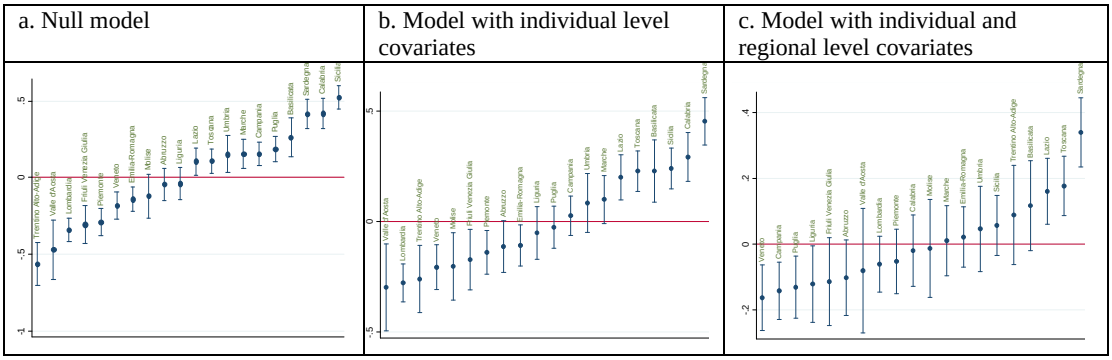
Model	2nd level variability		ICC (%)	
	τ^2	*(s.e.)*	ρ	*(s.e.)*
multilevel model with regions				
nul model	0.092	*0.032*	2.72	*0.91*
+ individual covariates	0.043	*0.017*	1.28	*0.49*
+ individual and contestual covariates	0.013	*0.006*	0.40	*0.19*
multilevel model with large areas				
nul model	0.101	*0.021*	2.98	*0.59*
+ individual covariates	0.069	*0.016*	2.06	*0.48*
+ individual and contestual covariates	0.032	*0.010*	0.96	*0.29*

The introduction of some contextual explicative variables determined a further reduction in second-level variability, proving their effectiveness, without relevant differences depending on the level of nesting (residual second-level variability equal to 0.013 and 0.032 in the regional and large area models). It is clear that multilevel modelling performs better than a single level one and that our attempt to approximate this residential variability through contextual covariates (multilevel model with both individual and contextual covariates) resulted useful and profitable.

On the one side, these results confirm also for the Italian case the minor role on self-rated health of contextual factors with respect to individual socioeconomic correlates (e.g. Robert 1998; Diez Roux, 2001; Pickett and Pearl, 2001) but, on the other side, they prove an autonomous contribution of the contextual level factors on the health outcome.

Let us now focus on Regional differences, looking at the random effects u_j of the hierarchical models, which summarize all the factors at regional level that have not been observed and explained by variables introduced in the model. The predicted random effects for a second-level unit j has been computed as the mean of the posterior distribution of the random intercept, with model estimates plugged in (Rabe-Hesket and Skrondal, 2008), the so-called Empirical Bayes (EB) residuals. For the null model, the model with individual level covariates, and the model with both individual and Regional-level covariates, the Empirical Bayes residuals at Regional level are presented in Figure 2. These results offer a synthetic way to compare the impact of the differences existing among territorial units with regard to many aspects: Regions with high negative residuals reveal a risk of bad self-rated health smaller than expected given the model estimates; vice versa, high positive residuals imply the presence of unobserved contextual factors that increase the risk to perceive less than fair health.

Figure 2 – Ranking of regional standardized empirical Bayes residuals u_j and their approximated 95% confidence interval.



Our elaboration on the results of the fitted logistic multilevel regression models without and with individual and contextual covariates. Reading: positive (negative) values reveal the presence of unobserved factors at regional level that increase (reduce) the risk of a bad health status perception.

Looking at Graphs a. (null model) of the Figure 2 we note that Northern Italian Regions report high negative residuals, whilst Centre and, above all, Southern Regions have positive residuals. This means that Northern Italian Regions perform better in the field of perceived health, a fact that generally persists also once accounted for individual demographic and socioeconomic characteristics (Graph b.). Moving from a. to b., we remark the displacement of some Regions: specifically, accounting for individual level covariates determines an unexpected higher risk to perceive bad health in Toscana and in Lazio, and a reduction of this risk in Molise and Puglia. Individual characteristics do not completely explain intra-regional heterogeneity, and Southern regions remain, generally, in a less favourable situation, a result in line with our expectations.

On the contrary, controlling also for second-level covariates, cross-Regional differences in health disappear, as highlighted by the fact that most confidence intervals overlap in the graph, and encompasses the value 0 (Graph c of the Figure). Now some Southern regions, namely Campania and Puglia, perform better than expected in the field of health. In the opposite situation, beside some southern Regions, we find Lazio, Toscana and Sardegna. For this group of Regions, the

declaration of a bad-health status reported by individuals is more frequent than expected based on model estimates.

