DETERMINANTS OF HEALTH DISPARITIES IN ITALIAN REGIONS

Luisa FRANZINI - Margherita GIANNONI

-

QUADERNI DEL DIPARTIMENTO DI ECONOMIA, FINANZA E STATISTICA

DETERMINANTS OF HEALTH DISPARITIES IN ITALIAN REGIONS

Luisa Franzini * and Margherita Giannoni **

* University of Texas School of Public Health
email: Luisa.Franzini@uth.tmc.edu

** University of Perugia (ITALY) , University of Lugano (CH)
email: m.giannoni@unipg.it

Abstract

Introduction: There is an extensive literature on regional disparities in health, but much of this literature focuses on the United States. Among European countries, Italy is the country where regional health disparities contribute the most to socioeconomic health disparities. In this paper, we report on regional differences in self-reported poor health and explore possible determinants at the individual and regional levels in Italy.

Methods: We use data from the "Indagine Multiscopo sulle Famiglie", a survey of aspects of everyday life in the Italian population, to estimate multilevel logistic regressions that model poor self-reported health as a function of individual and regional socioeconomic factors. Next we use the causal step approach to test if living conditions, healthcare characteristics, social isolation,

and health behaviors at the regional level mediate the relationship between regional socioeconomic factors and self-rated health.

Results: We find that residents living in regions with more poverty, more unemployment, and more income inequality are more likely to report poor health and that poor living conditions and private share of healthcare expenditures at the regional level are determinants of socioeconomic disparities in self-rated health among Italian regions.

Conclusion: The implications are that regional contexts matter and that regional policies in Italy have the potential to reduce health disparities by implementing interventions aimed at improving living conditions and access to quality healthcare.

Background

Health inequalities have been increasing faster in Italy compared to other European countries.[1, 2] Reports on equity in health in Italy have shown that differences in health were due to social differences, with the lowest social classes characterized by higher perinatal mortality rate, lower self assessed health status, higher chronic illness rates, higher cancer rates and higher mortality rates.[3-7] Moreover, though Italy has relatively poor self-reported health compared to other European countries, it is one of the Southern European countries with relatively low health inequalities, but high regional health disparities.[8] Self-rated health varies greatly by regions with the percentage of residents reporting poor health ranging from 4% in Trentino Alto Adige to 10% in Calabria and Sicilia. Out of 13 European countries, Italy was the country where regional health disparities contributed the most to socioeconomic health disparities.[8]

A study using data from the 2000 Italian National Health Interview Survey, looked at geographic variation in subjective health and presence of chronic conditions, focusing on the effects of individual and area-based socioeconomic conditions and their heterogeneity across regions.[9] The study finds a North-South gradient in self-assessed health, affected mainly by area composition with respect to individual education, and only slightly influenced by contextual factors, such as area level socioeconomic and power resources. Another study, based on a relatively small sample of individual households income and health data from Bank of Italy collected in 2004, has found that, although at national level individual income affects positively self-assessed health, there seem not to be a clear socioeconomic gradient in terms of North-South divide.[10] This study, however, did not consider simultaneously the role of regional and individual level characteristics.

As the evidence is not clear, it seems important to further investigate socioeconomic health inequalities in Italian regions. In this paper, we use data from the "Indagine Multiscopo sulle Famiglie", a survey of aspects of everyday life in the Italian population, to report on regional differences in self-reported poor health and explore possible determinants at the individual and regional levels.[11, 12]

Conceptual framework

The conceptual framework for our study draws on socio-ecological models that postulate that health is influenced by a wide range of factors at multiple levels.[13-15] Determinants of health include socioeconomic factors, social and physical environments, healthcare, and health behaviors.[16-18] Most models identify socioeconomic conditions at the individual level as well as at the group level as the fundamental causes of disease.[19, 20] Socioeconomic factors contribute to unequal social and physical environmental exposures which contribute to health inequalities. A large literature discusses the mechanisms that underline the relationship between socioeconomic factors and health at the regional level.[21-24] Two major theories have been proposed: one focuses on material deprivation and the other on social/psychological wellbeing. In the material deprivation interpretation, the negative effects of socioeconomic disadvantage on health operate through a lack of physical resources and underinvestment in infrastructure and services, including housing, environmental quality, and healthcare services.[17, 21, 25] The second theory emphasizes the role of social/psychological factors, including social capital and social isolation, in the relationship between socioeconomic factors and health.[24, 26-28]

In this paper we consider a socio-ecological model (see Figure 1) where regional socioeconomic factors affect health outcomes through material deprivation, social/psychological factors, and health behaviors measured at the regional level in order to investigate regional level

determinants of self-rated health among Italians. Our hypothesis is that, in Italy, regional health inequalities reflect regional socioeconomic disadvantage. Furthermore, we hypothesize that regional level socioeconomic disadvantage negatively affect health by impacting the social and physical environments at the regional level. We hypothesize that regions that are more disadvantaged socioeconomically will have: 1) more material deprivation resulting in poorer living conditions and worse healthcare; 2) more social/psychological disadvantage reflected in more social isolation; and 3) more unhealthy behaviors. We will test the hypothesis that regional level poor living conditions, healthcare factors, social isolation, and unhealthy behaviors mediate the impact of regional socioeconomic disadvantage on self-rated health in Italian regions.

