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Regional differences in loneliness among Polish migrants in the Netherlands: The impact of environmental factors

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Abstract

This study focuses on the impact of environmental factors on the variation of loneliness among Polish migrants in the Netherlands. Data stems from the Families of Poles in the Netherlands (FPN) survey, Statistics Netherlands, and manually obtained data. Several environmental factors that may be related to neighbourhood attachment and social cohesion, which function as protective factors against loneliness, were included in the study. Results of a linear regression analysis show that proximity of other Polish migrants, socio-economic deprivation, the share of owner-occupied housing, and perceived quality of roads, paths, and squares in a region have a negative impact on loneliness among Polish migrants. By contrast, the degree of ethnic diversity in a region has a positive impact on loneliness. These findings indicate the important impact of environmental factors on the variation of loneliness and the need for further research into the impact on loneliness on a smaller regional scale and of other possible environmental factors. When this impact is clear, policymakers can take this into account in interventions to combat loneliness.

Keywords: Loneliness, environmental factors, migrants, neighbourhood attachment, social cohesion

Introduction

Loneliness has serious consequences for well-being and health, similar to the effects of smoking (Hawkey & Cacioppo, 2007, 2010). For example, loneliness can lead to unhealthy behaviours, such as overeating and excessive alcohol consumption, which causes stress and lack of sleep (Cacioppo et al., 2002; Cacioppo & Patrick, 2008; Kearns, Whitley, Tannahill, & Ellaway, 2015a). Moreover, the effects of loneliness seem to increase over time, accelerating physiological ageing (Hawkey & Cacioppo, 2007, 2010). In this study, loneliness is defined as a distressing feeling that accompanies the perception that one's desired network of social relationships is not fulfilled by the quantity or especially the quality of one's network of social relationships (De Jong Gierveld, Van Tilburg, & Dykstra, 2006; Hawkey & Cacioppo, 2010). This study focuses on variation of loneliness among Polish migrants, one of the largest migrant groups in the Netherlands. More specifically, the geographic differences in loneliness and the impact of environmental factors on these differences are examined.

So far, the focus of studies has mostly been on comparing the level of loneliness between migrant groups and natives in the country of destination (De Jong Gierveld, Van der Pas, & Keating, 2015; Fokkema & Naderi, 2013; Ten Kate, Bilecen, & Steverink, 2020; Uysal-Bozkir, Fokkema, MacNeil-Vroomen, Van Tilburg, & De Rooij, 2017); virtually without exception, these studies show that people with a migration background are lonelier than people without a migration background. However, hardly any studies have examined whether there are also differences in loneliness within migrant groups. Moreover, almost all studies explaining differences in loneliness have focused on individual factors only. Some studies suggest the

possible impact of environmental factors on loneliness (e.g., Abshire, Graves, Amiri, & Williams-Gilbert, 2020; Menec, Newall, Mackenzie, Shoostari, & Nowicki, 2019; Scharf & De Jong Gierveld, 2008), but, to my knowledge, extensive research into this does not exist. Some exceptions only looked at the more general differences between regions, such as differences between rural and urban and a few area-level sociodemographic differences (Abshire et al., 2020; Menec et al., 2019). Scharf and De Jong Gierveld (2008) went a little further but included only a few regions (3 English cities and 11 Dutch municipalities), some environmental characteristics (level of urbanisation, the neighbourhood's socio-economic status, and the perceived quality of the neighbourhood), and only the older population (60 and older) in their research. Besides the fact that research on the impact of environmental factors is very limited, extensive research on this for migrants does, to my knowledge, not exist at all. Therefore, this study looks at the impact of more specific factors of a region on loneliness among migrants.

Since Poland joined the European Union in 2004, the number of Poles in the Netherlands has grown rapidly as the European Union allows free movement of people (Karpinska & Ooijevaar, 2016). Like several previous years, Poland was in 2020 again the largest country of origin for new migrants in the Netherlands (Statistics Netherlands, 2021). Previously, these were mainly Polish labour migrants, but more and more family migrants are arriving, indicating that they plan to stay longer (Statistics Netherlands, 2018). According to Van den Broek and Grundy (2017), Polish migrants, no different from other migrant groups, are on average lonelier than Dutch natives. This is worrying as loneliness can cause serious well-being and health problems.

Differences in loneliness between Dutch municipalities can be seen in the data from the Health Monitor (RIVM, 2016). To my knowledge, no research has been conducted into whether environmental factors are part of the explanation of this geographic distribution of loneliness. Moreover, these data only show regional differences for the entire Dutch population and not whether regional differences in loneliness occur among (Polish) migrants. As mentioned before, loneliness can cause serious health issues. Therefore, it is important to look at one of the largest migrant groups, who feel relatively lonely, to uncover possible differences in the loneliness within this group. When it is known which environmental factors play a role in this, and if these factors can be influenced, policymakers can respond to this in interventions to combat loneliness. Based on these insights, this research is questioning: *"To what extent are regional differences in loneliness among Polish migrants in the Netherlands attributable to variation in environmental factors?"*

Theoretical framework

What potentially plays a central role as a protective factor against loneliness is neighbourhood attachment and social cohesion. With a greater degree of social cohesion, there may be more social interaction and a sense of being socially integrated, which, in turn, may reduce feelings of loneliness (Yu et al., 2021). Also, people participate more actively in public space and engage in more social interactions when they feel attached to the neighbourhood, which may make them

feel less lonely (Bergefurt et al., 2019; Weijs-Perrée, Van den Berg, Arentze, & Kemperman, 2015). The migration process entails the loss of social ties, which increases the need for migrants to establish new communication networks (Kohlbacher, Reeger, & Schnell, 2015). In addition, everyday communication is an important tool to develop some sense of integration (Aroian, 1992; Kohlbacher et al., 2015; Rose, Carrasco, & Charboneau, 1998). The lack of social cohesion and neighbourhood attachment could therefore be an important cause of loneliness, especially for migrants. Regional characteristics could be a catalyst for feelings of loneliness when social integration, the formation of positive interpersonal relationships, and the formation of an engaged community are hindered (Buecker, Ebert, Götz, Entringer, & Luhmann, 2021). This goes beyond simple urban and rural subdivisions, which is often all that is included in similar studies. Moreover, the existing studies on the difference in loneliness between urban and rural settings have led to inconsistent findings. Some studies found more loneliness for individuals living in rural areas than their counterparts in urban areas (e.g., Routasalo, Savikko, Tilvis, Strandberg, & Pitkälä, 2006; Savikko, Routasalo, Tilvis, Strandberg, & Pitkälä, 2005), while others found the opposite (e.g., Ferreira-Alves, Magalhães, Viola, & Simoes, 2014). Environmental factors related to neighbourhood attachment and social cohesion and relevant in this study are population structure, ethnic amenities, population density, population dynamics, deprivation, crime, housing tenure, and neighbourhood quality.¹

Population structure

Attachment to the neighbourhood by migrants appears to be related to the proximity of members of their own cultural community and ethnic diversity in the neighbourhood (Buffel & Phillipson, 2011). The presence of members of their own cultural community offers opportunities to develop a social network (Buffel & Phillipson, 2011). As people tend to seek out friends who are somehow similar to them (Granovetter, 1983; Putnam, 2000), migration often brings people together based on shared ethnicity or nationality and who usually occupy a similar social position (Ryan, 2011). This ethnically specific network can be crucial, especially in the early stages of settlement (Ryan, 2011), as access to other existing networks in the destination country cannot be taken for granted and is complicated by, for example, language skills (Temple, 2010). However, it is clear that shared ethnicity is not enough to guarantee close friendships, but on the other hand, shared interests, similar careers, educational backgrounds, common aspirations can all form close friendships (Ryan, 2011). In the study by Ryan (2011), it was indicated that after a while, Polish migrants want to distance themselves from what are seen as close, exclusive, and restrictive Polish enclaves and forge close friendships with other ethnicities. Other literature also emphasizes the locally specific, temporary nature of loose relationships between Polish migrants (Gill & Bialski, 2011; Grzymała-Kazłowska, 2005; White & Ryan, 2008).

