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Original article

# Neighborhood Environment and Stress: Findings from the ESSE-RF-3 Epidemiological Study

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**Abstract:** *Introduction* — Both Russian and international studies demonstrate that living environment and neighborhood characteristics have influence on health status, including mental well-being. The aim of the study was to examine the associations between neighborhood environment and individual likelihood of stress among the Russian population.
*Material and Methods* — The multicentre study *"Epidemiology of Cardiovascular Diseases and Their Risk Factors in the Regions of the Russian Federation. Third Survey"* was conducted in 2020-2022 across 15 regions of Russia. The analysis included 28,731 men and women aged 35-74 years. Neighborhood infrastructure was assessed using the Russian version of the NEWS questionnaire, while stress was measured with the Perceived Stress Scale (PSS; Cohen's Scale). Associations between stress and neighborhood infrastructure characteristics were evaluated using logistic regression adjusted for covariates. Results were presented as odds ratios (OR) with 95% confidence intervals (CI).
*Results* — A lower likelihood of stress was associated with shorter distances from the place of residence to facilities (OR=0.91; 95% CI 0.87-0.94), greater accessibility of key facilities (OR=0.51; 95% CI 0.48-0.55), and improved traffic-related safety (OR=0.60; 95% CI 0.56-0.66). In contrast, higher population density (OR=1.002; 95% CI 1.001-1.004), better pedestrian infrastructure quality (OR=1.16; 95% CI 1.10-1.22), and enhanced neighborhood aesthetics (OR=1.08; 95% CI 1.03-1.13) were associated with increased stress probability.

*Conclusion* — The results of the study showed a substantial impact of certain neighborhood characteristics on stress, an indicator of mental health in the Russian population. The link between residential environment and mental health can be applicable in public health, policy-making, and urban planning.

**Keywords:** stress, infrastructure, residential neighborhood, population density, Russia

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## Introduction

A significant number of Russian and international studies shows that human health depends on the environment, including territorial characteristics of the area of residence [1, 2]. A residential neighborhood is an artificially created environment characterized by well-designed land use and transportation networks, improved public and courtyard spaces, thoughtfully planned building density, favorable social and utility infrastructure, and an aesthetically appealing natural and territorial landscape [3]. Since individuals spend a considerable time within their neighborhood, its influence is highly significant. Accordingly, the link between neighborhood characteristics and health outcomes has been attracting increasing attention from researchers and public health administrators [4].

Living in favorable conditions is associated with better physical health, lower prevalence of chronic diseases, and reduced mortality rates [5]. These associations can be explained by broader opportunities for education, employment, recreation, access to well-developed social infrastructure, and a wider range of services, including health care [6]. Neighborhood characteristics and the way they are perceived may influence not only physical health but also certain aspects of mental health, such as stress, depression, anxiety, and overall life satisfaction [7]. Over the past two decades, interest in the role of the "place of residence" in shaping population mental health has increased substantially [8]. In fact, this research problem has evolved into a new interdisciplinary field within health geography, integrating perspectives from ecology, public health, psychology, urban and rural planning, as well as sociology [9, 10].

According to Stanislav Kasl, stress may be associated with individual characteristics, as well as with neighborhood environmental factors [11]. Living in an unfavorable environment can trigger short- and long-term stress, which causes irreversible harm [5]. Studies from many countries around the world have demonstrated the significant impact of neighborhood environmental characteristics – such as housing conditions, availability of green spaces, neighborhood social support, safety, and others – on residents' mental health [9]. In 2002, Lawrence R.J. showed that insufficient safety, high noise levels, and limited access to amenities and green areas within the neighborhood was associated with mental well-being decline [12]. Numerous studies have further demonstrated that in neighborhoods lacking public amenities, safe environments, and adequate housing, residents experience elevated stress levels and an increased risk of depression [13]. These findings encourage researchers and urban planners to place greater emphasis on creating resident-oriented, comfortable living environments [3].

Studies have examined not only the overall level of neighborhood comfort but also the influence of specific components (characteristics). For instance, the beneficial effects of nature and urban greenery on mental health have been demonstrated in numerous studies conducted worldwide [9, 14, 15]. Other studies have highlighted the importance of crime rates, access to amenities, and neighborhood satisfaction in relation to physical health and several aspects of mental health, including stress, depression, and anxiety [16]. Perceived stress from traffic has been found to be primarily associated with general health status and depression, whereas neighborhood safety and residents' social connections are more strongly related to mental health [16].