Methods

Data

The data used for the analysis were collected both at the individual level and at the regional level. At the individual level, data were taken from Multiscopo, a survey on health and living conditions conducted by Istat, the Italian National Institute of Statistics, in the period 2004-2005.[11, 12] Multiscopo interviewed a representative sample of families and individuals in order to describe health and healthcare utilization of the Italian population. Starting in March 2004 until March 2005, every three months, one quarter out of a total 50,474 sampled families (defined as a group of people living together for several possible reasons) and 128,040 individuals, distributed in 1,465 Italian municipalities, were interviewed. Part of the questionnaire was completed by direct interviews and, when individuals were not available, information was gathered from another family member. Another part of the questionnaire was

self administered. Regional level variables were taken from Istat data available at the regional level for 2004 and 2005.[11, 12, 29, 30]

Measures

Individual level measures

Individual level variables were obtained from Multiscopo.[11, 12] The dependent variable used is a measure of self-rated health, which is well known to be highly predictive for mortality and the onset of disability.[31-33] Individuals were asked "How is your health in general?" with possible response: very good, good, fairly good, bad, and very bad. Following other researchers,[1, 34-37] the responses were dichotomized into a categorical variable (poor health) taking the value one for those reporting poor health (bad or very bad) and the value of zero for those not reporting poor health (very good, good, fair).

Individual sociodemographic characteristics included age (below 35, 35-44, 45-64, 65-74 and over 75), gender, marital status (married, separated or divorced, widowed or single), education (university degree or other post-graduate qualifications, high school or secondary school diploma, less than high school), and employment status (employed, self-employed, including professionals, retired, other not working, including the unemployed and those not in the labor force).

Regional level measures

Regional characteristics, obtained from Istat, include socioeconomic factors (socioeconomic disadvantage), material deprivation (living conditions and healthcare), social/psychological factors (social isolation), and health behaviors (obesity).[11, 12, 29, 30]

Regional level socioeconomic disadvantage was measured by a scale using three indicators: poverty, unemployment, and income inequality, measured by the Gini

coefficient.[30]. The socioeconomic disadvantage scale had good internal reliability with a Cronbach's alpha of 0.84.[38]

Regional level material deprivation was assessed by a scale reflecting living conditions and by characteristics of the healthcare sector. Living conditions were measured by the proportion of families reporting that were either a fair number or many problems in the area in which they lived, in terms of conditions of public places, housing quality, water resources, pollution, and crime.[12] The poor living conditions scale (alpha=0.85) consisted of 12 items representing the conditions of daily living: conditions of public places (dirty streets, parking difficulty, traffic, no public lights in streets, streets in poor condition), housing quality (small residential unit, residential unit far from family, residential unit in poor condition), water availability and quality (irregular water service, does not drink tap water), pollution (air pollution) and crime.

Characteristics of the healthcare sector at the regional level were measured by a scale for healthcare satisfaction, a healthcare capital intensity index, and the share of private healthcare expenditure. Satisfaction with healthcare was measured by reported satisfaction with their hospital stay for residents who had at least one hospital stay in the last three months (3.2% of sample). The healthcare satisfaction scale (alpha=0.90) had 4 items: percentage of respondents who were highly satisfied with physicians, with nurses, with room and board, and with hygiene.[12] Capital intensity in the healthcare sector was captured by an index that represents the number of medical equipment machines per resident in the region. The number of 18 types of medical machines, such as MRIs, dialysis equipment, ventilators, radiology equipment, and anesthesia equipment, is reported by Istat for each region.[29] Share of private healthcare

expenditure was measured as the percentage of total healthcare expenditure that was private expenditure.[29]

Social/psychological disadvantage was assessed by social isolation measured as the percentage of residents in a region who reported not having any friends.[12] Finally, we used regional obesity rates as a proxy for health behaviors since obesity often results from unhealthy behaviors such as poor diet and lack of physical activity.[29]

