LUND UNIVERSITY
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Master in Economic Demography

The impact of residential segregation on chronic disease prevalence: A case study on Roma communities in the Balkans

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Abstract: Using the data from the United Nations Development Programme survey (2004), the thesis explores whether the incidence of chronic diseases is associated with residential segregation. Possible differences are measured for Roma communities relative to the majority population living in urban residences inhabited by minority, mixed and majority groups. The sample consists of 17,669 observations from 7 Balkan countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Romania and Serbia. For each observation, controls for age, gender, marital status, employment status, income, education, healthcare access and housing conditions are used. The main methodological approach consists of logistic regression models that test the likelihood of chronic illnesses prevalence. The key finding of the study is that segregation and poor socio-economic outcomes affect Roma more than non-Roma groups. However, a higher level of Roma integration can lead to a much lower incidence of chronic diseases among Roma communities, relative to the majority populations of the countries observed in the current study.

Key words: Residential segregation, chronic illnesses, Roma, Balkans, logistic regression

EKHS02
Master thesis, Second Year (15 credits ECTS)
June 2018
Supervisor: Björn Eriksson
Examiner: Martin Dribe
Word Count: 11,997

Acknowledgements

I am especially grateful to my Master thesis supervisor, Björn Eriksson for his valuable guidance and support offered throughout the paper writing process. I would like to use this opportunity to thank him for constantly encouraging me and for providing me with essential advice necessary for writing the dissertation. All the other professors and staff at The Centre for Economic Demography at Lund University are also gratefully acknowledged.

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1 Introduction

The Roma community represents the largest and most vulnerable ethnic minority in Europe, estimated at approximately 8 to 12 million people. Originally from the North-Western regions of the Indian subcontinent, the Roma started their exodus towards Europe around 500 years ago and gradually settled across the continent. Nowadays they represent a well-established minority and only 20% of the Roma population is nomadic. The most populated areas are the Central Eastern European countries, where the population is estimated at around 6 to 8 million (Tanner, 2005).

There has long been a consensus that their low socioeconomic status is reflected in a poorer health relative to the non-Roma population. These disparities are mostly reflected in life expectancy, with a gap that can reach up to ten years (European Commission, 2014). Roma is one of the most deprived ethnic minorities, often living in isolated settlements found on the outskirts of urban residential areas, in houses with substandard living conditions. All these factors have a negative impact on socio-economic outcomes, leading to low educational, literacy and employment rates and high dependency on welfare support transmitted from one generation to another (Bobakova et al., 2015). Relative to the majority population, Roma report worse health outcomes reflected in higher infant and adult mortality and a worse self-perceived health status. Moreover, segregated Roma groups are more exposed to health risks due to socio-economic and environmental factors leading to a lifestyle prone to risk behaviors and a lower access to medical services (European Commission, 2004).

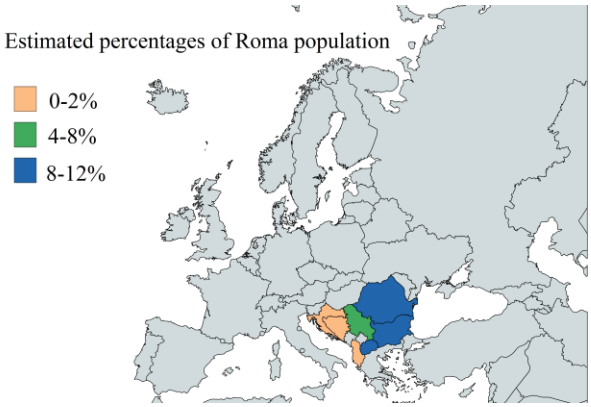

Figure 1: Map of Roma population. Source: UNDP (2006). At Risk: Roma and the displaced in Southeastern Europe

The main issue that the current study is going to examine is the effect of residential segregation upon health outcomes, more specifically chronic disease prevalence. Segregation is an important determinant for health, exacerbating health issues for minorities living in isolation. The health status of Roma is comparatively worse than the one of the majority population mostly due to their poorer socio-economic situation. From 2005 onwards, more interest towards social inclusion through welfare policies of Roma has been manifested throughout Central and Eastern Europe, both through governmental and legislative programmes such as the Decade of Roma Inclusion or the European Roma Policy Framework (Ivanov et al., 2015). In order to create efficient policies aimed at improving the health of Roma minorities, there is need for empirical evidence regarding the factors contributing to the gap in health outcomes between them and majority groups.

A growing body of literature documents the rise in non-communicable diseases of Roma in Eastern Europe (Földes and Covaci, 2012; Parekh and Rose, 2011; Dobranici et al. 2012). Even though some studies have documented the discrepancies in health outcomes based on social determinants (Hajioff, McKee, 2000; Cook et al., 2013), it is still unclear why these disparities persist among Roma communities. Thus, the current paper will look at the effect of residential segregation on the incidence of chronic diseases by comparing Roma and non-Roma groups but also by observing the differences within Roma population subgroups in 7 Balkan countries.

1.1 Background

This part examines the burden of chronic disease in Eastern Europe, while focusing on the Roma situation both from the perspective of health and the one of segregation. The objective of this subchapter is to provide a brief overview on the Roma situation in order to motivate the main research questions, hypotheses and expectations of the study.

1.1.1 Health situation of Roma

Data on Roma health is often very limited and based on national and regional measures underestimating the Roma population. However, key findings from ethnically disaggregated data suggest that the Roma population has a different demographic profile, being significantly younger than majority populations across all European countries. The Roma average age reaches 25.1, while for majority populations, the estimates are around 40.2 years in the E.U. Roma also differ in terms of longevity, with an average of 25.1% being aged over 75 compared to almost 51% among non-Roma. Large discrepancies can be noticed in Croatia and Slovakia, where the gap can go up to ten years. Roma minorities living in isolated settlements have twice or even three times higher mortality rates than integrated Roma. Compared to non-Roma, the risk of chronic disease rises more steeply after the age of 65 among Roma minorities. Moreover, Roma report higher levels of hypertension and obesity and a higher vulnerability to risk factors leading to cardiovascular and metabolic diseases. This has also been observed among young Roma who tend to have low levels of education attainment associated with a higher exposure to health risk behaviors such as smoking and inadequate diets, which negatively impact their health (European Commission, 2014).

The higher exposure to non-communicable diseases associated with health risk factors such tobacco and alcohol consumption, poor diet and lack of physical exercise are mostly associated with low incomes. Approximately 90% of the Roma interviewed in the European Union Agency for Fundamental Rights study (2014) reported an income under the national poverty threshold, directly affecting affecting their diet. Lack of proper nutrition is a factor leading to the incidence of chronic diseases such as hypertension and diabetes. Drug use is another issue that vulnerable Roma who live in social exclusion tend to have (UNDP, 2012). However, findings from the same study reveal that Roma and non-Roma population report

similar rates of chronic illnesses such as heart disease, cancer, arthritis and diabetis. It is suggested here that the Roma population may be even less exposed to the risk of chronic diseases, mostly due to the younger demographic structure. When comparing Roma and majority populations in Eastern Europe, similar patterns are observed in their self-perceived health status. Similarly, the incidence of chronic diseases seems to have very similar rates for the two groups, with levels of 17% for Roma, respectively 18% for non-Roma.

Lack of access to medical facilities and lack proper information regarding the healthcare system also contribute to the poorer health outcomes reported by Roma. When it comes to access to medical services, Roma might be facing different barriers such as lack of health insurance, spatial isolation from medical facilities or simply direct discrimination when receiving medical care. Generally, there are no differences in the treatment of Roma in the health insurance system. However, it is quite common that Roma remain excluded from the medical system due to their resilience to be covered by medical insurance or as a cause of being excluded from any type of formal employment that can provide them with health insurance plans. Existing evidence suggests that Roma overuse medical services such as emergency or child vaccination and immunization. In addition, lack proper documentation like health insurance cards will limit the Roma to use only emergency ward, rather than other specialized types of services. (European Commission, 2014).

The European Union Agency for Fundamental Rights report on women's health (2012) indicates that health of Roma females is generally worse than Roma men's. Among the most common problems, there is the high risk of poor maternal health. Levels of educational attainment are generally lower than the ones achieved by their male counterparts, which makes Roma women the main caregivers in their households. In addition, Roma women might also suffer from even more discrimination when accessing healthcare services since their employment rates are comparatively lower than men's, which makes them more likely to remain uncovered by medical insurance (Földes and Covaci, 2012). The general expectation is that, apart from racial discrimination and negative attitudes towards poverty, Romani women also suffer from gender discrimination, due to patriarchal roles within Roma households. Therefore, women might be even more vulnerable to health issues than men (Janevic et al., 2012).

1.1.2 Residential segregation of Roma

Residential segregation represents an issue that leads the isolation of vulnerable group into inadequate housing lacking proper infrastructure to employment opportunities, medical and educational services. Previous research from Eurofound (2012) has shown that spatial segregation among Roma communities is also associated with lack of proper sanitation that poses many health risks associated with the transmission of infectious diseases. Safety is also affected due to the comparatively higher rates of criminality present in ethnically isolated areas. Segregated neighborhoods often tend to be noisy, which increases the risk of health problems such as hypertension and high blood pressure, sleep deprivation or depression.

In most Eastern European countries, Roma minorities live clustered in neighborhoods inhabited by the same ethnic community. However, in Western EU member states, like

Denmark, Sweden, Portugal and Belgium, Roma live among other minorities in deprived residential areas. In most cases, Roma segregation is not a result of specific laws leading towards separation, but rather a consequence of administrative practices through which housing is allocated to Roma in specific areas. Despite the obligation of implementing non-discriminatory policies in housing, there is a strong impact of residents pressuring local authorities to prevent Roma communities from living in areas inhabited by majority groups. Private landlords also tend to discriminate and be less likely to rent out houses to Roma groups. In more recent times, local authorities in urban areas are obliged to impose implement desegregation plans in order to ensure a better integration of the Roma community (European Union Agency for Fundamental Rights, 2010).

The phenomenon of residential segregation is mostly present in urban areas. Most Roma communities live in segregated areas in cities as coping strategy ensuring social ties and networks compensating for the lack of essential public services. However, this can have adverse effects since segregated Roma tend to be more vulnerable to violence and criminal activity and more isolated from medical services, employment and education opportunities but also from the society as a whole (Eurofound, 2012). Roma employment rates fall far behind the non-Roma levels, with approximately one out of three Roma being unemployed. Lack of employment in the formal sector among the young Roma can be also explained by low levels of educational attainment. Discrimination of employers also plays a major role in the low employment rates of Roma. Estimates indicate that up to 38% of the Roma in Romania and 41% from Czech Republich have received unequal treatment in employment. It is important to note that residential segregation affects not only the Roma group, but also the majority population living in isolated areas, lowering their employment rates and making them more vulnerable to social and health risks (European Union Agency for Fundamental Rights, 2014).

The existing literature has mostly focused on the incidence of transmittable diseases associated with the poor living conditions and hygiene of disadvantaged Roma communities. There is limited research on the relationship between segregation and incidence of non-communicable diseases, but existing evidence suggests that Roma experience higher rates of chronic illnesses than the majority population if living in isolated areas, inside dwellings with substandard conditions for living. Dwellings found in segregated areas often tend to be in poor conditions, lacking access to basic amenities. In segregated areas, 62% of Roma are deprived from access to sanitation, as compared to 31% of the majority population living neighborhoods mostly inhabited by minorities. Chronic conditions such as respiratory and rheumatoid diseases are associated with lack of proper housing. In addition, overcrowding in houses increases the risk of domestic accidents. Poor conditions of dwellings such as lack of illumination and soundproofing lead to mental health problems, while the lack of ventilation and the presence of damp and mold increase the risk of having chronic respiratory problems. (Eurofound, 2012).