Most of these studies have focused predominantly on green spaces, while the influence of other important neighborhood characteristics – such as population density, the number and accessibility of infrastructure facilities, road safety, pedestrian infrastructure, and other resident-relevant parameters – on mental well-being has rarely been assessed. At the same time, successful development and implementation of preventive measures targeting environmental factors that affect mental health require an understanding of how differences in residential conditions across specific territories influence population health. Moreover, the vast majority of these studies have been conducted abroad, which limits the applicability of their findings to the Russian population. The few Russian studies available have mainly examined associations between neighborhood infrastructure and physical health indicators [17, 18, 19] or have not addressed the general population [20].

Therefore, the aim of the present study was to investigate the associations between neighborhood infrastructure characteristics and the individual probability of stress among Russian citizens.

## Material and Methods

Data for this analysis were drawn from the Russian multicenter study *Epidemiology of Cardiovascular Diseases and Their Risk Factors in Regions of the Russian Federation. Third Survey (ESSE-RF-3)*, conducted in 2020-2022 across 15 regions of the Russian Federation. The total sample included 28,731 men and women

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aged 35-74 years. Detailed information on the sampling procedures has been published previously [21]. The study was approved by the Ethics Committee of the National Medical Research Center for Therapy and Preventive Medicine and conducted in accordance with Good Clinical Practice (GCP) standards and the principles of the Declaration of Helsinki. All participants provided written informed consent.

Neighborhood infrastructure was assessed using the Russian-language version of the *Neighborhood Environmental Walkability Scale (NEWS)* [22]. Based on the questionnaire results, quantitative values were calculated for eight scales:

- Higher values on Scale A indicated greater population density.
- Higher values on Scale B indicated shorter average distances between facilities and the respondent's place of residence.
- Higher scores on Scales C through H indicated increased accessibility, walkability, quality, and safety of neighborhood infrastructure. Specifically, Scale C captured access to facilities; Scale D, street walkability; Scale E, quality of pedestrian infrastructure; Scale F, neighborhood aesthetics; Scale G, traffic-related safety; and Scale H, crime-related safety.

All scales had quantitative measures. The range of Scale A was 1-75; Scale B, 1-5; and Scales C-H, 1-4. The mean values ± standard deviation for the total sample were as follows: Scale A – 26.1±17.5, Scale B – 2.7±0.8, Scale C – 3.0±0.5, Scale D – 2.8±0.7, Scale E – 2.8±0.7, Scale F – 2.6±0.7, Scale G – 2.7±0.4, and Scale H – 3.3±0.7.

**Table 1. Sample characteristics.**

| *Characteristic* | *Criteria* | *Percentage (n)* |
|---|---|---|
| Men | | 47.0 (13,490) |
| | 35-44 | 25.0 (7,189) |
| Age | 45-54 | 25.3 (7,268) |
| | 55-64 | 26.1 (7,501) |
| | 65-74 | 23.6 (6,773) |
| Urban residence | | 78.5 (22,563) |
| | Low | 26.8 (7,699) |
| Income | Middle | 55.8 (16,026) |
| | High | 17.4 (5,006) |
| Higher education | | 47.0 (13,512) |
| Family | | 69.2 (19,874) |
| | White-collar | 45.5 (13,075) |
| Occupation | Blue-collar | 19.6 (5,639) |
| | Other | 34.9 (10,017) |
| Adequate physical activity | | 27.4 (7,885) |
| Smoking | | 17.0 (4,879) |
| Stress | ≥18 points | 25.5 (7,322) |

**Table 2. Associations between infrastructure-related scales and stress**

| *Infrastructure characteristic* | *Stress (n=28,426)* | |
|---|---|---|
| | OR (95% CI) | p-value |
| Scale A: population density | 1.002 (1.001-1.004) | 0.016 |
| Scale B: distance | 0.91 (0.87-0.94) | <0.001 |
| Scale C: accessibility | 0.51 (0.48-0.55) | <0.001 |
| Scale D: walkability | 0.90 (0.85-0.94) | <0.001 |
| Scale E: pedestrian infrastructure | 1.16 (1.10-1.22) | <0.001 |
| Scale F: aesthetics | 1.08 (1.03-1.13) | 0.001 |
| Scale G: safety (traffic) | 0.60 (0.56-0.66) | <0.001 |
| Scale H: safety (crime) | 1.05 (1.01-1.10) | 0.021 |

Adjusted for sex, age, urban/rural residence, income, marital status, education, occupation, smoking, and physical activity.

Stress levels were assessed using the *Perceived Stress Scale (PSS)*, scored according to Cohen's Stress Scale [23]. Scores in the upper quartile (≥18 points) were classified as indicative of stress.

