The influence of contextual factors on immigrants' health status: a population census approach

Vincent Lorant [1 *], Patrick Deboosere [2], Herman Van Oyen [3], Isabelle Thomas[4]

(1) Public Health School, Université Catholique de Louvain, Belgium
(2) Interface Demography,VUB, Belgium
(3) Epidemiology, ISSP, Belgium
(4) National Fund for Scientific research and Institute of Geography, Université Catholique de Louvain, Belgium

*corresponding author postal address :

(1) Clos chapelle aux champs 30.41 1200 Bruxelles, Belgium.

Phone 32-2-7643263; Fax 32-2-7643183; Email : lorant@sesa.ucl.ac.be

Abstract

Previous research on health disparities between immigrant and native populations has put the emphasis on individual socio-economic factors. However, poor health among immigrants might also be accounted for by risk factors linked to the place where they live. The aim of this study was to investigate the influence of contextual factors on disparities in self-rated health between immigrant groups. We used the Belgian census, covering 6,712,497 individuals aged 25-64 and living in private households. Subjective health and long-term illness were assessed for 15 groups of nationalities. Environmental nuisance, migrant concentration, lack of public service amenities, lack of social capital, and unemployment rate were the contextual factors computed at the neighborhood level. Logistic regression was used to analyze the influence of such factors, while controlling for socio-economic status. Compared with Belgians, immigrant groups from Turkey and Morocco were more likely to have poorer subjective health. Local unemployment rate and perceived lack of public services were associated with a higher risk of poor health status. These associations were weakened, but remained significant, after controlling for the composition of the neighbourhood. When contextual factors or socio-economic status were allowed for, all immigrant groups had a similar or even better health status than Belgians. The influence of contextual factors on migrant disparities in health were similar between metropolitan areas and non-metropolitan areas. We concluded that policies should aim at improving local opportunities in public services and tackling labour market discrimination.

Abstract Count: 257

Keywords : Immigrants; social class; social environment; health; environmental issues;

Word Count: 7900 (including references and tables)

Introduction

Migration is accelerating, becoming more global and diverse (Castles and Miller, 2003). Since the 1970s, annual net migration to Europe has increased strongly, reaching a yearly rate of five immigrants per 1000 inhabitants (European Commission, 2004). Without immigration, some countries, such as Germany or Italy, would have had a population loss.

Ethnic minorities and immigrants have long been of interest to public health investigation. Indeed, mortality disparities between ethnic groups have been shown in the US (Franks et al., 2003; Sorlie et al., 1995) and in the UK (Marmot et al., 1984). Disparities in morbidity or in health status have also been noted (Browning et al., 2003a; Kington and Smith, 1997).

Because ethnic minority groups tend to have a lower socio-economic status, previous research has been keen to disentangle the influences of ethnicity and social class on health status. Early studies concluded that social class is not an important explanation of higher mortality among ethnic minority groups (Marmot et al., 1984; Wild and Mckeigue, 1997). But such results have been disputed by contrasting studies showing that ethnic minority disparities in health were, to a large extent, attributable to low socio-economic status (Kington and Smith, 1997; Lindstrom et al., 2001; Navarro, 1990; Nazroo, 1998).

Several factors may explain such mixed results. One review suggests that the contribution of socio-economic status to health disparities is disease specific (LillieBlanton et al., 1996); other authors have raised doubt about the methods used to adjust for socio-economic status (Kaufman et al., 1997) or to define ethnic groups (Kaplan and Bennett, 2003).

However, research on health disparities among immigrants has overlooked the importance of the living environment. With some exceptions (Karlsen et al., 2002; Smaje, 1995; Subramanian et al., 2005), research on ethnic and immigrant disparities in health has put the emphasis on individual socio-economic factors. But disparities in immigrants' health might also be explained by the place where immigrants are living. After all, immigrant groups are generally concentrated in deprived neighborhoods, in areas with a higher concentration of ethnic minority groups, or in areas with a lower supply of social and health services (Smaje, 1995).

Besides, previous research on health status has had a limited capacity to address immigrant health status, with the exception of the UK, where a survey on minority groups was conducted (Chandola, 2001). As a consequence, investigations of immigrant health disparities have often used rather broad categories of immigrant (such as “Latinos”, “Asian”) ignoring important differences that might arise within these groups (Bhopal et al., 1991). This is odd, given previous results showing that, in the UK, Indians had a lower health risk than Bangladeshis or Pakistanis; or, that in the US, Latinos do even better than Whites.

The aim of this study is therefore to investigate the influence of living environment on disparities in self-rated health between immigrant groups. Thanks to a large census survey, we were able to measure disparities in self-rated health between immigrant groups, and to estimate the contribution that contextual factors and compositional factors made to such disparities.

Theoretical background

In previous studies, contextual factors have mostly been defined in terms of socio-economic disadvantage such as area median income or area deprivation (Pickett and Pearl, 2001). Browning and colleagues complained that most contextual research had been devoted to socio-economic disadvantage and had, in fact, produced mixed results (Browning et al., 2003a). A recent review concludes that the causal pathways underpinning the relation between contextual factors and health needed to be clarified (Pickett and Pearl, 2001). Macintyre identified five types of contextual features that might influence health: physical features such as the quality of the environment; public services to support individuals in their daily lives; decent housing; socio-cultural features; and, finally, the reputation of the area (Macintyre et al., 2002).

The first theoretical underpinning of contextual factors is provided by the environmental perspective on health. Environmental hazards may contribute to ethnic or immigrant inequalities in health. Indeed, chemical intensive facilities are more likely to be located in areas with large ethnic minority groups (Elliott et al., 2004). This kind of differences in immigrant exposure has led to an increasing interest in and social activism (Brown et al., 2003) related to environmental justice, particularly in relation to exposure to air toxin or

asthma (Lopez, 2002). While Blacks are 2.5 times as likely than whites to die from asthma in the US as a whole, in Chicago they are 4.7 times as likely (Samet et al., 2001).

Public policies are generally expected to tackle such negative externalities due to toxic exposure. These policies provide a second theoretical line of enquiry, which addresses the role of public policies in improving health through local area policies. Indeed, some areas can be underprivileged in terms of public services related to education, health, and welfare (Kaplan et al., 1996; Kennedy BP et al., 1998), particularly in those countries where human capital investment is funded or organized at the local level. A number of public policies may improve local area conditions by the provision of health care facilities, geographical planning of medical manpower (Gravelle and Sutton, 1998), distribution of resources to local health authorities(Borrell and Hatch, 2005), or the targeting of specific high-risk areas through health area zones or urban regeneration policies(Curtis et al., 2002).

Thirdly, health may be influenced by collective social functioning. The Roseto effect, from the name of an Italian community, in the US, suggested that communities could be protected against a nation-wide increase in cardiovascular events thanks, presumably, to their social cohesion (Lomas, 1998). This began to foster a very productive body of research investigating the role of several social functioning concepts in the improvement of health status. Social capital was one of these. It has been defined as the capacity of individuals to command scarce resources by virtue of their membership in networks or broader social structures (Portes, 1998). This perspective has dramatically improved knowledge of racial differences in crime in the US. As emphasized by Sampson and Wilson, the community context, particularly social disorganization and culture, matters for the racial differentiation of criminal violence. They concluded that “the sources of crime are remarkably invariant across race and rooted instead in the structural differences among communities” (Sampson and Wilson, 1995). Social capital has since been applied to self-rated health (Kawachi et al., 1999b; Veenstra, 2000c), morbidity (McCulloch, 2001a; Veenstra, 2000b) and mortality (Kawachi et al., 1997; Veenstra, 2000d).