1.2 Aim and Objectives

The lack of inclusion of Roma is a social issue that poses many problems to policy makers. As the Roma population is significantly younger and has a lower socio-economic status, the labor market can face serious challenges if Roma stay outside formal employment, as they are more vulnerable when it comes to health outcomes. Therefore, more specialized research and awareness-raising on the Roma situation is needed in order to tackle the health issues of marginalized Roma communities. However, the literature is limited, focusing mostly on the effect of socioeconomic determinants on the incidence of infectious diseases. The disparities in life expectancy are well-known, but yet it is still not clear what drives differences in health outcomes such as chronic diseases prevalence. Lack of equal opportunities in housing, education, employment, income and access to medical care are known to increase the risk of exposure to chronic illnesses. However, it is still not known to what degree does residential segregation contributes to the disparities in health between Roma and majority groups. Thus, this thesis will try to answer the following research question: "How does residential segregation affect the Roma – non-Roma gap in chronic disease prevalence?".

Estimates of Roma population are not yet accurate because of the stigmatization associated with Roma identity. Given that the level of social openness, inclusion and economic development varies across countries, the socio-economic status of Roma also differs. Thus, it is expected that in countries with higher levels of social inclusion, the Roma will be less segregated, which will subsequently have a positive impact upon their health. This leads us to the second research question of the study: "What drives differences in chronic disease prevalence among Roma?".

The general objective of the study is to examine the association between residential segregation and health outcomes among Balkan Roma communities, and more specifically whether living in segregated neighborhoods has any association with the incidence of chronic diseases.

1.3 Research Purpose

Studies on Roma are often limited to certain geographic areas with a small sample size, which poses difficulties to the study their health situation. It is still challenging to determine to what extent Roma suffer a disadvantage in health outcomes as a consequence of ethnic segregation. In addition, there is not so much theoretical insight on how majority ethnic groups living in areas mostly inhabited by minorities can be affected by segregation. The purpose of this paper is therefore to enlarge the literature dealing with Roma health problems relative to majority populations and to provide a comparative perspective in order to possibly find country-specific solutions to this issue.

1.4 Delimitations

The current research will only examine the effect of residential segregation, while using demographic and socio-economic controls, in order to determine what drives cross-country differences in the prevalence of chronic illnesses between different Roma populations and between Roma and non-Roma groups. Other health outcomes such as life expectancy or adult mortality are not included in the study. Only a brief literature on the health of Roma is provided in the background section, due to lack of previous research on chronic disease incidence among Roma. Moreover, the literature review on residential segregation uses theoretical frameworks and previous studies limited to ethnic minorities as a whole, without focusing on the situation of Roma. The last and probably most important delimitation that must be considered when reading this study is that the paper will not account for the impact of risk behaviors upon health outcomes, due to limited data.

1.5 Outline of the Thesis

The introduction section has provided a general overview of the situation of socially excluded Roma in Europe. The following section, including the literature review consists of a summary and a critical analysis of the most well-known studies in the demographic literature regarding the impact of residential upon health. In the third section, the data together with the main methodological framework are be presented. In the fourth chapter of the thesis, the results are presented and interpreted while relating to the aforementioned theories and studies. Limitations together with a concluding discussion are presented in the end of the paper, in order to assess whether the study has completed its main aims and objectives.

2 Literature/Theoretical Review

The following theoretical review will provide a clearer picture on how segregation and health are correlated, by providing a general overview on how living in a particular area determines health outcomes. The first section, "Defining and measuring residential segregation", addresses the problem of quantifying spatial isolation. The second subchapter, "Socio-economic implications of segregation", will explain how certain neighborhood factors such as housing conditions and access to healthcare, education, income and employment opportunities are correlated with the incidence of various chronic diseases, self-reported health and mortality. The relationship between age, gender and health is also explained in this section. Lastly, the chapter will addres the dimension of "Health implications of segregation", where the link between access to medical servuces and health outcomes is explained.

2.1 Defining and measuring residential segregation

There is an encompassing body of literature on the effects of segregation upon health. Timberlake and Ignatov (2014) define residential segregation as the degree of spatial separation between two or more groups in a specified geographic area. Groups are generally isolated on the basis of certain characteristics that can be either inherited such as race, ethnicity, religion, or based on achieved characteristics denoting their social position. Usually, residential segregation leads to the benefit of more affluent groups which are most often represented by the majority and to the disadvantage of those with fewer resources, mostly due to the exposure to the neighborhood socioeconomic position.

The theoretical framework used in this research paper is based on the theory elaborated by Massey, suggesting that spatial segregation is part of discrimination leading to unequal opportunities across ethnic groups (Massey, 1990; Massey and Denton, 1993; Massey and Fischer, 2000). Generally, minority groups are either under- or overrepresented in certain areas, depending on how unevenly distributed they are. Their exposure to majority groups varies, depending on how much place they take up, relative to the majority population. Minorities can be either concentrated in a small residential area, when occupying less space than majority groups, centralized, when residing in a central location of a urban center, clustered, in order to form an isolated enclave or scattered around an urban area (Massey and Denton, 1988). Residential segregation is a determining factor for the concentration of poverty and exclusion, which can subsequently translate into higher rates of crime, drug use and violence. If minority groups are concentrated in only one area, effects of poverty will also be concentrated around these groups. This theoretical model indicates that when residential segregation increases, the poverty rate concentrated in segregated areas will also rise. This will create a buffer effect upon groups that live in integrated areas, who will be less affected

by poverty. An additional risk associated with residential segregation is the creation of an underclass that is deprived from equal opportunities in education, employment and healthcare. Thus, when controlling for socio-economic determinants, it is found that the effect of segregation upon poverty is even stronger (Massey and Denton 1993).

Quantifying segregation is an issue that has often been approached in the literature. The classical model for measuring segregation proposed by Schelling (1969) suggests that a mild preference for residential areas of similar ethnicity can lead to different levels of segregation. In this agent-based model, individuals who prefer to be surrounded by agents who are ethnically different, still choose to isolate themselves from other groups. If the level of preference for certain neighborhoods exceeds a tolerance threshold, the residential pattern of a certain group will result either in complete integration or segregation.

Massey and Denton (1988) suggest five methods of measuring residential segregation. The first one is the uneven distribution of minority groups over certain residential areas, relative to majority groups. For measuring unevenness, an index of dissimilarity is used, representing the share of minority population that needs be replaced to a new residential area, so that an equal distribution could be achieved. When deriving the index from Lorenz curve, the dissimilarity index becomes sensitive only to transfers of minorities moving from neighborhoods where they are overrepresented to areas where they are less represented. Another method of quantifying residential segregation is using the Gini coefficient, which in this case represents the ratio of one Gini index capturing inequality between residential areas and another Gini index measuring inequality between individuals at the neighborhood level. As compared to the dissimilarity index, the Gini coefficient is sensitive to movements of majority groups or movements of minorities to areas where they are still overrepresented. The third method is represented by the entropy index measuring the average difference between the share of a group residing in a single area and the proportion residing in the city as a whole. The last approach is represented by the Atkinson index which is similar to the Gini coefficient, but allows for modifications in weighting spatial units where minorities are over- or underrepresented.

The second dimension that captures segregation, which has been mentioned in Massey's model, can be quantifyied through indexes of interaction and isolation. The first measure captures the exposure of minorities to majority groups, while the second index reflects the level of exposure of minority groups to one another. The third perspective that is taken into account when measuring segregation is concentration, which is a relative measure of the space occupied by minorities in urban areas. It can be argued that a group with of a relative larger size is more concentrated if it occupies less space in a residential area. Absolute concentration refers to the total area occupied by a group and compares it to largest and smallest areal units where a group of that size can live. Relative concentration is measured in a similar manner, with the difference that it takes into account the distribution of the majority group. The fourth aspect that is considered when quantifying spatial segregation is centralization, referring to the living proximity of a group from an urban center. Relative centralization represents the share of minority groups that would have to leave their area of residence in order to achieve the same level of centralization as the majority. Absolute centralization only takes into account the distribution of a minority group around an urban center. Finally, the last type of measurement is represented by clustering, which refers to the

extent to which the neighborhoods where a minority group resides can adjoin. In relative terms, clustering compares the living distance between members of the same minority group with the living distance between members of the majority group. Absolute clustering measures the average number of a minority living close to majority groups as a share of the total population living specific neighborhoods.

Real life segregation dynamics that are usually captured in census data, use the ethnical composition of neighborhoods as the main criteria for measurement. Here, the reference unit for segregation is represented by households rather than individuals. Household size is often dependent on ethnicity and family values, especially in the case of multiple-generation households. In addition, by using the household as the main unit of measurement for segregation, inferences can be made regarding social interactions of neighbors, who are expected to have closer social ties if having the same ethnicity. This measure allows for comparisons between the observed number of minority households located in the close proximity of majority groups to the predicted number of minority households, given the overall ethnic composition of the neighborhood. This measurement is based on the assumption that the location of the households is random and that the minority households are completely segregated (Logan and Parman, 2017). In other words, the measure used in this model, which has also been used in the UNDP dataset employed in this study, is a counterfactual between the actual and the expected distribution of households in a certain neighborhoods.

If the first part of the theoretical analysis has reviewed the main types of segregation measurements in the specialized literature, the following subchapters will focus more on the socio-economic implications of segregation in order to provide more insight on how health outcomes of minorities can be impacted by segregation.

2.1.1 Socio-economic implications of segregation

A second theoretical model is the one proposed by Wilson (1987, 1996) suggests that socio-economic determinants lead towards poverty and social issues. He indicates that structural changes in the economy and the migration of the middle class towards other geographic areas have contributed to the creation of ghettos with high rates of poverty and crime. The first model elaborated by Massey and colleagues is supported by empirical evidence from several other studies (Massey, Gross, and Shibuya, 1994), suggesting that residential segregation represents a form of structural racism and that the out-migration of minority groups with a high socio-economic status has not affected the rise in poverty of segregated minorities. This comes in contradiction with the argument formulated by Wilson (1987, 1996) indicating that minorities with a relatively higher SES are more able to escape poor housing conditions and move in less segregated areas, but they also contribute to the ghettoization of the areas where they have previously lived.

Apart from limiting opportunities reflected in housing among ethnic minorities, residential segregation also has negative effects on social mobility. This reflects in less educational opportunities that are reduced in segregated areas due to poor funding of schools and lack of qualified teachers. It is possible that minorities groups might be facing a “double penalty”

since society tends to deprive them of some opportunities such as schooling or social advancement, but also because they tend to cluster in areas with less social opportunities and amenities. Employment is also affected in the sense that there are less available jobs in segregated areas and fewer opportunities to search for new work (Wilson 1996). The lack of access to employment opportunities will further affect future generations, thus social mobility will have a downward trend. It is also expected that residential segregation will increase social disorder, since poverty is correlated with family breakdowns leading to higher rates of criminal activities. Family roles are also shaped by the high rates of unemployment, determining traditional gender norms, such as women being the main caregivers in the household (Testa et al., 1993).

According to the fundamental cause theory, demographic and socio-economic characteristics such as gender, ethnicity, education and income have a major contribution to the incidence of disease (Link and Phelan, 1995). This is mostly due to their strong association with access to resources enabling individuals to avoid health risks. It is suggested that risk factors need to be contextualized in order to understand why some individuals are more vulnerable. The literature emphasizes the role of social factors that can account for up to 60-75% of the exposure to disease (Williams and Collins, 2001). Segregation is used as a common measurement for the effects of discrimination, which can to some extent explain the persistence of racial differences. Some studies indicate that even after controlling for effects of education, income or employment status, discrepancies in health risk behaviors responsible for coronary heart disease still persist, particularly in the case of individuals living in segregated areas. Stress paradigm is another theory that emerged in order to explain the link between social conditions and health outcomes. Chronic diseases, depression and low birth weight of offspring are often associated with stressful life events. Despite the findings pointing to the link between social determinants and disease, causation is still difficult to establish.