Investigated associations were adjusted for a range of individual covariates: sex, age, place of residence (urban/rural), income, marital status (married / not married), educational attainment (higher education / no higher education), smoking, and physical activity level. Income was indirectly assessed using three questions capturing the proportion of income spent on food, respondents' perceptions of their family's financial resources, and their perceived standard of living relative to other families. Respondents' occupations were grouped into "white-collar," "blue-collar," and "nonworking" categories based on self-reported professional categories, classified according to the International Labour Organization's ISCO-08 standard. Overall physical activity was assessed using the *Global Physical Activity Questionnaire (GPAQ)*, with metabolic equivalents (METs) calculated and adequate physical activity defined as >600 MET-minutes per week [24].

Associations between neighborhood infrastructure and stress were evaluated using logistic regression. All covariates were included in the models. Scores for Scales A–H were entered simultaneously. If a statistically significant association between a specific infrastructure scale and stress was identified, additional analyses were conducted to examine associations between stress and each item within that scale. In such cases, all items from the scale were entered simultaneously into the regression model, while other scales and covariates remained unchanged. Associations are presented as odds ratios (OR) with 95% confidence intervals (CI). Statistical analyses were performed using SPSS software, version 22 (IBM Corp., USA).

## Results

In the study sample, men and women were equally represented. Most participants resided in urban areas, had a family, and were evenly distributed across age strata and education levels (*Table* 1). Nearly half of the respondents reported a middle income and were employed in non-industrial occupations. Only 27.4% had adequate physical activity, and 17% of the sample reported smoking. According to the methodology, every fourth participant (25.5%) had a high perceived stress score on the PSS scale.

A regression analysis of the stress level in relation to neighborhood infrastructure is presented in *Table* 2. Findings of the additional analysis are provided in the *Appendix*. An increase in neighborhood population density (Scale A) was associated with a higher likelihood of stress (OR=1.002; 95% CI 1.001-1.004).

Shorter distances from residence to infrastructure facilities (Scale B) were associated with a reduced likelihood of stress (OR=0.91; 95% CI 0.87–0.94).

Greater accessibility of key infrastructure facilities (Scale C) – such as shops, shopping centers, and public transport stops – as well as higher overall walkability of the neighborhood (Scale D) were both associated with lower odds of stress (OR=0.51; 95% CI 0.48-0.55 and OR=0.90; 95% CI 0.85-0.94, respectively).

Improved pedestrian infrastructure quality (Scale E) was positively associated with stress probability (OR=1.16; 95% CI 1.10-1.22). However, within this scale, only the the number of cars parked between the road and the sidewalk showed a significant

association: the more parked cars, the higher the likelihood of stress (OR=1.17; 95% CI 1.12-1.22).

Higher aesthetic characteristics of the neighborhood (Scale F) were associated with an increased likelihood of stress (OR=1.08; 95% CI 1.03-1.13). This relationship was mainly mediated by the presence of interesting places to look at (OR=1.05; 95% CI 1.00-1.09). At the same time, the presence of greenery along the streets was inversely associated with stress probability (OR=0.94; 95% CI 0.90-0.98).

Greater traffic-related safety (Scale G) was associated with a reduced likelihood of stress (OR=0.60; 95% CI 0.56–0.66), primarily due to fewer cars, lower traffic speed near residential areas, and improved street lighting (*Appendix*).

An increase in the safety of the respondent's place of residence was associated with an increase in the likelihood of stress (OR=1.05; 95% CI 1.01-1.10), mainly due to daytime safety (*Appendix*).

**Discussion**

The findings of this study showed a significant, and at times ambiguous, impact of neighborhood environment and its specific components on the likelihood of stress among the Russian population. Higher population density in residential areas negatively influenced stress indicators, which is consistent with the majority of studies conducted worldwide. A study carried out in Guangzhou, China, reported that a one–percentage point increase in building density was associated with a 0.08-unit decrease in General Health Questionnaire (GHQ, a mental health measure) scores, whereas a one-unit increase in per capita green space was associated with a 0.18-unit decrease in GHQ [9]. The greater the number of buildings and enclosed spaces, the narrower the streets and roadways, and the fewer the green areas, water bodies, and sunlight, the higher the susceptibility to stress, the lower the emotional well-being, and the greater the overall deterioration in mental health [3, 25].

