Exploring Differences in the Recourse to Health Services in Italy through Latent Class Analysis

Elena Pirani and Silvana Salvini

Abstract: Recent analysis shows how Italian population still presents elements of heterogeneity in the field of health. People living in deprived areas are at increasing risk of bad self-rated health or functional impairment, even after controlling for the effects of individual characteristics. Using the most recent data on health conditions of the Italian population our aim is twofold. Firstly, using Latent Class analysis we intend to verify if, and to what extent, the individual health status and the individual access to health and sanitary services change in relations to socioeconomic characteristics, preventing an equal recourse to them. Secondly our aim is to verify if inequalities in the access to health services exist among North, Centre and South of Italy, and in that case, which are the main socio-economic and territorial factors into play.

Keywords: Health status, Health Service Research, Italy, Latent Variable Models.

1 Background and objectives

Empirical evidence suggests that health status is influenced by environmental context, as well as by personal circumstances (Mitchell et al., 2000; Ongaro and Salvini, 2009). The positive association between health status and socio-economic conditions has been reported by a number of studies, even in developed countries with high level of public health services (Mackenbach, 1992) and evidence has been verified also for Italian population (Ongaro and Salvini, 2009). People in lower socio-economic conditions are more exposed to health hazards in the physical environment (Volkers et al., 2007; Costa-Font, 2008), they experience psychosocial stressors more often, and they are more likely to adhere to unhealthy behaviours, such as smoking, inadequate diet, alcohol abuse, and lack of physical exercise (Pirani and Salvini, in press).

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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 (ISTAT 2009). Moreover, recent analysis shows how, notwithstanding improvements, Italian population still presents elements of heterogeneity also in the field of health. People living in deprived areas are at increasing risk of bad self-rated health or functional impairment, even after controlling for the effects of individual characteristics.

Beside these points regarding individual and aggregate health status variability, we hypothesize that a certain degree of heterogeneity persists also referring to the recourse to health services. Using the most recent data on health conditions of Italian population our aim is twofold. Firstly, our analysis proposes a comprehensive overview about the recourse to a series of health services. Using Latent Class analysis we intend to verify if, and to what extent, the individual health status and the individual access to health and sanitary services change in relations to socioeconomic characteristics, preventing an equal recourse to them. Secondly, in light of proved territorial differences among Italian areas, our aim is to verify if also inequalities in the access to health services exist among North, Centre and South of Italy, and in that case, which are the main socio-economic and territorial factors into play.

The basic questions explored in our contribution are the following: starting from the evidence of a regional gradient in the subjective evaluation of health, do socio-economic inequalities operate in the domain of health services access? Do health inequalities depend on the area of residence? And, is this territorial context linked to the use of health services? This study aims to answer these questions making use of the representative cross-sectional survey *Health conditions and recourse to health services* carried out by the Italian National Statistical Office (ISTAT) in 2004-2005.

2 Model specification and indicators

2.1 *Model specification*

In this contribution, we propose to explore factors that may affect access to a various set of health services in Italy following a Latent Class (LC) approach (Hagenaars and McCutcheon, 2002). In presence of heterogeneous populations LC analysis allows the study of multiple unidentified groups that behave differently regarding the problem at hand. The latent classes represent the levels of a categorical latent variable, and they structure the cases with respect to a set of observed indicators allocating each unit to one of the classes. In our empirical application, the latent classes represent different typologies of individuals on the basis of their need of health and their level of recourse to health services, according to their responses to the survey. Covariates are used to improve the description of the latent classes in terms of individual characteristics.

Consider individuals $i = 1,...,I$ for whom a set of $k = 1,...,K$ indicators, representing the health status and the recourse to various health services, has been

collected. So, Y_{ik} represents the response to item k of person i. $\mathbf{Z}_i$ denotes the full vector of individual covariates. We assume a latent variable X_i that represents the recourse to health services. Given their response patterns to the selected indicators, individuals will be classified in a probabilistic way in one of the T latent classes of X_i, with $t = 1,...,T$. The probability structure of the model is:

$$P\left(\mathbf{Y}_i = \mathbf{s}\big|\mathbf{Z}_i\right) = \sum_{t=1}^{T} P\left(X_i = t\big|\mathbf{Z}_i\right) P\left(\mathbf{Y}_i = \mathbf{s}\big|X_i = t\right) = \sum_{t=1}^{T} P\left(X_i = t\big|\mathbf{Z}_i\right) \prod_{k=1}^{K} P\left(Y_{ik} = s_k \big|X_i = t\right).$$