Thus, the presence of other ethnic communities is of relevance. However, some studies show that when the level of ethnic diversity in a neighbourhood is higher, residents experience

¹ See Figure S1 in the Supplementary Material for the conceptual model.

less neighbourhood attachment and social cohesion and more insecurity (Laurence, 2011; Letki, 2008). Jennissen and colleagues (2018) found that in the Netherlands this is a non-linear relationship, in which the negative coherence of diversity and the assessment of social cohesion and neighbourhood attachment do not always decrease to the same extent. In addition, people continue to judge the neighbourhood as less cohesive the greater the diversity of a neighbourhood, albeit to a lesser extent (Jennissen, Engbersen, Bokorst, & Bovens, 2018). Importantly, people of immigrant origin, a key source of cultural diversity, also trust their neighbours less if they believe their local community is more diverse (Koopmans & Schaeffer, 2016).

Based on these insights the following hypotheses are formulated:

Hypothesis 1: A high number of Polish migrants in a region has a negative impact on loneliness among Polish migrants.

Hypothesis 2: High ethnic diversity in a region has a positive impact on loneliness among Polish migrants.

Ethnic amenities

Furthermore, attachment of migrants to the neighbourhood also appears to be related to the proximity to ethnic amenities in the neighbourhood (Buffel & Phillipson, 2011). Such ethnic amenities can serve as hubs of planned and spontaneous social interactions (Finlay & Kobayashi, 2018). In this case, ethnic amenities such as Polish supermarkets may be especially important for Polish migrants to develop social connections with members of their own cultural community. In this way, it becomes less likely that their desired network of social relationships will not be fulfilled by the quantity or quality of their actual network of social relationships. This leads to the following hypothesis:

Hypothesis 3: The presence of ethnic amenities in a region has a negative impact on loneliness among Polish migrants.

Population density

The rural/urban division made in existing studies is mainly about the density of the population, in which densely populated regions could offer more opportunities to interact with other people, leading to less loneliness (Delmelle, Haslauer, & Prinz, 2013; Talen, 1999). Others, on the other hand, assume that the greater the density of a region, the weaker would be community participation and attachment (Kasarda & Janowitz, 1974; Woolever, 1992). Although densely populated regions could offer more interaction opportunities, these regions may be characterized by anonymity and social transformations (Buecker et al., 2021). High-density levels cause people to withdraw from others, especially on an informal basis, as an effective way of coping with the diversity and overstimulation of the urban environment (Woolever, 1992). When this occurs,

people participate less in the community and this could lead to loneliness. In line with this, the following hypothesis has been formulated:

Hypothesis 4: High population density in a region has a positive impact on loneliness among Polish migrants.

Population dynamics

Population dynamics are important in this study as this is related to the degree to which social cohesion can be built. Buecker and colleagues (2021) imply that the greater the population change in a region, the greater the loneliness. Due to a population that is constantly changing, it is difficult to form and maintain social bonds. Migrants often settle primarily in urban areas, where there are (low-skilled) jobs and where they can often rely on already established migrant communities (Scholten, 2018), which is also the case for the migrants in the Netherlands (Statistics Netherlands, 2021). Even though these places are characterized by high turnover, a significant proportion of the people who stay have a migration background (Engbersen, 2016). Thus, the non-migrants in particular are part of the turnovers, making it difficult for migrants to develop close friendships with this group. As discussed earlier, this is not yet such a big problem in the initial phase of establishment. This develops the longer migrants have been in the destination country and the desire arises to forge friendships outside their ethnic group. Based on these insights, a hypothesis has been formulated:

Hypothesis 5: A high turnover in a region has a positive impact on loneliness among Polish migrants.

Deprivation

The degree of deprivation of a place also seems to impact the degree of loneliness according to several studies (Kearns, Whitley, Tannahill, & Ellaway, 2015b; Scharf, Philipson, & Smith, 2004; Victor & Pikhartova, 2020). This concerns socio-economic deprivation conceptualized as socio-economic status at the neighbourhood level. Indicators of this measure are, for example, the share of unemployed people, the share receiving benefits, and average income (Drukker & Van Os, 2003). It has been suggested in the study by Drukker and Van Os (2003) that, among other things, a lower degree of cohesion and informal social control occurs more often in disadvantaged regions, which can therefore have an impact on the degree of loneliness. Also, Tolsma and colleagues (2009) indicate that, at neighbourhood level, economic deprivation is most clearly negatively related to social cohesion. Next to this, more loneliness in deprived regions is related to neighbourhood attachment (Beech & Murray, 2013; Livingston, Bailey, & Kearns, 2010). The reduced quality of deprived neighbourhoods can make neighbourhood attachment in these places less likely (Livingston et al., 2010). Thus, greater deprivation appears to result in greater loneliness, leading to the following hypothesis:

Hypothesis 6: A high level of socio-economic deprivation in a region has a positive impact on loneliness among Polish migrants.

Crime

Crime, and in particular fear of crime, also appears to be related to neighbourhood attachment and social cohesion (Barnes, Blom, Cox, Lessof, & Walker, 2006; Lee, Ang, & Chan, 2020). Fear of crime adds barriers to social engagement (Barnes et al., 2006), could weaken trust between neighbours, and could cause alienation, which is not conducive to social cohesion and neighbourhood attachment (Matthews et al., 2019; Prezza & Pacilli, 2007). Baker and colleagues (2017) suggest that perceived vulnerability to victimization is the main factor driving the fear of crime. However, this is generated by the perception that victimization is likely rather than actual victimization (Silverman & Kennedy, 1985). To test this, the following hypothesis has been formulated:

Hypothesis 7: A high level of fear of crime in a region has a positive impact on loneliness among Polish migrants.