Statistical analysis

Descriptive statistics were computed for individual and regional variables. Multilevel models were used to model the relationship between reporting poor health (bad/very bad health) and individual and regional characteristics. Multilevel methods, developed for use with nested data structures, are found in many areas of research that investigate contextual level effects.[39, 40] Given that the outcome variable (reporting poor health) is categorical, we estimated a multilevel logistic regression with Stata software.[41] We report odds ratios with their 95% confidence interval. The odds ratios for categorical variables represent the probability that reporting poor health is the same in two groups. For continuous variables, the odds ratios represent the odds of reporting poor health for a one-unit increase in the continuous variable. In our analysis, we rescaled regional level scales, the share of private healthcare expenditures, and obesity rates so that the odds ratios represent the odds of reporting poor health for a 10-unit increase. Regional level variance and the inter-correlation coefficient (ICC), representing the percentage of total variance in poor health attributable to regional level variance, are also reported.

Mediation was tested using the causal step approach which specifies a series of tests in a causal chain. The causal step approach to test if Z mediated the effect of X on Y consists of (1)

regressing X on Y and (2) regressing Z and X on Y. If two conditions are met (the coefficient of X on Y in (1) is significant, the coefficient of Z on Y in (2) is significant while the coefficient of X on Y in (2) is not significant), Z is said to mediate the effect of X on Y. A more stringent test, proposed by Judd and Kenney, adds a third regression, (3) regress Z on X, and requires the coefficient of Z on X in (3) to be significant.[42, 43] Such mediation tests, when used with observational data, demonstrate that the causal processes hypothesized in the model are consistent with the data but do not prove causality.

Results

Sample description

Table 1 describes the individual level sociodemographic characteristics of the sample. The 7% prevalence of poor health in this Italian sample is consistent with Carrieri [10] and van Doorslaer & Jones [44] who used Bank of Italy data (2004) and the European Community Household Panel (1996) respectively, but were lower than the prevalence reported in the Italian Health Interview Survey.[1, 37] The characteristics of the 20 Italian regions are described in Table 2. All socioeconomic measures varied greatly between regions.

Multilevel models

Estimates for the multilevel logit regressions are reported in Table 3. Model 1 includes only individual level factors. Individual determinants of self-rated health were consistent with those in the other studies of self-rated health in Italy and elsewhere: health decreased with age and increased with education; non married individuals reported worse health than married individuals; and those who were working, either as employee or self-employed, reported better health than those who were not working.[8, 34, 35, 37, 45]

9

Model 2 adds the index for socioeconomic disadvantage at the regional level. Living in a region with 10% higher socioeconomic disadvantage increased the odds of reporting poor health by 36%. Similar results are obtained by estimating the model with each indicator of regional socioeconomic disadvantage separately. A 10% increase in poverty rate increased the odds of reporting poor health by 19% (OR 1.19, 95% CI: 1.05, 1.35), a 10% increase in unemployment rate increased the odds of reporting poor health by 32% (OR 1.32, 95% CI: 1.17, 1.49), and a 0.10 increase in income inequality as measured by the Gini coefficient increased the odds of reporting poor health by 70% (OR 1.70, 95% CI: 1.14, 2.53).

Model 3 adds other regional factors which may mediate the effects of socioeconomic status on poor health. Economic disadvantage is no longer statistically significant but living in regions with worse living conditions (by 10%) increased the odds of reporting poor health by 41% and living in regions with a larger share of private healthcare expenditures (by 10%) decreased the odds by 6%. These results indicate that poor living conditions and share of private healthcare expenditures mediate the association of regional socioeconomic status to poor health.

Using the more stringent Judd and Kenney[42] test, we estimated the regression of socioeconomic disadvantage on living conditions, satisfaction with healthcare, capital intensity in healthcare, share of private healthcare expenditures, social isolation, and obesity rates in the 20 regions (Table 4). While all the coefficients were the expected sign, only share of private healthcare expenditures reached statistical significance. Therefore the Judd and Kenney[42] test supports the hypothesis that regional share of private healthcare expenditures mediates the effects of socioeconomic disadvantage on poor health.

In the empty model (not reported), the ICC for poor health was statistically significant at 1.8%, implying that 1.8% of the total variation in poor health was due to variation in poor health

between regions. After adjusting the ICC for individual level factors (model 1), the ICC was still statistically significant at 2.0, implying that differences in poor health by region were not due to compositional effects. The ICC decreased after adding regional factors (model 2 and 3), but remained statistically significant, indicating that the regional factors included in our models did not fully account for regional variations in poor health.