Gender is consistently linked with several chronic illnesses, making men more vulnerable than women to some diseases and vice-versa. Arthritis is generally more common among females than among males, while cardiovascular morbidity and mortality are more often faced by men rather than women (Morewitz, 2006). In addition, women tend to suffer from chronic diseases at younger ages, relative to men, and even though they have higher life expectancy rates, women have less social protection against illnesses, mostly due to differences in income and social security contributions (PAHO/WHO, 2011). Marital status is also associated with health outcomes. Theory suggests that marriage has a positive effect upon health since it ensures more social integration, increased economic resources, reducted predisposition to health risk behaviors associated with smoking and increased social support for household work (Pandley, 2009).

2.1.2 Health implications of segregation

Poor housing and lack of access to medical services contribute to physical disorder. Lack of recreational spaces where residents can exercise and limited access to supermarkets where people can buy food products meeting their nutritional needs can lead to a lifestyle prone to health risk behaviors such as tobacco, alcohol and drug consumption. Living conditions, as

part of the socio-economic status are a strong determinant of chronic illnesses. Some examples are coronary morbidity due hypertension caused by smoking and sedentary lifestyle. Patients suffering from these kinds of illnesses usually reside in neighborhoods that are socio-economically deprived (Williams and Collins 2001).

Accessing health services is another aspect worth considering when examining the health situation of minority groups, due to its direct association with health outcomes and socio-economic factors. An initial behavior model developed in the 1960s suggests that accessing healthcare services is a function of personal needs and predisposition for medical care, but also of factors enabling or preventing individuals from using medical services. Despite its practicality, the model fails to capture the influence of social interactions, networks, health attitudes or culture. A subsequent version of the model created in the 1970s also considered the impact of the national health policy, while more recent revisions started taking into account the improvements of medical services. These are related to income, health insurance status and health factors such as current state of health and symptoms. Even though this framework is mostly focused on the usage of medical services, it also considers the impact of economic, political and physical factors as determinants of understanding these services (Andersen, 1995).

Residents of segregated areas are generally less likely to have health insurance coverage. Various barriers are faced by residents of segregated areas. Firstly, they are limited by financial resources and they cannot access proper medical care, due to the concentration of poverty in isolated areas. Lack of employment is another obstacle that can limit access to healthcare, since insurance is usually provided both by employers and the state. The lower levels of educational attainment may also lead to less knowledge regarding access to medical care and health behaviors. Proximity to medical centers can also be limited by lack of healthcare facilities in segregated neighborhoods and shortage of proper transportation that can facilitate the access to specialized medical centers (Gaskin et al. 2012).

Segregated minority groups tend to have less social networks than majority groups, which affects their informal access to medical services (Cornwell and Cornwell, 2008). The authors emphasize the role of social capital in accessing experts in various fields. Individuals of ethnic minorities or those with a lower socio-economic status are less likely to have strong informal networks enabling them to access specialized knowledge. Social resources are an important feature in transmitting certain sets of norms such as discouraging health-risk behaviors like drug or alcohol consumption. Those with informal access to medical expertise also tend to have less risk behaviors because they benefit from a lower cost of specialized knowledge, such as consultations that become more effective and personalized. Thus, individuals with a higher socio-economic status also tend to have a higher social capital translated as more high-status contacts. Minorities are less likely to seek professional help from physicians due to limited proximity to medical facilities. The ethnic composition of residential areas can also determine the supply of healthcare providers. In addition, the time price of using medical services can be influenced by the proximity of medical facilities in the sense that residents will have to wait longer for receiving medical, which will negatively impact the work schedules of minorities residing in segregated areas. Isolating minority groups is therefore seen as an institutional mechanism of discrimination because it limits the access to a wide range of socio-economic resources, such as employment, schooling and

healthcare. Thus, spatial segregation can be regarded as a vital determinant of illnesses, given that social factors are the main component accounting for the variance in disease exposure (Gaskin et al., 2009).

2.2 Chapter Summary

This section has analyzed the main theories and methods of measuring residential segregation. The main theoretical framwork was concentrated on the impact of segregation on poverty and inequality. However, the section also explained how inequalities related to segregation can lead worse socio-economic outcomes of ethnic minorities, which can negatively affect their health. Most of the cited work focuses on segregation of ethnic minorities as a whole, due to the lack of research on Roma communities living in segregation. Given that theoretical insight on Roma segregation is mostly lacking, the current study will try to frame the context of health discrepancies in countries where Roma represent the largest and most vulnerable ethnic minority.

3 Methodology

In this section, the main hypotheses of the study are formulated together with the research model. The data is also described and analyzed and the main shortcomings of the employed data and method are mentioned in the limitations subchapter.

3.1 Research Approach

In order to answer the first research question, "How does residential segregation affect the Roma – non-Roma gap in chronic disease prevalence?", I formulated the following hypothesis:

H1 Segregated Roma are more likely to experience chronic diseases than segregated majority groups.

As it was mentioned in the previous sections, a higher level of segregation is generally associated with less social inclusion, more difficult access to healthcare facilities and poorer living conditions. Therefore, it is expected that Roma who live in countries with high levels of segregation to be more deprived of good living standards which can subsequently lead to worse health outcomes. The main causes driving variations in Roma health outcomes are still unclear. Therefore, a second research question was addressed: "What drives differences in chronic disease prevalence among Roma?". In order to answer this question, a second hypothesis was formulated:

H2 Roma who live in highly segregated areas are expected to be more likely to have chronic diseases than Roma who live in areas inhabited by majority groups or mixed neighborhoods.

The main expectation underlying this hypothesis is that in countries with higher levels of ethnic segregation, Roma will be more exposed to a higher incidence of chronic diseases.

3.2 Research Design

The main research question of the study is trying to determine if there is any relationship between residential segregation and incidence of chronic diseases. Various demographic and socio-economic models will be used in order to establish whether these factors have any influence upon health outcomes. The models will be tested through binary logistic regression determining the log odds of incidence of chronic diseases. The logistic regressions will be run

for the two samples separately, in order to investigate if there is any association between the variables of interest and for measuring the strength of association between the dependent and independent variables. The regressions will be conducted in a stepwise manner, in order to allow for comparisons with the basic model where no controls are used. The relationship between the variables will be captured by using the following function:

$$\pi i = \Pr(Y_i = 1 | X_i = x_i) = \frac{exp(\beta_0 + \beta_1 x_i)}{1 + exp(\beta_0 + \beta_1 x_i)}$$

where, Y_i is the binary response variable and X = $(x_1, x_2, \dots, x_k)$ is a set of explanatory variables for the observation i.

The binary regression model is used in order to predict which of the two possible outcomes is more likely to happen given the independent variable (Collet, 1994). The bivariate logistic odds-ratio model will be represented through the following model:

$$\psi = \frac{p_{11}}{p_{10}} / \frac{p_{01}}{p_{00}}$$

where ψ represents the ratio between the odds of Y_1= 1 if Y_2 = 1 and the odds of Y_1= 1 if Y_2= 0 and where ψ = 1 indicates independence between $Y_1$and Y_2.

The general model used in the study can be represented through the following equation:

$$\pi i = \Pr(\text{incidence of chronic diseases} = 1 \mid X_i = x_i)$$

where X_i= type of neighborhood, age, gender, marital status, employment, income, education, healthcare access and housing conditions.

3.3 Data Collection Method

The main goal of the study is to identify the relationship between residential segregation and incidence of chronic diseases. In order to achieve this aim, I will employ secondary data from the UNDP regional survey on Roma in CEE and South-Eastern Europe (2004). The samples were randomly chosen from Roma households residing in Roma and non-Roma living in households in the close proximity to Roma. The two samples were selected from areas with shares of Roma above the national average. In order to map the areas inhabited by Roma minorities, the survey used census data containing information regarding the share of Roma population living in each settlement. Roma clusters were defined as settlements containing approximately 30 Roma households. On average, 750 Roma and 350 non-Roma households have been included in the survey, with approximately 2,500 observations per country (UNDP, 2012).

3.4 Data Analysis

This section will describe the dependent, independent and control variables employed in the study. First of all, it is indicated how the variables were constructed. Secondly, it is mentioned what is the expected relationship between the variables in accordance with the theories cited in the previous section.

Incidence of chronic diseases

The dependent binary variable represented by the incidence of chronic diseases. The question asked in survey was: "Does she/he have any long-standing illness or health problem?". The illnesses covered in the data are: high blood pressure, ulcer, bronchitis, emphysema, arthritis, diabetes, meningitis or other pulmonary, cardiovascular, gastroenteral, hepatobiliary, dermal, joints-related, eye-sight and hearing diseases.

Type of neighborhood

In order to capture the degree of residential segregation, the type of neighborhood was used as the main unit of measurement. Three types of residential areas are distinguished: Minority, Mixed and Majority. Neighborhoods ethnically composed by minority groups are represented by residential areas where the share of Roma exceeds 40% of the total population. Mixed areas are those where Roma make up between 10% and 40% of the total population living in a specific neighborhood. Lastly, the majority neighborhoods are defined as residential areas where none of the households had Roma members. The non-Roma sample was selected from the communities living in close proximity to Roma neighborhoods because it was assumed that majority groups living close to Roma settlements would share more common administrative and socio-economic characteristics, thus providing a more accurate benchmark for the Roma population (European Union Agency for Fundamental Rights, 2014). The main expectation behind this variable is that more segregation should generate a poorer health status, thus a higher incidence of chronic diseases.

In order to determine the interaction effect between ethnicity and segregation, a new categorical variable with values ranging from 1 to 6 was created. The degree of segregation is described by neighborhood type which can be "Minority", "Mixed" and "Majority". The variable "Minority" can take either the value 1 when describing Roma living in areas inhabited mostly by Roma minorities (which are expected to have the worst outcomes given the high level of residential segregation) or the value 4 in the case of non-Roma living in areas inhabited mostly by Roma minorities. The variable "Mixed" can take either the value 2 for Roma and 4 for non-Roma living in mixed neighborhoods. Lastly, the variable "Majority" takes the value 3 for Roma and 6 for non-Roma living in areas where the majority population is overrepresented. The chosen reference group was the non-Roma living in "Majority" neighborhoods since it is expected that this group should have the best socio-economic position associated with better health outcomes and a low incidence of chronic diseases. This variable was used only when running the regression predicting the combined effect of segregation and ethnicity on chronic disease incidence (Section 4.3).

Age

The age variable is grouped in four categories: 18-29, 30-44, 45-59 and over 60. It is expected that those aged above 60 should have the highest incidence of chronic diseases, as age is a clear indicator for health deterioration.

Gender

The study also controls for gender, as previous empirical research indicates that men and women are expected to have different rates of chronic disease incidence. Roma women are expected to be more exposed to risk of chronic illnesses due to their lower socio-economic status relative to men. It is difficult to make any inferences for the non-Roma sample, in terms of health status relative to men, but the general expectation is that non-Roma women should have better health outcomes than their Roma counterparts.

Employment

Two possible outcomes are determined when it comes to employment: employed, which includes both individuals who are formally employed and self-employed or unemployed, where other work statuses such as housekeeper, retired and disabled are included. The general expectation is that being employed will generate a lower incidence of chronic diseases.

Income

The monthly income variable ranges from 75 to over 250 euros per month. A salary between 5 and 125 euros per month is defined as low. A monthly wage above 125 euros but below 250 euros was defined as medium. Any income exceeding 250 euros per month was defined as high, even though this value is considerably lower than national averages of the countries under observation. The dataset had predefined values for income, which were chosen in order to reflect the average incomes of Roma at the risk of poverty. Higher income levels are expected to decrease the risk of chronic disease prevalence.

Marital status

Two possible outcomes are available when it comes to marital status: married or not-married. The latter also includes individuals who are divorced, separated, widowed or never married. It is expected that married individuals have more social integration that can subsequently translate as better health outcomes.