Housing tenure

The ratio of rental and owner-occupied homes in a region also plays a role in the degree of neighbourhood attachment and social cohesion. When someone owns a residence, they feel more connected with the neighbourhood and form more social contacts with neighbours compared to tenants (Dekker & Bolt, 2005; Kleinhans & Bolt, 2010). The difference in the amount of social contacts between homeowners and tenants can be explained by the fact that homeowners have more time to build up a social network in the neighbourhood as they tend to live in a residence longer than tenants (Dekker & Bolt, 2005; Völker, Flap, & Lindenberg, 2007). Besides, owners of owner-occupied residences are less tolerant of undesirable behaviour in the neighbourhood (Dekker, 2007). This is because homeowners benefit from keeping the neighbourhood liveable and having a good reputation, as this affects the value of their residence (Dekker, 2007). Thus, tenants often deal differently with their residence and the environment compared to homeowners. Homeowners want the neighbourhood to remain liveable and the quality of the (green) facilities to remain high. When a region has a larger share of owner-occupied homes, there is a higher chance that social cohesion and neighbourhood attachment can arise, which could lead to less loneliness. Firstly, because the often longer length of stay of residents in owner-occupied homes can create more social ties between residents. Second, residents in an owner-occupied home often make more investments in the immediate environment, which increases neighbourhood attachment. Based on these insights, the following hypothesis has been formulated:

Hypothesis 8: A large share of owner-occupied housing in a region has a negative impact on loneliness among Polish migrants.

Neighbourhood quality

When a neighbourhood is managed and kept clean, the social quality of a neighbourhood improves, as this causes local residents to assess each other more positively and have higher, shared expectations (Blokland, 2009). In this way, a clean neighbourhood can have a positive effect on the degree of social cohesion in the neighbourhood. Also, an orderly environment is important to ensure that people feel safe in a neighbourhood (Wilson & Kelling, 1982), which, as explained, can have an effect on social cohesion and neighbourhood attachment. On the other hand, pollution and deterioration of the immediate living environment give people the feeling that there are no shared expectations and this is detrimental to the degree of social cohesion and neighbourhood attachment.

The quality of certain facilities also plays a role in people's social behaviour, because the facilities can serve as meeting places (Bergeijk, Kokx, Bolt, & Kempen, 2008; Peters, Elands, & Buijs, 2010; Völker et al., 2007). For example, in neighbourhoods designed primarily for pedestrians, people have more social interaction than neighbourhoods that are mainly designed for car use (Kerstens, 2015). After all, when someone goes shopping on foot, they are more likely to meet other people compared to someone moving by car (Atkinson & Kintrea, 2000). When the quality of these pedestrian areas is good, it will be used more and will promote interaction in the neighbourhood. The following hypothesis is in line with this:

Hypothesis 9: A high level of neighbourhood quality in a region has a negative impact on loneliness among Polish migrants.

Coherence of factors

It is important to keep in mind that these factors are interrelated. Looking at the population structure and ethnic amenities, it can be expected that more Polish migrants in a region will increase the likelihood of Polish amenities being present. Also, deprivation is related to population dynamics and crime. More deprived regions are characterized by high turnover and rapidly changing (ethnic) composition, which undermines social networks, trust and feelings of security, and reduces social interaction (Livingston et al., 2010). In addition, a greater degree of deprivation also results in a greater degree of crime and the fear of crime, whereby the neighbourhood attachment is also negatively impacted in this way. Ethnic heterogeneity, like deprivation, also often goes hand in hand with turnover and crime rates (Tolsma, Van der Meer, & Gesthuizen, 2009). Besides, population density and population dynamics are linked by the fact that populated regions are mainly cities, with cities often being the temporary residence of floating populations (Engbersen, 2016; Scholten, 2018). Finally, different types of housing result in different ways of maintenance of the neighbourhood and in this way these factors concerning housing tenure and quality of the neighbourhood are also related.

Research design

Data

For this research data from the survey Families of Poles in the Netherland (FPN) held in 2014-2015 is used (Karpinska, Dykstra, & Fokkema, 2016). When newcomers enter the country and intend to stay longer than four months, they are expected to register in the municipality where they live. The FPN survey consists of a sample of 1131 respondents who were born in Poland, registered for the first time in the Netherlands in 2004 or later, and between 18 and 49 years old at the time of the most recent registration. As two respondents were younger than 18 years old according to the data, these cases have been removed and a final dataset with 1129 respondents remains. Between October 2014 and April 2015, the data was collected through an internet survey and computer-assisted face-to-face interviews. The data was weighted to correct for systematic non-response (response rate of 51.5%). See Karpinska and colleagues (2016) for more information on data collection, non-response and weights. Municipal level data of Statistics Netherlands is linked to the FPN survey data. By doing this, information about population structure, population density, population dynamics, deprivation, crime figures, housing tenure, and quality of the neighbourhood can be linked to the loneliness of Polish migrants. This data is from January 1, 2015, which is in the middle of the period when the FPN survey was conducted. Neighbourhood data concerning Polish shops is obtained manually via google maps, company pages, and other websites with useful information about, for example, the founding or closing dates of the Polish stores. This neighbourhood-level data is based on the zip code.

Measures

Loneliness. The dependent variable loneliness stems from the FPN survey and is measured based on the shortened version of De Jong Gierveld loneliness scale (DJGLS) (De Jong Gierveld & Van Tilburg, 2006). Besides being translated and validated in both the Netherlands (De Jong Gierveld & Van Tilburg, 1999) and Poland (Grygiel, Humenny, Rebisz, Świtaj, & Sikorska, 2013), the scale reliability of DJGLS also turned out to be high for Polish migrants in the Netherlands ($\alpha=0.79$) (Djundeva & Ellwardt, 2020). The scale consists of six items; three are formulated positively and three are formulated negatively. An example of the positively worded items is "There are plenty of people I can rely on when I have problems" and of the negatively worded items "I experience a general feeling of emptiness". The number of negative answers ("no" and "more or less") to the positively formulated items together with the number of positive answers ("yes" and "more or less") to the negatively formulated items makes up the total loneliness score from 0, meaning not lonely, to 6, meaning intensely lonely.

Municipality and neighbourhood characteristics. Data from Statistics Netherlands has been included to consider the impact of environmental characteristics on loneliness and is at the municipal level. First, population structure is measured through the *number of Polish migrants*

and the *Herfindahl-Hirschman index* (HHI).² Ethnic diversity is expressed in the HHI, which ranges from 0 to 1, and which shows the probability that any two persons living in a region belong to a different origin group. This means that the larger the number in the index, the greater the probability, and thus the diversity. This index was drawn up in the report by Jennissen and colleagues (2018). As social cohesion and neighbourhood attachment appear to show a non-linear relationship with the effect of diversity (Jennissen et al., 2018), HHI, HHI², and HHI³ are included in the analyses. Second, the impact of *population density* on loneliness among Polish migrants is measured by the number of inhabitants per square km in the municipality. Third, the degree of population turnover has been included in this study as a measure of population dynamics. The *population turnover rate* is a measure of the intensity of migration to and from the municipality, calculated by adding up the number of people who have left and settled, dividing this by the number of inhabitants, and then multiplying by one hundred (Dennett & Stillwell, 2008). Fourth, the measuring instrument for socio-economic deprivation is the *share of social welfare benefit recipients*, consisting of people who have no or too low income to live on and therefore receive social assistance.³ Fifth, people who are often *afraid of becoming a victim of crime* in the neighbourhood (as percentage of people from the municipality) has been used as the crime-related indicator of loneliness. Sixth, the indicator for the effect of the housing tenure on loneliness is the *share of owner-occupied housing*. Seventh, the quality of the neighbourhood is measured by means of the *perceived presence of deterioration* of the physical environment in the neighbourhood and the *perceived quality of roads, paths, and squares* in the neighbourhood. Physical deterioration consists of four forms of nuisance, namely: 'rubbish on the street', 'street furniture, such as garbage cans, benches or bus shelters, that has been destroyed', 'defaced walls or buildings', and 'dog poo on the sidewalk, street or in the flower beds'. The variable used consists of the percentage of people in the municipality who indicate that one or more of these forms of deterioration sometimes occurs in the neighbourhood. The perceived quality of roads, paths, and squares consists of the proportion of people who indicate that roads, paths, and squares in the neighbourhood are well maintained. Finally, the manually obtained data is available at neighbourhood level and concerns ethnic amenities and consists of *the presence of Polish stores*. This is a dummy variable indicating whether there was a Polish store within the neighbourhood at the time of the interview.