Finally, the deep structure of racism and discrimination may also explain disparities in immigrants’ health (Annandale, 1998). The way in which racism operates in medicine has long been investigated from the early racist discourse on the high rate of tuberculosis among black, to the more recent Tuskegee trial (Krieger, 1987). As suggested by Annandale, such

early scientific racism may be now increasingly superseded by cultural and socio-economic racism (Annandale, 1998). Indeed, the link between discrimination and poor health outcome is now being evidenced. Several studies have evidenced association between ethnic harassment or discrimination against immigrants and poor health status (Karlsen and Nazroo, 2002; Wiking et al., 2004). There is also widespread suspicion of ethnic discrimination in access to health care (Stronks et al., 2001) or in human rights violation by the health care system (Bhui et al., 2003). Increasingly, however, ethnic discrimination is considered at the contextual level, particularly in relation to residential segregation. In the US, a longstanding body of research has shown that, for a given social class, Blacks tend to be segregated within poor neighborhoods: for example, an average middle-class Black Philadelphian lives in a neighborhood with an unemployment rate of 11.4% while his White counter-part lives in a neighborhood with 4.8% unemployment (Pattillo, 2005). Evidence has also accumulated that such residential segregation is detrimental to health status (Williams and Collins, 2001) and increases the risk of morbidity (Acevedo-Garcia, 2001) and mortality(Fang et al., 1998).

In this paper we focus on these four types of contextual factors and assess whether environmental hazards, public amenities, socio-cultural factors, and socio-economic discrimination influence the disparities in self-rated health between immigrant groups.

Methods

Setting and Data

Belgium is a small but highly urbanized European country (with more than 10 million inhabitants in an area of approximately 30,000 sq. km). It is characterized by a quite dense urban network with large suburban areas. On average, city centers are occupied by deprived populations and suburban areas by better-off populations (Goffette-nagot et al., 2000). We used the Belgian 2001 Housing and Population Census, which is based on a questionnaire that was mailed to all residents aged six and over. Individuals not returning their questionnaire were sent a reminder. The National Institute of Statistics contacted 9,631,313 individuals aged 6+, of whom 9,333,428 replied (97%). The participation rate was high mainly because the census is mandatory under Belgian law. We limited our analysis to individuals aged between 15 and 64, and living in a private household (n=6,712,497).

Variables

Health status

We analysed two widely-used (Bowling, 1997)and validated (Idler, 1992)health variables: prevalence of poor subjective health and prevalence of long-standing illness. We modelled the probability of having poor subjective health (28%), or of having a longstanding illness (24%).

Individual-level variables

We included the following individual-level variables: gender, age group, educational status, employment status, housing tenure, and household type. As in previous studies, immigrant status was defined by nationality at birth (Wiking et al., 2004). For privacy reasons, the nationalities were available in 15 categories (table 1).

Contextual variables

We computed factors covering four features of the context: environmental hazards, public amenities, socio-cultural factors, and socio-economic discrimination. In relation to the environment, respondents were asked to rate the unpleasantness of their proximate environment in terms of noise pollution (19.1% complained of noise pollution, std=13.1%) and air pollution (mean=12.2%, std=12.4%). Because perceived noise pollution and air pollution were correlated (0.77), we computed an index of environmental nuisance that is the average of the standardized values of perceived noise pollution and perceived air pollution. Lack of services and amenities were assessed by an index computed on 5 questions regarding the availability of health services, public services, schools, childcare and cultural facilities. The index was the sum of the standardized variables (mean=0, std=4.26).

A summary index of social capital was computed on the basis of variables known to be related to collective efficacy (Sampson et al., 1997): percentage of single-parent families, percentage of elderly people living alone, percentage of renters and percentage of households complaining about litter in their neighborhood. The index was the sum of the standardized variables (mean=0, std=3.16) and was checked for its internal reliability (Chronbach's α =0.81). .

Two indicators of discrimination or segregation were computed. Migrant concentration concentration was computed as the percentage of non-Belgians in the population (mean=7.4%, std=11.6%) (Karlsen et al., 2002). To address discrimination in the labor market (Pattillo, 2005), we computed the percentage of unemployed individuals (mean=12.1%, std=8.2%) .

The percentage of immigrant is mapped in Figure 1. Large numbers of immigrants residents are mainly observed within urban agglomerations. A high proportion of foreign population is observed in the urban agglomeration of Brussels (centre) with a strong centre-periphery gradient, in the center of Antwerpen (north) as well as in the communes of the former coalmines and steel industry regions (Mons-Charleroi; Liège). A border effect also shows up in the east (with the Netherlands) and west (with France).

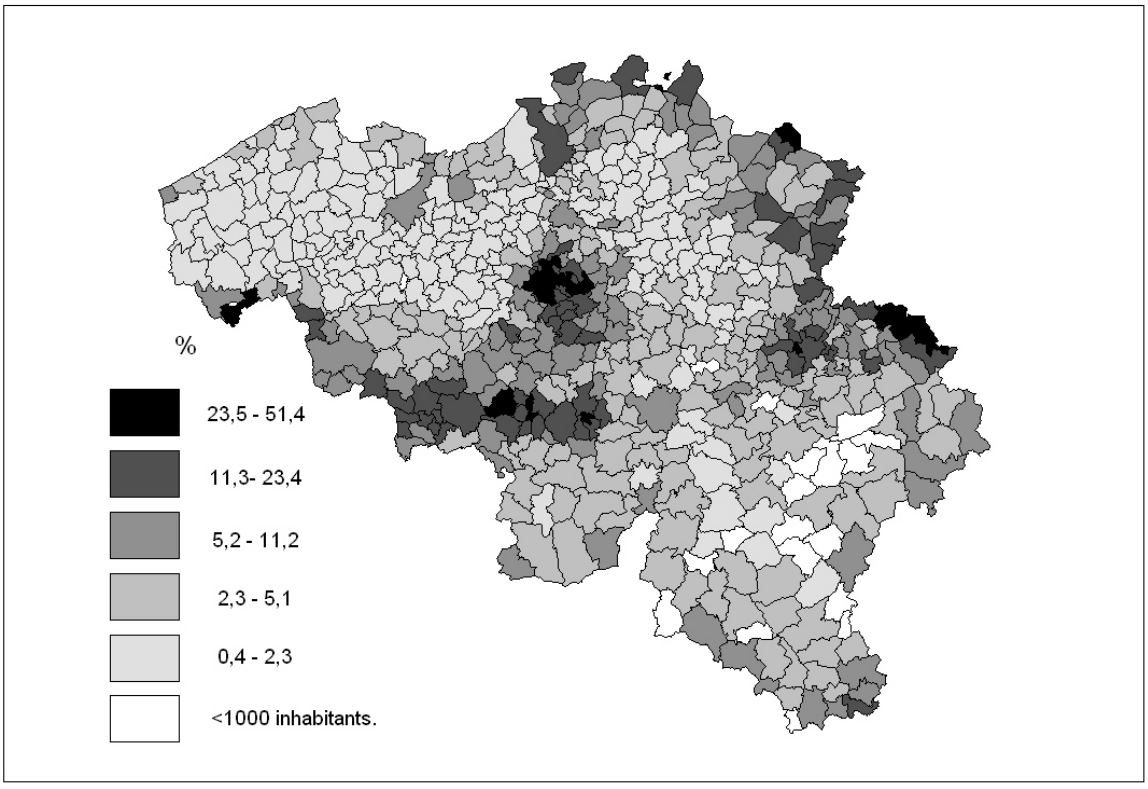

Figure 1 : Percentage of non-Belgian inhabitants in Belgium by commune
Source :Census 2001.

