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# Regional Disparities In Access To Health Care: A Multilevel Analysis In Selected OECD Countries

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# REGIONAL DISPARITIES IN ACCESS TO HEALTH CARE: A MULTILEVEL ANALYSIS IN SELECTED OECD COUNTRIES

Monica Brezzi and Patrizia Luongo[1]

**Abstract**

This paper investigates regional disparities in access to healthcare, measured by self-reported unmet medical needs. It looks at disparities across 86 regions in 5 European countries: Czech Republic, France, Italy, Spain and the United Kingdom. The results show that in addition to individual factors, such as age, gender, health status, or education, the characteristics of the region where people live, such as the average skill endowment or employment rate, have a significant impact on the probability of unmet medical needs. Individual and regional determinants play different roles across regions in these five countries. Moreover, in three of these countries (Czech Republic, Italy and Spain), age and chronic illness have different impacts on unmet medical needs depending on the region of residence, when all the other conditions are kept the same. The result calls for further investigation on regional-specific factors that could be modified with targeted policies in order to reduce the probability of foregone health care.

**JEL classification codes**: I14, R11, R12, C14

**Keyword:** regional inequality, health, access to healthcare, multilevel logistic analysis.

[1] Monica Brezzi, OECD monica.brezzi@oecd.org and Patrizia Luongo, World Bank pluongo@worldbank.org. *The views and findings in this paper are entirely those of the authors and should not be attributed to the OECD, the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent. The authors wish to acknowledge comments provided by colleagues at the OECD and World Bank.*

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## 1. Introduction

Regional variation in health care can be expected to be limited in most of the OECD countries, where the national health systems ensure full – or almost full – coverage of the costs of basic health services. Notwithstanding this, recent findings reveal that there exists great variability in the use of health care, such as hospital medical admissions or rates of medical procedures, both between and within OECD countries even after having taken into account differences in demographic structures (OECD, 2014a).

In addition to differences in the population characteristics, patients' needs and preferences, regional differences in health care may be due to characteristics related to the health delivery system (supply-side drivers), including the design and funding of the national health care system, its statutory coverage, the booking system and waiting time, and the volume and distribution of human, physical and financial resources (Allin and Masseria, 2009).

In many OECD countries the institutional organisation for the provision of health care is a shared responsibility of central and subnational governments (Box 1). On average, around one-fourth of the total public expenditure in health in the OECD countries in 2013 was carried out by subnational governments; and this share is above 60% in Denmark, Finland, Italy, Spain and Sweden (OECD, Subnational Finance Statistics). Health services and doctors are distributed unequally across different regions in most OECD countries, and this causes concern about how to ensure access to health everywhere and foster better health outcomes. On average, people in less densely populated regions in France, Germany and the United States have a much lower physical access to hospitals than other parts of the country (OECD, 2014b). Regional variations in the number of doctors per inhabitants were the largest in the United States, Greece, the Czech Republic, and the Slovak Republic among OECD countries in 2013, but almost all countries are concerned with improving access to health services in lagging regions (OECD, 2016).

**Box 1. Competences in health care provision in five European countries**

For the five European countries where data on unmet medical needs allows an analysis at the regional level, the organization of competences in the provision of health care across levels of government is as follows.

In the Czech Republic responsibility for the provision of health care is shared between regions and the central government. The former is responsible for the organisation and delivery of health care while the policy agenda and legislation is under the responsibility of the Minister of Health. Private health insurance plays a minor role in the funding of the health system that is mainly financed through the Social Health Insurance and, partly, through out of pocket payments, mostly used for pharmaceutical, medical aids and some kind of health services not covered through the Social Health Insurance.

Healthcare is provided through a mix of public and private services in France; universal coverage is guaranteed through a public social insurance model complemented by private providers. The administration of the health system is shared between the central government and the statutory of health insurance funds. However, after the creation of the Regional Health Agencies in 2010, the role of Regions in the governance of the health system is stronger, with the regional agencies responsible for defining regional plans and managing the health care resources. The social health insurance covers around 70% of the total health care expenditure, while the remaining 30% is financed through private health insurance and direct households payments.

In Italy, responsibility for the health service involves three levels of governments: the central, regional and local level. Services not included in the list of "Essential levels of care" – defined by the central government – have to be paid by households, even though regions could use their own resources to provide additional services to their citizens. Regions are also quite autonomous in the organization of the delivery of health services for which they work with the local health agencies. The National Health System ensures universal coverage; it is financed through taxation and a system of transfer works to lower disparities between regions in the tax leverage capacity. Regions can also introduce out-of-pocket payments for additional services, diagnostic procedures and pharmaceuticals.

**Box 1. Competences in health care provision in five European countries** *(cont.)*

In Spain, the National Health Service is 94% financed through general taxation. The healthcare system was decentralized in 2002. Since then regions are responsible for the organization, delivery, budget setting and funding of the health care system. The regional health expenditure is financed through regional general budgets complemented by a central fund that addresses regional disparities in tax-revenue capacity. The provision of health care is mostly free even though prescribed drugs are partly paid by households.

In the United Kingdom, the provision of health care is free for people residing in the UK. The organization of the system has been recently modified but its funding is still based on general taxation and national insurance contributions. Resources are distributed to each geographical area through a per capita basis which is weighted to take into account differences in needs and reduce health inequalities.

Source: OECD (2013), Health at a Glance, Paris, OECD Publishing.

We are interested in investigating whether people's reporting of lack to access health services is significantly different across regions within a country. Access to services – whether essential such as housing, health, education or advanced, such as financial, digital, advanced education - affects how people obtain what is necessary to satisfy their needs and wants. For this reason, it is one of the key dimensions to measure well-being in regions in the OECD framework, together with material conditions and other quality of life domains (OECD, 2014b).[2] While physical access to services facilitates well-being outcomes, other economic, institutional, or knowledge barriers may hamper accessibility by reducing the demands for services of certain population groups. Notwithstanding the relevance of accessibility to services to measure well-being outcomes in regions and cities, geo-localised data on location and use of services use are still scarce and often not comparable across regions even in the same country.[3]

The variable of interest in this paper is self-reported unmet medical needs. The indicator is collected through household surveys in which respondents indicate whether in one or more occasions they had foregone a medical treatment or examination in the year prior the survey. This indicator captures a broader definition of accessibility to health than just the physical one, since respondents can specify the causes of limitations in access to healthcare services, if cost, distance, lack of time, or length of waiting time, and as such, it may be part of the regional indicators of the OECD Well-Being framework when regional values become available in more countries. Subjective measures as the one chosen here may be affected by individual perceptions and thus be less robust than objective indicators (such as number of patients, number of surgery procedures, or density of practitioners in a country) for cross-country comparison. However, they are commonly used in the literature on disparities in access to health care as they may reveal critical conditions in the population or in the organisation of the service that otherwise would go unnoticed with indicators related only to users of health services (Cavalieri, 2013; Chen and Hou, 2002; Diamant et al., 2004; Levesque et al., 2008; Pagan and Pauly, 2006; Allin and Masseria, 2009).

[2] The OECD Regional Well-Being Database measures 11 headline indicators across the 370 OECD regions on nine topics: income, jobs, housing, health, education, safety, access to services, environment, civic engagement and governance. All the topics are measured through *objective* indicators (for example life expectancy at birth in the health dimension). Recent updates include also subjective (or self-reported) indicators to measure the dimensions of social connections and life satisfaction.

[3] As an example, the only indicator available for all the 370 OECD regions to measure accessibility to services in the OECD Regional Well-Being Database is the share of households with broadband connection (http://www.oecdregionalwellbeing.org).