Control variables. In previous studies, loneliness has been found to be related to gender, age, educational level, employment status, presence and location of partner and children, health

² As the presence of members of their own cultural community provides opportunities to develop a social network (Buffel & Phillipson, 2011), more Polish migrants will provide more opportunities. The ratio of Polish migrants to the total population is therefore not important here.

³ Besides the share of social welfare benefit recipients, as stated in the literature, the share of the unemployed people and the average income are also indicators of socio-economic deprivation (Drukker & Van Os, 2003). These indicators have been examined, but due to a high correlation between these indicators, only the share of social welfare benefit recipients was chosen as the measuring instrument in this study.

status, financial pressure, years of residence, dwelling tenure, language proficiency, and religiosity (Barreto et al., 2021; Ciobanu & Fokkema, 2017; Neto & Barros, 2000; Pyle & Evans, 2018; Savikko et al., 2005; Van den Broek & Grundy, 2017; Yang & Victor, 2011). Therefore, these variables will be included in the analysis as control variables.

The educational level, based on the International Standard Classification of Education (ISCED-97), consists of 3 groups: low (ISCED 0–2), medium (ISCED 3–4), and high (ISCED 5–6). Employment status consists of a dummy variable whether or not the respondent has a paid job. Presence and location of partners consists of a categorical variable: those with a partner in the Netherlands (reference group), those with a partner not living in the Netherlands, and those without a partner. The presence and location of children is measured as follows: those who have children who live in the Netherlands but no children who live abroad (reference group), those who have children living abroad but no children in the Netherlands, those who have children who live in the Netherlands and children who live abroad, and those who are childless. Subsequently, dummy variables indicate whether respondents rated their own health as less than good rather than good or very good and whether respondents indicate that their household (in the Netherlands) has difficulties making ends meet financially. Dwelling tenure consists of a categorical variable: those who own an accommodation (reference group), those who pay rent, those who live in a rent-free accommodation, and other. Scores on the proficiency (understanding, speaking, reading, and writing) of the Dutch language vary from 4 to 20. The four answer scales of these skills with five categories each ranging from ‘not at all’ to ‘very well’ have been added together and form a very consistent scale (Cronbach's $\alpha = 0.94$). The minimum mastery of each of these skills would give a score of 4 and the maximum mastery a score of 20. Finally, a variable indicates the degree of religiosity: non-religious (reference group), religious and attends religious services less than monthly, and religious and attends religious services at least once a month. The respondents in the dataset are almost exclusively Roman Catholic. The descriptive statistics can be found in Table 1, where the mean levels and standard deviations of loneliness and the environmental characteristics in the final sample ($N = 1,129$) are presented.

Data analysis

Using Stata version 16, linear regression analysis is performed to examine the impact of the different regional factors on loneliness. Because respondents can be part of the same municipality and therefore have similar characteristics, a correction has been made for clustered standard errors. Also, analytic weights, based on gender, age, time since registration in population registers, household type, personal income, socio-economic status, nationality, area of residence, and urbanisation level, are used. Finally, the continuous variables are centered.

Due to high correlation (>0.70) between certain environmental characteristics (see Table S1 in the Supplementary Material), it was also examined how the environmental characteristics per theme separately impact loneliness among Polish migrants: population structure (Model A), ethnic amenities (Model B), population density (Model C), population dynamics (Model D), socio-

economic deprivation (Model E), crime (Model F), housing tenure (Model G), and neighbourhood quality (Model H). The outcomes of these models are presented in Table S2.

Then, as an additional analysis, two interaction terms were also considered. The first one is the interaction between the number of Poles in the region and the number of years of the Polish migrant in the Netherlands to examine, as suggested in the literature (see Theoretical framework), whether the presence of the same ethnic community is especially important in the first years of arrival and decreases the longer they stay in the country of destination. The second interaction term is between the population turnover rate and the number of years of the Polish migrants in the Netherlands, as according to the literature a high degree of turnover (mainly non-migrants) in the initial phase after the migration may be less problematic.

Finally, to visualize the spatial distribution of loneliness of Polish migrants within the Netherlands, the predicted loneliness score for a typical Polish migrant is calculated based on the regression equation from the full model. For the individual factors, the values of the independent variables in the sample are fixed to the means. Subsequently, the values of all environmental factors that are used in the regression of all Dutch municipalities are plugged in.

Table 1. Descriptive statistics for variables in the analysis ($N=1,129$).

Variables	Mean (SD) / Percentage
Loneliness	2.6 (1.9)
Number of Polish migrants	2457 (3325)
Herfindahl-Hirschman index	0.40 (0.19)
Polish store present	56.6
Population density	1941.7 (1884.5)
Population turnover rate	10.1
Share of social welfare benefit recipients	2.4
Afraid of becoming a victim	3.8
Share owner-occupied housing	57.7
Perceived deterioration	82.2
Perceived quality roads, paths, and squares	69.0
Female	51.1
Age	33.3 (7.6)
Educational level	
Low	27.4
Medium	49.5
High	23.1
Employed	78.7
Partner	
Partner, in NL	73.3
Partner, not in NL	7.6
No partner	19.1
Presence and location of children	
Children in NL and not abroad	32.8
Children abroad	12.4
Children in NL and abroad	4.7
No children	51.1
Self-rated health	
Less than good	19.7
Financial status	
Difficulty making ends meet	31.4

Years in NL	5.3 (3.3)
Dwelling tenure	
Owner	22.6
Tenant or subtenant, paying rent	72.0
Accommodation is provided rent-free	1.5
Other	3.9
Proficiency Dutch language	10.5 (4.18)
Religiosity	
Not religious	15.7
Religious, attends religious services < monthly	64.8
Religious, attends religious services ≥ monthly	19.5

Note: Presented scores based on values before centering.

Results

The results of the linear regression analysis are presented in Table 2. When looking at the impact of the individual-level variables, a few things stand out. A Polish migrant with a paid job appears to be less lonely than a Polish migrant who does not. Polish migrants without a partner, and also Polish migrants with a partner living abroad, are clearly lonelier than Polish migrants with a partner living in the Netherlands (of which 90.66% live together). There is no difference in loneliness between those having no partner and those having a partner abroad (Δb : 0.198, $p=0.373$). This implies that having a partner is only a buffer against loneliness when living together or living in the same country. Having children in both the Netherlands and abroad offers the best protection against loneliness. Compared to Polish migrants who have all children living abroad, loneliness among Polish migrants who have both children living in the Netherlands and children living abroad appears to be low (Δb : -1.255, $p<0.0005$). Childless Polish migrants are also relatively lonely compared to Polish migrants having both children living in the Netherlands and children living abroad (Δb : -0.996, $p<0.0005$). No differences in loneliness are found between having children abroad and having no children (Δb : -0.259, $p=0.211$). Less than good self-rated health and financial difficulties have a positive impact on loneliness among Polish migrants. Finally, the respondent's dwelling tenure also plays a role: compared to Polish migrants who own a house, tenants or those who live in a rent-free home are less lonely.