Discussion

We found significant disparities in self-rated health by regional socioeconomic status in Italy. Residents living in regions with more poverty, more unemployment, and more income inequality were more likely to report poor health. This is consistent with studies in other countries, in particular the United States.[27, 34] However, regional low socioeconomic status ceased to be significant when regional living conditions, healthcare, social isolation, and health behaviors were added to the model. In particular, variables reflecting living conditions and healthcare factors were significant and mediated socioeconomic disparities in health status among Italian regions. A more stringent test of mediation, the Judd and Kenney[42] test, supported that private share of healthcare expenditures mediated socioeconomic differences in self-rated health. The lack of significance of living conditions in the more stringent test could be due to the small sample size (20 regions).

Poor living conditions are likely to affect self-rated heath through several mechanisms. The stress of daily life is increased by hassles such as difficulty parking, traffic, living away from family, and poor public services (e.g. irregular water and dirty and unlit streets). Higher crime rates make residents feel unsafe and increases stress. Higher stress often leads to worse health.[46, 47] Poor quality housing and poor conditions of public places can impact both

physical health as well as mental wellbeing. For example, individuals living in small, overcrowded, and damp homes are more likely to get sick. So are those living on dirty streets, where trash collection may be infrequent. Pollution and poor water quality also have the potential for impacting physical health directly. Improving daily living conditions was identified as an overreaching principle to reduce health inequalities by The Commission on Social Determinants of Health set up by the WHO.[18]

The proportion of private expenditure of total healthcare expenditure affects positively self-rated health. There is evidence, for Italy, of pro-rich horizontal inequity in access to privately paid healthcare services, such as specialist services, diagnostic services and dental care.[48] As access to healthcare ultimately affects health status of individuals, this result could reflect problems of equity in access to private and often better quality and faster access healthcare in Italy. Moreover, particularly in Southern regions the supply of public healthcare is insufficient to cover the population needs, and private healthcare developed over time acting as a substitute of public healthcare.[49]

The findings in this study lend some support to the material deprivation interpretation.[17, 21, 25] The factors found to explain socioeconomic differences in health in this study include a lack of physical resources (housing quality, air pollution) and underinvestment in infrastructure (difficulty parking, traffic, unlit streets) and services (healthcare, irregular water service, dirty streets). While social isolation was not significant in our model, it should not be interpreted as evidence against the social/psychological interpretation, as we had very limited data on social/psychological factors. Only one item (having no friends) was used to measure social isolation, but there were no measures for social
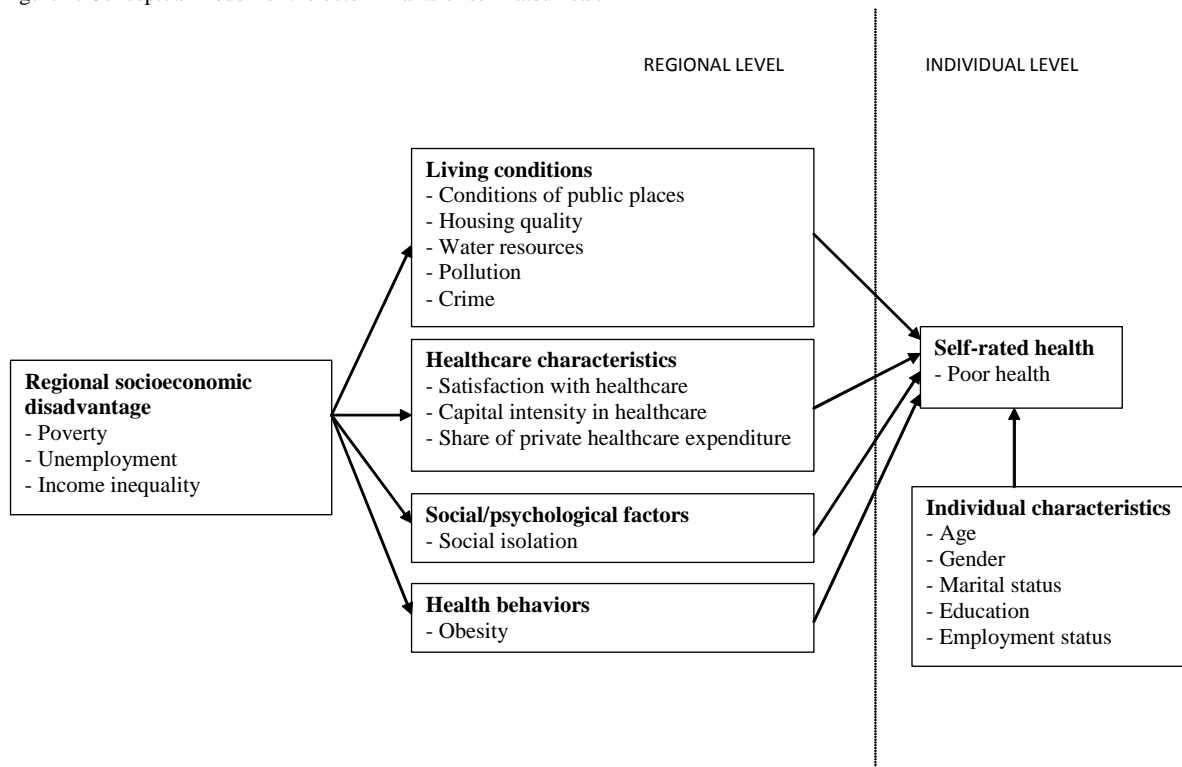
capital, trust, or measures of socially hazardous environments that have been shown to influence health.[23, 24]