Previous studies have analysed disparities in foregone health care among countries, using a range of measures including subjective reporting of unmet medical needs (Allin and Masseria, 2009; Koolman, 2006; OECD, 2014a). Fewer studies address the *within* country variability in unmet medical needs, usually with a one country focus, for example Canadian provinces (Sybler and Glaizer, 2009), or Italian regions (Cavalieri, 2013). Finally, other studies have explored socio-economic determinants of unmet medical needs in a specific subnational region (Diamant et al., 2004).

We follow the methodology used in Cavalieri (2013) for the Italian regions with three main extensions. First, the analysis of regional disparities in foregone health care is extended to 86 regions in five European countries using the same source of data, the European Statistics on Income and Living Condition (EU-SILC 2013), which allows comparison of results between and across countries.[4] Second, we use a multivariate logistic model to explore if regional factors play a role in shaping people's probability of experiencing an unmet medical need, in addition to individual factors, and thus if we can disentangle from the individual characteristics a *region effect* that explains part of the observed differences in unmet medical needs.[5] Finally, we investigate whether the impact of some of the determinants of unmet medical needs, (age and chronic illness), is region-dependent or, in other words, if there are significant differences on unmet medical needs within countries, when all the other explanatory variables are kept equal.

The rest of the paper is organized as follows. Section 2 introduces the data and some descriptive statistics. The empirical model and the main results are presented in Section 3. Section 4 concludes. The estimation procedure is detailed in the Appendix.

## 2. Data and descriptive statistics

The variable of interest is a self-reported measure of unmet medical need in the previous year collected through the 2013 European Statistics on Income and Living Condition (EU-SILC 2013) and referring to the year 2011.[6] EU-SILC is the main source of data on the conditions of households and individuals based on a harmonised questionnaire across European countries. While the information on the region of residence is included in the survey, only Czech Republic, France, Italy, Spain and the United Kingdom had a sample significant at the subnational level and thus our analysis is restricted to these countries. The other limitation of the subnational analysis is that it is not possible to discriminate between the causes (*e.g.* economic, distance, time, *etc.*) for not seeing a doctor.

There is great variability in the share of individuals experiencing foregone healthcare: with the exception of Corsica, where this share is equal to zero, it ranges from the 0.8% in Trento (Italy) and Catalonia (Spain) to 15.6% in Campania (Italy). Spain and Italy are the two countries with the largest regional differences (Table 1).

[4] Regions represent the first tier of subnational administrative and political government in France, Italy and Spain; in the Czech Republic and the United Kingdom this geographical level does not correspond to a full administrative government.

[5] The effect of groups or peer characteristics on individual's behavior and outcomes has been widely analyzed in the literature on peer effects, especially in the economics of education (for an extensive review see Sacerdote, 2011).

[6] The question in the survey "Was there any time during the last twelve months when, in your opinion, you needed a medical examination or treatment for a health problem but you did not receive it?"

**Table 1. Regional variation in unmet medical needs, 2011**

| Country | Number of regions | Percent of people who report unmet medical needs | | | | |
|---|---|---|---|---|---|---|
| | | Country average | Region with largest value | value | Region with smallest value | value |
| **Czech Republic** | 8 | 3.7 | Southwest | 5.7 | Moravia-Silesia | 1.9 |
| **France** | 22 | 5.6 | Lorraine | 8.5 | Corse | 0.0 |
| **Italy** | 21 | 7.3 | Campania | 15.6 | Trento | 0.8 |
| **Spain** | 19 | 5.5 | Castilla-La Mancha | 11.0 | Catalonia | 0.8 |
| **United Kingdom** | 12 | 3.7 | Scotland | 5.5 | North East England | 1.4 |

Source: Authors' elaborations on EU-SILC data.

Differences in self-reported unmet medical need can be driven by factors related to the demand, e.g. characteristics of the population, or to the supply side, for example organisation of the healthcare system. On the demand side, individual factors that may drive disparities in access to health services are grouped in three categories: predisposing characteristics, enabling factors, and needs (Andersen, 1995). Predisposing characteristics describe the propensity of individuals to look for help and use the available services; they include demographic and socio-economic characteristics, like gender or educational level, plus an individual's belief in health and healthcare, for example, their attitude towards and knowledge about health care as well as the social and cultural definition of illness they have learned (Aday and Andersen, 1974). Enabling factors usually include the employment status, income, as well as family characteristics. Finally, the need category refers to the individual's health status, which can be measured in objective or subjective ways, which is by reporting individual's diseases or by asking people a self-evaluation of their health status.

In the empirical analysis, gender, age, marital status and education level are included as predisposing factors restricted to a sample of adults. The first three variables are dummies; they are equal to one for a married male aged above 65. The cut-off age of 65 years is intended to capture differences between the population of working and not-working age. The educational attainments are classified as individuals with no more than primary education, those with at most secondary education and, people with a tertiary or higher degree. The enabling factors chosen are participation to the labour market and income. The household disposable income, normalized through the OECD equivalence scale, is divided into five quintiles. For the labour market, we use a dummy (active) equal to 1 for employed and self-employed individuals in a part-time or full-time job. Finally, need factors are measured through two objective indicators, presence of chronic illness (yes/no) and being limited by any disease in the daily activities (yes/no), and a subjective indicator where self-reported health conditions are ranked on a 5-level scale from "very bad" to "very good".

In addition to the individual factors, we include also some variables at the regional level that can be seen as proxy of well-being in a region, according to a multidimensional database that compares OECD regions on nine dimensions comprising indicators of material living conditions and quality of life (OECD, 2014b and http://www.oecdregionalwellbeing.org).

The design, institutional organisation, management and funding of the healthcare system can also drive differences in access to healthcare (from the supply side). Since these characteristics vary across countries, the empirical investigation is conducted separately for each country. We cannot observe directly

whether these characteristics vary also within countries, with the exception of two variables related to the supply of doctors and hospital beds. In any case, the empirical analysis tests whether the impact of the determinants of unmet medical needs changes in regions of the same country thus signalling the presence of other (non-observed) region-specific factors at play on the access to healthcare.

Table 2 provides the distribution of individual and regional characteristics included in the best specifications found in the empirical analysis; for each variable the country average and standard deviation are showed and for the individual factors also the standard deviation between regions and that within regions. The five countries show a similar gender composition and an almost equal share of individuals aged above 65. Analogies are observed also in marital status (with slightly more than the 50% of married individuals in each country) and in the share of individuals reporting limits in daily activities due to health problems. The percentage of people suffering from chronic illness ranges from 26% (Spain) to 39% (United Kingdom). In almost all countries the majority of individuals have at least a secondary school degree and the proportion that is active in the labour force goes from 44% in Spain to 57% in the United Kingdom. Most people in all countries rated their health condition as good or very good. Finally the largest differences in the regional characteristics are found for the variables share of workforce with at least secondary education (95% in the Czech Republic and 58% in Spain), and number of hospital beds per 10 000 population (66 in the Czech Republic and 31 in Spain).