The probabilities $P\left(\mathbf{Y}_i = \mathbf{s}\big|\mathbf{Z}_i\right)$, corresponding to a certain response pattern of the i-th individual, are a weighted average of the T *class-specific (or conditional) probabilities* $P\left(\mathbf{Y}_i = \mathbf{s}\big|X_i = t\right)$. The weights are the proportion of persons belonging to the latent class t given their pattern of covariates, $P\left(X_i = t\big|\mathbf{Z}_i\right)$, called *latent class probabilities*. Both latent class and conditional probabilities are specified using multinomial logit models. Particularly the probability that respondent i belongs to a particular class of the latent variable X_i, given individual covariates is

$$P\left(X_i = t\big|\mathbf{Z}_i\right) = \frac{\exp\left(\gamma_{0t} + \gamma_{1t}Z_{1i} + ... + \gamma_{Kt}Z_{Ki}\right)}{\sum_{t'=1}^{T} \exp\left(\gamma_{0t'} + \gamma_{1t'}Z_{1i} + ... + \gamma_{Kt'}Z_{Ki}\right)}, \text{ while the joint probability that the}$$

i-th respondent follows the pattern $\mathbf{s}_i$ given individual latent class membership is

$$\prod_{k=1}^{K} P\left(Y_{ik} = s_k \big|X_i = t\right) = \prod_{k=1}^{K} \frac{\exp\left(\beta_{0s_k} + \beta_{1s_k t}\right)}{\sum_{s'}^{S_k} \exp\left(\beta_{0s'} + \beta_{1s't}\right)}.$$

Latent class probabilities provide information about the distribution of the population among the T classes, and they are helpful to compare different populations: two populations could have similar latent structures but differ in the class size distribution. The conditional probabilities enable to characterize the structure of the latent typology, and they are used to name the latent classes. The inspection of these parameters allows discovering to which of the T classes an individual following a certain response pattern is most likely to belong.

2.2 The indicators

In order to depict profiles of individuals according to their recourse to health services, a set of indicators has been selected from the survey. First, we accounted for the health status of individuals, since it is crucial in determining the recourse to health services: on the one hand we considered the subjective measure of health perceived by individuals (good/bad health), and on the other hand we used individual declarations concerning the presence of multi-chronic diseases (no chronic diseases, one or two, three or more chronic diseases). Referring to the indicators of consume of health services, different kinds of services has been accounted for. The variable "drugs and medicine use" distinguish among no use, occasional use due to a temporary health problem (acute use), continuous use due to presence of chronic illness (chronic use). The survey collected data about the number of diagnostic tests and general practitioner

(GP) visits made in the month before the interview. Both variables have been coded in our analysis distinguishing among no visit/test, one, two or more visits/tests. In Italian context these health services are often free of charge for users. On the contrary, an important amount of specialist doctor visits (e.g. gynaecological, cardiologic, and so on) are paid by individuals. To account for this difference, the indicator of specialist visits has been built distinguishing among: no visit, one free of charge visit, two or more free of charge visits, one "out of pocket" visit (that is paid directly by the user), two or more "out of pocket" visits. The frequency of periodical check-up for cholesterol, blood pressure and glycaemia (never, every 5 years, every 2-5 years, at least once yearly) has been added.

Finally, a composite indicator of recourse to health services has been introduced in the analysis. This indicator synthesizes, using appropriate weights, various information about the use of health services in different periods before the interview (for a more detailed description see ISTAT 2007). We used it to facilitate the description of individual profiles and to offer a synthetic evaluation of the topic under investigation.

In LC models covariates are useful to improve the description of the latent classes in terms of individual characteristics. As the prevalence of bad health and the recourse to health services is negligible in young people, we focused our analysis on people aged 35 and more, subdividing age in the following groups: 35-44, 45-54, 55-64, 65-74, 75 or more. The other demographic covariates used in the analysis are sex and marital status (single, married, separated or divorced, widowed). The socio-economic status of individuals is taken into account using three components: educational level (low, medium, high), satisfaction of financial resources (very good or adequate, scarce or insufficient), and main activity (employed, unemployed, inactive, unable to work).