More importantly, there are also some interesting results concerning the environmental factors at the regional level. First, Polish migrants living in a more ethnically diverse region report more loneliness. However, as this relationship is not linear, three distinct phases can be discovered. The effect of ethnic diversity on loneliness is positive, the effect of squared ethnic diversity is negative, and the effect of ethnic diversity to the power of three is positive again. This means that first loneliness increases, it then flattens and decreases slightly, and finally increases again. When there is a small degree of ethnic diversity (up to an HHI of about 0.2) there is a small increase in loneliness among Polish migrants. When the ethnic diversity in the region subsequently increases to an HHI of approximately 0.6, the impact of ethnic diversity on loneliness flattens, and even decreases slightly, so that at an HHI of 0.5 the impact of ethnic diversity on loneliness is approximately equal to an HHI of 0.1. A strong increase can be seen from an HHI of 0.6. Second, contrary to the expectation, individuals living in a region with a larger share

of social welfare benefit recipients, and therefore live in a more socio-economically disadvantaged region, are less lonely. Third, Polish migrants living in a region with a large share of owner-occupied housing experience less loneliness. Note that the effects of the share of social welfare benefit recipients and the share of owner-occupied housing are not significant when considered separately (Model F and G in Table S2). Fourth, living in a region where the inhabitants experience better maintenance of paths, roads, and squares in the neighbourhood results in less loneliness among Polish migrants. Concerning the other environmental factors – the number of other Polish migrants, the presence of a Polish shop nearby, population density, population turnover rate, fear of crime, and the presence of deterioration – have no significant impact on loneliness. When only the indicators for population structure and individual factors are studied (Model A in Table S2), living in a region with a high number of Polish migrants does have a negative impact on loneliness. It is not significant in the full model due to the inclusion of the variables regarding the social benefit recipients and/or the share of owner-occupied housing. The correlation between a region with many Poles, a larger share of people entitled to social assistance, and a smaller percentage of owner-occupied homes is reflected in this. In this study, the variance of loneliness is explained for 14.4% by individual factors and 2.4% by environmental factors.

Table 2. Results of the full linear regression model of loneliness (0= Not lonely vs. 1-6 = Lonely) among Polish migrants in the Netherlands ($N=1,129$).

Variables	β
Population structure	
Number of Polish migrants (x100)	-0.003
Herfindahl-Hirschman index	14.145*
Herfindahl-Hirschman index ²	-42.881**
Herfindahl-Hirschman index ³	38.347**
Ethnic amenities (ref: No Polish store present)	
Polish store present	0.095
Population density	-0.000
Population dynamics	
Population turnover rate	-0.032
Socio-economic deprivation	
Share of social welfare benefit recipients	-0.343**
Crime	
Afraid of becoming a victim	-0.058
Housing tenure	
Share owner-occupied housing	-0.045**
Neighbourhood quality	
Perceived deterioration	-0.006
Perceived quality roads, paths, and squares	-0.044***
Female	-0.038
Age	
Educational level (ref: Low)	
Medium	0.053
High	0.004
Employed	-0.264*
Partner (ref: Partner, in NL)	
Partner, not in NL	0.408*

No partner	0.606***
Presence and location of children (ref: Children in NL and not abroad)	
Children abroad	0.396
Children in NL and abroad	-0.859***
No children	0.137
Self-rated health	
Less than good	1.066***
Financial status	
Difficulty making ends meet	0.633***
Years in NL	0.008
Dwelling tenure (ref: Owner)	
Tenant or subtenant, paying rent	-0.266*
Accommodation is provided rent-free	-1.241**
Other	0.104
Proficiency Dutch language	-0.009
Religiosity (ref: Not religious)	
Religious, attends religious services < monthly	0.088
Religious, attends religious services ≥ monthly	-0.133
Intercept	2.273***
R-squared	0.169

Legend: * p<0.05; ** p<0.01; *** p<0.001

Additional analyses were then performed, adding two interactions: between the number of Polish migrants and population turnover in a region, respectively, and the number of years that a respondent has lived in the Netherlands (see Table S3). The main effect of the number of Polish migrants in the region on loneliness is now statistically significant with more Polish migrants in a region resulting in less loneliness. Yet, the interaction effect is positively significant, indicating that the effect of the number of other Polish migrants in the region as a protective factor against loneliness decreases the longer Polish migrants live in the Netherlands. From this outcome, it can be inferred that after about nine years there is a tipping point where more Poles in the region result in more loneliness. There is no significant interaction between population turnover in the region and Polish migrants' years of residence in the Netherlands. By adding the interactions, the explained variance of loneliness by environmental factors increased to 3.0%.

Finally, Figure 1 visualizes the predicted loneliness of a typical Polish migrant per Dutch municipality in 2015. Regions can be discovered throughout the Netherlands where the predicted risk of loneliness among Polish migrants is high. A relatively large proportion of regions with high predicted loneliness can be found in the province of South-Holland, the southwest of Gelderland, and on the border between the south of Drenthe and the north of Overijssel.

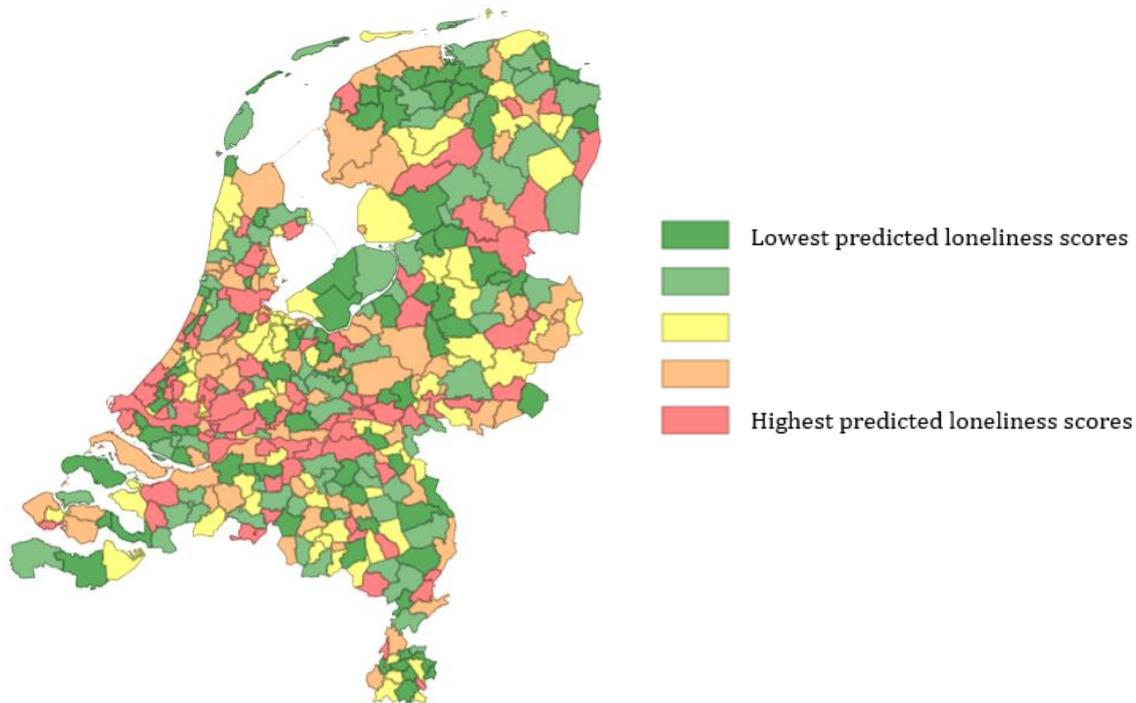


Figure 1. Predicted loneliness of the 393 Dutch municipalities in 2015. *Source:* author.