## Table 2. Descriptive Statistics

| | | Variables | | Czech Republic | | Spain | | France | | Great Britain | | Italy | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Mean | Std. Dev | Mean | Std. Dev | Mean | Std. Dev | Mean | Std. Dev | Mean | Std. Dev |
| Individual Level | Predisposing characteristics | Age | Overall | 0.25 | 0.43 | 0.25 | 0.43 | 0.23 | 0.42 | 0.28 | 0.45 | 0.26 | 0.44 |
| | | | Between | | 0.02 | | 0.04 | | 0.04 | | 0.03 | | 0.03 |
| | | | Within | | 0.43 | | 0.43 | | 0.42 | | 0.45 | | 0.44 |
| | | Gender | Overall | 0.47 | 0.50 | 0.48 | 0.50 | 0.48 | 0.50 | 0.47 | 0.50 | 0.48 | 0.50 |
| | | | Between | | 0.01 | | 0.01 | | 0.01 | | 0.01 | | 0.01 |
| | | | Within | | 0.50 | | 0.50 | | 0.50 | | 0.50 | | 0.50 |
| | | Education | | | | | | | | | | | |
| | | Primary | Overall | 0.15 | 0.36 | 0.50 | 0.50 | 0.26 | 0.44 | 0.21 | 0.41 | 0.48 | 0.50 |
| | | | Between | | 0.03 | | 0.06 | | 0.05 | | 0.09 | | 0.04 |
| | | | Within | | 0.36 | | 0.50 | | 0.44 | | 0.41 | | 0.50 |
| | | Secondary | Overall | 0.71 | 0.45 | 0.20 | 0.40 | 0.44 | 0.50 | 0.43 | 0.49 | 0.37 | 0.48 |
| | | | Between | | 0.04 | | 0.03 | | 0.04 | | 0.10 | | 0.04 |
| | | | Within | | 0.45 | | 0.40 | | 0.49 | | 0.49 | | 0.48 |
| | | Tertiary | Overall | 0.14 | 0.34 | 0.30 | 0.46 | 0.30 | 0.46 | 0.36 | 0.48 | 0.15 | 0.35 |
| | | | Between | | 0.07 | | 0.05 | | 0.05 | | 0.06 | | 0.02 |
| | | | Within | | 0.34 | | 0.46 | | 0.45 | | 0.48 | | 0.35 |
| | Enabling Factors | Labour Market Status | Overall | 0.49 | 0.50 | 0.44 | 0.50 | 0.53 | 0.50 | 0.57 | 0.50 | 0.46 | 0.50 |
| | | | Between | | 0.03 | | 0.05 | | 0.04 | | 0.02 | | 0.06 |
| | | | Within | | 0.50 | | 0.49 | | 0.50 | | 0.49 | | 0.49 |
| | | Marital Status | Overall | 0.56 | 0.50 | 0.58 | 0.49 | 0.52 | 0.50 | 0.57 | 0.50 | 0.58 | 0.49 |
| | | | Between | | 0.02 | | 0.03 | | 0.03 | | 0.03 | | 0.02 |
| | | | Within | | 0.50 | | 0.49 | | 0.50 | | 0.49 | | 0.49 |
| | Need | Health Status | | | | | | | | | | | |
| | | Very good | Overall | 0.16 | 0.37 | 0.19 | 0.39 | 0.22 | 0.42 | 0.34 | 0.47 | 0.12 | 0.33 |
| | | | Between | | 0.02 | | 0.07 | | 0.03 | | 0.04 | | 0.05 |
| | | | Within | | 0.37 | | 0.39 | | 0.41 | | 0.47 | | 0.32 |
| | | Good | Overall | 0.39 | 0.49 | 0.53 | 0.50 | 0.45 | 0.50 | 0.43 | 0.49 | 0.53 | 0.50 |
| | | | Between | | 0.02 | | 0.07 | | 0.03 | | 0.04 | | 0.07 |
| | | | Within | | 0.49 | | 0.50 | | 0.50 | | 0.49 | | 0.49 |
| | | Fair | Overall | 0.31 | 0.46 | 0.19 | 0.39 | 0.24 | 0.43 | 0.18 | 0.38 | 0.23 | 0.42 |
| | | | Between | | 0.01 | | 0.03 | | 0.02 | | 0.02 | | 0.03 |
| | | | Within | | 0.46 | | 0.39 | | 0.43 | | 0.38 | | 0.42 |
| | | Bad | Overall | 0.11 | 0.31 | 0.06 | 0.24 | 0.07 | 0.26 | 0.05 | 0.21 | 0.10 | 0.30 |
| | | | Between | | 0.02 | | 0.01 | | 0.02 | | 0.01 | | 0.03 |
| | | | Within | | 0.31 | | 0.24 | | 0.26 | | 0.21 | | 0.30 |
| | | Very bad | Overall | 0.03 | 0.16 | 0.02 | 0.15 | 0.01 | 0.11 | 0.01 | 0.10 | 0.03 | 0.16 |
| | | | Between | | 0.01 | | 0.01 | | 0.01 | | 0.01 | | 0.01 |
| | | | Within | | 0.16 | | 0.15 | | 0.11 | | 0.10 | | 0.16 |
| | | Chronic illness | Overall | 0.33 | 0.47 | 0.26 | 0.44 | 0.37 | 0.48 | 0.39 | 0.49 | 0.27 | 0.44 |
| | | | Between | | 0.03 | | 0.05 | | 0.04 | | 0.04 | | 0.05 |
| | | | Within | | 0.47 | | 0.43 | | 0.48 | | 0.49 | | 0.44 |
| | | Limits in daily activities | Overall | 0.26 | 0.44 | 0.24 | 0.42 | 0.25 | 0.43 | 0.23 | 0.42 | 0.28 | 0.45 |
| | | | Between | | 0.02 | | 0.04 | | 0.03 | | 0.03 | | 0.04 |
| | | | Within | | 0.44 | | 0.42 | | 0.43 | | 0.42 | | 0.45 |
| Regional level | Predisp. Char. | Skill Endowment | Overall | 94.48 | 1.89 | 58.48 | 8.00 | 77.75 | 3.35 | 81.68 | 2.29 | 64.77 | 4.80 |
| | | | Between | | 2.24 | | 8.45 | | 4.28 | | 2.64 | | 5.23 |
| | | | Within | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 |
| | Enabling Factors | Employment rate | Overall | 67.24 | 3.23 | 55.42 | 5.36 | 63.03 | 3.36 | 70.90 | 2.90 | 59.85 | 10.08 |
| | | | Between | | 3.80 | | 6.41 | | 6.16 | | 3.02 | | 10.48 |
| | | | Within | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 |
| | | Doctors (for 1 000 people) | overall | 3.56 | 1.08 | 3.93 | 0.75 | 3.28 | 0.49 | 3.87 | 0.46 | 2.60 | 0.34 |
| | | | between | | 1.33 | | 0.96 | | 0.43 | | 0.49 | | 0.34 |
| | | | within | | 0 | | 0.00 | | 0.00 | | 0.00 | | 0.00 |
| | | Hospital Beds (for 10 000 people) | overall | 66.22 | 7.15 | 30.52 | 5.59 | 63.99 | 5.02 | 34.53 | 3.96 | . | . |
| | | | between | | 8.35 | | 5.65 | | 6.03 | | 4.14 | | . |
| | | | within | | 0 | | 0.00 | | 0.00 | | 0.00 | | . |