Education

Three levels of educational attainment are used in the study: primary, secondary and tertiary. The first group consists of individuals with completed compulsory eight-year education. The second category refers to an education corresponding to at least four years of secondary school, while the last category consists of individuals with completed university studies. It is expected that individuals with higher levels of educational attainment should have better mechanisms of avoiding risk behaviors and a higher propensity to use medical services, thus a lower incidence of chronic diseases.

Healthcare access

This variable captures only the proximity to medical facility. The question asked to those who participated in the survey was "Tell me, how far from your house, in terms of kilometers is the nearest medical center/general practitioner/polyclinic or hospital". Between less than 1 and 3 kilometers, the access was defined as easy. Between 3 and 10 kilometers, the access to medical facilities was assessed as medium, while a distance over 10 kilometers was defined as difficult access to medical care. A closer proximity to medical care facilities is expected to be correlated with a lower incidence of chronic diseases.

Housing conditions

The variable defined as "Housing conditions" captures the external evaluation of the household's dwelling. Four possible outcomes are included: apartment in a block of flats in good conditions, new house in good condition, older house in relatively good condition and slum. Houses with worse living conditions are expected to generate a higher likelihood of being chronically ill.

Table 1: Summary statistics of sample distribution across variables

Dependent variable	**Chronic disease**	**Albania**		**Bulgaria**		**Bosnia and Herzegovina**		**Croatia**		**Macedonia**		**Romania**		**Serbia**	
		Roma	**Non-Roma**	**Roma**	**Non-Roma**	**Roma**	**Non-Roma**	**Roma**	**Non-Roma**	**Roma**	**Non-Roma**	**Roma**	**Non-Roma**	**Roma**	**Non-Roma**
	Yes	18%	15%	21%	30%	19%	18%	13%	22%	30%	27%	18%	18%	21%	22%
	No	82%	85%	79%	70%	81%	82%	87%	78%	71%	73%	82%	82%	79%	78%
Independent variable	**Type of residential area**														
	Minority	69%	96%	75%	41%	39%	40%	42.5%	60%	82%	93%	54%	4%	57%	75%
	Mixed	20%	2%	17%	51%	53%	60%	42.5%	30%	10%	2%	38%	66%	30%	24.5%
	Majority	11%	2%	8%	8%	8%	-	15%	10%	8%	5%	8%	30%	13%	0.5%
Control variables	**Age**														
	18-29	37%	27%	34%	19%	39%	31%	40%	28%	34%	25%	36%	21%	32%	26%
	30-44	34%	28%	31%	25%	29%	29%	38%	26%	31%	25%	31%	27%	33%	28%
	45-59	18%	29%	24%	24%	23%	23%	14%	21%	21%	26%	21%	28%	23%	29%
	60+	11%	14%	11%	32%	9%	17%	8%	25%	14%	24%	12%	24%	12%	17%
	Gender														
	Male	50%	49%	48%	46%	50%	45%	51%	48%	51%	47%	49%	49%	51%	49%
	Female	50%	51%	52%	54%	50%	55%	49%	52%	49%	53%	51%	51%	49%	51%
	Marital Status														
	Married	76%	72%	71%	66%	61%	59%	77%	60%	72%	63%	39%	54%	75%	62%
	Not Married	24%	28%	29%	34%	39%	41%	23%	40%	28%	34%	61%	46%	25%	38%
	Employment														
	Employed	40%	50%	23%	45%	6%	28%	17%	40%	9%	32%	9%	31%	14%	37%
	Not-employed	60%	50%	77%	55%	94%	72%	83%	60%	91%	68%	91%	69%	86%	63%
	Income														
	Low	18%	4%	25%	18%	15%	6%	2%	3%	19%	7%	15%	15%	17%	7%
	Medium	9%	8%	9%	14%	11%	12%	9%	5%	10%	10 %	4%	13%	10%	10%
	High	73%	88%	65%	68%	74%	82%	89%	82%	71%	83%	81%	72%	73%	83%
	Education														
	Primary	93%	32%	89%	25%	87%	33%	83%	34%	86%	26%	88%	40%	80%	16%
	Secondary	6%	43%	11%	58%	12.5%	52%	15%	50%	13%	58%	11%	47%	19%	57%
	Tertiary	1%	25%	1%	17%	0.5%	15%	2%	16%	1%	16%	1%	13%	1%	27%
	Healthcare access														
	Easy	90%	98%	95%	95%	79%	88%	57%	69%	94%	97%	87%	91%	86%	89%
	Medium	9%	1.5%	4%	3%	17%	10%	33%	26%	3%	3%	12%	8%	11%	8%
	Difficult	1%	0.5%	1%	2%	4%	2%	10%	5%	3%	-	1%	1%	3%	2%
	Housing conditions														
	Apartment	17%	43%	7%	41%	9%	41%	7%	25%	2%	33%	7%	27%	5%	40%
	New house	19%	47%	13%	16%	16%	19%	23%	25%	15%	24%	12%	20%	14%	14%
	Old house	45%	9%	44%	39%	36%	30%	43%	36%	47%	37%	52%	51%	30%	28%
	Slum	19%	1%	36%	4%	39%	10%	27%	14%	36%	5%	29%	2%	51%	18%
Observations		1,503	1,282	1,048	994	1,023	1,013	567	921	1,213	830	2,816	1,450	1,249	1,760

From the results obtained from the summary statistics, it appears that the two samples do not report large discrepancies in terms of chronic disease prevalence. However, it seems that there is a positive relationship between country level of segregation and incidence of chronic diseases. In order to provide a clearer picture on how segregation varies across countries, the following graph showing the distribution of Roma in different types of neighborhoods was provided:

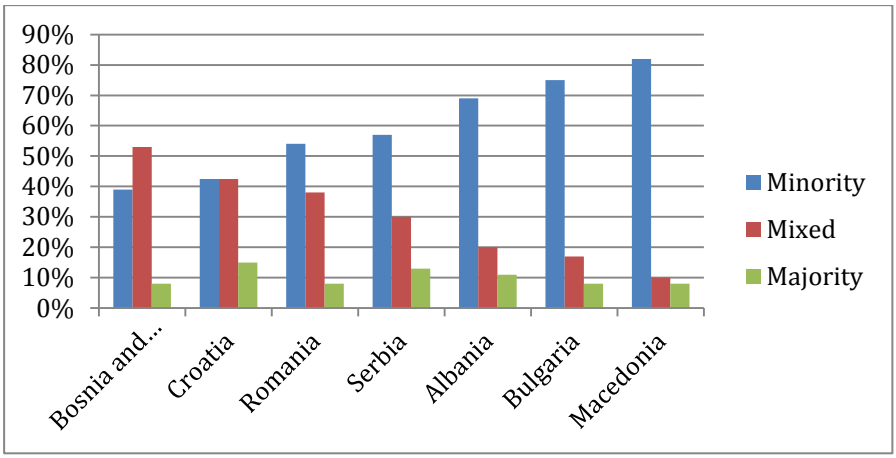

Figure 2: Proportion of Roma living in settlements inhabited by minority, mixed and majority groups

The next graph presents the shares of non-Roma populations living in different types of residential settlements. The disparities are mostly explained by the differences in sampling procedures targeting Roma and non-Roma. In the countries like Serbia, Macedonia and Albania, the non-Roma sample was selected from majority groups living in neighborhoods inhabited by Roma. Conversely, in Romania, the non-Roma sample was selected from neighborhoods inhabited either by mixed or majority groups.

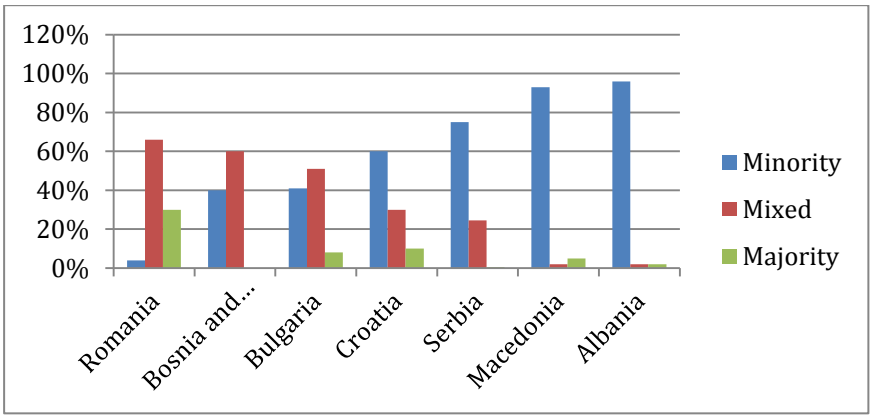

Figure 3: Proportion of non-Roma living in settlements inhabited by minority, mixed and majority groups

The following figure exhibits the incidence of chronic diseases by Roma and non-Roma population. Similar levels are reported for the two groups despite the discrepancies in their socio-economic status. The largest disparities are in Croatia and Bulgaria. The highest incidence of chronic diseases is reported for Macedonia, the country with the highest levels of Roma segregation. However, a more in-depth analysis is presented in the following chapter containing the interpretation of the results obtained from the logistic regressions.

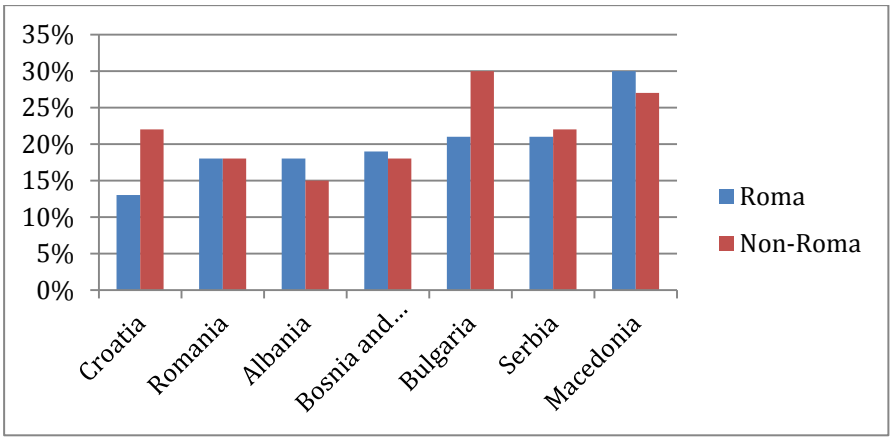

Figure 4: Incidence of chronic diseases among Roma and Non-Roma

3.5 Limitations of the data

The present study does not control for risk behaviors such as smoking or alcohol consumption, lack of physical activity or dietary choices, due to the limited data. In addition, when it comes to this ethnic group, data often poses some problems since many individuals refuse to identify themselves as Roma due to the social stigma associated with it. A further limitation is that the study only uses the distance from medical facilities as the main proxy for healthcare access. Due to limited data, other variables such as coverage of medical insurance cannot be used. Moreover, the study only access cross-sectional micro-data, which does not allow for longitudinal comparisons on the health situation of Roma.

4 Analysis and Discussion

This chapter includes the results of the logistic regressions run in STATA. The tables contain the results of the binary logistic regression of chronic disease prevalence on residential segregation presented as odds ratios, for both Roma and non-Roma sample. The starting point is the basic model that only takes into account the impact of residential segregation upon chronic disease incidence. The second model includes demographic controls for age, gender and marital status. The third model controls for socio-economic determinants. Lastly, both demographic and socio-economic controls are included. Country-specific results are also discussed in this chapter, but the results are included only in the appendix section. The third part of this chapter contains the results from another logistic regression, capturing the interaction effect between segregation and ethnicity. The section ends with a brief discussion of the findings and limitations of the study.