Different models have been estimated. First, a model considering all Italian population aged 35 and more, in order to depict typologies of users of health services at national level. Secondly, given the well-known territorial differences concerning Italy, we estimated three separate models, one for the North, one for the Centre and one for the South, in order to confirm if the gradient North-South, verified with reference to several socio-economic aspects, exists also in the domain of health services.

3 Profile of users of health services

Our analysis yields to the identification of seven classes $T = 7$ representing different represent typologies of individuals with respect to their characteristics of health status and recourse to health services. The characteristics of each class, in terms of their similarities and differences, are shown in Table 1. This "profile" table contains, in the first line, the *estimated latent class probabilities* $\hat{P}(X = t)$ for each t-th class, representing the class size. In the core of the Table, the *class-specific marginal probabilities* associated with each indicator $\hat{P}(Y_{ik} = s_k | X = t)$ show how the latent classes are related to the indicator variables used. Through the examination of the profile table, we can characterize each class of the latent variable in term of response probability to each level of the indicators, and thus describe the different typologies that emerge.

Table 1: Profile table of the latent variable X_i: size class $\hat{P}(X = t|\mathbf{Z})$ and class specific marginal probabilities $P(Y_{ik} = s_k | X = t)$

		Latent classes for X_i							
	t	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Overall**
Size class $P(X = t|\mathbf{Z}_i)$		0.346	0.083	0.094	0.167	0.091	0.122	0.099	
self perceived health status									
good		0.995	0.984	0.987	0.982	0.919	0.753	0.500	0.906
bad		0.005	0.016	0.013	0.018	0.081	0.247	0.500	0.094
chronic diseases									
0 chronic diseases		0.850	0.702	0.707	0.272	0.172	0.033	0.016	0.485
1 or 2 chronic diseases		0.141	0.271	0.272	0.671	0.669	0.451	0.245	0.348
3 or more chronic diseases		0.009	0.027	0.021	0.057	0.160	0.516	0.739	0.167
overall recourse to health services									
no use		0.993	0.000	0.000	0.000	0.000	0.000	0.000	0.343
very low use		0.000	1.000	0.000	0.143	0.000	0.029	0.000	0.110
medium use		0.000	0.000	0.703	0.504	0.000	0.084	0.008	0.161
high use		0.000	0.000	0.130	0.353	0.081	0.887	0.001	0.186
very high use		0.007	0.000	0.168	0.000	0.919	0.000	0.991	0.199
drug and medecines use									
no use		0.903	0.301	0.503	0.000	0.024	0.001	0.003	0.387
acute use		0.097	0.549	0.433	0.000	0.060	0.004	0.004	0.126
chronic use		0.000	0.150	0.064	1.000	0.917	0.995	0.994	0.488
diagnostic tests									
0 diagnostic tests		1.000	0.888	0.667	0.955	0.525	0.907	0.554	0.854
1 diagnostic test		0.000	0.050	0.138	0.024	0.134	0.033	0.085	0.046
2 or more diagnostic tests		0.000	0.062	0.195	0.021	0.341	0.060	0.361	0.101
general practitioner (GP) visits									
0 GP visists		1.000	0.755	0.606	0.895	0.572	0.705	0.357	0.787
1 GP visist		0.000	0.245	0.261	0.081	0.246	0.278	0.213	0.135
2 or more GP visists		0.000	0.000	0.133	0.024	0.182	0.017	0.431	0.078
specialist visits									
no specialist visit		1.000	1.000	0.458	0.957	0.377	0.988	0.499	0.835
1 free of charge spec. visit		0.000	0.000	0.144	0.016	0.185	0.010	0.174	0.051
2 or more free of charge visits		0.000	0.000	0.044	0.000	0.128	0.000	0.153	0.031
1 out of pocket visit spec.		0.000	0.000	0.239	0.027	0.159	0.003	0.096	0.051
2 or more out of pocket visits		0.000	0.000	0.116	0.000	0.152	0.000	0.078	0.033
periodical check-up									
never		0.162	0.110	0.082	0.040	0.022	0.004	0.004	0.082
every 5 years		0.071	0.049	0.047	0.026	0.012	0.007	0.003	0.039
every 2-5 years		0.218	0.168	0.162	0.096	0.052	0.034	0.017	0.131
at least once yearly		0.549	0.674	0.709	0.838	0.915	0.955	0.976	0.748

In class number 1, we find more than one-third of the population aged 35 and more (class size equal to 34.6%). It identifies individuals in a good health status – both perceived and without chronic diseases – that recur scarcely to any type of health services. In terms of covariates (Table 2), this class is composed mostly by young and educated people, married or singles, employed or who are looking for a job. Moreover, this profile identifies mainly men with respect to women, and people who are satisfied by their financial resources with respect people who are not.