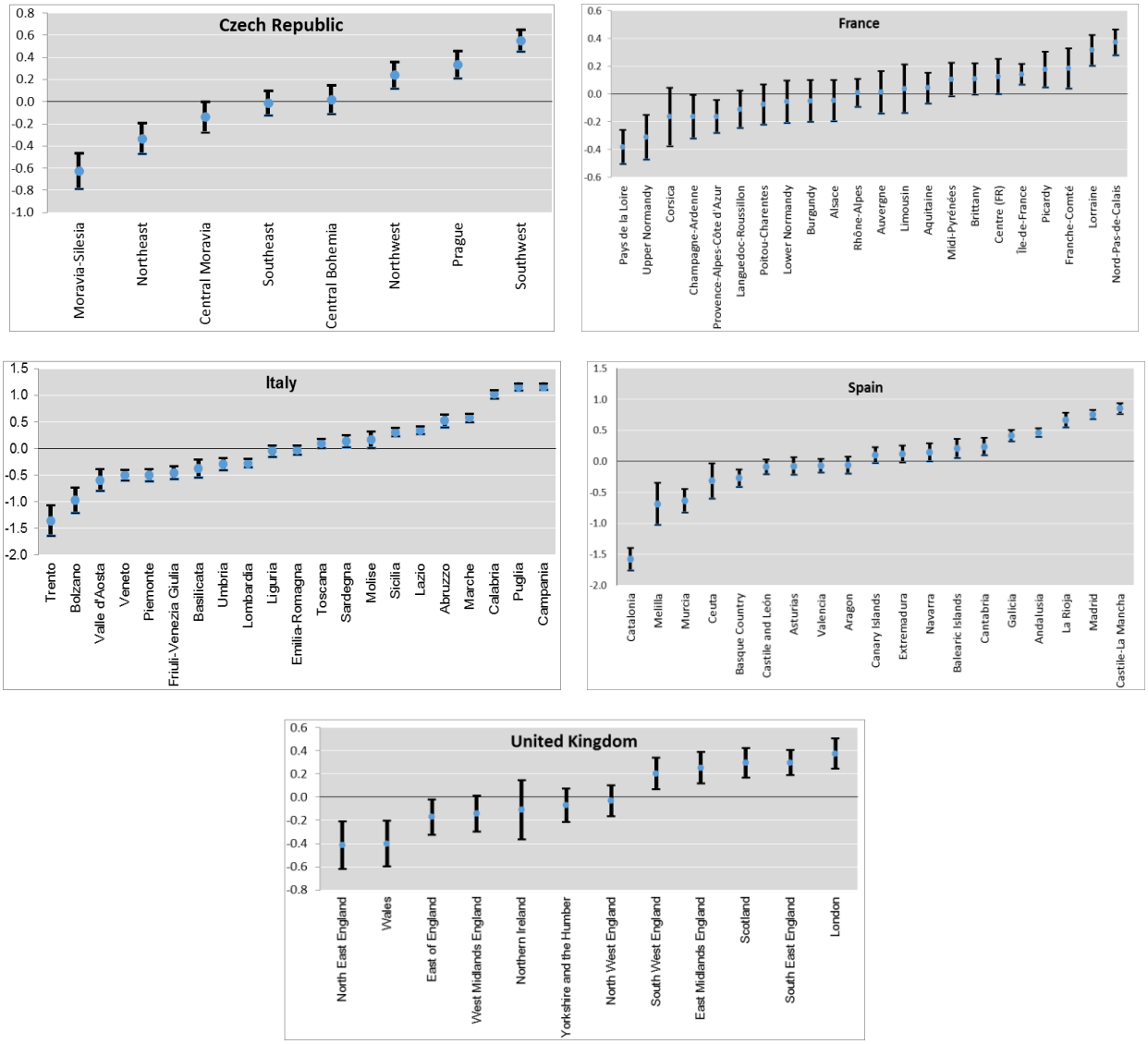
Note: The overall standard deviation is defined as the square root of the mean squared deviation of observation from the overall mean. The between regions standard deviation is defined as the square root of the mean squared deviation of the region mean from the overall mean. The within regions standard deviation is defined as the square root of the mean squared deviation of observation from the regional mean.

Source: Authors' calculations based on EU-SILC 2013 data.

Another way to look at within country variability is to consider whether the regional values vary significantly from the average country value. Figure 1 shows for each region the probability of not receiving medical treatment in case of need (dot in the figure) together with the 95% confidence interval (bar in the figure). The line set at zero represents the probability of not receiving needed healthcare in the country; if the confidence interval of the regional value is below (or above) the zero-line, then the probability of experiencing unmet medical needs in the region is significantly lower (or higher) than the national average. In the majority of regions the probability of experiencing unmet medical needs differs significantly from the national average, with the exception of France where in half of the regions there is no significant difference with the national value (Figure 1).

**Figure 1. Regional probability of experiencing unmet medical needs, 2011**

Regional values (blue dots) expressed as difference from the national value (zero-line) and their 95% confidence intervals (bars)




Note: The values are the residuals in a null-model where the dependent variable is assumed to vary only according to the region without other control variables. Regions are ranked in increasing order together with their 95% confidence interval.

Source: Authors' calculation on EU-SILC 2013.

## 3. Empirical specification and results

Regional disparities in self-reported unmet medical needs are assessed through a multilevel model to test first the impact of the individual factors on access to health; second, whether some regional characteristics explains part of the variance in access to healthcare; and finally, if part of the unexplained variance (residual component) is due to non-observable factors that are region-dependent. The first two steps are carried out through a random intercept model, while for the third step a random coefficient model is used (see Appendix for a detailed explanation of the models).

***Random intercept model***

In the first specification, only the individual factors have been included (Table 3, first column for each country), while the two regional characteristics are added in the second specification to test changes in the residual variance once the regional factors are taken into account (second column for each country in Table 3). Formally, the estimated equation is:

$$y_{ij} = \beta_0 + \beta_k x_{kij} + \varepsilon_{ij} \quad (1)$$

Where $y_{ij}$ is experiencing unmet medical needs of the individual $i$ living in region $j$; $x_{kij}$ are the $k$ independent factors (age, education, etc.) of the individual $i$ living in region $j$

and $\varepsilon_{ij} = \epsilon_{ij} + \gamma_j$

$\epsilon_{ij}$ and $\gamma_j$ are, respectively, the level 1 and level 2 residuals, with the latter interpreted as a "region effect", while the region-specific intercept is given by $\beta_0 + \gamma_j$.

Results are shown in Table 3. The individual factors have different predictive power across countries, for example being a male reduces the probability of foregone medical examination in Italy and in the United Kingdom but it has not a significant effect in the other three countries. In all regions the probability of foregone health care decreases significantly with age; the estimated reduction for individuals aged above 65 ranges from the 27% in the Czech regions to more than 100% in French regions. Being in good health also reduces the probability of foregone health care even though only in French and Spanish regions does reporting very good health status affect significantly the odds of unmet medical needs. Suffering from a chronic illness increases the probability of experiencing foregone healthcare, with the impact ranging from 23% in French regions to 40% in British regions (not significant in the Czech Republic). In Italy, the higher the education, the lower the probability of experiencing unmet medical needs, while in France and the United Kingdom the higher the education, the higher the probability of unmet medical needs. Being in the lower part of the income distribution, increases the probability of experiencing unmet medical needs in French and Italian regions. Being employed affects significantly and positively the probability of unmet medical needs in all the regions, with the exception of the United Kingdom.

The results are in line with previous empirical findings (Allin and Masseria, 2009; Cavalieri, 2013; Levesque et al., 2008). A higher rate of unmet medical needs for younger individuals actively participating to the labour market, for example, could be related to time constraints. Results on the impact of education have been justified in the literature by considering that most educated individuals could have higher expectations on healthcare services and this could explain their reasons for reporting unmet medical need. Moreover, higher skilled individuals are more likely to belong to younger cohort and to be employed, so this result could simply "reinforce" those factors related to age and labour market status. Higher probability of unmet medical needs for individuals in lower quintiles of the income distribution can be a signal of financial constraints in accessing health services.