All contextual variables were computed at the block level, a block being comprised of about 640 individuals (Std=692). However, for legal and privacy reasons, the matching for small blocks was made at the municipality level. Our population was thus distributed into 13,686 blocks (covering 85.1% of the population) and 255 mainly rural municipalities (14.9% of the population).

Statistical analysis

In order to carry out our analysis of individual and neighborhood variables we used a contextual model (Diez-Roux, 2000). Despite the popularity of random model, we choose a contextual model for two reasons. First, as we used a census, there was no sampling of neighborhood as in the case of survey data. Second, we were interested in the fixed-effects of both of neighbourhood-level variables and individual-level variables and not in the variance components. However, we need to consider the issue of residual correlation, or clustering, because individuals living in the same neighbourhood are likely to share similar unobserved features that might inflate precision. Because our dependent variable was binary, a logistic regression containing fixed effects was used and estimated with the generalized-estimating equations (GEE) to account for clustering. All estimations were carried with SAS version 9.

We used the modeling strategies suggested by McCulloch(McCulloch, 2001b). In the first model, we controlled for age and gender. Model 2 involved controlling for all contextual factors. Model 3 aimed at separating contextual factors from compositional factors : individuals socio-economic characteristics were added in order to assess how far the relation between contextual factors and health depends upon the composition of the neighborhood.

The influence of contextual factors on disparities in immigrants' health is likely to differ between metropolitan areas and suburban areas. This could be particularly true for some migrant groups, such as Turks and Moroccans, which tend be confined to poor urban neighbordhoods, and to live in accommodation of poor quality and have faced a deteriorating labor market position in the Eighties (Kesteloot and Cortie, 1998). The first and third models were thus repeated separately for metropolitan areas (41% of the population) and non-metropolitan areas.

Results

Migrant from the EU and from Turkey/Morocco had a lower educational level than Belgians or migrant from other countries (table 1). All migrants groups were less likely to be owner of their housing or to be working than Belgians. Among migrant, those from Turkey or Morocco were more disadvantaged than Belgians: 61.6% had only primary education, 57.8% were tenants and 21.8% were unemployed.

Sixty-four percent of migrants from Turkey and Morocco were located in the higher quintile of environmental nuisance against 16.7% among Belgians. This group of migrant was much concentrated in the upper quintile of density of non-Belgian (80.9%) or of local unemployment (69.4%). Eighty-four percent of migrants from Turkey and Morocco are living in metropolitan areas.

[Table 1 here]

Immigrant groups had different risks of poor health status (table 2). Compared with Belgians, individuals born in Germany, the UK and the Netherlands were less likely to have poor subjective health, while those born in southern European countries or in France were more likely to have poor subjective health. Broadly, we observed a North-South gradient: immigrants from the North having a better health status than Belgians, while immigrants from the South had a poorer health status. Among non-European immigrant groups, Turks and Moroccans had the highest risk of poor subjective health status.

[Table 2 here]

Similar results were observed with longstanding illness: immigrants from southern European countries, from Turkey, or from Maghreb countries (including Morocco) had a slightly higher risk of long-standing illness. However, in all immigrant groups, the risk was smaller for long-standing illness than for subjective health. It is interesting to note that the immigrant differences in health status do not correspond to EU frontiers. Immigrants from southern European countries such as Italy, Spain, Portugal or Greece showed similar risk of poor health status to individuals from Turkey or North Africa.

Perceived exposure to nuisance, lack of public amenities, lack of social capital, unemployment rates, and poor housing comfort increased the risk of poor subjective health (table3, model 2). A higher density of non-Belgian was associated with lower risk of poor subjective health. After allowing for these contextual features, immigrant differences in subjective health status were reduced, particularly for the Turks and Moroccans (model 2, from OR=2.25 to 1.46). After including individual socio-economic variables in the analysis (model 3), immigrants from Turkey and Morocco were less likely than Belgians to have poor subjective health (OR=0.81). Immigrants from other non-European countries were also less likely to have poor subjective health (OR=0.54).

[Table 3 here]

The results for long-term illness (table 4) were similar, but of smaller magnitude. Long-term illness increased with lack of public amenities, lack of social capital, unemployment, and poor housing comfort (model 2). These contextual factors led to significant changes in immigrants' risk of poor health status: the risk of long-standing illness for Turks and Moroccans was reduced (from OR=1.24 to OR=0.94). When differences in socio-economic status were accounted for (model 3), all immigrant groups were less likely to have long-standing illness than Belgians.

[Table 4 here]

Because contextual factors and immigrants groups are not randomly distributed in cities or in rural areas, we stratified the analysis of subjective health by level of urbanization (table 5). Disparities in immigrants' health were observed in both metropolitan and non-metropolitan areas (model 1). Very slight differences were observed between metropolitan areas and non-metropolitan areas. Incorporating all contextual and individual socio-demographic variables (model 3) did not change this pattern: immigrants living in metropolitan areas were in better health than Belgians (OR=0.81, $p<0.001$) as well as immigrants living in non-metropolitan areas ((OR=0.83, $p<0.001$).

[Table 5 here]

Discussion

Main findings

We found the following: (1) three immigrant groups, from Turkey, Morocco and southern Europe have much poorer health status than Belgians. Other immigrant groups, mostly from the rest of Europe, have a better health status than Belgians. (2) Contextual exposures were significantly associated with health status. Local unemployment rate and perceived lack of public services were associated with a higher risk of poor health status. (3) These contextual factors accounted partly for health disparities between immigrant groups. When contextual factors or socio-economic status were allowed for, all immigrant groups tended to have a health status similar or even better than Belgians. (4) Finally, and somewhat surprisingly, immigrants are not in better shape when living outside metropolitan areas compared with immigrants living in non-metropolitan areas, even when taking the contextual factors into consideration.

Interpretation

The higher risk of poor subjective health evidenced for Turks and Moroccans was consistent with previous studies carried out in Sweden and in the Netherlands: in both countries theses groups were 3 to 5 times as likely to have poor health status compared with nationals(Reijneveld, 1998; Wiking et al., 2004) and these groups were the most at risk of poor health status compared with other immigrant groups.