4.1 Results – Non-Roma population

Table 2: Results of binary logistic regression of chronic disease prevalence on residential segregation presented as odds ratios - (Non-Roma sample)

	A1	St. Error	A2	St. Error	A3	St. Error	A4	St. Error
Type of Neighborhood								
Minority	1.152	(0.126)	1.005	(0.119)	1.103	(0.138)	1.069	(0.144)
Mixed	1.276**	(0.147)	1.198	(0.150)	1.285**	(0.164)	1.236	(0.170)
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.032**	(0.008)			0.025**	(0.007)
30-44			0.080**	(0.009)			0.072**	(0.010)
45-59			0.290**	(0.024)			0.260**	(0.028)
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.485**	(0.049)			0.499**	(0.056)
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			1.190†	(0.1244)			1.097	(0.127)
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.207**	(0.021)	0.492**	(0.058)
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					1.154	(0.121)	1.033	(0.119)
Medium					1.146	(0.119)	1.143	(0.129)
High					1	(omitted)	1	(omitted)
Education								
Primary					0.222**	(0.030)	0.210**	(0.032)
Secondary					0.602**	(0.076)	0.812	(0.112)
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					0.743	(0.198)	0.634	(0.188)
Medium					0.735	(0.213)	0.811	(0.261)
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					2.886**	(0.423)	2.121**	(0.334)
New house					1.984**	(0.312)	1.725**	(0.291)
Old house					1.941**	(0.261)	1.442**	(0.208)
Slum					1	(omitted)	1	(omitted)
Observations	8,250							

**** p<0.05, † p<0.1. Standard errors in parentheses**

The analysis begins with a basic model predicting the odds having a chronic disease for the non-Roma population. It can be observed that non-Roma living in neighborhoods inhabited by mixed and minority groups report the highest likelihood of being chronically ill. The effect of segregation decreases in the following models and remains statistically significant only for mixed neighborhoods in the first and third model. In the second model (A2), where demographic controls are added, all variables are statistically significant at a 0.05, respectively 0.1 per cent level. As expected, those in the above 60 age group are the most likely to report chronic diseases. Surprisingly, men report much lower odds of reporting chronic diseases than women, while married individuals seem to be more vulnerable. From

the third model (A3), it can be observed socio-economic determinant such as employment, high income levels and close proximity to a medical facilities are associated with lower odds of being chronically ill. However, low levels of educational attainment are not associated with poorer health. In addition, non-Roma living in apartments and new houses have the highest likelihood of reporting chronic diseases, as compared to those living in old houses and slums. Similar values are reported in the last model, where both demographic and socio-economic controls are added, but the effect of segregation decreases even more.

When analyzing each county separately, the likelihood of the majority population of reporting a chronic disease varies to a large extent. In Macedonia and Serbia, non-Roma are more vulnerable when living in Roma neighborhoods. In Albania, Bosnia and Herzegovina and Bulgaria non-Roma living in mixed neighborhoods, are the most likely to have a higher incidence of chronic illnesses. In Romania and Croatia, those living in areas inhabited by majority groups have the highest likelihood of being sick. In the second model (A2), the results indicate that being over 60 is associated with a higher incidence of disease in all countries. Similarly, women also seem to be more vulnerable to chronic diseases. Mixed results are provided with respect to marital status, since in Romania and Croatia, married non-Roma report a lower likelihood of having a chronic disease.

In the third model (A3), the effect of segregation increases when socio-economic variables are added, in the case of Romania and Macedonia. Unemployment is a predictor of ill-health in all countries. A low income translates in a higher probability of reporting chronic diseases in the case of Romania, Bosnia and Herzegovina, Croatia and Serbia. Low education is a predictor of bad health only in the case of Serbia. Close access to medical care is correlated with a lower incidence of chronic diseases in the case of Romania, Bulgaria and Bosnia and Herzegovina. In most countries, living in an apartment generated the worst outcomes in the incidence of chronic illnesses, with the exception of Serbia, where living houses was associated with the highest likelihood of reporting chronic diseases.

In the fourth model (A4), both demographic and socioeconomic variables are included. Here, the negative effect of segregation upon the incidence of chronic diseases increases for all countries, with the exception Albania and Croatia. Once again, an old age is a clear predictor of bad health, since those in the 60+ age group are the most exposed to chronic illnesses. Being a male was associated with a lower likelihood of reporting chronic illnesses in all countries. Being married was generally correlated with a higher exposure to chronic illnesses, with the exception of Croatia. Being employed was a strong predictor for good health in all countries. A low income generated mixed results across countries. In Bulgaria, Albania, Bosnia and Herzegovina and Macedonia, the results were in line with the main expectation of the study, since those with a low income reported worse health outcomes. Conversely, in Romania, Croatia and Serbia, the non-Roma with a better financial situation were more likely to report health problems. In none of the countries a low level of educational attainment was associated with poor health. Close proximity to medical facilities was a predictor of better health outcomes only in the case of Bulgaria and Bosnia and Herzegovina, while living in an apartment generated the worst health outcomes in most countries.

4.2 Results – Roma population

Table 3: Results of binary logistic regression of chronic disease prevalence on residential segregation presented as odds ratios - (Roma sample)

	B1	St. Error	B2	St. Error	B3	St. Error	B4	St. Error
Type of Neighborhood								
Minority	1.483**	(0.164)	1.389**	(0.156)	1.155	(0.151)	1.127	(0.150)
Mixed	1.056	(0.127)	1.008	(0.123)	0.920	(0.126)	0.908	(0.127)
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.146**	(0.028)			0.198**	(0.043)
30-44			0.435**	(0.042)			0.643**	(0.078)
45-59			0.827**	(0.072)			1.498**	(0.161)
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.799**	(0.077)			0.838	(0.093)
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			0.905	(0.089)			1.076	(0.122)
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.606**	(0.064)	0.645**	(0.073)
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					1.307**	(0.140)	1.260**	(0.138)
Medium					1.043	(0.123)	0.998	(0.120)
High					1	(omitted)	1	(omitted)
Education								
Primary					17.094**	(6.630)	19.189**	(7.462)
Secondary					3.690**	(1.455)	3.962**	(1.567)
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					2.390**	(0.789)	2.391**	(0.806)
Medium					1.525	(0.541)	1.655	(0.600)
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					0.712**	(0.098)	0.622**	(0.088)
New house					1.024	(0.141)	0.908	(0.128)
Old house					0.969	(0.100)	0.830†	(0.089)
Slum					1	(omitted)	1	(omitted)
Observations	9,419							

**** p<0.05, † p<0.1. Standard errors in parentheses**

From the the basic model (B1), it can be observed that the incidence of chronic diseases is more common among Roma minorities living in segregated and mixed neighborhoods. When adding demographic control variables, the effect of segregation decreases but remains statistically significant at a 0.05 per cent level for Roma neighborhoods. For gender, the results are similar with those obtained for the non-Roma sample in the sense that females are more likely to report chronic illnesses than men. Similarly, an old age is a good predictor of sickness for Roma, as it is for non-Roma. Married individuals are less vulnerable to chronic diseases, as compared to unmarried non-Roma are more likely to be sick. From the third model (B3), it can be noticed that employment and high income levels are associated with a lower likelihood of being chronically ill. When controlling for education, it seems that Roma with low levels of educational attainments are much more vulnerable to health issues. Another

difference is that the close proximity to medical facilities does not translate in a lower incidence of chronic diseases, whereas in the case of non-Roma, living close to a healthcare center decreases the odds of reporting chronic illnesses. Lastly, it is reported that Roma who live in new houses and slums are the most exposed to the risk of chronic diseases.

When analyzing the basic model (B1) for each country individually, the odds of Roma reporting a chronic diseases is the highest for those living in segregated neighborhoods in Serbia, Bulgaria and most obviously in Romania. Roma living in mixed neighborhoods report the highest probability of having poor health outcomes in Albania and Macedonia. The only exception is represented by Bosnia and Herzegovina, where Roma living in residential areas inhabited by majority groups are the most vulnerable to chronic diseases.

In the second model (B2), the effect of segregation increases when adding demographic variables for most countries, with the exception of Albania and Serbia. When controlling for age, two categories of countries can be distinguished. The first category includes the countries where Roma in the 45-59 age group are more likely to report chronic diseases: Romania, Bulgaria and Bosnia and Herzegovina. Croatia is an outlier since those in the 30-44 age group have the highest odds of being ill. In the second group of countries, including Albania, Macedonia and Serbia, Roma over the age of 60 are more likely to report chronic illnesses. In addition, females are generally more likely than men to experience non-communicable diseases, with the exception of Albania. Mixed results are reported for marital status effects. In Romania, Bulgaria, Albania, and Serbia, married individuals report lower odds of having long-standing health problems, whereas in the rest of the countries, an opposite pattern is observed.

From the third model (B3), it can be observed that for most countries, with the exception of Albania and Bosnia and Herzegovina, the effect of segregation increases. A finding that was consistent for all the countries was that unemployment and low levels of educational attainment are associated with a higher likelihood of reporting chronic diseases. Mixed results are obtained with respect to income. In Romania, Bosnia and Herzegovina, Bulgaria, Macedonia and Serbia, a low income was associated with poorer health outcomes, while in the rest of the countries, Roma with a higher income reported more health problems. In most countries, living close to a healthcare facility does not translate as a lower likelihood to be sick, with the exception of Albania and Macedonia, where the close proximity to medical facilities is correlated with a lower incidence in chronic illnesses among the Roma group. Living conditions also influence the health of Roma. With the exception of Croatia and Serbia, living in slums generated the highest odds of having health problems.

In the last model (B4), in Albania, Croatia and Serbia, the effect of segregation upon incidence of chronic diseases decreases relative to the previous model. For the rest of the countries, the effect becomes even stronger. In Romania, Bulgaria, Bosnia and Herzegovina and Serbia, Roma in the 45-59 age group report the highest odds of having chronic diseases. In Albania and Macedonia, those aged over 60 have poorer health. In Croatia, Roma aged 30-44 have the worst health outcomes. In this model, being a male being is correlated with a lower risk of chronic diseases in most countries, with the exception of Albania and Croatia. Being married is a predictor of good health only in Romania, Serbia and Albania. As in the previous model, being employed lowers the odds of being sick. In Croatia and Bosnia and

Herzegovina, a low income is not correlated with a higher incidence of chronic diseases. Education still represents a strong predictor of ill health in all countries under observation. The close proximity to medical facilities is correlated with a lower risk of chronic diseases only in Albania and Macedonia. In most countries, Roma living in houses with substandard conditions described as "slums" reported the highest incidence of sickness. However, in Croatia and Serbia, those living in new houses had poorer health than the Roma living in slums, while in Macedonia the Roma living in old houses had the worst outcomes.

4.3 Results – Combined effect of residential segregation and ethnicity

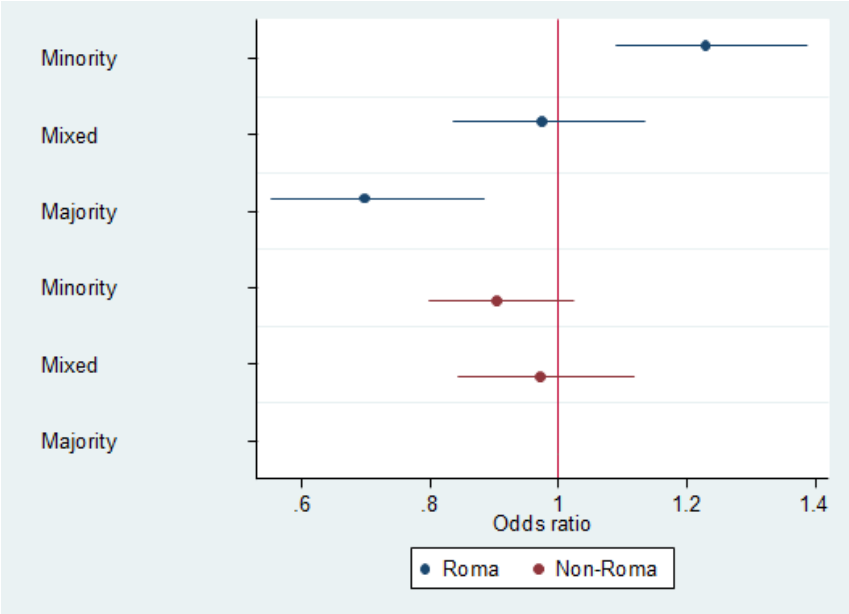

Figure 5: Combined effect of residential segregation and ethnicity

This last section presents the results obtained from plotting the interaction effect between segregation and ethnicity. Another logistic regression was run in order to determine the association between chronic disease prevalence and the level of segregation. As it can be noticed from the graph presented above, the Roma group living in residential areas inhabited by majority groups is the least exposed to the risk of chronic diseases. The most vulnerable group is the one represented by Roma living in segregated neighborhoods who report 1.2 higher odds to be chronically ill than the reference group, represented by Majority populations living in non-segregated neighborhoods. Non-Roma living in neighborhoods inhabited by minority groups also less exposed to chronic diseases than other groups. Also, Non-Roma who live in areas inhabited by mixed groups still report low odds of being chronically ill.