**Table 3. Probability of foregone medical examination by explanatory variables**

Increased (reduced) probability of explanatory variables according to the Random Intercept Model

| | Czech Republic | | Spain | | France | | Great Britain | | Italy | |
|---|---|---|---|---|---|---|---|---|---|---|
| Individual variables | Model I | Model II | Model I | Model II | Model I | Model II | Model I | Model II | Model I | Model II |
| Age | -0.270* | -0.272* | -0.432*** | -0.433*** | -1.091*** | -1.091*** | -0.681*** | -0.687*** | -0.511*** | -0.509*** |
| | (0.136) | (0.136) | (0.086) | (0.086) | (0.119) | (0.119) | (0.136) | (0.136) | (0.059) | (0.059) |
| Gender | 0.171 | 0.171 | 0.0363 | 0.0364 | 0.0813 | 0.0813 | -0.262** | -0.262** | -0.240*** | -0.240*** |
| | (0.097) | (0.097) | (0.055) | (0.055) | (0.066) | (0.066) | (0.101) | (0.101) | (0.045) | (0.045) |
| Education | | | | | | | | | | |
| Primary | -0.299 | -0.289 | 0.121 | 0.121 | -0.272** | -0.269** | -0.481** | -0.467** | 0.486*** | 0.488*** |
| | (0.190) | (0.191) | (0.069) | (0.069) | (0.097) | (0.097) | (0.147) | (0.147) | (0.079) | (0.079) |
| Secondary | -0.264 | -0.258 | 0.0788 | 0.0785 | -0.245** | -0.245** | -0.279* | -0.281* | 0.206* | 0.208* |
| | (0.142) | (0.142) | (0.082) | (0.082) | (0.080) | (0.080) | (0.114) | (0.114) | (0.082) | (0.082) |
| Labour Market Status | 0.544*** | 0.545*** | 0.469*** | 0.468*** | 0.280*** | 0.279*** | -0.113 | -0.111 | 0.271*** | 0.273*** |
| | (0.134) | (0.134) | (0.068) | (0.068) | (0.077) | (0.077) | (0.129) | (0.128) | (0.055) | (0.055) |
| Marital Status | -0.433*** | -0.426*** | 0.0353 | 0.0354 | -0.557*** | -0.557*** | -0.267** | -0.262** | 0.0330 | 0.0308 |
| | (0.099) | (0.099) | (0.058) | (0.058) | (0.068) | (0.068) | (0.101) | (0.101) | (0.045) | (0.045) |
| Income quintile | | | | | | | | | | |
| I | 0.153 | 0.176 | 0.162 | 0.164 | 1.132*** | 1.132*** | 0.111 | 0.131 | 1.097*** | 1.086*** |
| | (0.172) | (0.173) | (0.096) | (0.096) | (0.114) | (0.114) | (0.179) | (0.179) | (0.087) | (0.087) |
| II | 0.203 | 0.223 | 0.0851 | 0.0862 | 0.556*** | 0.557*** | 0.205 | 0.232 | 0.646*** | 0.640*** |
| | (0.169) | (0.169) | (0.097) | (0.097) | (0.120) | (0.120) | (0.174) | (0.174) | (0.088) | (0.088) |
| III | -0.0769 | -0.0598 | 0.0791 | 0.0797 | 0.247* | 0.248* | 0.120 | 0.140 | 0.334*** | 0.330*** |
| | (0.169) | (0.170) | (0.093) | (0.093) | (0.123) | (0.123) | (0.169) | (0.169) | (0.091) | (0.091) |
| IV | -0.0750 | -0.0635 | 0.145 | 0.145 | -0.0124 | -0.0121 | -0.160 | -0.144 | 0.308*** | 0.306*** |
| | (0.165) | (0.165) | (0.089) | (0.089) | (0.127) | (0.127) | (0.178) | (0.178) | (0.092) | (0.092) |
| Health Status | | | | | | | | | | |
| Very good | -2.122*** | -2.120*** | -0.416* | -0.416* | -1.096*** | -1.101*** | -1.584*** | -1.596*** | -1.993*** | -1.992*** |
| | (0.302) | (0.302) | (0.207) | (0.207) | (0.298) | (0.298) | (0.324) | (0.324) | (0.149) | (0.149) |
| Good | -1.337*** | -1.337*** | -0.178 | -0.177 | -0.537 | -0.541 | -1.015*** | -1.024*** | -1.279*** | -1.275*** |
| | (0.250) | (0.250) | (0.194) | (0.194) | (0.286) | (0.286) | (0.295) | (0.295) | (0.111) | (0.111) |
| Fair | -0.829*** | -0.829*** | 0.118 | 0.119 | 0.0372 | 0.0324 | -0.674* | -0.682* | -0.655*** | -0.653*** |
| | (0.219) | (0.219) | (0.180) | (0.180) | (0.278) | (0.279) | (0.284) | (0.284) | (0.094) | (0.094) |
| Bad | -0.694** | -0.691** | -0.0983 | -0.0978 | -0.0135 | -0.0182 | -0.465 | -0.468 | -0.389*** | -0.390*** |
| | (0.221) | (0.221) | (0.199) | (0.199) | (0.287) | (0.287) | (0.304) | (0.303) | (0.093) | (0.093) |
| Chronic illness | 0.287 | 0.283 | 0.269** | 0.269** | 0.230** | 0.229** | 0.396* | 0.395* | 0.332*** | 0.336*** |
| | (0.153) | (0.153) | (0.085) | (0.085) | (0.086) | (0.086) | (0.155) | (0.155) | (0.064) | (0.064) |
| Limits in daily activities | 0.0385 | 0.0375 | 0.309** | 0.309** | 0.0875 | 0.0882 | 0.587*** | 0.586*** | 0.372*** | 0.372*** |
| | (0.163) | (0.163) | (0.095) | (0.095) | (0.096) | (0.096) | (0.153) | (0.153) | (0.073) | (0.073) |
| Regional variables | | | | | | | | | | |
| Skill Endowment | | -0.143* | | -0.00410 | | 0.0143 | | 0.0954*** | | 0.00271 |
| | | (0.073) | | (0.029) | | (0.021) | | (0.029) | | (0.022) |
| Employment rate | | 0.123** | | 0.0217 | | 0.00500 | | 0.0436 | | -0.0325** |
| | | (0.044) | | (0.040) | | (0.023) | | (0.024) | | (0.011) |
| Intercept | 0.1519 | 0.0682 | 0.3725 | 0.3686 | 0.0432 | 0.0449 | 0.1158 | 0.0192 | 0.2896 | 0.1788 |
| N regions | 8 | 8 | 19 | 19 | 22 | 22 | 12 | 12 | 21 | 21 |
| N Obs. | | | | | | | | | | |
| Min | 1247 | 1247 | 256 | 256 | 74 | 74 | 162 | 162 | 667 | 667 |
| Avg. | 1639.8 | 1639.8 | 1449.3 | 1449.3 | 932.3 | 932.3 | 1007.1 | 1007.1 | 1785.7 | 1785.7 |
| Max | 2187 | 2187 | 3243 | 3243 | 3018 | 3018 | 1654 | 1654 | 3897 | 3897 |

Note: In the empirical models gender, age, marital status and employment are dummies equal to one for male, aged above 65 years, married, employed and self-employed in part-time or full-time job. The educational attainments are classified with respect to the individuals with a tertiary or higher degree. The household disposable income is with respect to the highest quintile. Chronic illness and being limited by any disease in the daily activities are classified as positive (presence) answers. Self-reported health conditions are classified with respect to the best class. Standard errors in brackets. ***, ** and * denote, respectively, 1%, 5% and 10% level of significance.

Source: Authors' calculation on EU-SILC 2013 and OECD Regional Well-Being Database.

In a second step, two regional-level variables were included, the average regional employment rate and average regional educational attainments (Table 3 model II).[7] In Czech regions both regional variables are significant. In the United Kingdom only skill endowment has a significant impact and in Italy only the employment rate (Table 3, model II). As expected, the effects of the regional variables are limited compared to those of the individual factors, in part because some individual characteristics, such as income and education, may already capture the regional effects, in part because the dependent variable - self-reported medical needs – measures accessibility to health services from the demand-side as perceived by individuals and thus is less sensitive to the supply of healthcare (such as number of doctors or hospital beds). In any case, ), the introduction of the regional control variables improves the portion of variance explained by the model by 8%, 10% and 11% respectively in the Czech Republic, United Kingdom and Italy (see reduction of the intercept variance in Table 3).