Immigrants' health was vulnerable to contextual factors. This is consistent with a previous US study where contextual socio-economic factors reduced slightly the risk of poor health status among Latinos (Browning et al., 2003b; Subramanian et al., 2005). In the UK, using the 4th national ethnic minority survey, Chandola similarly showed that ward deprivation slightly explained the higher risk of poor health status of Indians, Pakistanis, and Bangladeshis(Chandola, 2001). However, these studies could not explain how neighborhood deprivation could affect disparities in immigrants' health. Our study shed some light on the pathways explaining how the context might influence disparities in immigrants' health status: environmental hazards, public amenities, socio-cultural factors, and socio-economic discrimination.

As in Karlsen and colleagues (Karlsen et al., 2002), we found slight influence of environmental hazards on subjective health status and our study showed that the association between environmental hazards and health status is largely confounded by the other contextual factors. This, however, could be due to our measurement, which relied on subjective perception, did not reflect the duration of exposure, and focused on outdoor pollution.

Public amenities remained a significant predictor of poor health status, after allowing for the other contextual and individual variables. This fits with the results of a study carried out in West Scotland (Macintyre et al., 2003) and supports the thesis that public policy is an important pathway to explaining neighborhood effect on disparities in immigrants' health.

Our study reached mixed results regarding two socio-cultural factors, migrant concentration and social capital. On the surface, the protective effect of migrant concentration on health might appear to clash with the very important body of research showing the detrimental effect of ethnic/racial discrimination on health (Williams and Collins, 2001). This discrepancy could be due to two reasons. As pointed out by Subramanian, most previous studies on segregation have been carried out at the aggregate level, thus overlooking important individual-level differences in risk factors, particularly socio-economic status (Subramanian et al., 2005). This is supported by our analyses: poor health status increased with migrant concentration considered without the other contextual variables (results not shown, OR=1.17) and decreased when migrant concentration was considered jointly with the other contextual factors and individual factors. Indeed our results were consistent with two multilevel studies that have looked into the effect of segregation while controlling for individual factors : these found mixed effects of ethnic concentration on self-rated health (Karlsen et al., 2002) or, in the case of a psychiatric morbidity survey, found a protective effect (Halpern and Nazroo, 2000). Secondly, ethnic concentration in the US is higher (black/white index of dissimilarity of 0.66) than in Belgium (Turks/Moroccans index of dissimilarity of 0.49). Belgium, unlike France, does not segregate its ethnic minorities in impoverished suburbs, nor has it pushed them into the infamous HLM dwellings so much criticised during the riots that struck French suburbs in 2005. Our results would thus hint that the effect of segregation on health status is vulnerable to urban policies. Further, preferably cross-national, research is needed in order to address how urban regeneration policies might affect disparities in immigrants' health.

Lack of social capital was associated with poorer health status but did not remain significant once other contextual and individual factors were taken into account. Early studies carried out either at the aggregate (Kawachi et al., 1999a), or individual level(Veenstra, 2000a) showed a significant association between social capital and self-rated health. However, more recent multilevel studies have shown that social capital is associated with better health status at the individual but not at the aggregate level (Poortinga, 2005). Our study suggests that social capital is associated with better health status at the neighborhood level but that this association is confounded by other contextual factors. The fact that the effect of social capital became non-significant once individual features were added suggests that the effect of social capital depends upon the composition of the context, as was suggested by others (Subramanian et al., 2003). However, interpretation must be cautious, as our measurement of social capital is indirect and we lacked information on trust or participation in civic organizations, which are the most popular indicators of social capital.

Our study provided some support for the thesis of socio-economic discrimination at the contextual and individual-levels. Firstly, the percentage of unemployed was an important contextual effect, as in two recent studies (Cummins et al., 2005; Robert, 1998; Stafford et al., 2004). These results suggest that the overall unemployment rate has an effect over and above the risk attached to individual risk of unemployment status. Because unemployment is strongly linked to psychosocial resources such as self-esteem, mastery, and coping styles, our results suggested that the neighborhood level might be relevant to the production of such resources. Secondly, disparities in immigrants' health were mainly explained by individual socio-economic factors. Indeed, our results indicated that most of the reduction in immigrants' risk of poor health occurred after socio-economic factors were accounted for. This parallels previous empirical European studies of immigrants (Chandola, 2001; Lindstrom et al., 2001; Nazroo, 1997) and fits with the conclusions of the Acheson report that socio-economic inequalities are central to the understanding of ethnic or migrant inequalities in health (Nazroo, 1999).

Last but not least, we showed that, even when contextual factors are taken into account, immigrants are not in poorer shape when living in urban areas. This finding runs against the common assumption of an "urban health penalty", which, in the US, makes Latinos and Blacks more likely to experience the health disadvantage associated with urban life(Borrell

and Hatch, 2005). However, previous empirical findings are mixed and suggest that, even in the US, the picture becomes blurred, with residents of rural areas having worse health status on many indicators than residents in areas with different levels of urbanization (Eberhardt and Pamuk, 2004). Our study suggests a possible explanatory mechanism for this urban paradox: migrant concentration, which is higher in metropolitan areas, lowered the risk of poor health status, once other contextual and individual factors were taken into account. This protective effect of ethnic group concentration, also found in a UK study of psychiatric morbidity (Halpern and Nazroo, 2000), must be investigated further. Although segregation is generally considered to be detrimental, some studies have shown that ethnic concentration provides advantages such as nurturing social contacts, improving job opportunities and integration of newly arrived immigrants (van Kempen and Ozuekren, 1998). Our results suggest that current and recent public policies aimed at spreading immigrants out of towns would not improve migrant's health.

Limitations

Certain limitations must be acknowledged. This study might be affected by misclassification bias, as defining immigrant status through nationality has limitations. It overlooks individuals born in Belgium but living with parents who were born abroad and thus likely to belong to an ethnic minority group. Conversely, it also pools together individuals of the same nationality regardless of how long they have been resident, and thus of t heir level of integration. As a consequence, in both cases, we are likely to under-estimate slightly the effect of ethnic minority group on health status.

The ability of self-rated health measures to address immigrant health status differences has been under fire. Some critics argue that such variables have poor cross-cultural validity and, hence, limited reliability for tracking ethnic or immigrant health status. We are, however, confident, that this problem is not a major threat. Firstly, previous validation studies suggested that there was little evidence that the association of self-rated health with more objective measures of morbidity differed between ethnic groups. This has been shown for ethnic minority groups (Chandola and Jenkinson, 2000). Self-report morbidity status has also been validated as a better mortality predictor than physician-evaluated morbidity with no significant difference between blacks and whites in the US (Ferraro and Farmer, 1999).