Discussion and conclusion

This study examined environmental factors and their impact on regional variation in loneliness among Polish migrants in the Netherlands. This is different from previous studies which most of the time only used individual-level characteristics or merely limited and simple environmental factors to explain differences in loneliness. In this study, the impact of more specific environmental factors on loneliness among Polish migrants was examined. It shows that certain environmental factors impact the degree of loneliness among Polish migrants in the Netherlands.

The result concerning the number of Polish migrants and the impact on loneliness partly confirms the first hypothesis of more Polish migrants in the region reducing loneliness among Polish migrants. This is consistent with what was expected in the theory; the presence of people from the same cultural community offers opportunities to build a social network (Buffel & Phillipson, 2011). However, there is only evidence for this impact when years of residence is taken into account: more Poles in the region reduce loneliness, but the longer someone lives in the Netherlands, the weaker this effect becomes. This may be the result of language barriers and the lack of a network in the initial phase after migration which ensure that these migrants mainly interact with each other, while at some point they want to look beyond their own cultural community. This is in line with the study by Ryan (2011) who indicates that sharing ethnicity is not enough for good friendships and that at some point migrants look beyond their own.

The hypothesis of greater ethnic diversity in a region leading to more loneliness among Polish migrants is also partly confirmed (Hypothesis 2). Although ethnic diversity leads to loneliness, the impact of diversity on loneliness is not linear. Between an HHI of 0.2 and 0.5,

loneliness does not increase and especially in regions with an HHI of 0.6 or higher, there is a rapid increase in loneliness. A possible explanation for this could be that, in addition to the negative impact of ethnic diversity on social cohesion, ethnic diversity to a certain degree (in this case an HHI of 0.5) may not necessarily lead to less interethnic social cohesion (Van der Meer & Tolsma, 2014). When ethnic diversity has passed that point, interethnic social cohesion may also decline. This is different from the report by Jennissen and colleagues (2018) who found that the degree to which people rate the neighbourhood as less cohesive flattens as the ethnic diversity of a neighbourhood increases. Consistent with Jennissen and colleagues (2018), there is no tipping point where loneliness reaches a lowest point at a certain value of ethnic diversity and then becomes stronger again.

No evidence is found for the effect of the presence of ethnic amenities on loneliness among Polish migrants (Hypothesis 3). The presence of Polish supermarkets has been used as an indicator, but supermarkets may be used less than expected as social meeting places. Another possible explanation could be that the owners of these Polish supermarkets in the Netherlands are largely not of Polish origin (Van Bokkum, 2018). Because of this, the real Polish feeling may be less present in these places and when Poles specifically go to these supermarkets for this feeling, it may not live up to the expectation of the Polish customer. It may also be the case that the presence of Polish supermarkets is not the most optimal measure of the impact of ethnic amenities on loneliness. For example, no distinction is made in the size of the supermarket. It is possible that some supermarkets are too small with a limited supply, which means that Polish migrants may come there less often and stay for a short time. When a Polish supermarket is slightly larger, customers may stay longer in the supermarket, which increases the chance to meet people. However, it may be the case that personal contact with supermarket staff occurs more often in smaller supermarkets than in large-scale supermarkets. Besides, Polish supermarkets may not be the most optimal measuring instrument to measure the impact of the presence of ethnic amenities on loneliness. For example, the presence of Polish associations in the region could serve more as a social hub where contacts may be more in-depth compared to a spontaneous meeting in the supermarket. Future research could examine whether taking into account supermarkets from a certain size or the presence of Polish associations have an impact on loneliness.

Concerning the expected positive impact of population density on loneliness (Hypothesis 4), it does not appear to have an impact on loneliness among Polish migrants. A possible explanation for this is that population density has been included at the municipality level in this study. Within municipalities in the Netherlands, however, there can be a large difference in population density. For example, very large municipalities may have a relatively high population density due to the presence of one or a few larger towns, while Polish migrants live in a less densely populated region within this municipality.

No effect of population turnover in a region has been found on loneliness among Polish migrants. Hypothesis 5 is therefore rejected. What may have to do with this is that no distinction has been made between the people who are part of the turnover in the region. When people of

the same age group or socioeconomic class leave and very different people take their place, many possible social contacts could be lost as people tend to build social connections with people who are similar to them (Granovetter, 1983; Putnam, 2000). In follow-up studies, it could be examined whether the composition of the population turnover has an impact on loneliness.

The sixth hypothesis contains the expectation that a high degree of socio-economic deprivation in a region has a positive impact on loneliness among Polish migrants. In contrast, findings show that Polish migrants living in a region with a large share of social welfare benefit recipients are less lonely, thus hypothesis 6 is rejected. In regions with more deprivation, there would be a lower degree of cohesion and informal social control, as argued by Drukker and Van Os (2003), possibly resulting in more loneliness. This apparently applies to a lesser extent to Polish migrants. A possible explanation for this could be that a larger proportion of people with social welfare benefits, and therefore no paid job, increase the chance to form social ties with this group. If people in the region are always working, social ties might develop to a lesser extent.

Contrary to Hypothesis 7, the proportion of people with fear of becoming a victim appears to have no impact on loneliness. This may be because the perceived crime could have both a positive and a negative impact on loneliness. According to Skogan (1990), attachment in the neighbourhood and social cohesion can be reduced or strengthened, because residents can have both positive and negative reactions when they experience local problems. On the one hand, fear of crime may add barriers to social engagement, weaken trust between neighbours and cause alienation (Barnes et al., 2006; Matthews et al., 2019; Prezza & Pacilli, 2007). On the other hand, when residents are confronted with disorder or crime, this may not diminish attachment or sever ties with neighbours, and even increases the residents' willingness to jointly solve local problems (Woldoff, 2002). Follow-up studies could include how people deal with fear of crime in the neighbourhood.

A higher share of owner-occupied housing in a region decreases the level of loneliness among Polish migrants, which is in line with Hypothesis 8. Based on the literature, having a large proportion of homeowners in a region could lead to more social cohesion and neighbourhood attachment in the region. Homeowners often live in a certain neighbourhood for a longer period of time and often invest more in the objective and social environment in the neighbourhood, resulting in less loneliness.