***Random coefficient model***

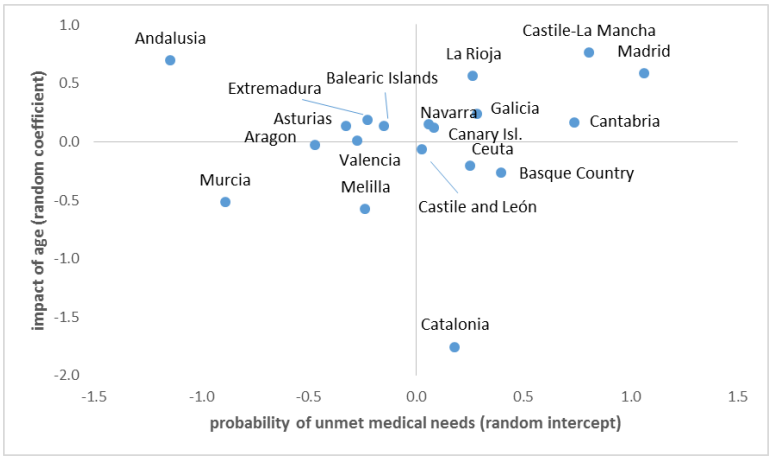
The random coefficient model is used to test whether the control variables have different impact on the probability of experiencing unmet medical needs across the regions of the same country. If this is the case, we can assume that there are some non-observable regional characteristics that explain part of the variability. In France and the United Kingdom, none of the different specifications of the random coefficient model provide a better explanation of the variability across regions than the random intercept model. It means that all the independent variables have the same impact on the probability of experiencing unmet medical needs for people living in different regions. In the case of the Czech Republic, Italy and Spain, instead, being aged above 65 and suffering from a chronic illness has a different impact on the probability of reporting unmet medical needs, when all the other factors are kept the same, across the regions. Such information may be valuable for regions wanting to improving access to healthcare by targeting specific population groups.

The variance between regions in the effect of being aged above 65 ranges from 0.10 in Czech and Italian regions to 0.41 in Spanish regions (Table 4). The regions in the upper-right area of each panel of Figure 2 are those where the probability of experiencing unmet medical need is higher and the impact of age is stronger than the average country value; the opposite holds for regions in the bottom-left area of the panels. For example in Spain, people in Madrid and Catalonia experience unmet medical needs more than the rest of the country; but while being older than 65 years increases the probability of unmet medical needs in Madrid, the reverse is true in Catalonia. In the Czech Republic, age increases the probability of unmet medical needs in all regions, with the exception of the southeast region. In Italy, in nine out of the twelve regions where the probability of unmet medical needs is lower than the country average, being older than 65 years decreases such a probability; only in Marche, Toscana and Molise people aged 65 and over are worse-off (Figure 2). These results can provide some guidance on population-group specific interventions in the different regions, for example towards aged population to reduce the "disadvantage" of age on access to healthcare.

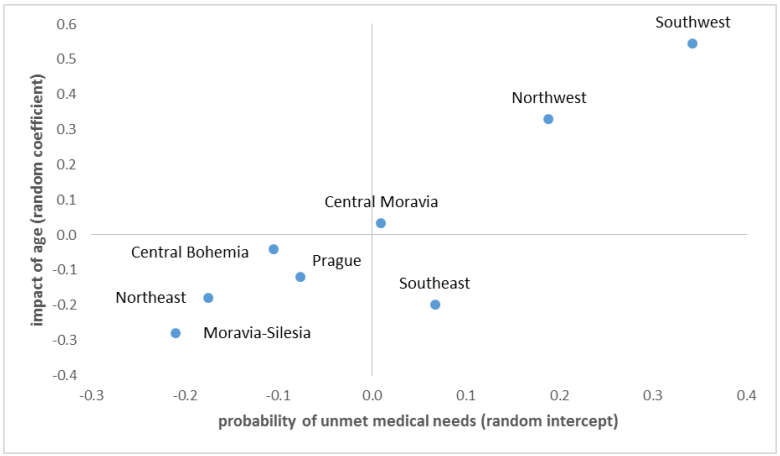
[7] Other regional variables had been included in previous versions, such as income per capita, crime rates, or life expectancy. However, either they didn't significantly affect the probability of experiencing unmet medical needs or they did only for few countries (for example life expectancy in France and income in the Czech Republic). Similarly, the two regional variables related to the supply of healthcare, (number of doctors and hospital beds), are significant only in the Czech Republic and in Spain and thus they were not retained in the model presented.

**Figure 2. Relationship between the probability of unmet medical needs and age**

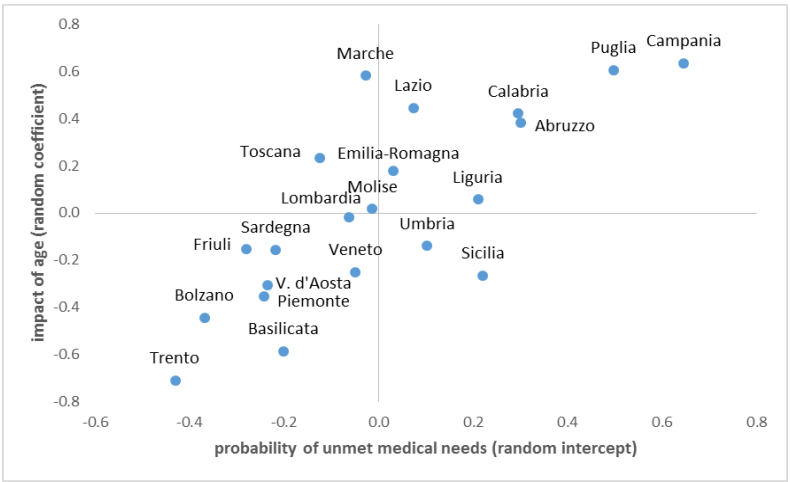
Panel A: Spain




Panel B: Czech Republic




Panel C: Italy

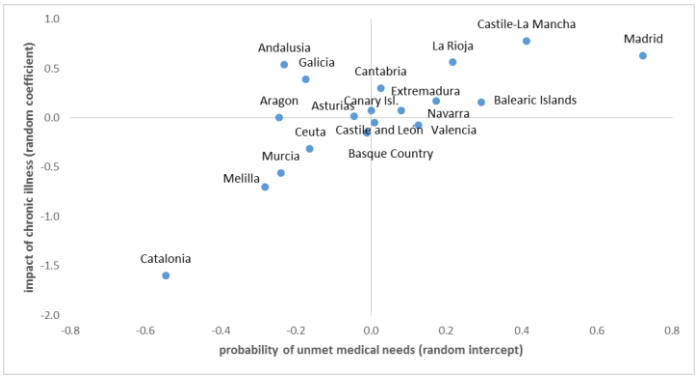



Source: Authors' calculation based on EU-SILC 2013.