The magnitude of contextual effects could also be vulnerable to our design. On the one hand, because we have no information about the time individuals have been living in their current neighborhood, our results pooled together individuals with a short time of residence with individuals with longer residence, leading to likely under-estimation of the contextual effect. It is also possible that contextual factors may be overshadowed by individual-level socio-economic factors. Indeed, in order to separate the contextual effect from the composition effects, we controlled for several measures of socio-economic status. But this carries the risk of adjusting away the part of contextual factors that influenced health indirectly through the individual's own socio-economic status (Kawachi and Berkman, 2003). Indeed, if these socio-economic indicators are mediators rather than confounders of the neighborhood effect, than our results would under-estimate these true neighbourhood effects (Diez Roux, 2004). On the other hand, unobserved individual differences may lead to overestimation of true contextual effects: let us here simply give the example of unemployment. Neighborhoods with high unemployment rates could harbor individuals with a long history of unemployment, whatever their current employment status. In such a situation it is likely that the contextual effect may catch the unobserved lifecycle effect of unemployment. However, the first risk (under-estimation) should not be a major issue here, as our results indicated that the effects of the contextual variables were very slightly affected by controlling for individual socio-economic status (comparing model 3 and model 4). As a consequence, although socio-economic status and socio-demographics are major drivers of immigrants' disparities in health, they do not overshadow contextual factors. The second risk (over-estimation due to unobserved heterogeneity) is harder to dismiss because of our cross-sectional design. Further research on contextual factors may benefit from having more information on residence duration and from longitudinal design. In any case, as suggested by others (Duncan and Raudenbush, 1999), we must remain cautious regarding the interpretation of the magnitude of such contextual effects.

Such limitations are frequent in recent contextual analyses. Further longitudinal studies or quasi-experimental studies could provide further insights into these contextual effects. Public policies and urban planning should be aware of these effects and particularly those related to the labor market and public services.

References

Acevedo-Garcia,D. (2001). Zip code-level risk factors for tuberculosis: neighborhood environment and residential segregation in New Jersey, 1985-1992. *American Journal of Public Health* 91 (5), 734-741.

Annandale, E. 1998, *The sociology of health and medicine : a critical introduction* Polity Press, Malden, MA.

Bhopal,R.S., Phillimore, P., & Kohli, H. S. (1991). Inappropriate use of the term 'Asian': an obstacle to ethnicity and health research. *J Public Health Med* 13 (4), 244-246.

Bhui,K., Stansfeld, S., Hull, S., Priebe, S., Mole, F., & Feder, G. (2003). Ethnic variations in pathways to and use of specialist mental health services in the UK. Systematic review. *British Journal of Psychiatry* 182 (2), 105-116.

Borrell, L. & Hatch, L. 2005, Racial/ethnic minorities and health : the role of urban environment, in *Handbook of urban health: populations, methods, and practice*, S. Galea & D. Vlahov, eds., Springer, New York, pp. 63-77.

Bowling, A. 1997, *Measuring health a review of quality of life measurement scales*, 2nd ed edn, Open University Press, Buckingham.

Brown,P., Mayer, B., Zavestoski, S., Luebke, T., Mandelbaum, J., & McCormick, S. (2003). The health politics of asthma: environmental justice and collective illness experience in the United States. *Social Science & Medicine* 57 (3), 453-464.

Browning,C.R., Cagney, K. A., & Wen, M. (2003a). Explaining variation in health status across space and time: implications for racial and ethnic disparities in self-rated health. *Social Science and Medicine* 57 (7), 1221-1235.

Browning,C.R., Cagney, K. A., & Wen, M. (2003b). Explaining variation in health status across space and time: implications for racial and ethnic disparities in self-rated health. *Social Science and Medicine* 57 (7), 1221-1235.

Castles, S. & Miller, M. J. 2003, *The age of migration*, 3rd ed edn, Guilford Press, New York.

Chandola,T. (2001). Ethnic and class differences in health in relation to British South Asians: using the new National Statistics Socio-Economic Classification. *Social Science and Medicine* 52 (8), 1285-1296.

Chandola,T. & Jenkinson, C. (2000). Validating self-rated health in different ethnic groups. *Ethnicity and Health* 5 (2), 151-159.

Cummins,S., Stafford, M., Macintyre, S., Marmot, M., & Ellaway, A. (2005). Neighbourhood environment and its association with self rated health: evidence from Scotland and England. *Journal of Epidemiology and Community Health* 59 (3), 207-213.

Curtis,S., Cave, B., & Coutts, A. (2002). Is urban regeneration good for health? Perceptions and theories of the health impacts of urban change. *Environment and Planning C Government and Policy* 20 (4), 517-534.

Diez Roux,A.V. (2004). Estimating neighborhood health effects: the challenges of causal inference in a complex world. *Social Science & Medicine* 58 (10), 1953-1960.

Diez-Roux,A.V. (2000). Multilevel analysis in public health research. *Annual Review of Public Health* 21 (), 171-192.

Duncan,G.J. & Raudenbush, S. W. (1999). Assessing the effects of context in studies of child and youth development. *Educational Psychologist* 34 (1), 29-41.

Eberhardt,M.S. & Pamuk, E. R. (2004). The importance of place of residence: examining health in rural and nonrural areas. *American Journal of Public Health* 94 (10), 1682-1686.

Elliott,M.R., Wang, Y., Lowe, R. A., & Kleindorfer, P. R. (2004). Environmental justice: frequency and severity of US chemical industry accidents and the socioeconomic status of surrounding communities. *Journal of Epidemiology and Community Health* 58 (1), 24-30.

European Commission 2004, *Eurostat yearbook 2004 : the statistical guide to Europe*.

Fang,J., Madhavan, S., Bosworth, W., & Alderman, M. H. (1998). Residential segregation and mortality in New York City. *Social Science & Medicine* 47 (4), 469-476.

Ferraro,K.F. & Farmer, M. M. (1999). Utility of health data from social surveys: Is there a gold standard for measuring morbidity? *American Sociological Review* 64 (2), 303-315.

Franks,P., Gold, M. R., & Fiscella, K. (2003). Sociodemographics, self-rated health, and mortality in the US. *Social Science & Medicine* 56 (12), 2505-2514.

Goffette-nagot, F., Thomas, I., & Zenou, Y. 2000, Structure urbaine et revenu des ménages, in *Economie géographique: les théories à l'épreuve des faits*, C. Baumont et al., eds., Economica, Paris, pp. 276-302.

Gravelle,H. & Sutton, M. (1998). Trends in geographical inequalities in provision of general practitioners in England and Wales [letter]. *Lancet* 352 (9144), 1910.

Halpern,D. & Nazroo, J. (2000). The ethnic density effect: results from a national community survey of England and Wales. *International Journal of Social Psychiatry* 46 (1), 34-46.

Idler,E.L. (1992). Self-assessed health and mortality : a review of studies. *International Review of Health Psychology*1), 33-54.

Kaplan,G.A., Pamuk, E. R., Lynch, J. W., COHEN, R. D., & Balfour, J. L. (1996). Inequality in income and mortality in the United States: analysis of mortality and potential pathways. *BMJ* 312 (7037), 999-1003.

Kaplan,J.B. & Bennett, T. (2003). Use of race and ethnicity in biomedical publication. *Journal of the American Medical Association* 289 (20), 2709-2716.

Karlsen,S. & Nazroo, J. Y. (2002). Relation between racial discrimination, social class, and health among ethnic minority groups. *American Journal of Public Health* 92 (4), 624-631.

Karlsen,S., Nazroo, J. Y., & Stephenson, R. (2002). Ethnicity, environment and health: putting ethnic inequalities in health in their place. *Social Science and Medicine* 55 (9), 1647-1661.