A more detailed analysis of our results revealed that the adverse effect of “pedestrian infrastructure” on stress levels was mediated by the presence of cars parked between the road and the sidewalk. The negative impact of parked cars on residents’ psycho-emotional state can be explained by narrow streets and sidewalks, additional difficulties when crossing roads, obstacles for pedestrians, and restricted visibility of walking areas, all of which create further discomfort.

To our surprise, Scale F, reflecting neighborhood aesthetics, was also negatively associated with stress levels. The strongest negative contribution came from residents’ agreement with the statement about the presence of “many interesting places to look at” in the neighborhood. This is likely related to the greater number of visitors to such areas, which can create additional inconveniences (domestic, economic, transport, and social) and negatively affect the health, safety, and well-being of residents. Similar findings were reported by Huang et al. (2021), who showed that cultural or historical sites, and recreational areas were significantly associated with an increased risk of depression [26].

Our study demonstrated that neighborhood safety decrease stress indicators. These findings stand in line with prior research, showing that an unfavorable environment, crime, antisocial behavior, vandalism, and neglected surroundings are predictors of mental health decline, that lead to stress and anxiety, sleep disturbances and other deteriorations in psychological well-being [4, 9, 27, 28]. When analysing neighborhood safety components, negative perceptions were primarily linked to “feeling unsafe when walking in the neighborhood during the day due to crime.” Adult residents, who may feel a personal responsibility for the safety of younger generations, could be particularly concerned, as children and grandchildren tend to spend more time in the area during daylight hours. Evidence suggests that individuals with sedentary lifestyles may attribute their inactivity to unfavorable neighborhood conditions, perceiving the area as unsafe [4]. Moreover, visible signs of a neighborhood disorder – such as graffiti, litter, and vandalism – common in many modern urban districts, can elicit negative emotions and heighten fear of crime, thereby contributing to increased stress and anxiety [27].

In our study, numerous neighborhood characteristics demonstrated a protective role in mitigating stress. As anticipated, shorter distances to key daily used infrastructure (e.g. supermarkets, post offices, schools, food outlets, fitness centres, laundries) were associated with lower stress levels. This observation indirectly supports the influence of accessibility (Scale C) of amenities (shops, parking slots, etc.) and the absence of mobility barriers in reducing the likelihood of stress. Khosravi and Tehrani (2019) likewise identified neighborhood safety and walkability as key determinants of mental health among older adults [28]. Furthermore, high walkability, together with access to public services and amenities, green spaces, and recreational areas, has consistently been shown to exert beneficial effects on mental health outcomes, enhancing quality of life and alleviating psychological stress [5, 9, 29].

As supported by our findings, perceived traffic safety in the residential environment may also play a role in reducing stress. When nearby traffic is slower, drivers comply with speed limits, vehicular flow does not impede pedestrian movement, and streets are adequately illuminated, residents are more likely to perceive local traffic as safe, which in turn exerts a favorable effect on stress indicators. These results are consistent with evidence from other countries. A systematic review of studies evaluating the impact of transport and traffic activity demonstrated that higher traffic volumes, road congestion, and the difficulty of crossing streets obstruct residents’ social interaction, thereby leading to poorer mental health outcomes [30, 31].

Thus, our study demonstrated that proximity and pedestrian accessibility of public facilities and services, together with high street walkability, perceived pedestrian safety, and favorable traffic conditions, represent important environmental determinants of mental health, contributing to a reduced likelihood of stress. In contrast, higher population density, lower safety indicators, inadequate pedestrian infrastructure, and the presence of tourist attractions within the neighborhood are associated with an increased likelihood of stress among residents.

**Conclusion**

This study provides important evidence on the influence of neighborhood conditions on the mental health of the Russian population.

Consistent with large-scale epidemiological studies worldwide, our findings showed the substantial impact of neighborhood environment on stress, a key indicator of population health. Critical factors include population density, distance to and well-designed pedestrian accessibility of neighborhood facilities, as well

as perceived safety. All these factors shape neighborhood perception and may mediate the relationship between the residential environment and stress.

Overall, obtained results advance understanding of how specific neighborhood characteristics affect the population health and well-being. Associations between place of residence and mental health carry practical significance and implications for public health, government policy, and urban and district planning.

Investments in healthy neighborhood environment may improve human health across the lifespan, reduce health disparity, and enhance overall quality of life at the population level.

**Ethical approval**

The study was approved by the Ethics Committees of National Research Center for Therapy and Preventive Medicine (Moscow, Russian Federation) No. 01–01/20 (04.02.2020) and No. 04-08/20 (02.07.2020).

**Conflict of interest**

The authors declare that they have no conflict of interest.

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**AI statement**

The authors declare that no generative AI or AI-assisted technologies were used in the preparation of this manuscript.