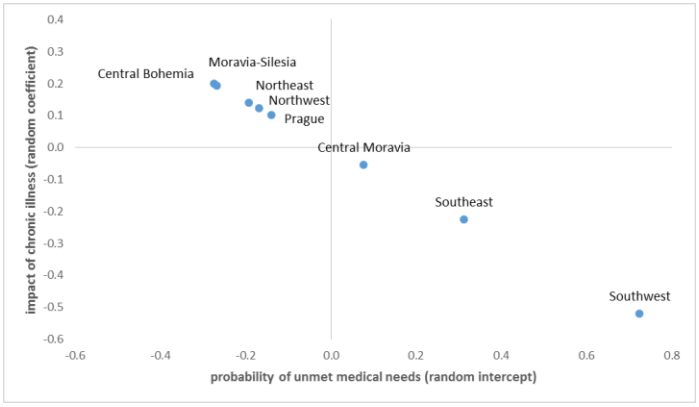
For what regards the impact of experiencing a chronic illness, regions in the Czech Republic and Italy with above the average unmet medical needs tend to have below the average effect of chronic disease. Instead, in the Spanish regions where the probability of experiencing unmet medical needs is higher than the national average the effect of suffering from a chronic disease is also stronger (Figure 3).

**Figure 3. Relationship between the probability of unmet medical needs and chronic illness**

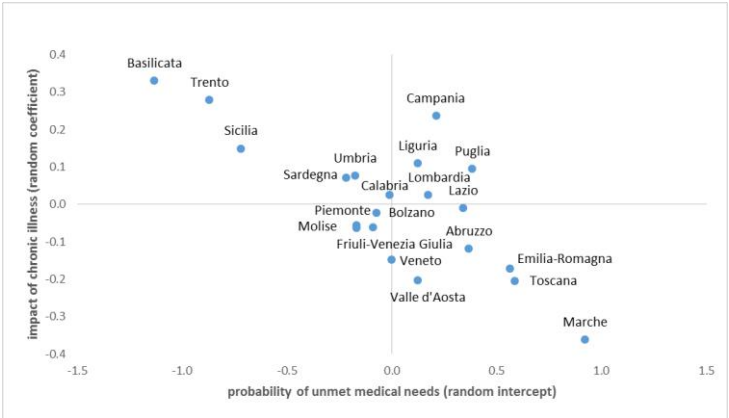
Panel A: Spain




Panel B: Czech Republic




Panel C: Italy




Source: Authors' calculation based on EU-SILC 2013.

**Table 4. Probability of foregone medical examination according to age and chronic illness**

Increased (reduced) probability of explanatory variables according to the Random Coefficient Model

| | Czech Republic | | Spain | | Italy | |
|---|---|---|---|---|---|---|
| | random coefficient age | random coefficient chronic illness | random coefficient age | random coefficient chronic illness | random coefficient age | random coefficient chronic illness |
| *Individual variables* | | | | | | |
| Age | -0.365* | -0.270* | -0.663*** | -0.449*** | -0.664*** | -0.517*** |
| | (0.185) | (0.136) | (0.191) | (0.086) | (0.104) | (0.059) |
| Gender | 0.171 | 0.173 | 0.0355 | 0.0394 | -0.239*** | -0.241*** |
| | (0.097) | (0.097) | (0.056) | (0.056) | (0.045) | (0.045) |
| Education | | | | | | |
| Primary | -0.286 | -0.298 | 0.105 | 0.125 | 0.492*** | 0.492*** |
| | (0.191) | (0.190) | (0.070) | (0.069) | (0.079) | (0.079) |
| Secondary | -0.257 | -0.267 | 0.0701 | 0.0744 | 0.213** | 0.210* |
| | (0.142) | (0.142) | (0.082) | (0.082) | (0.082) | (0.082) |
| Labour Market Status | 0.546*** | 0.542*** | 0.482*** | 0.467*** | 0.258*** | 0.267*** |
| | (0.134) | (0.134) | (0.069) | (0.068) | (0.055) | (0.055) |
| Marital Status | -0.425*** | -0.428*** | 0.0341 | 0.0375 | 0.0330 | 0.0310 |
| | (0.099) | (0.099) | (0.058) | (0.058) | (0.045) | (0.045) |
| Income quintile | | | | | | |
| I | 0.180 | 0.179 | 0.150 | 0.157 | 1.110*** | 1.091*** |
| | -0.173 | (0.172) | (0.096) | (0.096) | (0.087) | (0.087) |
| II | 0.226 | 0.217 | 0.0747 | 0.0780 | 0.658*** | 0.645*** |
| | (0.169) | (0.169) | (0.097) | (0.097) | (0.088) | (0.088) |
| III | -0.0541 | -0.0605 | 0.0749 | 0.0737 | 0.340*** | 0.335*** |
| | (0.170) | (0.170) | (0.093) | (0.093) | (0.091) | (0.091) |
| IV | -0.0541 | -0.0711 | 0.140 | 0.138 | 0.306*** | 0.308*** |
| | (0.165) | (0.165) | (0.089) | (0.089) | (0.092) | (0.092) |
| Health Status | | | | | | |
| Very good | -2.144*** | -2.114*** | -0.409* | -0.394 | -1.973*** | -1.979*** |
| | (0.302) | (0.302) | (0.208) | (0.208) | (0.150) | (0.150) |
| Good | -1.362*** | -1.322*** | -0.199 | -0.181 | -1.265*** | -1.271*** |
| | (0.251) | (0.249) | (0.195) | (0.196) | (0.112) | (0.111) |
| Fair | -0.863*** | -0.819*** | 0.119 | 0.118 | -0.645*** | -0.644*** |
| | (0.220) | (0.219) | (0.182) | (0.182) | (0.095) | (0.095) |
| Bad | -0.712** | -0.680** | -0.0874 | -0.0938 | -0.391*** | -0.393*** |
| | (0.222) | (0.221) | (0.201) | (0.201) | (0.094) | (0.093) |
| Chronic illness | 0.286 | 0.338 | 0.257** | 0.147 | 0.330*** | 0.343*** |
| | (0.154) | (0.182) | (0.085) | (0.134) | (0.064) | (0.087) |
| Limits in daily activities | 0.0302 | 0.0520 | 0.305** | 0.316*** | 0.372*** | 0.368*** |
| | (0.164) | (0.164) | (0.095) | (0.095) | (0.073) | (0.073) |
| Regional variables | | | | | | |
| Skill Endowment | -0.0646 | -0.175** | -0.0106 | -0.00569 | -0.00924 | 0.0123 |
| | (0.088) | (0.055) | (0.029) | (0.027) | (0.022) | (0.023) |
| Employment rate | 0.0899 | 0.128*** | 0.0208 | 0.00331 | -0.0106 | -0.0437** |
| | (0.047) | (0.034) | (0.039) | (0.040) | (0.015) | (0.014) |
| Variance | | | | | | |
| Intercept | 0.0419192 | | 0.3375028 | | 0.1712859 | |
| Age | 0.1041106 | | 0.4144219 | | 0.1075007 | |
| Covariance | 0.0446892 | | 0.0329319 | | 0.0817385 | |
| Intercept | | 0.1368298 | | 0.3188286 | | 0.2525169 |
| Chronic disease | | 0.0711235 | | 0.1211844 | | 0.0502008 |
| Covariance | | -0.09865 | | 0.1060379 | | -0.0732296 |
| Numb. regions | 8 | 8 | 19 | 19 | 21 | 21 |
| Numb. Obs. | | | | | | |
| Min | 1247 | 1247 | 256 | 256 | 667 | 667 |
| Avg. | 1640 | 1640 | 1449 | 1449 | 1786 | 1786 |
| Max | 2187 | 2187 | 3243 | 3243 | 3897 | 3897 |

Note: In the empirical models gender, age, marital status and employment are dummies equal to one for male, aged above 65 years, married, employed and self-employed in part-time or full-time job. The educational attainments are classified with respect to the individuals with a tertiary or higher degree. The household disposable income is with respect to the highest quintile. Chronic illness and being limited by any disease in the daily activities are classified as positive (presence) answers. Self-reported health conditions are classified with respect to the best class. Standard errors in brackets. ***, ** and * denote, respectively, 1%, 5% and 10% level of significance.