Kaufman,J.S., Cooper, R. S., & McGee, D. L. (1997). Socioeconomic status and health in blacks and whites: The problem of residual confounding and the resiliency of race. *Epidemiology* 8 (6), 621-628.

Kawachi,I., Kennedy, B. P., & Glass, R. (1999a). Social capital and self-rated health: A contextual analysis. *American Journal of Public Health* 89 (8), 1187-1193.

Kawachi,I., Kennedy, B. P., & Glass, R. (1999b). Social capital and self-rated health: A contextual analysis. *American Journal of Public Health* 89 (8), 1187-1193.

Kawachi,I., Kennedy, B. P., Lochner, K., & ProthrowStith, D. (1997). Social capital, income inequality, and mortality. *American Journal of Public Health* 87 (9), 1491-1498.

Kawachi, I. & Berkman, L. F. 2003, *Neighborhoods and health* Oxford University Press, Oxford.

Kennedy BP, Kawachi I, Glass, R., & Prothrow-Stich, D. (1998). Income distribution, socioeconomic status, and self rated health in the United States : multilevel analysis. *BMJ* 317 (7163), 917-921.

Kesteloot,C. & Cortie, G. (1998). Housing Turks and Moroccans in Brussels and Amsterdam: The difference between private and public markets. *Urban Studies* 35 (10), 1835-1853.

Kington,R.S. & Smith, J. P. (1997). Socioeconomic status and racial and ethnic differences in functional status associated with chronic diseases. *American Journal of Public Health* 87 (5), 805-810.

Krieger,N. (1987). Shades of difference: theoretical underpinnings of the medical controversy on black/white differences in the United States, 1830-1870. *International Journal of Health Services* 17 (2), 259-278.

LillieBlanton,M., Parsons, P. E., Gayle, H., & Dievler, A. (1996). Racial differences in health: Not just black and white, but shades of gray. *Annual Review of Public Health* 17 (), 411-448.

Lindstrom,M., Sundquist, J., & Ostergren, P. O. (2001). Ethnic differences in self reported health in Malmo in southern Sweden. *Journal of Epidemiology and Community Health* 55 (2), 97-103.

Lomas,J. (1998). Social capital and health: Implications for public health and epidemiology. *Social Science and Medicine* 47 (9), 1181-1188.

Lopez,R. (2002). Segregation and Black/White differences in exposure to air toxics in 1990. *Environmental Health Perspectives* 110 (S2), S289-S295.

Macintyre,S., Ellaway, A., & Cummins, S. (2002). Place effects on health: how can we conceptualise, operationalise and measure them? *Social Science and Medicine* 55 (1), 125-139.

Macintyre,S., Ellaway, A., Hiscock, R., Kearns, A., Der, G., & McKay, L. (2003). What features of the home and the area might help to explain observed relationships between housing tenure and health? Evidence from the west of Scotland. *Health Place.* 9 (3), 207-218.

Marmot, M. G., Adelstein, A. M., Bulusu, L., Great, B., & Office of Population Censuses and Surveys 1984, *Immigrant mortality in England and Wales, 1970-78 : causes of death by country of birth* H.M.S.O, London.

McCulloch,A. (2001a). Social environments and health: cross sectional national survey. *BMJ* 323 (7306), 208-209.

McCulloch,A. (2001b). Ward-level deprivation and individual social and economic outcomes in the British Household Panel Study. *Environment and Planning A* 33 (4), 667-684.

Navarro,V. (1990). Race or class versus race and class - mortality differentials in the United-States. *Lancet* 336 (8725), 1238-1240.

Nazroo,J.Y. (1998). Genetic, cultural or socio-economic vulnerability? Explaining ethnic inequalities in health. *Sociology of Health and Illness* 20 (5), 710-730.

Nazroo, J. Y. 1999, Ethnic inequalities in health, in *Inequalities in health : the evidence presented to the Independent Inquiry into Inequalities in Health, chaired by Sir Donald Acheson*, D. Gordon et al., eds., The Policy Press, Bristol, pp. 155-169.

Nazroo, J. Y. 1997, *The health of Britain's ethnic minorities : findings from a national survey*, no. 835 edn, Policy Studies Institute, London.

Pattillo,M. (2005). Black middle-class neighborhoods. *Annual Review of Sociology* 31 (), 305-329.

Pickett,K.E. & Pearl, M. (2001). Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. *Journal of Epidemiology and Community Health* 55 (2), 111-122.

Poortinga,W. (2005). Social capital: An individual or collective resource for health? *Social Science and Medicine* in press (.

Portes,A. (1998). Social Capital: Its origins and applications in modern sociology. *Annual Review of Sociology* 24 (), 1-24.

Reijneveld,S.A. (1998). Reported health, lifestyles, and use of health care of first generation immigrants in The Netherlands: do socioeconomic factors explain their adverse position? *Journal of Epidemiology and Community Health* 52 (5), 298-304.

Robert,S.A. (1998). Community-level socioeconomic status effects on adult health. *Journal of Health and Social Behavior* 39 (1), 18-37.

Samet,J.M., Dearry, A., Eggleston, P. A., Ford, J., Froines, J., Gelobter, M. et al. (2001). Urban air pollution and health inequities: A workshop report. *Environmental Health Perspectives* 109 (S3), S357-S374.

Sampson, R. & Wilson, W. 1995, Towards a theory of race, crime, and urban inequality, in *Crime and Inequality*, J. Hagan & R. D. Peterson, eds., Stanford University Press, Stanford, Calif, pp. 37-54.

Sampson,R.J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. *Science* 277 (5328), 918-924.

Smaje,C. (1995). Ethnic residential concentration and health: Evidence for a positive effect? *Policy and Politics* 23 (3), 251-269.

Sorlie,P.D., Backlund, E., & Keller, J. B. (1995). US mortality by economic, demographic, and social characteristics: the National Longitudinal Mortality Study. *American Journal of Public Health* 85 (7), 949-956.

Stafford,M., Martikainen, P., Lahelma, E., & Marmot, M. (2004). Neighbourhoods and self rated health: a comparison of public sector employees in London and Helsinki. *Journal of Epidemiology and Community Health* 58 (9), 772-778.

Stronks,K., Ravelli, A. C., & Reijneveld, S. A. (2001). Immigrants in the Netherlands: equal access for equal needs? *Journal of Epidemiology and Community Health* 55 (10), 701-707.

Subramanian,S.V., Acevedo-Garcia, D., & Osypuk, T. L. (2005). Racial residential segregation and geographic heterogeneity in black/white disparity in poor self-rated health in the US: a multilevel statistical analysis. *Social Science & Medicine* 60 (8), 1667-1679.

Subramanian,S.V., Lochner, K. A., & Kawachi, I. (2003). Neighborhood differences in social capital: a compositional artifact or a contextual construct? *Health & Place* 9 (1), 33-44.

van Kempen,R. & Ozuekren, A. S. (1998). Ethnic segregation in cities: New forms and explanations in a dynamic world. *Urban Studies* 35 (10), 1631-1656.

Veenstra,G. (2000a). Social capital, SES and health: an individual-level analysis. *Social Science and Medicine* 50 (5), 619-629.