Finally, there is partial evidence that, as formulated in Hypothesis 9, a high level of deterioration in a region has a positive impact on loneliness among Polish migrants. First, there is no evidence that perceived presence of deterioration has a positive impact on loneliness. An explanation for this could be that residents can also have both positive and negative reactions to these types of local problems. Moreover, it may not necessarily mean that the presence of deterioration causes people to experience nuisance. For example, Marans (1979) found that perceptions of environmental problems in particular were the most important predictors of neighbourhood satisfaction. Therefore, it may be that the chosen measuring instrument is not the most optimal for assessing the impact of deterioration on loneliness. Future studies could, for example, examine the extent to which nuisance is experienced as a result of deterioration and its

impact on loneliness. Second, evidence has been found that the quality of roads, paths, and squares has an impact on loneliness. When maintenance of roads, paths, and squares in the region is assessed as better, the loneliness of Polish migrants is lower. This could mean that a better quality of pedestrian areas leads to more use, which, as expected in the literature (Atkinson & Kintrea, 2000; Kerstens, 2015), promotes interaction within the neighbourhood, resulting in more social cohesion and therefore less loneliness.

This study aimed to identify the role of environmental factors in the regional variation of loneliness among Polish migrants in the Netherlands. Based on a quantitative analysis, it can be concluded that the presence of other Polish migrants, especially in the first years after migration, the degree of ethnic diversity, socio-economic deprivation, housing tenure, and perceived quality of the neighbourhood are important factors to consider when explaining the regional variation in loneliness of Polish migrants. The findings indicate that the degree of neighbourhood attachment and social cohesion can function as protective factors against loneliness. This mainly concerns the quality and physical layout of the neighbourhood in relation to neighbourhood attachment and social cohesion. Characteristics concerning the composition of the population or the change in this composition appear to have a lesser impact. These insights can be used in interventions by policymakers to stimulate neighbourhood attachment and social cohesion, thereby offering protection against loneliness.

The study illustrates the impact of certain environmental factors on loneliness, however, several hypotheses could not be proven due to statistically insignificant results. This may be due to the fact that the data has been included at the municipal level, while it might have given statistically significant results at the neighbourhood level. There are differences in the size of municipalities, whereby there may also be large differences in environmental factors within larger municipalities. This might give a distorted picture when using the values of the entire municipality. Further research is needed to determine the effect of environmental factors on loneliness on a smaller regional scale, such as zip codes. To conclude, besides individual characteristics and superficial environmental factors used in existing studies, this article has provided more comprehensive insights into environmental factors that impact loneliness.

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Supplementary material

Table S1. Correlation matrix of the environmental indicators.

	Loneliness	Number of Polish migrants	Herfindahl-Hirschman index	Polish store present	Population density	Population turnover rate	Share of social welfare benefit recipients	Afraid of becoming a victim	Share owner-occupied housing	Perceived deterioration	Perceived quality roads, paths, and squares
Loneliness	1.0000										
Number of Polish migrants	0.0066	1.0000									
Herfindahl-Hirschman index	0.0127	0.7872	1.0000								
Polish store present	0.0148	0.4824	0.6009	1.0000							
Population density	0.0167	0.7857	0.8307	0.5030	1.0000						
Population turnover rate	0.0089	0.4099	0.5893	0.2124	0.5934	1.0000					
Social benefit recipients	0.0164	0.7651	0.8795	0.5247	0.7031	0.4749	1.0000				
Afraid of becoming a victim	0.0292	0.7289	0.7656	0.4363	0.6353	0.4024	0.7640	1.0000			
Owner-occupied housing	-0.0418	-0.6617	-0.8758	-0.5209	-0.7682	-0.6412	-0.6855	-0.8989	1.0000		
Perceived deterioration	0.0381	0.4828	0.6815	0.5004	0.5883	0.4587	0.6447	0.6568	-0.6841	1.0000	
Perceived quality roads, paths, and squares	-0.0823	0.0689	-0.0001	-0.0770	0.0392	0.1995	-0.1848	-0.1135	0.0177	-0.3057	1.0000

Table S2. Results of linear regression models of loneliness (0= Not lonely vs. 1-6 = Lonely) among Polish migrants in the Netherlands ($N=1,129$).

Variables	Model A	Model B	Model C	Model D	Model E	Model F	Model G	Model H	Model I
Population structure									
Number of Polish migrants (x100)	-0.009**								-0.003
Herfindahl-Hirschman index	14.377*								14.145*
Herfindahl-Hirschman index ²	-41.904**								-42.881**
Herfindahl-Hirschman index ³	36.182**								38.347**
Ethnic amenities									
Polish store present		0.045							0.095
Population density									
			-0.000						-0.000
Population dynamics									
Population turnover rate				-0.013					-0.032
Socio-economic deprivation									
Share of social welfare benefit recipients					-0.015				-0.343**
Crime									

Afraid of becoming a victim								-0.008		-0.058
Housing tenure										
Share owner-occupied housing									-0.003	-0.045**
Neighbourhood quality										
Perceived deterioration										-0.013
Perceived quality roads, paths, and squares										-0.028*
Female	-0.045	-0.045	-0.046	-0.042	-0.045	-0.045	-0.045	-0.046	-0.049	-0.038
Age	-0.020	-0.019	-0.020	-0.020	-0.020	-0.020	-0.020	-0.019	-0.019	-0.018
Educational level (ref: Low)										
Medium	0.024	0.018	0.018	0.026	0.019	0.019	0.019	0.014	0.046	0.053
High	-0.013	0.000	0.005	0.024	0.014	0.010	0.010	-0.016	0.047	0.004
Employed	-0.236	-0.241	-0.241	-0.241	-0.243	-0.240	-0.240	-0.239	-0.249	-0.264*
Partner (ref: Partner, in NL)										
Partner, not in NL	0.422*	0.464*	0.463*	0.463*	0.462*	0.463*	0.463*	0.465*	0.470*	0.408*
No partner	0.587***	0.563***	0.565***	0.567***	0.571***	0.566***	0.566***	0.560***	0.564***	0.606***
Presence and location of children (ref: Children in NL and not abroad)										
Children abroad	0.416	0.420	0.419	0.422	0.419	0.421	0.421	0.418	0.386	0.396
Children in NL and abroad	-0.825**	-0.825**	-0.820**	-0.815**	-0.818**	-0.820**	-0.820**	-0.826**	-0.808**	-0.859***
No children	0.144	0.160	0.161	0.170	0.160	0.161	0.160	0.160	0.172	0.137
Self-rated health										
Less than good	1.020***	1.038***	1.038***	1.039***	1.040***	1.040***	1.040***	1.037***	1.048***	1.066***
Financial status										
Difficulty making ends meet	0.676***	0.673***	0.674***	0.674***	0.674***	0.674***	0.674***	0.673***	0.665***	0.633***
Years in NL	0.008	0.009	0.009	0.010	0.009	0.009	0.009	0.009	0.009	0.008
Dwelling tenure (ref: Owner)										
Tenant or subtenant, paying rent	-0.272*	-0.280*	-0.282*	-0.279*	-0.285*	-0.283*	-0.283*	-0.281*	-0.255	-0.266*
Accommodation is provided rent-free	-1.184*	-1.189*	-1.192*	-1.205*	-1.200*	-1.194*	-1.194*	-1.180*	-1.206*	-1.241**
Other	0.107	0.066	0.060	0.063	0.053	0.056	0.056	0.068	0.082	0.104
Proficiency Dutch language	-0.008	-0.007	-0.007	-0.008	-0.008	-0.008	-0.008	-0.007	-0.008	-0.009
Religiosity (ref: Not religious)										
Religious, attends religious services < monthly	0.110	0.076	0.076	0.074	0.074	0.076	0.076	0.083	0.063	0.088
Religious, attends religious services ≥ monthly	-0.118	-0.146	-0.145	-0.149	-0.148	-0.145	-0.145	-0.139	-0.151	-0.133
Intercept	2.287***	2.292***	2.316***	2.301***	2.319***	2.314***	2.314***	2.317***	2.290***	2.257***
R-squared	0.152	0.145	0.144	0.145	0.145	0.144	0.144	0.145	0.149	0.169

Legend: * p<0.05; ** p<0.01;*** p<0.001

Table S3. Results of linear regression models of loneliness with interactions (0= Not lonely vs. 1-6 = Lonely) among Polish migrants in the Netherlands ($N=1,129$).