Source: Authors' calculation on EU-SILC 2013 and OECD Regional Well-Being Database.

## 4. Conclusions

The paper investigates whether there is significant difference across regions in the access to health. Recent studies have shown a great variability in the use of healthcare across OECD countries, but few have addressed the issue within countries, also because of data limitation. Using the same source of data for the Czech Republic, France, Italy, Spain and the United Kingdom, the paper finds significant regional differences within and between countries in self-reported unmet medical needs in 2011. Overall, self-reported foregone care is a good measure of (lack) access to health care, especially when responses can be analysed by locality to compare places within the same country. At the same time, measuring the accessibility to health through the self-reported medical needs variable has two main drawbacks. First, it may actually represent dissatisfaction with the health system rather than lack of accessibility, if those who report unmet medical needs make a more frequent use of health care than those who do not report this access problem (Allin and Masseria, 2009). Secondly, due to sample size, the causes of foregone health care - whether cost, distance, waiting list, or simply lack of time - cannot be investigated at the regional level.

The econometric analysis finds that the probability of experiencing unmet medical needs decreases with age and with a self-reported good health. Having a chronic illness and being in the bottom part of the income distribution, instead, increase the probability of unmet medical needs. However, the predictive power of the various determinants varies among the five countries. Once the individual factors have been taken into account, we find that the educational level and labour market situation of the region explain part of the regional variance. Finally, we find that being aged 65 or more and having a chronic illness have a differentiated impact on the probability of unmet medical needs in regions *within* the same country, in the Czech Republic, Italy and Spain. Such a result implies that policies to reduce inequality in health calls for complementing national wide policies to increase healthcare access with actions targeted to specific population groups according to the needs and results of specific regions.

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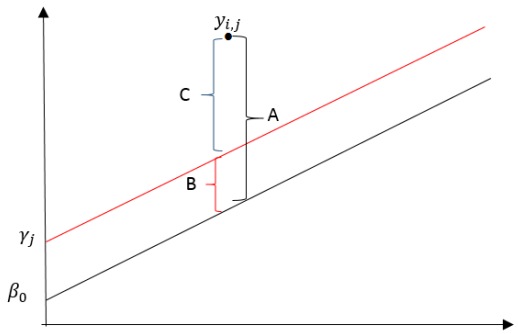
## Appendix

Geographical disparities in unmet medical needs are evaluated through a multilevel model. The use of a 2-level structure allows to disentangle the "region" effect from the "individual" effect. Before presenting the model formally, a graphical illustration may prove to be useful to explain this distinction.

Assume that the outcome of individual *i* living in region *j* is $y_{ij}$ and that it differs from the overall mean $\beta_0$, as shown in Figure A.1. By using a multilevel model, the distance A is decomposed in two parts: the distance between the regional average $\gamma_j$ and the overall average $\beta_0$ (the *region effect*, B in Figure 4) and the share due to the distance of the individual outcome $y_{ij}$ from the regional average (the *individual effect*, C in Figure 4).

**Figure 4. Multilevel model, graphical illustration**




Source: authors' elaboration.

More formally, we consider a two levels structure with n individuals (with $i = 1, \dots, n$) clustered in $N$ regions (with $j = 1, \dots, N$) whose outcome depends on $K$ observable characteristics. We consider two model specifications, a random intercept and a random coefficient model. The random intercept model assumes that the intercept varies across regions and it can be written as in (1)

$$y_{ij} = \beta_0 + \beta_k x_{kij} + \varepsilon_{ij} \quad (1)$$

With

$$\varepsilon_{ij} = \epsilon_{ij} + \gamma_j$$

$\epsilon_{ij}$ and $\gamma_j$ are, respectively, the level 1 and level 2 residuals, with the latter interpreted as a "region effect", while the region-specific intercept is given by $\beta_0 + \gamma_j$.

The assumptions on the residuals' distribution vary depending if the outcome variable is continuous or dichotomous. When $y_{ij}$ is a binary variable, as in our case, it is necessary to assume a specific distribution function for the level 1 variance $\epsilon_{ij}$ (Rabe-Hesket and Skrondal, 2012). In our case the level 1 variance is assumed to follow a logistic distribution, then $\gamma_j \sim N(0, \sigma_\gamma^2)$ and $\epsilon_{ij} \sim (0, \sigma_\epsilon^2)$ with $\sigma_\epsilon^2 = \pi/3$ .

Rewriting equation (1) in terms of probability, it becomes:

$$F^{-1}(\pi_{ij}) = \beta_0 + \beta_k x_{kij} + \gamma_j$$

With $F^{-1}(\cdot)$ denoting the link function and $\pi_{ij} \equiv \Pr(y_{ij=1})$.

The region-specific probability can be expressed as

$$\text{logit}\{\Pr(y_{ij} = 1|x_{ij}, \gamma_j)\} = \beta_0 + \beta_k x_{kij} + \gamma_j$$

the region-specific conditional variance is

$$Var(y_{ij}|x_{ij}, \gamma_j) = Pr(y_{ij} = 1|x_{ij}, \gamma_j)\{1 - Pr(y_{ij} = 1|x_{ij}, \gamma_j)\}$$

And the proportion of total variance due to between-region variation is given by

$$\frac{\sigma_\gamma^2}{\sigma_\gamma^2 + \pi/3}$$

While in the random intercept model all the control variables have the same impact across regions, the random coefficients model assumes that one (or more) control variable(s) have different impact on the outcome variable in each region. Formally, the log-odds can be represented as follows

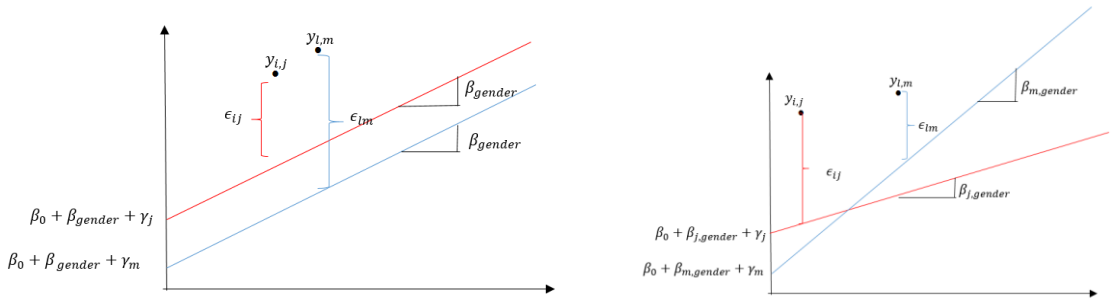
$$F^{-1}(\pi_{ij}) = \beta_0 + \beta_k x_{kij} + \epsilon_{ij} + \gamma_{0j} + \gamma_{1j} x_{1ij}$$

Where $\gamma_{0j} \sim N(0, \sigma_{\gamma 0}^2)$ is the intercept residual, $\gamma_{1j} \sim N(0, \sigma_{\gamma 1}^2)$ the regional effect of the control variable 1 (i.e. age and chronic illness in our analysis) and their covariance is $\sigma_{\gamma 01}$.

A graphical illustration might help in understanding better the difference between the two specifications. Figure 5 depicts a random intercept model on the left hand side and a random coefficient model on the right hand side. Assume, for simplicity, that the overall average is set at 0 and that there is only one control variable, let's say gender.

In the left hand side, the two regression line have the same slope meaning that being, for example, female, affects the outcome in the same way, independently from the regions where individuals live. In the right hand side panel, the regression line for region *m* is steeper than for region *j*, meaning that the impact of gender on the outcome is higher for individuals living in region *m* than for those living in region *j*.

**Figure 5. Random intercept and random coefficient models, graphical illustration**




Source: authors' elaboration.