Veenstra,G. (2000d). Social capital, SES and health: an individual-level analysis. *Social Science and Medicine* 50 (5), 619-629.

Veenstra,G. (2000b). Social capital, SES and health: an individual-level analysis. *Social Science and Medicine* 50 (5), 619-629.

Veenstra,G. (2000c). Social capital, SES and health: an individual-level analysis. *Social Science and Medicine* 50 (5), 619-629.

Wiking,E., Johansson, S. E., & Sundquist, J. (2004). Ethnicity, acculturation, and self reported health. A population based study among immigrants from Poland, Turkey, and Iran in Sweden. *Journal of Epidemiology and Community Health* 58 (7), 574-582.

Wild,S. & Mckeigue, P. (1997). Cross sectional analysis of mortality by country of birth in england and wales, 1970-92. *BMJ* 314 (7082), 705.

Williams,D.R. & Collins, C. (2001). Racial residential segregation: a fundamental cause of racial disparities in health. *Public Health Rep.* 116 (5), 404-416.

Table 1. Distribution of migrant groups according to socio-economic and contextual factors: percentage.

	Nationality			
	Belgian (%)	UE (%)	Turk-Moroccan (%)	Others (%)
Education				
Lower secondary or less	37.4	44.5	61.6	32.5
Upper secondary	33.2	26.9	21.0	26.0
Superior	29.4	28.6	17.4	41.5
House ownership				
Owner	73.7	58.3	42.2	24.9
Tenant	26.3	41.7	57.8	75.1
Activity				
Working	62.9	58.9	30.3	43.6
Unemployed	6.6	11.4	21.8	21.1
Inactive	30.5	29.7	47.9	35.4
Environnmental nuisances				
Low -1st Quintile	21.5	12.4	1.7	7.3
2nd Quintile	21.3	13.0	3.5	10.2
3rd Quintile	20.8	16.9	9.2	14.3
4th Quintile	19.6	23.3	18.2	24.1
Up - 5th Quintile	16.7	34.4	67.4	44.0
Lack of public services				
Low -1st Quintile	20.9	15.3	9.1	21.1
2nd Quintile	20.0	20.1	15.6	25.7
3rd Quintile	19.6	21.4	26.5	24.4
4th Quintile	19.4	22.8	30.4	18.4
Up - 5th Quintile	20.1	20.5	18.4	10.3
Lack of social integration				
Low -1st Quintile	21.7	11.1	1.3	6.2
2nd Quintile	21.5	11.7	3.7	8.7
3rd Quintile	20.9	16.0	7.6	12.6
4th Quintile	19.7	24.6	15.8	22.8
Up - 5th Quintile	16.2	36.6	71.6	49.6
Density of non-Belgian				
Low -1st Quintile	13.2	4.1	0.2	1.7
2nd Quintile	35.4	18.7	2.3	9.4
3rd Quintile	18.3	15.8	4.2	9.2
4th Quintile	17.3	23.5	12.4	17.5
Up - 5th Quintile	15.9	38.0	80.9	62.2
Local Unemployment				
Low -1st Quintile	21.6	7.0	1.4	6.1
2nd Quintile	21.7	11.1	3.4	11.8
3rd Quintile	20.7	17.6	7.9	18.8
4th Quintile	19.4	24.7	18.0	28.1
Up - 5th Quintile	16.6	39.6	69.4	35.1
Urbanisation				
Metropolitan	39.0	63.4	83.6	77.6
Non-metropolitan	61.0	36.6	16.4	22.4

Table 2. Risk of poor health status among immigrant groups : odds ratios and 95%CI from the logistic regression.

	N	(%)	Poor subjective health [a] OR (95%CI)			Long-standing illness[a] OR (95%CI)		
Belgium (ref)	5,895,463	91.4	1.0			1.0		
Germany	24,722	0.4	0.92	(0.88 , 0.95)	***	0.86	(0.83 , 0.89)	***
France	71,416	1.1	1.19	(1.16 , 1.21)	***	1.00	(0.98 , 1.02)	
UK	17,682	0.3	0.52	(0.49 , 0.54)	***	0.53	(0.51 , 0.56)	***
Lux	3,301	0.1	1.14	(1.04 , 1.24)	**	1.07	(0.97 , 1.18)	
The Netherlands	67,058	1.0	0.71	(0.69 , 0.72)	***	0.78	(0.76 , 0.80)	***
Italy-Spain-Port-Greece	213,196	3.3	1.84	(1.82 , 1.85)	***	1.24	(1.23 , 1.26)	***
EU – others	9,870	0.2	0.39	(0.36 , 0.42)	***	0.44	(0.41 , 0.48)	***
Europe – others	17,712	0.3	1.29	(1.23 , 1.34)	***	0.81	(0.77 , 0.85)	***
Turkey	24,329	0.4	2.96	(2.87 , 3.06)	***	1.51	(1.46 , 1.56)	***
Morocco	46,957	0.7	2.32	(2.27 , 2.38)	***	1.28	(1.25 , 1.32)	***
Other Maghreb	6,636	0.1	2.21	(2.08 , 2.35)	***	1.35	(1.27 , 1.45)	***
Congo	5,466	0.1	0.68	(0.62 , 0.75)	***	0.90	(0.82 , 0.98)	*
USA	6,486	0.1	0.36	(0.32 , 0.40)	***	0.39	(0.35 , 0.44)	***
Others	38,013	0.6	1.03	(1.00 , 1.07)	*	0.72	(0.69 , 0.75)	***

[a] Odds ratios are controlled for age and gender; *p<0.05;**p<0.01;***p<0.001

Table 3. Risk of poor subjective health among immigrant groups: odds ratio and 95%CI from the logistic regressions.