Classes 2 and 3 group individuals who feel good and do not suffer of chronic diseases, but they are differentiated in the use of health services. Individuals in class 2 (the 8.3% of the population) have a high probability to use drugs and medicines due to temporary illness, and with a probability of 0.24 they recur to one general practitioner visit (against an average value of 0.13). We can denote this class as the class of good health and low recourse to health services. In terms of covariates this class is similar to the number 1: young, employed and educated people who have a good financial

situation. On the contrary, class number 3 groups people that although a good health status, present a high level of recourse to health services. Their use of drugs and medicines refers mainly to acute illnesses, but they recur frequently to diagnostic tests and to GP visits, with a probability that is double with respect to the overall mean. People classified in this class are more likely to recur to specialist visits, principally out of pocket visits. Class number 3 thus identifies people that report good health conditions, but also a high level of recourse to health services for which, generally, they have to pay and they are not refunded by the National Health Care System. The description of this class in terms of covariates shows a high presence of youngest people (35-44 and also 45-54), employed and with a high level of education. Moreover, people reporting a good financial situation are over-represented in this class.

Table 2: Conditional probabilities of X_i for selected covariates: $\hat{P}(X_i = t | Z_i = z)$

	Latent classes for X_i						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Overall	0.346	0.083	0.094	0.167	0.091	0.122	0.099
sex							
male	0.404	0.082	0.088	0.165	0.087	0.098	0.077
female	0.294	0.084	0.099	0.168	0.095	0.143	0.118
classes of age							
35-44	0.550	0.136	0.160	0.093	0.051	0.007	0.004
45-54	0.450	0.103	0.122	0.173	0.089	0.038	0.026
55-64	0.315	0.067	0.074	0.227	0.120	0.115	0.083
65-74	0.169	0.043	0.043	0.210	0.121	0.223	0.191
>75	0.082	0.030	0.021	0.149	0.088	0.341	0.288
marital status							
single	0.457	0.084	0.101	0.148	0.077	0.077	0.055
married	0.360	0.088	0.100	0.174	0.095	0.103	0.080
separated/divorced	0.429	0.109	0.122	0.136	0.076	0.072	0.058
widowed	0.137	0.042	0.037	0.156	0.089	0.285	0.254
educational level							
high	0.433	0.105	0.134	0.157	0.088	0.051	0.032
medium	0.413	0.098	0.109	0.158	0.086	0.077	0.059
low	0.218	0.052	0.049	0.181	0.098	0.216	0.185
satisfaction on financial resources							
very good/adequate	0.367	0.086	0.100	0.176	0.094	0.105	0.072
scarce/insufficient	0.298	0.077	0.079	0.145	0.084	0.159	0.158
main activity							
employed	0.492	0.114	0.137	0.145	0.073	0.026	0.013
unemployed	0.462	0.108	0.111	0.140	0.091	0.046	0.044
inactive	0.226	0.058	0.058	0.190	0.108	0.200	0.160
unable to work	0.068	0.020	0.018	0.060	0.050	0.313	0.472

    Classes 4 and 5 identify typologies of individuals that present a divergence between the perceived health status and the presence of chronic diseases. These two classes are characterized by a relevant presence of people aged 55-74, who are employed or not active. In these classes, especially in class 4, there is a presence higher than the overall mean of low educated people and of people who are satisfied by their income situation. There are no relevant gender differences. People in class number 4 (the 16.7% of the sample) have a probability of 0.67 to suffer of one or two chronic diseases, but a high probability (0.98) to perceive good health. In this case, the medium-high recourse to health services is mainly due to a chronic use of drugs and medicines, while the other kinds of services (visits, tests and check-up) are scarcely used. The 9% of the sample classified with high probability in class 5 is likely to have one or two chronic diseases, and the probability to report a bad health status is slightly

below the overall mean. The characteristic of this class is a very high recourse to all kinds of health services. If we consider the recourse to specialist visits, we observe that the probability is almost equally allocated among the modalities considered, without identifying a clear-cut prevalence toward free of charge or out of pocket visits.