It is noteworthy that self-rated health variation at the regional level accounted for about 2% of total variation in self-rated health, which is in a range consistent with findings in other studies. For example, variation in health status is 2% at the municipality level in Sweden [50] and is 4% in U.S. states.[34] Our findings, unlike Costa et al.,[9] imply that regional context matters in explaining regional disparities in health among Italian regions.

A limitation of the data is the absence of information on regional level social capital and on individual level income. However, we used education as a proxy for individual level socioeconomic status, which has the advantage of being more stable. Moreoever, available evidence based on individual households income and health data, but not considering the role of regional characteristics, confirms our findings using regional aggregate measures.[10]

Overall, we found that poor living conditions and private share of healthcare expenditures at the regional level are determinants of socioeconomic disparities in self-rated health among Italian regions. The implications are that regional contexts matter and that regional policies have the potential to reduce health disparities. The results in this study suggest that regions can positively impact health disparities by implementing policies and interventions aimed at improving living conditions and access to quality healthcare.

Figure 1: Conceptual model for the determinants of self-rated health

REGIONAL LEVEL   INDIVIDUAL LEVEL

Living conditions
- Conditions of public places
- Housing quality
- Water resources
- Pollution
- Crime

Healthcare characteristics
- Satisfaction with healthcare
- Capital intensity in healthcare
- Share of private healthcare expenditure

Regional socioeconomic disadvantage
- Poverty
- Unemployment
- Income inequality

Social/psychological factors
- Social isolation

Health behaviors
- Obesity

Self-rated health
- Poor health

Individual characteristics
- Age
- Gender
- Marital status
- Education
- Employment status

References

1	Kunst AE, Bos V, Lahelma E, *et al.* Trends in socioeconomic inequalities in self-assessed health in 10 European countries.[see comment]. *International Journal of Epidemiology* 2005;**34**:295-305.

2	Mackenbach JP, Bos V, Andersen O, *et al.* Widening socioeconomic inequalities in mortality in six Western European countries.[see comment]. *International Journal of Epidemiology* 2003;**32**:830-7.

3	Costa G, Faggiano F. *L'equità nella salute in Italia*. Milan, Italy: Franco Angeli 1994.

4	Costa G, Spadea T, Cardano M. Disuguaglianze di salute in Italia. *Epidemiologia e Prevenzione* 2004;**28**:1-161.

5	Dalstra JAA, Kunst AE, Borrell C, *et al.* Socioeconomic differences in the prevalence of common chronic diseases: an overview of eight European countries. *International Journal of Epidemiology* 2005;**34**:316-26.

6	Huisman M, Kunst AE, Bopp M, *et al.* Educational inequalities in cause-specific mortality in middle-aged and older men and women in eight western European populations.[see comment]. *Lancet* 2005;**365**:493-500.

7	Mamo C, Marinacci C, Demaria M, *et al.* Factors other than risks in the workplace as determinants of socioeconomic differences in health in Italy. *International Journal of Occupational & Environmental Health* 2005;**11**:70-6.

8	van Doorslaer E, Koolman X. Explaining the differences in income-related health inequalities across European countries. *Health Economics* 2004;**13**:609-28.

9   Costa G, Marinacci C, Caiazzo A, *et al.* Individual and contextual determinants of inequalities in health: the Italian case. *International Journal of Health Services* 2003;**33**:635-67; discussion 743-9.

10   Carrieri V. Disuguaglianze di salute e condizioni socio-economiche in Italia: esiste una questione meridionale? *Politiche sanitarie* 2008;**9**:15-24.

11   Istat. Indagine Multiscopo sulle Famiglie, "Condizioni di salute e ricorso ai servizi sanitari" Anno 2005. Istituto Nazionale di Statistica, Rome, Italy 2007.