	Model 1 [a]		Model 2 [b]		Model 3 [c]	
	OR	95%CI	OR	95%CI	OR	95%CI
Nationality						
Belgian (reference)	1.0	.	1.00	.	1.00	.
EU	1.30***	(1.29 , 1.31)	1.03***	(1.02 , 1.04)	0.90***	(0.89 , 0.91)
Turk-Morocco	2.25***	(2.22 , 2.29)	1.46***	(1.44 , 1.48)	0.81***	(0.80 , 0.82)
Other	0.97*	(0.94 , 1.00)	0.80***	(0.78 , 0.82)	0.54***	(0.53 , 0.56)
Unemployment (%)						
Low 1st quintile (ref.)			1.00	.	1.00	.
2nd quintile			1.12***	(1.11 , 1.12)	1.08***	(1.07 , 1.08)
3rd quintile			1.27***	(1.26 , 1.28)	1.20***	(1.19 , 1.21)
4th quintile			1.55***	(1.54 , 1.57)	1.41***	(1.40 , 1.43)
High 5th quintile			2.27***	(2.25 , 2.30)	1.75***	(1.73 , 1.77)
Environnemental nuisance (score)						
Low 1st quintile (ref.)			1.00	.	1.00	.
2nd quintile			1.05***	(1.04 , 1.05)	1.02***	(1.02 , 1.03)
3rd quintile			1.06***	(1.05 , 1.07)	1.04***	(1.03 , 1.04)
4th quintile			1.08***	(1.07 , 1.09)	1.06***	(1.06 , 1.07)
High 5th quintile			1.13***	(1.12 , 1.14)	1.11***	(1.10 , 1.12)
Lack of public amenities (score)						
Low 1st quintile (ref.)			1.00	.	1.00	.
2nd quintile			1.04***	(1.04 , 1.05)	1.05***	(1.04 , 1.06)
3rd quintile			1.09***	(1.08 , 1.10)	1.09***	(1.08 , 1.10)
4th quintile			1.15***	(1.14 , 1.16)	1.15***	(1.15 , 1.16)
High 5th quintile			1.19***	(1.18 , 1.20)	1.21***	(1.20 , 1.22)
Lack of social capital (score)						
Low 1st quintile (ref.)			1.00	.	1.00	.
2nd quintile			1.10***	(1.09 , 1.10)	1.06***	(1.05 , 1.07)
3rd quintile			1.18***	(1.17 , 1.19)	1.11***	(1.10 , 1.12)
4th quintile			1.25***	(1.23 , 1.26)	1.13***	(1.12 , 1.14)
High 5th quintile			1.41***	(1.39 , 1.43)	1.16***	(1.15 , 1.18)
Density of non-belgian (%)						
Low 1st quintile (ref.)			1.00	.	1.00	.
2nd quintile			0.95***	(0.95 , 0.96)	0.99*	(0.98 , 1.00)
3rd quintile			0.91***	(0.90 , 0.92)	0.99	(0.99 , 1.00)

	Model 1 [a]		Model 2 [b]		Model 3 [c]	
	OR	95%CI	OR	95%CI	OR	95%CI
4th quintile			0.86***	(0.85 , 0.87)	0.96***	(0.95 , 0.97)
High 5th quintile			0.78***	(0.77 , 0.78)	0.88***	(0.87 , 0.89)

[a] Odds ratios are controlled for age and gender; ; [b] Controlled for age, gender and contextual covariates included in the table;; [c] OR controlled for age, gender, socio-demographic covariates individual socio-demographic covariates (household type, education, housing tenure, activity status and assets score) and contextual covariates included in the table; *p<0.05;**p<0.01;***p<0.001

Table 4 Risk of longstanding illness among immigrant groups: odds ratio and 95%CI from the logistic regressions.

	Model 1 [a]		Model 2 [b]		Model 3 [c]	
	OR	95%CI	OR	95%CI	OR	95%CI
Nationality						
Belgian (reference)	1.0	.	1.00	.	1.00	.
EU	0.99*	(0.98 , 1.00)	0.85***	(0.84 , 0.86)	0.76***	(0.75 , 0.77)
Turk-Morocco	1.24***	(1.22 , 1.27)	0.94***	(0.92 , 0.95)	0.58***	(0.57 , 0.59)
Other	0.66***	(0.64 , 0.68)	0.58***	(0.56 , 0.60)	0.41***	(0.39 , 0.42)
Unemployment (%)						
Low 1st quintile (ref.)			1.00	.	1.00	.
2nd quintile			1.08***	(1.07 , 1.09)	1.05***	(1.04 , 1.06)
3rd quintile			1.19***	(1.18 , 1.20)	1.13***	(1.12 , 1.14)
4th quintile			1.36***	(1.35 , 1.37)	1.26***	(1.24 , 1.27)
High 5th quintile			1.74***	(1.72 , 1.76)	1.41***	(1.40 , 1.43)
Environnemental nuisance (score)						
Low 1st quintile (ref.)			1.00	.	1.00	.
2nd quintile			1.03***	(1.02 , 1.04)	1.01***	(1.01 , 1.02)
3rd quintile			1.03***	(1.02 , 1.03)	1.01*	(1.00 , 1.02)
4th quintile			1.03***	(1.02 , 1.03)	1.02***	(1.01 , 1.03)
High 5th quintile			1.03***	(1.02 , 1.04)	1.01**	(1.00 , 1.02)
Lack of public amenities (score)						
Low 1st quintile (ref.)			1.00	.	1.00	.
2nd quintile			1.01***	(1.01 , 1.02)	1.02***	(1.01 , 1.02)
3rd quintile			1.03***	(1.03 , 1.04)	1.03***	(1.03 , 1.04)
4th quintile			1.06***	(1.05 , 1.06)	1.06***	(1.05 , 1.07)
High 5th quintile			1.08***	(1.07 , 1.08)	1.09***	(1.08 , 1.10)
Lack of social capital (score)						
Low 1st quintile (ref.)			1.00	.	1.00	.
2nd quintile			1.14***	(1.13 , 1.15)	1.08***	(1.07 , 1.09)
3rd quintile			1.20***	(1.19 , 1.22)	1.12***	(1.11 , 1.13)
4th quintile			1.33***	(1.32 , 1.35)	1.15***	(1.13 , 1.16)
High 5th quintile					1.15***	(1.13 , 1.16)
Density of non-belgian (%)						
Low 1st quintile (ref.)			1.00	.	1.00	.
2nd quintile			0.98***	(0.97 , 0.99)	1.00	(0.99 , 1.01)
3rd quintile			0.94***	(0.94 , 0.95)	1.00	(0.99 , 1.01)

	Model 1 [a]		Model 2 [b]		Model 3 [c]	
	OR	95%CI	OR	95%CI	OR	95%CI
4th quintile			0.90***	(0.89 , 0.91)	0.97***	(0.96 , 0.98)
High 5th quintile			0.83***	(0.82 , 0.84)	0.90***	(0.89 , 0.91)

[a] Odds ratios are controlled for age and gender; ; [b] Controlled for age, gender and contextual covariates included in the table;; [c] OR controlled for age, gender, socio-demographic covariates individual socio-demographic covariates (household type, education, housing tenure, activity status and assets score) and contextual covariates included in the table; *p<0.05;**p<0.01;***p<0.001

Table 5. Risk of poor subjective health among immigrant groups by level of urbanisation: odds ratio and 95%CI from the logistic regressions stratified by urbanisation level for model 1 and model 3.

	Model 1		Model 3	
	OR	95% CI	OR	95% CI
Metropolitan:				
Belgian (ref)	1.00	.	1.00	.
EU	1.26***	(1.24 , 1.27)	0.89***	(0.88 , 0.90)
Turk-Moroccan	2.03***	(1.99 , 2.06)	0.81***	(0.79 , 0.82)
Other non EU	0.88***	(0.85 , 0.90)	0.54***	(0.53 , 0.56)
Non-metropolitan:				
Belgian (ref)	1.00			
EU	1.21***	(1.19 , 1.22)	0.91***	(0.90 , 0.92)
Turk-Moroccan	2.08***	(2.00 , 2.16)	0.83***	(0.80 , 0.87)
Other non EU	0.93***	(0.87 , 0.99)	0.55***	(0.52 , 0.59)

[a] Odds ratios are controlled for age and gender; ; [b] OR controlled for age, gender, all contextual covariates controlled, individual socio-demographic covariates (household type, education, housing tenure, activity status and assets score) and for local average rent.
*p<0.05;**p<0.01;***p<0.001