Variables	Final Model I	I with Interaction
Population structure		
Number of Polish migrants (x100)	-0.003	-0.009*
Number of Polish migrants (x100) # Years in NL		0.001***
Herfindahl-Hirschman index	14.145*	14.375*
Herfindahl-Hirschman index ²	-42.881**	-43.604**
Herfindahl-Hirschman index ³	38.347**	39.049**
Ethnic amenities		
Polish store present	0.095	0.097
Population density		
	-0.000	-0.000
Population dynamics		
Population turnover rate	-0.032	-0.023
Population turnover rate # Years in NL		-0.001
Socio-economic deprivation		
Share of social welfare benefit recipients	-0.343**	-0.349**
Crime		
Afraid of becoming a victim	-0.058	-0.057
Housing tenure		
Share owner-occupied housing	-0.045**	-0.046**
Neighbourhood quality		
Perceived deterioration	-0.006	-0.004
Perceived quality roads, paths, and squares	-0.044***	-0.045***
Female	-0.038	-0.033
Age	-0.018	-0.018
Educational level (ref: Low)		
Medium	0.053	0.035
High	0.004	-0.006
Employed	-0.264*	-0.282*
Partner (ref: Partner, in NL)		
Partner, not in NL	0.408*	0.410*
No partner	0.606***	0.606***
Presence and location of children (ref: Children in NL and not abroad)		
Children abroad	0.396	0.397
Children in NL and abroad	-0.859***	-0.891***
No children	0.137	0.132
Self-rated health		
Less than good	1.066***	1.047***
Financial status		
Difficulty making ends meet	0.633***	0.626***
Years in NL	0.008	-0.002
Dwelling tenure (ref: Owner)		
Tenant or subtenant, paying rent	-0.266*	-0.256*
Accommodation is provided rent-free	-1.241**	-1.238**
Other	0.104	0.102
Proficiency Dutch language	-0.009	-0.010
Religiosity (ref: Not religious)		
Religious, attends religious services < monthly	0.088	0.078
Religious, attends religious services \geq monthly	-0.133	-0.133
Intercept	2.257***	2.289***
R-squared	0.169	0.173

Legend: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Reflection

Conceptual model

The figure below visualizes the conceptual model of this study based on theories about the impact of environmental factors on the degree of neighbourhood feelings and social cohesion, which act as protective factors against loneliness. With a greater degree of social cohesion, there may be more social interaction and a sense of being socially integrated (Yu et al., 2021). Also, people participate more actively in public space and engage in more social interactions when they feel attached to the neighbourhood (Bergefurt et al., 2019; Weijs-Perrée et al., 2015). When these environmental factors contribute to more neighbourhood feelings and/or social cohesion, this is expected to lead to less loneliness among Polish migrants in the Netherlands.

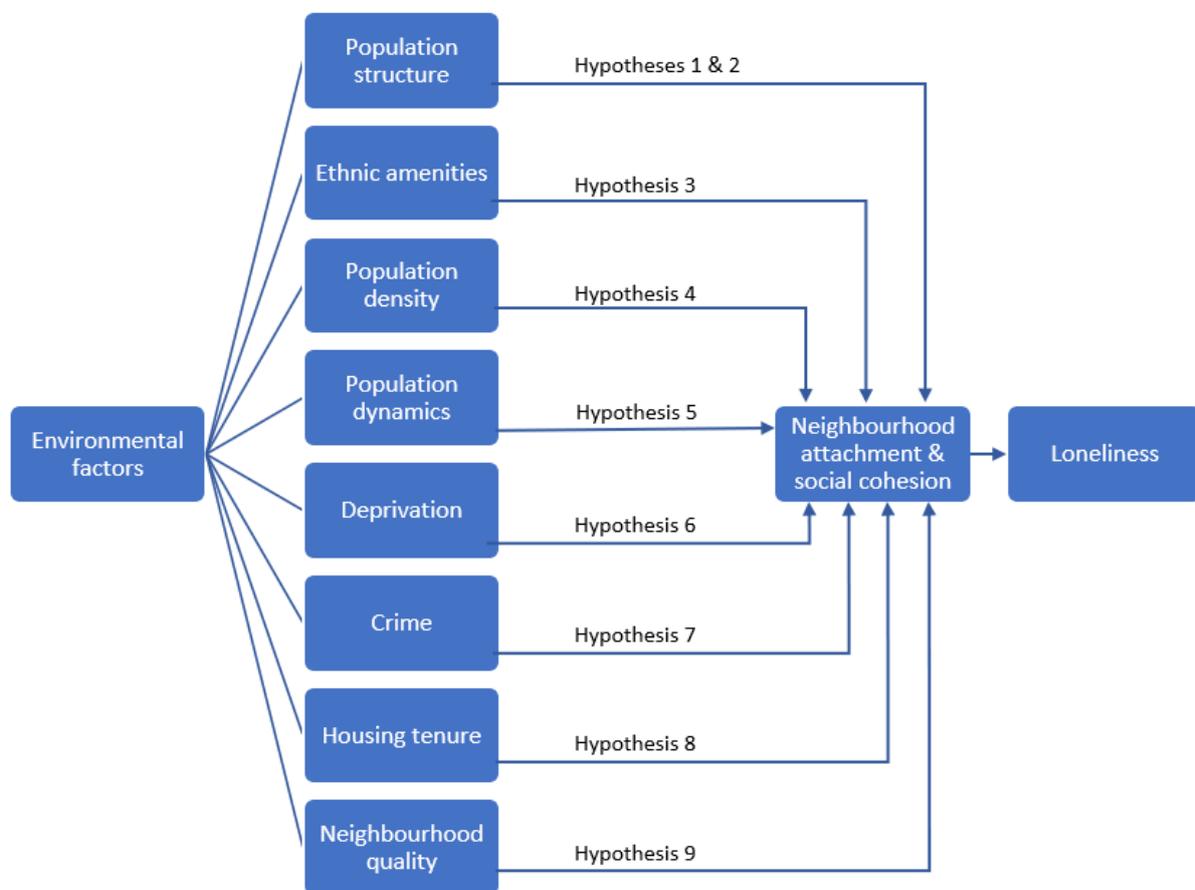


Figure S1. Conceptual model. *Source:* author's own illustration, based on theoretical framework and literature review.