12   Istat. Indagine Multiscopo sulle Famiglie "Aspetti della vita quotidiana" Anno 2005. Istituto Nazionale di Statistica, Rome, Italy 2007.

13   Sallis J, Owen N. Ecological models of health behavior. In: Glanz K, Rimer BK, Lewis FM, eds. Health behavior and health education: theory, research, and practice, 3rd ed. 2002:462-84.

14   Schultz A, Kannan S, Dvonch J, *et al.* Social and physical environments and disparities in risk for cardiovascular disease: The Healthy Environment Partnership conceptual model. *Environmental Health Perspectives* 2005;**113**:1817-25.

15   Schultz A, Northridge M. Social determinants of health: Implications for environmental health promotion. *Health Education and Behavior* 2004;**31**:455-71.

16   De Vogli R, Gimeno D, Martini G, *et al.* The pervasiveness of the socioeconomic gradient of health. *European Journal of Epidemiology* 2007;**22**:143-4.

17   Lynch JW, Smith GD, Kaplan GA, *et al.* Income inequality and mortality: importance to health of individual income, psychosocial environment, or material conditions. *BMJ* 2000;**320**:1200-4.

18   Marmot M, Friel S, Bell R, *et al.* Closing the gap in a generation: health equity through action on the social determinants of health. *Lancet* 2008;**372**:1661-9.

19   Link BG, Phelan JC. Understanding sociodemographic differences in health--the role of fundamental social causes. *American Journal of Public Health* 1996;**86**:471-3.

20   Phelan JC, Link BG, Diez-Roux A, *et al.* "Fundamental causes" of social inequalities in mortality: a test of the theory.[erratum appears in J Health Soc Behav. 2005 Mar;46(1):v]. *Journal of Health & Social Behavior* 2004;**45**:265-85.

21   Kaplan G, Pamuk E, Lynch J, *et al.* Inequality in Income and Mortality in the United States: Analysis of Mortality and Potential Pathways. *British Medical Journal* 1996;**312**:99-1003.

22   Kahn HS, Patel AV, Jacobs EJ, *et al.* Pathways between area-level income inequality and increased mortality in U.S. men. *Annals of the New York Academy of Sciences* 1999;**896**:332-4.

23   Kawachi I, Kennedy B. Income inequality and health: pathways and mechanisms. *Health Services Research* 1999;**34**:215-27.

24   Marmot M, Wilkinson RG. Psychosocial and material pathways in the relation between income and health: a response to Lynch et al. *BMJ* 2001;**322**:1233-6.

25   Lynch J, Kaplan GA, Pamuk ER, *et al.* Income Inequality and Mortality in Metropolitan Areas of the United States. *American Journal of Public Health* 1998;**88**:1074-80.

26   Wilkinson RG, Pickett KE. Income inequality and population health: a review and explanation of the evidence. *Social Science & Medicine* 2006;**62**:1768-84.

27   Kim D, Kawachi I. U.S. state-level social capital and health-related quality of life: multilevel evidence of main, mediating, and modifying effects. *Annals of Epidemiology* 2007;**17**:258-69.

28   Wilkinson R. Unhealthy societies: The afflictions of inequality. London: Routledge 1996:Chapter 9-10.

29   Istat. Health for all (HFA) database. Istituto Nazionale di Statistica, Rome, Italy 2008.

30   Istat. Reddito e condizioni economiche in Italia (2004-2005), Statistiche in breve 28.12.2006. Istituto Nazionale di Statistica, Rome, Italy 2006.

31   Farmer M, Ferraro K. Distress and percieved health: Mechanisms of health decline. *Journal of Health and Social Behavior* 1997;**39**:298-311.

32   Idler E, Benyamini Y. Self-rated health and mortality: A review of twenty seven community studies. *Journal of Health and Social Behavior* 1997;**38**:21-37.

33   van den Brink CL, Tijhuis M, van den Bos GAM*, et al.* The contribution of self-rated health and depressive symptoms to disability severity as a predictor of 10-year mortality in European elderly men. *American Journal of Public Health* 2005;**95**:2029-34.

34   Subramanian SV, Kawachi I, Kennedy BP. Does the state you live in make a difference? Multilevel analysis of self-rated health in the US. *Social Science & Medicine* 2001;**53**:9-19.

35   Subramanian SV, Kim DJ, Kawachi I. Social trust and self-rated health in US communities: a multilevel analysis. *Journal of Urban Health* 2002;**79**:S21-34.

36   Blakely TA, Lochner K, Kawachi I. Metropolitan area income inequality and self-rated health--a multi-level study. *Social Science & Medicine* 2002;**54**:65-77.