Our model allows, finally, the identification of two profiles where the health status, in both its components here considered, is bad. Individuals classified in class 6 (class size equal to 12.2%) have a probability equal to 0.25 to perceive a bad health status and a probability 0.52 to suffer of 3 or more chronic diseases. Individuals of this class present a high level of consumption of health services, which seems due to the fact that they are chronic users of drug and medicines, have registered on average one GP visit in the month before the interview and they carry out check-up at least one time per year. Thus, in this class we find more likely people that although precarious health conditions, are characterized by a medium-high recourse to health services, and above all the generic ones. Finally, class number 7 groups people who report a bad self-rated status with a high probability (equal to 0.5 vs. an average value of 0.09) and are affected by multi-chronic diseases. For this class, which groups about 10% of the sample, the probability to recur largely to health services is the highest for almost all the services. Beside a chronic use of drugs and medicines, they have recurred, with a probability higher than the average, to 2 or more diagnostic tests and GP visits in the month before the interview. They declare to do often periodical check-up. Their probability to recur at least to one specialist visit is higher than the overall mean, however they seems to benefit mainly of free of charge visits. The composition of the latent classes 6 and 7 is similar referring to covariates. As expected, in these classes elderly people (65 and more) and women are over-represented, and consequently we observe a high presence of widowed and retired/unable people. Moreover, referring to the socio-economic conditions, in these classes are over-represented people that have achieved a low level of education and who consider their economic resources as scarce or insufficient, a presence that is relevant mainly in the most disadvantaged class 7.

We estimated the same model considering separately the three Italian macro-areas: the North, the Centre and the South and Islands (results not reported for space limitation, however available by request). We thus may compare the characteristics of the resulting classes in terms of size differences and of response probabilities. We found that the class number 1 of each single area reflects the national situation, but its size is bigger in the South with respect to the other areas (37,4% of the sample). Also class number 2 does not present relevant differences among the three areas, except for a lower probability to use drugs and medicines chronically in the North. Class number 3 presents instead different response patterns in the three areas. Generally, in the Centre and in the South the recourse to health services is higher with respect to the North. In the former areas we found a higher probability to have 2 or more GP visits and diagnostic tests, or two or more specialist out of pocket visits. These probabilities are especially high for the South of Italy. In the North, the class number 3 is characterized by the fact to register the highest probability to have one specialist visit for which individuals have to pay directly. In terms of covariates, in this class people with a satisfactory financial situation are over-represented in the Centre and in the South, while there are no relevant differences in the North. Another class presenting relevant territorial differences is the number 5. In the South, and in less measure also in the Centre, the probability to perceive bad health conditions and to have three or more chronic diseases is higher than the overall mean. In the North, where the class size is smaller, health status is better, considering both aspects. These differences entail that in

the North this class is characterized by a low recourse to health services, with reference to diagnostic tests and GP visits, while the highest probability to recur to two or more out of pocket visits is detected. Also in terms of covariates we remark territorial differences: in the South people with a low level of education and inactive are over-represented in class 5, contrary to the high presence of high educated and well-off people in the same class identified for the North. Finally, the two most disadvantaged classes 6 and 7, that present in all areas a strong prevalence of people who are unsatisfied of their financial situation and have a low level of education, are more numerous in the North, however, in the Centre and in the South people in these classes are more likely to feel bad and to have 3 or more chronic diseases. For class 7 in the South the probability to have 2 or more GP visits is double with respect to the North and higher with respect to the Centre. Moreover, while in the Centre and South people have high probability to have 2 or more free of charge visits and diagnostic tests, in the North one usually recur to only 1 specialist visit.

To conclude, our analysis proved a worst perception of self-rated health in southern regions, the presence of different patterns of health inequalities depending on the area of residence, and marked territorial differences in the recourse to health services. In particular, the North evidences a low level of recourse to health services, even in classes characterized by bad health conditions, where just one visit/test is most probably to occur. Moreover, in this area, we observe that people without health problems are likely to recur to out of pocket services, without relevant differences in terms of socio-economic status. On the contrary, in the South and in the Centre, people, above all who declare a bad health status, tend to exploit in a higher measure 2 or more free of charge visits, and, mostly in the South, the recourse to out of pocket health services is strictly relied to the economic situation of individuals.

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