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**Appendix. Associations between neighborhood infrastructure characteristics and stress among the Russian population**

| *Scale* | *Neighborhood infrastructure characteristics* | *Stress* | |
|---|---|---|---|
| | | OR (95% CI) | p-value |
| B | Small grocery store | 1.19 (1.12-1.28) | <0.001 |
| | Supermarket | 0.94 (0.89-0.99) | 0.039 |
| | Hardware store | 1.07 (1.00-1.13) | 0.037 |
| | Fruit/vegetable market | 0.97 (0.93-1.02) | 0.29 |
| | Laundry/dry cleaner | 0.90 (0.86-0.95) | <0.001 |
| | Clothing store | 1.05 (0.99-1.11) | 0.12 |
| | Post office | 0.92 (0.87-0.97) | 0.002 |
| | Library | 0.96 (0.91-1.01) | 0.085 |
| | Kindergarten | 0.96 (0.90-1.03) | 0.27 |
| | School | 0.92 (0.86-0.98) | 0.012 |
| | Bookstore | 1.12 (1.06-1.18) | <0.001 |
| | Cafe/fast food outlet | 1.03 (0.97-1.09) | 0.30 |
| | Bank | 0.99 (0.94-1.06) | 0.95 |
| | Restaurant | 0.95 (0.91-1.01) | 0.078 |
| | Pharmacy | 1.01 (0.95-1.07) | 0.78 |
| | Hairdresser | 1.01 (0.95-1.06) | 0.78 |
| | Public transport stop | 1.15 (1.09-1.21) | <0.001 |
| | Park | 0.99 (0.94-1.04) | 0.67 |
| | Cultural/entertainment centre | 1.03 (0.97-1.09) | 0.39 |
| | Gym | 0.91 (0.86-0.96) | 0.001 |
| C | Shops are within walking distance from home | 0.87 (0.84-0.91) | <0.001 |
| | Parking near nearby shops/shopping centres is difficult | 0.89 (0.86-0.92) | <0.001 |
| | Many facilities are within walking distance of home | 0.93 (0.89-0.97) | 0.001 |
| | Bus stop is within walking distance of home | 0.92 (0.88-0.96) | <0.001 |
| | Streets in my neighborhood are hilly, making walking difficult | 0.88 (0.85-0.92) | <0.001 |
| | There are serious barriers to walking in the neighborhood | 0.88 (0.85-0.92) | <0.001 |
| D | Few cul-de-sacs in the neighborhood | 0.95 (0.92-0.98) | 0.001 |
| | Short distances between intersections in the neighborhood | 0.98 (0.94-1.01) | 0.22 |
| | Many alternative routes available nearby | 0.97 (0.93-1.01) | 0.16 |
| E | Most streets have sidewalks | 1.00 (0.95-1.04) | 0.87 |
| | Cars parked between road and sidewalk | 1.17 (1.12-1.22) | <0.001 |
| | Median strip between road and sidewalk | 0.98 (0.95-1.02) | 0.39 |
| F | Trees line the streets in the neighborhood | 0.94 (0.90-0.98) | 0.002 |
| | Many interesting places to look at in the neighborhood | 1.05 (1.00-1.09) | 0.041 |
| | Many natural attractions in the neighborhood | 1.03 (0.98-1.07) | 0.22 |
| | Beautiful buildings in the neighborhood | 1.03 (0.98-1.07) | 0.20 |
| G | So many cars on nearby streets that walking is difficult | 0.87 (0.83-0.90) | <0.001 |
| | Cars on nearby streets usually travel slowly (≤50 km/h) | 0.93 (0.90-0.97) | <0.001 |
| | Most drivers exceed speed limits in the neighborhood | 0.87 (0.83-0.90) | <0.001 |
| | Neighborhood streets are well lit at night | 0.90 (0.86-0.94) | <0.001 |
| | Many pedestrians on the streets in the neighborhood | 0.98 (0.94-1.02) | 0.37 |
| | Many pedestrian crossings and traffic lights in the neighborhood | 0.97 (0.93-1.01) | 0.19 |
| H | High crime rate in the neighborhood | 1.01 (0.96-1.08) | 0.62 |
| | Daytime walks in the neighborhood are unsafe due to crime | 1.08 (1.01-1.15) | 0.019 |
| | Night-time walks in the neighborhood are unsafe due to crime | 0.97 (0.91-1.02) | 0.24 |

Adjusted for sex, age, urban/rural residence, income, family status, education, occupation, smoking, and physical activity.

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