4.4 Discussion

When comparing the Roma and non-Roma sample, there are some similarities when it comes to the effect of segregation on health outcomes. In the case of non-Roma, living in neighborhoods inhabited by mixed and minority groups generated the highest likelihood of being chronically ill. For Roma, a higher level of segregation was associated with even stronger odds of reporting chronic diseases (Table 2 and 3). The results obtained from the regression predicting the combined effect of residential segregation and ethnicity indicate that Roma reported approximately 1.2 higher odds of being chronically ill if living in segregated neighborhoods. On the other hand, Roma living in neighborhoods inhabited by majority groups were the least exposed to the incidence of chronic diseases. Thus, the second hypothesis of the study suggesting that "Roma who live in highly segregated areas are expected to be more likely to have chronic diseases than Roma who live in areas inhabited by majority groups or mixed neighborhoods." was confirmed. The first hypothesis of the study, "Segregated Roma are more likely to experience chronic diseases than segregated majority groups" was also confirmed. This is based on the results obtained from Figure 5, indicating that Roma report 1.2 higher odds to be chronically ill than the non-Roma living in neighborhoods inhabited by majority groups. However, an interesting finding is that Roma who live in integrated area have lower odds of reporting chronic diseases than majority populations living in all types of neighborhoods. This finding contradicts the argument proposed by Timberlake and Ignatov (2014), suggesting that segregation leads to the benefit of more affluent groups, mostly represented by the majority groups.

In countries with high levels of segregation, like Macedonia, non-Roma reported worse health outcomes if living in segregated neighborhoods, while the Roma living in mixed neighborhood reported the worst health outcomes. Conversely, in countries with low levels of Roma segregation, such as Bosnia and Herzegovina, Roma living in residential areas inhabited by majority groups were the most vulnerable to chronic diseases. Therefore, no relationship can be established between the country level of segregation and incidence of chronic disease. When adding control variables for demographic and socio-economic characteristics, the effect of segregation was diminished. Being over 60 years old was correlated with a higher propensity of being chronically ill. Also, females were more likely to have worse health outcomes in both samples. Marital status generated different effects among the two groups. Being married was correlated with a higher risk of chronic diseases among non-Roma and lower risk among Roma. Employment and high levels of income were associated with lower odds of being chronically ill among both groups. Education, on the other hand, was a predictor of good health only among the Roma. Another difference consists in the fact that close proximity to medical facilities is associated with a lower likelihood to report chronic diseases only among the non-Roma group. The results also differed when taking into account the impact of housing conditions, since the non-Roma were most likely to be ill if living in apartments, while the Roma reported the highest likelihood to report chronic diseases if living in slums.

4.5 Limitations

The current study is not without limitations. Although the data employed from the UNDP survey is nationally representative, the results can only be generalized for the Roma community and for majority groups living in the close proximity of Roma settlements. In addition, the study fails to take into account the impact of health risk behaviors, which is known, from previous empirical studies, to be the most important contributor to the chronic disease incidence. Better indexes for poverty that have been suggested in the literature, such as Gini coefficients could be used as a proxy indicating the socio-economic differences between the Roma and non-Roma. Also, instead of running separate regressions the two samples and for each country under observation, simple controls for ethnicity and country effects could be used.

5 Conclusion

The current study has underscored that the disparities in chronic diseases between Roma and non-Roma are driven by residential segregation. Even though the two samples reported similar rates of chronic disease prevalence, some differences were found when taking into account the impact of residential segregation and the effect of demographic and socio-economic characteristics. The results were mostly consistent with the expectations formulated in the introductory part. However, one key finding that can draw a clear difference between the two groups is that segregation and poor socio-economic outcomes are more obvious drivers for chronic disease prevalence among Roma.

Thus, it can be concluded that efforts to reduce residential segregation among the Roma should focus on both individual and community-level factors. This can be achieved if community-based organizations put more efforts in implementing effective programs aiming to improve the health of Roma community. Housing opportunities should target the creation of safe spaces with adequate standards for living. It is vital that education and employment opportunities will be created at the local level. Women should also benefit from more efficient programs since they represent an even more vulnerable group. In addition, specialized programs addressing the negative effects of spatial segregation could encourage positive changes in the culture and preferences of Roma minorities. Last but not least, programmes aimed at improving the health status of majority populations should be implemented, as it has been demonstrated that majority populations may be even more exposed to the risk of chronic diseases than integrated Roma.

5.1 Research Aims

In the introductory section, the following research questions were addressed: “How does residential segregation affect the Roma – non-Roma gap in chronic disease prevalence?” and “What drives differences in chronic disease prevalence among Roma?”. The study compared the two samples by examining the impact of segregation and other demographic and socio-economic factors upon the incidence of chronic diseases. It concluded that segregation is a stronger indicator of poor health in the case of Roma.

5.2 Research Objectives

The objective of the present study was to examine the association between residential segregation and health outcomes among the Balkan Roma communities, and more specifically

whether living in segregated neighborhoods has an association with chronic disease prevalence. This was for the purpose of enlarging the literature dealing with Roma health and social situation and for providing a comparative perspective in order to possibly find solutions to this issue. Since the study found that segregation and chronic disease prevalence are correlated, several methods of reducing residential segregation have been addressed in the following section, containing practical implications of the study.

5.3 Practical Implications

The study has shown that there is a strong relationship between residential segregation and health outcomes. Thus, new policies and projects should be developed in order to increase integration and to improve the situation of Roma through more vocational trainings and employment opportunities. This can be achieved through more investments in urban planning but also through social programmes directed towards increased integration. Housing initiatives should also focus on decreasing segregation and ensure equal opportunities for vulnerable groups. More programmes for targeting Roma communities are needed in order to gather reliable data that can offer more insight on the relationship between residential segregation, housing conditions, health outcomes and healthcare access.

Roma social housing provided by municipalities often intensifies the degree of segregation since it clusters Roma even more in certain residential areas. The issue of substandard living conditions also needs to be addressed by national authorities. Thus, special housing projects need to ensure adequate accommodation in order to decrease the degree of marginalization among Roma. Complementary to housing renovation and building, construction of access roads to networks such as electricity, water and waste disposal services should be provided in order to ensure a more effective desegregation process. In order to effectively promote new strategies for desegregation, the Roma minority should also be involved in the process, through community management structures targeting health, housing, education and employment (European Commission, 2004).

5.4 Future Research

Further research can include other determinants of health related to lifestyle such as tobacco and alcohol consumption and physical exercise. In addition, the study can also take into account residential segregation in rural areas. More updated data from the UNDP 2011 can be used for future research once it is made available, in order to capture the time dynamics of the impact of residential segregation. In addition, data from the FRA Roma Pilot Survey can also be added to the UNDP dataset, in order to examine the Roma situation in more EU countries and to provide a comparable picture of the Roma health and their living conditions in different contexts. Possible future studies can also try to address the above-mentioned limitations in order to provide more reliable evidence on the Roma health situation.

References

Andersen, R.M. (1995): Revisiting the Behavioral Model and Access to Medical Care: Does It Matter?. *Journal of Health and Social Behavior*, Vol. 36 (March): 1-10.

Bobakova, D., Dankulincova Z.V., Babinska, I., Klein, D. Geckova. A.M., Cislakova, L. (2015). Differences between Roma and non-Roma in how social support from family and friends helps to overcome health care accessibility problems. *International Journal for Equity in Health*. 14:37. DOI 10.1186/s12939-015-0165-z.

Collet, D. (1994). Modelling Binary Data. Chapman & Hall, London, UK.

Cook, B.;Wayne, G.F.; Valentine, A.; Lessios, A.; Yeh, E. (2013). Revisiting the evidence on health and health care disparities among the Roma: A systematic review 2003-12. *Int. J. Public Health.* 58, 885–911.

Cornwell E.Y., Cornwell B. (2008). Access to expertise as a form of social capital: an examination of race- and class-based disparities in network ties to experts. *Sociological Perspectives*. 51(4):853–876.

Dobranici, M., Buzea, A., Popescu, R. (2012). The cardiovascular risk factors of the Roma (Gypsies) people in Central-Eastern Europe: a review of the published literature. *J Med Life*. 5:382–389

Eurofound (2012). European Foundation for the Improvement of Living and Working Conditions. Living conditions of the Roma: Substandard housing and health.

European Commission (2004). Equality and non-discrimination in an enlarged European Union. ISBN 92-894-7665-6.

European Commission (2014). Report on the health status of the Roma population in the EU and monitoring data collection in the area of Roma health in the Member States. ISBN 978-92-79-37904-8. DOI 10.2772/3140.

European Union Agency for Fundamental Rights (2010). The State of Roma and Traveller Housing in the European Union Steps towards Equality. ISBN: 978-92-9192-582-7. doi:10.2811/6705.

European Union Agency for Fundamental Rights (2012). The situation of Roma in 11 EU Member States - Survey results at a glance. ISBN 978-92-9192-932-0 (FRA). doi: 10.2811/76056.

European Union Agency for Fundamental Rights (2014). Report Roma Pilot Survey. Technical report: methodology, sampling and fieldwork, ISBN 978-92-9239-291-8 doi:10.2811/49351.

European Union Agency for Fundamental Rights (2014). Roma survey – Data in focus Poverty and employment: the situation of Roma in 11 EU Member States. ISBN 978-92-9239-308-3. doi:10.2811/50875.

Földes, M.E. and Covaci, A. (2012). Research on Roma health and access to healthcare: state of the art and future challenges. *Int J Public Health*. 57:37–39. DOI 10.1007/s00038-011-0312-2.

Gaskin D.J., Price, A., Brandon, D.T., LaVeist, T.A. (2009) Segregation and disparities in health services use. *Medical Care Research and Review*. 66(5):578–89.

Gaskin, D.J, Dinwiddie, G.Y., Chan, K., McCleary, R. (2012). Residential Segregation and Disparities in Health Care Services Utilization. *Medical Care Research and Review* 69(2) 158–175. DOI: 10.1177/1077558711420263

Hajioff, S.; McKee, M. (2000). The health of the Roma people: A review of the published literature. J. Epidemiol. Community Health, 54, 864–869.

Ivanov, A., Keller, S., & Till-Tentschert, U. (2015). Roma poverty and deprivation : the need for multidimensional anti-poverty measures. Oxford Poverty & Human Development Initiative (OPHI).

Janevic , T., Jankovic, J., Bradley, E. (2012) Socioeconomic position, gender, and inequalities in self-rated health between Roma and non-Roma in Serbia. *International Journal of Public Health.* 57(1):49-55. doi: 10.1007/s00038-011-0277-1

Link, B.G. and Phelan, J. (1995). Social Conditions As Fundamental Causes of Disease. *Journal of Health and Social Behavior*. Published by: American Sociological Association. DOI: 10.2307/2626958.