37   Desesquelles AF, Egidi V, Salvatore MA. Why do Italian people rate their health worse than French people do? An exploration of cross-country differentials of self-rated health. *Social Science & Medicine* 2009;**68**:1124-8.

38   Nunnally J, Bernstein I. *Psychometric theory (3rd ed.)*. New York: McGraw-Hill 1994.

39   Goldstein H. Hierarchical data modeling in the social sciences. *Journal of Educational and Behavioral Statistics* 1995;**20**:201-4.

40   Snijders TAB, Bosker RJ. *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*. Thousand Oaks, CA Sage 1999.

41   StataIC/10.0. StataCorp LP. College Station, TX 2007.

42   Judd C, Kenny C. Process analysis: Estimating mediation in treatment evaluations. *Evaluation Review* 1981;**5**:602-19.

43   MacKinnon DP, Lockwood CM, Hoffman JM*, et al.* A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods* 2002;**7**:83-104.

44   van Doorslaer E, Jones AM. Income-related inequality in health and health care in the European Union. *Health Economics* 2004;**13**:605-8.

45   Kawachi I, Kennedy BP, Glass R. Social capital and self-rated health: a contextual analysis.[see comment]. *American Journal of Public Health* 1999;**89**:1187-93.

46   Brunner E, Marmot M. Social organization, stress, and health. In: MG Marmot and RG Wilkinson, ed. *Social Determinants of Health*. Oxford: Oxford University Press 1999.

47   McEwen B. Protective and damaging effects of stress mediators. *New England Journal of Medicine* 1998;**338**:171-9.

48   Giannoni M. Equity in met and unmet needs for access to health care services in Italy: 2004-2005. *paper presented at the iHea International Conference "Harmonizing Health and Economics", Beijing, 12-15 July* 2009.

49   Atella V, Deb P. Are primary care physicians, public and private sector specialists substitutes or complements? Evidence from a simultaneous equations model for count data. *Journal of Health Economics* 2008;**27**:770-85.

50   Islam MK, Merlo J, Kawachi I*, et al.* Does it really matter where you live? A panel data multilevel analysis of Swedish municipality-level social capital on individual health-related quality of life. *Health Economics, Policy, & Law* 2006;**1**:209-35.

Table 1: Description of individual level characteristics (N=107,087)

Individual characteristics	Percentage (%)	Frequency (N)
Age group		
17-34	26%	28,351
35-44	19%	20,140
45-64	31%	33,438
65-74	13%	13,656
75 and over	11%	11,502
Gender		
Male	48%	51,072
Female	52%	56,015
Marital status		
Married	57%	61,367
Separated/divorced	5%	5,685
Widowed	10%	10,321
Single	28%	29,714
Education		
University degree or higher	9%	9,743
High school	31%	33,724
Less than high school	59%	63,620
Employment status		
Employee	33%	35,413
Self-employed	12%	12,517
Retired	20%	21,206
Not working/other	35%	37,951
Self-rated health		
Very good	17%	18,228
Good	42%	45,202
Neither good nor bad	34%	35,989
Bad	6%	6,281
Very bad	1%	1,387
Poor health (bad/very bad)	*7%*	*7,668*

Table 2: Description of regional level characteristics for the 20 Italian regions

Regional Characteristics	Mean	Standard deviation	Min	Max	Cronbach's Alpha
Economic disadvantage[1]	*0.17*	*0.06*	*0.11*	*0.27*	*0.84*
Poverty rate	0.13	0.08	0.04	0.27	
Unemployment rate	0.09	0.07	0.02	0.23	
Gini coefficient	0.29	0.03	0.25	0.33	
Material deprivation					
Poor living conditions[1]	*0.29*	*0.05*	*0.17*	*0.39*	*0.85*
Dirty streets[2]	0.30	0.09	0.15	0.49	
Difficulty parking[2]	0.38	0.09	0.28	0.57	
Traffic[2]	0.42	0.10	0.25	0.60	
No public lights in streets[2]	0.30	0.06	0.19	0.39	
Streets in poor conditions[2]	0.43	0.09	0.23	0.57	
Small residential unit[2]	0.12	0.03	0.10	0.18	
Residential unit far from family[2]	0.21	0.05	0.11	0.32	
Residential unit in poor conditions[2]	0.05	0.02	0.03	0.10	
Irregular water service[2]	0.14	0.09	0.02	0.36	
Does not drink tap water[2]	0.34	0.14	0.05	0.65	
Air pollution[2]	0.34	0.12	0.13	0.57	
Crime[2]	0.24	0.11	0.12	0.53	
Satisfaction with healthcare[1]	*0.29*	*0.10*	*0.15*	*0.50*	*0.90*
Highly satisfied with physicians[2]	0.35	0.13	0.14	0.56	
Highly satisfied with nurses[2]	0.34	0.13	0.15	0.55	
Highly satisfied with room and board[2]	0.22	0.10	0.12	0.43	
Highly satisfied with hygiene[2]	*0.29*	*0.12*	*0.11*	*0.49*	
Capital intensity in healthcare[3]	*23.35*	*4.92*	*15.05*	*34.14*	
Share of private healthcare expenditure	*0.38*	*0.21*	*0.04*	*0.77*	
Social/psychological factors					
Social isolation (no friends[2])	*0.05*	*0.02*	*0.03*	*0.08*	
Health behaviors					
Obesity rate	*0.10*	*0.02*	*0.07*	*0.13*	