5 Concluding remarks

In this contribution, we addressed socioeconomic health inequalities of Italian elderly, aiming to deepen the understanding of health correlates both at national and sub-national level. As in most current studies about health conditions, in Italy and elsewhere, the lack of longitudinal data enforces the analysis towards the associations between the health status and the various correlated, losing the possibility to investigate and to evaluate any causal mechanism.

The proposed multilevel modelling proved to be very useful in order to shed light on relevant aspects in the field of perceived health, which, in our opinion, still experiences a shortage of empirical investigation in the Italian scenery.

The first result of this study is that, besides the acknowledged inequalities of age, Italy still presents gender and socioeconomic health differences, in line with similar findings from international literature. A direct comparison with results coming from other countries is difficult, even if impossible, due to the incomparability of indicators used, but the existence of a social and economic gradient in health perception is confirmed also for the Italian case. The importance of the education in self-rated health seems to be lower with respect to previous similar and comparable studies (e.g. Rueda *et al.*, 2008; Basta *et al.*, 2008). However, it has to be said that they did not account for other individual characteristics that are, at least in part, connected to a lack of education, like lifestyles or other behavioural factors.

Furthermore, we found that each component of the socioeconomic condition – educational level, financial conditions and housing assets – is autonomously and distinctively correlated with the individual health status perception, so stressing the importance to consider all the facets of the individual socioeconomic condition to better measure the extent of health inequalities. On the contrary, we found no evidence about the variation of these elements depending on the context of residence.

The lack of relationships networks, although in its crude approximation here used, also emerged to be strongly associated with poor health status for Italian elderly people. In particular, we identified the family as the driving force in supporting a situation of illness and bad health for an old person.

A second result is that the residential context, both considering the Italian Regions and the large areas, emerges to be associated with the perception of individual health status. Individual characteristics, even representing the most important correlates of health, do not completely explain intra-regional heterogeneity, confirming the existence of a *contextual effect*. Generally, Southern Regions are in a less favourable situation, however the introduction of some area-level variables allowed to somewhat explain this regional heterogeneity. Our findings lead to two considerations. It is conceivable that filling the existing gap of some Southern Regions in term of socioeconomic wellness, quality of health services and accessibility to them could help in improving health conditions, at least at subjective level. Besides, for other regions, namely Toscana, Lazio and Sardegna, it seems that the elements we introduced are not able to catch the contextual level, so it remains to explain the presence of a certain degree of heterogeneity in self-rated health. As

previously discussed, geographic regions synthesize many factors that we tried to approximate, but we can assume that also subjective aspects, such as psychological, social and cultural characteristics of people, come into play. Moreover, elements like education, health education, the development and the diffusion of virtuous behaviours in terms of prevention and lifestyles affect the health consciousness, as well as elements like transport facilities, organization and efficiency, coverage and presence in the territory, are susceptible to favour health services access and the health status of individuals. Accounting for these aspects might help in explaining residual territorial heterogeneity in health perception. In this sense, a major effort toward data availability in these domains, both at individual and local level, is hoped.

Thirdly, the comparison of the models referring to the different levels of territorial aggregation suggests a reflection. We found that territorial differences were present among Regions – Nuts level-2 areas representing administrative units of reference for the definition of health policies in Italy – but also among large areas – Nuts level-3 areas or similar, responsible for the management of health services. However, the random part of the models has revealed that, at least from the point of view of health perception of elderly, the intra-regional differences are not so relevant and critical. The large area level of detail does not add further and improved insights to territorial heterogeneity, so the Regions seem to represent, for Italian health context, a good territorial breakdown in order to approximate the residential environment of individuals. A rationale for this may be that, in the field of health, policies are targeted at Regional level. Anyway, this does not exclude that inequalities and imbalances are still present among large areas inside the Regions. It might be that in some areas, health care infrastructures or hospital centres attract patients thanks to their quality, ease of access or efficiency, to the detriment of other areas within the same Region and of their residents. It may occur a sort of intra-regional mobility towards areas that are better equipped from the point of view of health facilities, a solution that is likely to be adopted by well-off people. These hypotheses should be analyzed in depth, but more precise and detailed data are needed.

Overall, our findings imply that there is still a lot of scope for improvements in health of Italian old population. Socioeconomic status is a key factor in assessing a population's health status and its need for health care, both at individual and at aggregate level, but the public Health System does not seem to be able to answer in a differentiated way to the specific needs of the population. This relation calls for integrated policies and interventions, in order to reduce health inequalities, at least those that are avoidable. To achieve successfully this objective, health status should be of concern to policy makers in different sectors, not solely those involved in health policy. A reduction of health inequalities cannot leave aside interventions aiming at filling the existing socioeconomic gaps and at improving quality of life of individuals, in all its dimensions.

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