Logan, T.D.; Parman, J.M. (2017). *Journal of Economic History*. Vol. 77 Issue 1, p127-170. 44p. DOI: 10.1017/S0022050717000079.

Massey, D.S. (1990). "American Apartheid: Segregation and the Making of the Underclass." *The American Journal of Sociology*. 96(2):329-357.

Massey, D.S. and Denton, N.A. (1988). The Dimensions of Residential Segregation. *Social Forces.* Volume 67:2.

Massey, D.S. and Denton, N.A. (1993). American Apartheid: Segregation and the Making of the Underclass. *Harvard University Press*. Cambridge, MA.

Massey, D.S. and Fischer, M.J. (2000). "How Segregation Concentrates Poverty." *Ethnic and Racial Studies*. 23(4):670-691.

Massey, D.S., Andrew B.G. and Shibuya, K. (1994). Migration, Segregation, and the Geographic Concentration of Poverty. *American Sociological Review* 59(3):425-445.

Morewitz, S.J. (2006). Chronic Diseases and Health Care - New Trends in Diabetes, Arthritis, Osteoporosis, Fibromyalgia, Low Back Pain, Cardiovascular Disease, and Cancer. Springer US. pp. 33-34.

PAHO/WHO (2011). Women and Men Face Different Chronic Disease Risks. [online] www.paho.org. [Accessed 10 Apr. 2018].

Pandley, M.K. (2009). Association between Marital Status and Health: Examining the Role of Age and Gender. ASARC Working Paper.

Parekh N., Rose T. (2011). Health inequalities of the Roma in Europe: a literature review. *Central European Journal of Public Health.* 19:139–142

Schelling, T.C. (1969). Models of Segregation. *The American Economic Review*, Vol. 59, No. 2, Papers and Proceedings of the Eighty- first Annual Meeting of the American Economic Association, pp. 488-493.

Tanner, A. (2005). The Roma of Eastern Europe: Still Searching for Inclusion. [online] migrationpolicy.org. Available at: https://www.migrationpolicy.org/article/roma-eastern-europe-still-searching-inclusion [Accessed 10 Apr. 2018].

Testa, M., Astone, N.M., Krogh M., Neckerman, K.M. (1993). Employment and Marriage among Inner-city Fathers". pp. 96-108 in The Ghetto Underclass, edited by William Julius Wilson. Newberry Park, CA: Sage.

Timberlake, J.M and Ignatov, M.D. (2014). Residential Segregation. *Sociology*. DOI: 10.1093/obo/9780199756384-0116.

UNDP (2006). At Risk: Roma and the Displaced in Southeast Europe. ISBN: 92-95042-53-0.

UNDP (2012). Integrated household surveys among Roma populations - One possible approach to sampling used in the UNDP - World Bank - EC Regional Roma Survey 2011. ISBN 978-92-95092-53-2.

Williams, D.R., Collins, C. (2001). Racial Residential Segregation: A Fundamental Cause of Racial Disparities in Health. *Public Health Rep*. 116(5): 404–416. DOI: 10.1093/phr/116.5.404.

Wilson, W.J. (1987). The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy. Chicago, IL: University of Chicago. ISBN-13: 978-0-226-90126-8 (paper).

Wilson, W.J. (1996). When Work Disappears: The World of the New Urban Poor. New York, NY: Random House.

Appendix A

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Non-Roma) – Albania

	A1	St. Error	A2	St. Error	A3	St. Error	A4	St. Error
Type of Neighborhood								
Minority	9.007**	(9.137)	7.636**	(7.850)	5.208	(5.491)	3.497	(3.699)
Mixed	1.234	(1.525)	1.061	(1.336)	0.663	(0.843)	0.472	(0.604)
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.037**	(0.038)			0.111**	(0.119)
30-44			0.050**	(0.021)			0.090**	(0.044)
45-59			0.298**	(0.075)			0.323**	(0.113)
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.319**	(0.178)			0.304†	(0.189)
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			1.675	(0.881)			1.578	(0.936)
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.122**	(0.033)	0.349**	(0.120)
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					0.198**	(0.080)	0.307**	(0.129)
Medium					0.494**	(0.160)	0.599	(0.203)
High					1	(omitted)	1	(omitted)
Education								
Primary					0.680	(0.247)	0.643	(0.249)
Secondary					0.608	(0.206)	0.723	(0.249)
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					5.161	(5.442)	6.821†	(7.236)
Medium					1	(omitted)	1	(omitted)
Housing								
Apartment					3.076**	(1.305)	3.008**	(1.330)
New house					2.094†	(0.899)	2.074†	(0.917)
Old house					1.208	(0.984)	1.104	(1.132)
Slum					1	(omitted)	1	(omitted)
Observations	1,282							

**** p<0.05, † p<0.1. Standard errors in parentheses**

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Roma) – Albania

	B1	St. Error	B2	St. Error	B3	St. Error	B4	St. Error
Type of Neighborhood								
Minority	1.167	(0.486)	0.974	0.420)	2.556†	1.264	2.214	(1.116)
Mixed	2.906**	(1.343)	2.836**	(1.358)	6.288**	3.536682	6.561**	(3.791)
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.113**	(0.071)			0.060**	(0.048)
30-44			0.352**	(0.088)			0.323**	(0.111)
45-59			0.298**	(0.076)			0.464**	(0.153)
60+			1	(omitted)			1	(omitted)
Gender								
Male			1.719	(0.806)			2.790†	(1.601)
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			0.305**	(0.122)			0.261**	(0.129)
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.330**	(0.076)	0.564**	(0.154)
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					3.717**	(1.597)	5.009**	(2.228)
Medium					2.325†	(1.025)	2.525**	(1.143)
High					1	(omitted)	1	(omitted)
Education								
Primary					4.757**	(2.351)	4.030**	(2.011)
Secondary					1.225	(0.612)	1.016	(0.539)
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					0.357**	(0.141)	0.351**	(0.149)
Medium					1	(omitted)	1	(omitted)
Housing								
Apartment					0.310**	(0.181)	0.154**	(0.095)
New house					0.878	(0.469)	0.426	(0.241)
Old house					1.082	(0.552)	0.666	(0.354)
Slum					1	(omitted)	1	(omitted)
Observations	1,503							

**** p<0.05, † p<0.1. Standard errors in parentheses**

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Non-Roma) – Bulgaria

	A1	St. Error	A2	St. Error	A3	St. Error	A4	St. Error
Type of Neighborhood								
Minority	0.454**	(0.134)	0.395**	(0.134)	0.366**	(0.123)	0.401**	0.148
Mixed	1.224	(0.358)	1.091	(0.369)	0.865	(0.287)	0.0896**	0.330
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.030**	(0.022)			0.029**	0.022
30-44			0.062**	(0.020)			0.0561**	0.021
45-59			0.248**	(0.053)			0.197**	0.055
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.538**	(0.137)			0.507**	0.144
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			1.187	(0.310)			1.080	0.324
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.149	(0.039)	0.530**	0.165
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					0.937	(0.266)	0.647	0.204
Medium					1.049	(0.295)	0.951	0.286
High					1	(omitted)	1	(omitted)
Education								
Primary					0.310	(0.112)	0.297	0.119
Secondary					1.055	(0.356)	1.204	0.455
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					0.164	(0.109)	0.245**	0.175
Medium					0.224†	(0.183)	0.400	0.345
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					7.728	(3.595)	3.681**	1.806
New house					7.257	(3.407)	3.322**	1.652
Old house					5.304	(2.314)	2.741**	1.253
Slum					1	(omitted)	1	(omitted)
Observations	994							

**** p<0.05, † p<0.1. Standard errors in parentheses**

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Roma) – Bulgaria

	B1	St. Error	B2	St. Error	B3	St. Error	B4	St. Error
Type of Neighborhood								
Minority	3.047**	(1.260)	3.157**	(1.327)	2.654**	(1.145)	2.719**	(1.217)
Mixed	0.795	(0.358)	0.754	(0.344)	0.958	(0.455)	0.907	(0.445)
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			1	(omitted)			1	(omitted)
30-44			0.768	(0.199)			0.903	(0.277)
45-59			1.585**	(0.367)			2.042**	(0.551)
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.606**	(0.152)			0.574†	(0.165)
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			0.954	(0.252)			1.025	(0.312)
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.944**	(0.237)	0.990	(0.281)
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					3.035**	(1.525)	3.593**	(1.855)
Medium					2.972**	(1.540)	3.251**	(1.725)
High					1	(omitted)	1	(omitted)
Education								
Primary					1	(omitted)	6.430**	(2.475)
Secondary					6.188	(2.324)	1	(omitted)
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					1.290	(1.068)	1.380	(1.151)
Medium					0.639	(0.671)	0.583	(0.627)
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					0.601	(0.238)	0.506	(0.213)
New house					0.871	(0.297)	0.720	(0.262)
Old house					1.188	(0.289)	0.958	(0.257)
Slum					1	(omitted)	1	(omitted)
Observations	1,448							

**** p<0.05, † p<0.1. Standard errors in parentheses**

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Non-Roma) – Bosnia and Herzegovina

	A1	St. Error	A2	St. Error	A3	St. Error	A4	St. Error
Type of Neighborhood								
Minority	0.524**	(0.125)	0.566**	(0.141)	0.513	0.131	0.555	0.147
Mixed	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Majority	-		-		-		-	
Age								
18-29			0.093**	(0.051)			0.090	0.051
30-44			0.172**	(0.052)			0.179	0.060
45-59			0.322**	(0.085)			0.350	0.100
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.563†	(0.181)			0.371	0.132
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			1.164	(0.380)			1.208	0.416
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.362	0.113	0.6140	0.205
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					1.151	0.365	0.957	0.320
Medium					1.479	0.402	1.439	0.417
High					1	(omitted)	1	(omitted)
Education								
Primary					0.612	0.267	0.421	0.198
Secondary					1.226	0.496	1.279	0.543
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					0.833	0.551	0.611	0.435
Medium					0.888	0.640	0.783	0.609
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					1.956	0.687	0.996	0.381
New house					1.312	0.508	0.873	0.359
Old house					0.864	0.293	0.541	0.196
Slum					1	(omitted)	1	(omitted)
Observations	1,013							

**** p<0.05, † p<0.1. Standard errors in parentheses**

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Roma) – Bosnia and Herzegovina

	B1	St. Error	B2	St. Error	B3	St. Error	B4	St. Error
Type of Neighborhood								
Minority	0.426†	(0.202)	0.456	(0.225)	0.532	(0.279)	0.623	0.340)
Mixed	0.284**	(0.133)	0.291**	(0.143)	0.393**	(0.201)	0.444	0.237)
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.328**	(0.159)			0.326**	(0.168)
30-44			0.652	(0.199)			0.630	(0.212)
45-59			1.289	(0.360)			1.512	(0.455)
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.421**	(0.125)			0.613	(0.198)
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			1.286	(0.391)			1.414	(0.461)
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.424**	(0.158)	0.413**	(0.159)
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					1.271	(0.367)	1.270	(0.380)
Medium					1.066	(0.300)	1.194	(0.347)
High					1	(omitted)	1	(omitted)
Education								
Primary					11.785**	(12.198)	9.977**	(10.381)
Secondary					2.431	(2.561)	2.269	(2.402)
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					1.484	(0.880)	1.128	(0.680)
Medium					1.838	(1.182)	1.514	(0.986)
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					0.594	(0.219)	0.455**	(0.177)
New house					0.933	(0.319)	0.772	(0.275)
Old house					0.960	(0.256)	0.780	(0.217)
Slum					1	(omitted)	1	(omitted)
Observations	1,023							