[1] Scale with indictors as listed in the table.
[2] Percent reporting regional characteristics.
[3] Number of medical equipment machines per 10,000 residents.

Table 3: Odds ratios and 95% confidence intervals from multilevel logistic regressions of poor health on individual and regional characteristics N=107,087

Dependent variable: Poor health	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Individual level factors						
Age						
Less than 35	0.12	(0.10, 0.14)	0.12	(0.10, 0.14)	0.12	(0.10, 0.14)
35-44	0.37	(0.33, 0.42)	0.37	(0.33, 0.42)	0.37	(0.33, 0.42)
45-64	ref		ref		ref	
65-74	1.82	(1.69, 1.96)	1.82	(1.69, 1.96)	1.82	(1.69, 1.96)
75 and over	3.74	(3.47, 4.03)	3.74	(3.47, 4.03)	3.74	(3.47, 4.03)
Gender						
Female	ref		ref		ref	
Male	1.00	(0.94, 1.07)	1.00	(0.94, 1.07)	1.00	(0.94, 1.07)
Marital status						
Married	ref		ref		ref	
Separated/divorced	1.43	(1.26, 1.61)	1.43	(1.26, 1.62)	1.43	(1.26, 1.62)
Widowed	1.28	(1.20, 1.37)	1.28	(1.20, 1.37)	1.28	(1.20, 1.37)
Single	1.41	(1.29, 1.53)	1.41	(1.29, 1.53)	1.41	(1.29, 1.53)
Education						
College degree	ref		ref		ref	
High school	1.16	(0.99, 1.36)	1.16	(0.99, 1.36)	1.16	(0.99, 1.36)
Less than high school	2.07	(1.79, 2.39)	2.07	(1.79, 2.39)	2.07	(1.79, 2.39)
Employment status						
Employee	ref		ref		ref	
Self-employed	0.73	(0.62, 0.86)	0.73	(0.62, 0.86)	0.73	(0.62, 0.86)
Retired	2.17	(1.95, 2.41)	2.17	(1.95, 2.41)	2.17	(1.95, 2.42)
Not working/other	3.01	(2.72, 3.34)	3.01	(2.71, 3.33)	3.00	(2.71, 3.33)
Regional level factors						
Economic disadvantage[1]			1.36	(1.15,1.62)	0.99	(0.75, 1.31)
Poor living conditions[1]					1.41	(1.04, 1.91)

Satisfaction with healthcare[1]				0.96	(0.85, 1.08)
Capital intensity in healthcare[2]				1.00	(0.97, 1.02)
Share of private healthcare expenditure[1]				0.94	(0.88, 0.99)
Social isolation (no friends)				0.99	(0.91, 1.09)
Obesity rate[1]				1.24	(0.59, 2.61)
Region level variance	0.07	(0.03, 0.13)	0.04	(0.02, 0.08)	0.03	(0.01, 0.05)
ICC	0.020	(0.010, 0.038)	0.012	(0.006, 0.024)	0.008	(0.004, 0.016)

[1]: Rescaled so that OR represent change in poor health associated with a 10% change in regional factor.
[2]: Number of medical equipment machines per 10,000 residents

Table 4: Mediation regression: OLS regression of economic disadvantage (20 regions)

Dependent variable: Economic disadvantage	Coefficient	CI 95%
Poor living conditions	0.46	(-0.12, 1.03)
Satisfaction with healthcare	-0.10	(-0.33, 1.30)
Capital intensity in healthcare[1]	-0.21	(-0.73, 0.30)
Share of private healthcare expenditure	-0.12	(-0.23, -0.01)
Social isolation	-0.22	(-2.02, 1.58)
Obesity rate	1.13	(-0.22, 2.47)
Adjusted R^2= 0.64		

[1]: Number of medical equipment machines per 10,000 residents