**** p<0.05, † p<0.1. Standard errors in parentheses**

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Non-Roma) – Croatia

	A1	St. Error	A2	St. Error	A3	St. Error	A4	St. Error
Type of Neighborhood								
Minority	0.783	(0.233)	0.542†	(0.193)	0.644	0.212	0.595	0.230
Mixed	0.618	(0.198)	0.446**	(0.169)	0.582	0.202	0.548	0.224
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.049**	(0.021)			0.037**	0.018
30-44			0.053**	(0.018)			0.037**	0.015
45-59			0.261**	(0.070)			0.174**	0.058
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.616	(0.188)			0.612	0.195
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			0.846	(0.259)			0.703	0.223
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.555	0.147	1.697	0.584
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					2.984	1.222	3.175**	1.563
Medium					2.293	0.664	2.072**	0.736
High					1	(omitted)	1	(omitted)
Education								
Primary					0.7055	0.301	0.645	0.309
Secondary					1.335	0.516	1.751	0.747
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					1.967	1.057	1.381	0.858
Medium					2.310	1.267	1.534	0.978
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					2.804	1.088	1.381	0.624
New house					1.062	0.417	1.157	0.523
Old house					1.257	0.425	0.932	0.373
Slum					1	(omitted)	1	(omitted)
Observations	921							

**** p<0.05, † p<0.1. Standard errors in parentheses**

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Roma) – Croatia

	B1	St. Error	B2	St. Error	B3	St. Error	B4	St. Error
Type of Neighborhood								
Minority	0.324**	(0.136)	0.378**	(0.162)	0.324**	(0.147)	0.278**	(0.134)
Mixed	0.551	(0.232)	0.597	(0.254)	0.482	(0.216)	0.388**	(0.185)
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.453	(0.330)			1.137	(0.994)
30-44			1.908	(0.933)			6.562**	(4.448)
45-59			1.617	(0.851)			6.158**	(4.360)
60+			1	(omitted)			1	(omitted)
Gender								
Male			1.756	(0.926			3.402	(2.443)
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			1.314	(0.665)			1.357	(0.822)
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.591	(0.252)	0.372	(0.165)
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					0.342	(0.358)	0.459	(0.488)
Medium					1.336	(0.562)	1.933	(0.871)
High					1	(omitted)	1	(omitted)
Education								
Primary					4.417	(4.760)	3.223	(3.532)
Secondary					1.659	(1.801)	1.012	(1.121)
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					2.730	(2.936)	3.251	(3.578)
Medium					2.590	(2.815)	3.511	(3.909)
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					1.075	(0.778)	1.612	(1.258)
New house					1.972	(1.181)	2.110	(1.316)
Old house					1.681	(0.906)	1.840	(1.031)
Slum					1	(omitted)	1	(omitted)
Observations	567							

**** p<0.05, † p<0.1. Standard errors in parentheses**

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Non-Roma) – Macedonia

	A1	St. Error	A2	St. Error	A3	St. Error	A4	St. Error
Type of Neighborhood								
Minority	1.121	(0.452)	1.325**	(0.567)	1.268	(0.573)	1.653	(0.802)
Mixed	0.231**	(0.190)	0.301	(0.256)	0.333	(0.285)	0.449	(0.403)
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.205	(0.093)			1	(0.147)
30-44			0.142**	(0.045)			0.143**	(0.052)
45-59			0.349**	(0.084)			0.349**	(0.105)
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.438	(0.116)			0.463**	(0.143)
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			1.607	(0.490)			1.351	(0.474)
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.520**	(0.142)	0.960	(0.308)
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					0.494**	(0.147)	0.813	(0.274)
Medium					0.482**	(0.139)	0.617	(0.192)
High					1	(omitted)	1	(omitted)
Education								
Primary					0.543	(0.205)	0.395**	(0.162)
Secondary					0.703	(0.243)	0.832	(0.311)
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					1.435	(1.103)	1.138	(0.905)
Medium					1.406	(1.114)	1.260	(1.103)
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					11.175**	(5.297)	9.299**	(4.666)
New house					3.712**	(1.754)	3.198**	(1.573)
Old house					2.933**	(1.282)	2.625**	(1.192)
Slum					1	(omitted)	1	(omitted)
Observations	830							

**** p<0.05, † p<0.1. Standard errors in parentheses**

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Roma) – Macedonia

	B1	St. Error	B2	St. Error	B3	St. Error	B4	St. Error
Type of Neighborhood								
Minority	0.491**	(0.155)	0.513**	(0.164)	0.221**	(0.098)	0.233**	(0.108)
Mixed	1.368	(0.590)	1.568	(0.691)	0.537	(0.298)	0.670	(0.383)
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.350**	(0.143)			0.180**	(0.085)
30-44			0.569**	(0.139)			0.371**	(0.115)
45-59			0.873	(0.192)			0.691	(0.198)
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.695	(0.156)			0.699	(0.183)
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			1.239	(0.318)			1.744**	(0.548)
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.481**	(0.145)	0.518**	(0.165)
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					2.113**	(0.722)	2.671**	(0.944)
Medium					3.595**	(1.247)	4.052**	(1.440)
High					1	(omitted)	1	(omitted)
Education								
Primary					7.486**	(5.757)	8.664**	(6.796)
Secondary					1.518	(1.199)	1.826	(1.474)
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					0.337	(0.238)	0.411	(0.296)
Medium					0.435	(0.379)	0.533	(0.472)
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					0.049**	(0.038)	0.035**	(0.028)
New house					0.843	(0.257)	0.717	(0.225)
Old house					1.137	(0.265)	1.032	(0.248)
Slum					1	(omitted)	1	(omitted)
Observations	1,213							

**** p<0.05, † p<0.1. Standard errors in parentheses**

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Non-Roma) – Romania

	A1	St. Error	A2	St. Error	A3	St. Error	A4	St. Error
Type of Neighborhood								
Minority	0.022**	(0.013)	0.0225**	(0.013)	0.031**	(0.020)	0.042**	(0.026)
Mixed	0.564**	(0.111)	0.5747**	(0.123)	0.585**	(0.130)	0.571**	(0.137)
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.081**	(0.044)			0.066**	(0.043)
30-44			0.085**	(0.028)			0.066**	(0.026)
45-59			0.391**	(0.087)			0.334**	(0.092)
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.525**	(0.119)			0.557**	(0.162)
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			1.439	(0.394)			1.401	(0.435)
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.191**	(0.055)	0.436**	(0.141)
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					1.594	(0.559)	1.843	(0.712)
Medium					1.682	(0.591)	1.576	(0.590)
High					1	(omitted)	1	(omitted)
Education								
Primary					0.248**	(0.097)	0.173**	(0.075)
Secondary					0.381**	(0.139)	0.469†	(0.184)
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					0.096†	(0.134)	0.027**	(0.048)
Medium					0.073†	(0.106)	0.020**	(0.035)
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					24.132**	(25.131)	18.857**	(20.013)
New house					10.422**	(10.982)	9.034**	(9.739)
Old house					15.551**	(15.897)	12.294**	(12.775)
Slum					1	(omitted)	1	(omitted)
Observations	1,450							

**** p<0.05, † p<0.1. Standard errors in parentheses**

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Roma) – Romania

	B1	St. Error	B2	St. Error	B3	St. Error	B4	St. Error
Type of Neighborhood								
Minority	11.411**	(4.935)	16.398**	(7.264)	7.784**	(3.486)	10.078**	(4.665)
Mixed	5.081**	(2.200)	5.728**	(2.513)	4.937**	(2.192)	5.282**	(2.394)
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.132**	(0.065)			0.148**	(0.083)
30-44			0.295**	(0.081)			0.537**	(0.164)
45-59			1.257	(0.271)			2.020**	(0.500)
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.525**	(0.119)			0.614†	(0.155)
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			0.712†	(0.161)			0.646†	(0.161)
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.507**	(0.145)	0.577†	(0.178)
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					1.595	(0.586)	1.541	(0.598)
Medium					0.747	(0.310)	0.704	(0.307)
High					1	(omitted)	1	(omitted)
Education								
Primary					2.000	(1.165)	1.904	(1.139)
Secondary					0.673	(0.404)	0.778	(0.478)
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					1.531	(0.481)	1.584	(0.532)
Medium					1.169	(0.208)	1.251	(0.337)
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					1.097	(0.426)	0.640	(0.265)
New house					0.927	(0.329)	0.769	(0.290)
Old house					0.928	(0.221)	0.648†	(0.169)
Slum					1	(omitted)	1	(omitted)
Observations	2,816							

**** p<0.05, † p<0.1. Standard errors in parentheses**

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Non-Roma) – Serbia

	A1	St. Error	A2	St. Error	A3	St. Error	A4	St. Error
Type of Neighborhood								
Minority	1.320	0.230	1.499**	(0.284)	0.736	(0.300)	1.457	(0.308)
Mixed	1.159	(0.104)	1.228	(0.201)	0.987	(0.415)	1.216	(omitted)
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.013**	(0.013)			0.013	(0.014)
30-44			0.099**	(0.023)			0.104	(0.029)
45-59			0.319**	(0.059)			0.334	(0.075)
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.482**	(0.120)			0.482	(0.135)
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			1.072	(0.260)			1.099	(0.294)
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.388**	(0.129)	0.329	(0.080)
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					1.416**	(0.371)	1.140	(0.281)
Medium					0.756	(0.224)	0.995	(0.234)
High					1	(omitted)	1	(omitted)
Education								
Primary					8.882	(2.628)	0.193	(0.058)
Secondary					1.396	(0.380)	1.001	(0.234)
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					3.154	(2.504)	0.595	(0.390)
Medium					2.047	(1.723)	1.015	(0.715)
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					0.337**	(0.158)	2.033	(0.553)
New house					1.531	(0.504)	0.877	(0.284)
Old house					1.334	(0.327)	0.086	(0.225)
Slum					1	(omitted)	1	(omitted)
Observations	1,760							

**** p<0.05, † p<0.1. Standard errors in parentheses**

Results of binary logistic regression of incidence of chronic diseases on residential segregation presented as odds ratios (Roma) – Serbia

	B1	St. Error	B2	St. Error	B3	St. Error	B4	St. Error
Type of Neighborhood								
Minority	0.735	(0.256)	0.602	(0.215)	0.736	0.300	0.624	(0.268)
Mixed	0.938	(0.344)	0.747	(0.282)	0.987	0.415	0.916	(0.404)
Majority	1	(omitted)	1	(omitted)	1	(omitted)	1	(omitted)
Age								
18-29			0.247**	(0.112)			0.325	(0.173)
30-44			0.406**	(0.096)			0.426	(0.124)
45-59			0.664†	(0.140)			1.011	(0.270)
60+			1	(omitted)			1	(omitted)
Gender								
Male			0.657	(0.169)			0.861	(0.295)
Female			1	(omitted)			1	(omitted)
Marital Status								
Married			0.726	(0.178)			0.431	(0.140)
Not Married			1	(omitted)			1	(omitted)
Employment								
Employed					0.388**	0.129	0.493	(0.172)
Not-employed					1	(omitted)	1	(omitted)
Income								
Low					1.416	0.371	1.449	(0.392)
Medium					0.756	0.224	0.986	(0.303)
High					1	(omitted)	1	(omitted)
Education								
Primary					8.882**	2.628	9.089	(2.709)
Secondary					1.809	(0.314)	1.922	(0.497)
Tertiary					1	(omitted)	1	(omitted)
Healthcare access								
Easy					3.154	2.504	3.435	(2.745)
Medium					2.047	1.723	2.272	(1.927)
Difficult					1	(omitted)	1	(omitted)
Housing								
Apartment					0.337**	0.158	0.196	(0.097)
New house					1.531	0.504	1.337	(0.462)
Old house					1.334	0.327	1.259	(0.319)
Slum					1	(omitted)	1	(omitted)
Observations	1,249							

**** p<0.05, † p<0.1. Standard errors in parentheses**