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ORIGINAL RESEARCH

Unveiling Seniors' Perception of Mobility: Urbanization, Region, and Physical Activity

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Background: Maintaining mobility is fundamental to active aging, allowing older adults to lead dynamic and independent lives. The perception of mobility among older adults significantly impacts their overall well-being and quality of life. Given the aging population, mobility has become an increasingly pressing issue.

Aim: This study focused on the perception of urban neighborhoods, including considerations of urban tissue (crossings and sidewalk maintenance), urban scenes (benches and traffic), and safety (fears and street lighting quality). We investigated the differences in the perception of the surroundings of residences by urban and rural seniors concerning their demographic and social characteristics and environmental determinants.

Methods: A quantitative study design utilizing a questionnaire survey was employed. Data were collected mainly through face-to-face interviews in the field (PAPI) and via an online questionnaire (CAWI). The final sample comprised 525 participants. Hypotheses regarding the influence of gender, age, social status, level of physical activity, degree of urbanization, and region on environmental perception were tested using ordinal regression.

Results: The hypothesis regarding the dependence of the perception of the surroundings on the level of urbanization was confirmed; that regarding the dependence of the perception of the residence surroundings on seniors' age was not confirmed. The other hypotheses were partially confirmed. For the seven investigated environmental attributes, gender was significant in two cases, social status and physical activity in three cases, and region in four cases.

Conclusion: While most studies have focused on urban settings, this study highlights the situation in rural municipalities. Substantially worse pedestrian conditions in availability of pedestrian crossings, benches, and lighting were recognized in rural municipalities versus cities. Understanding the complexity of mobility and the spatial locations relevant for older persons concerning potential barriers and facilitators for mobility aids in planning and adapting neighborhood environments to promote active and healthy aging in place.

Keywords: seniors, mobility, walking, perception, survey

Introduction

Maintaining mobility is essential for active aging, enabling older persons to continue living active and independent lives.[1] Impaired mobility has been identified as an early predictor of physical disability and is associated with negative outcomes such as falls, institutionalization, and mortality.[2] The perception of mobility among older adults significantly impacts their overall well-being and quality of life. Mobility is closely linked with independence and autonomy.[3,4] The ability to move around freely and access various places and services allows seniors to maintain their independence, make choices, and engage in activities that contribute to their physical, mental, and social well-being.[5] A positive perception of mobility encourages older adults to participate in social activities, reducing social isolation and loneliness.[6]

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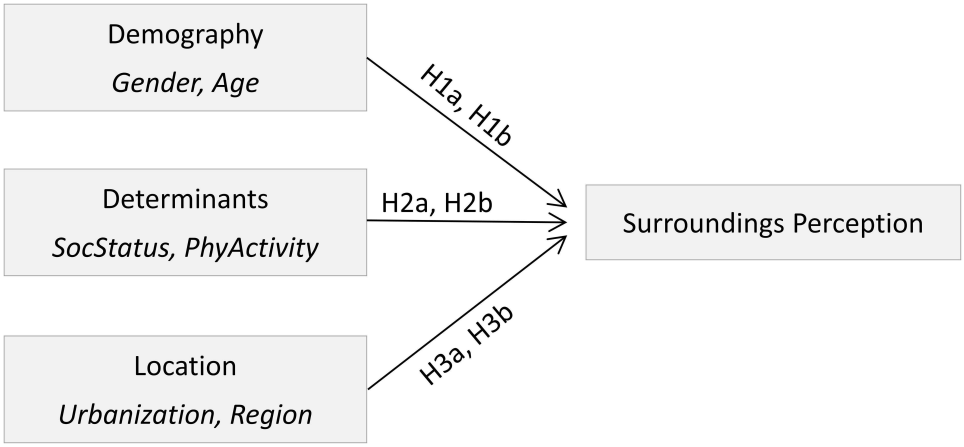

Figure 1 Scheme of Hypotheses.

Previous research has concluded that an age-friendly community has various dimensions, including physical environment, housing conditions, social environment, accessibility to activities, formal and informal support, health care, transport, and social interactions.[7–11] Studies have illustrated that factors such as personal safety, amenities, open spaces, proximity to healthcare services, and physical characteristics of the environment (eg, accessibility, walkability, safety, noise levels, lighting, and the presence of green spaces) play vital roles in older adults' perceptions of their surroundings.[12,13] Ran et al concluded that subjective socioeconomic status significantly affects the health of older adults with different class mobility trajectories.[14] The availability and quality of age-friendly infrastructure, including public transportation systems, accessible buildings, senior-friendly housing options, and community centers, can play a crucial role in how seniors perceive their surroundings.[15] Additionally, evidence indicates that out-of-home mobility is notably restricted in older adults living in rural areas due to less infrastructure, car dependency, and poor access to healthcare, indicating the need for intervention studies in rural areas.[16]

Overall, the perception of mobility and the environment in which seniors move can be influenced by factors such as age, level of physical activity, social status, level of urbanization, and regional specificities. Therefore, researchers have extensively analyzed factors affecting mobility and strategies to enhance mobility as people age.[17]

Our study aims to identify the differences in the perception of the surroundings of residence surroundings by urban and rural seniors concerning their characteristics and environmental determinants. This study contributes to the knowledge base on the perception of the environment from the perspective of senior citizens and how differences between cities and villages and regions influence this perception. While most studies have focused on urban municipalities, this study extends the research on rural municipalities. Understanding how older adults perceive the environment in which they move is crucial for developing effective municipal policies, infrastructure improvements, and age-friendly environments.

Methods

The previous section identified a set of factors that may significantly influence older adults' perceptions of their surroundings. Based on the most promising factors for planned research, the following hypotheses are proposed, schematically represented in Figure 1:

Hypotheses

H1a: Senior men and women perceive their surroundings differently.

H1b: The age of seniors affects their perception of their surroundings.

H2a: The social status of seniors affects their perception of their surroundings.

H2b: The level of physical activity of seniors affects their perception of their surroundings.

H3a: The level of urbanization affects seniors' perception of their surroundings.

H3b: The specificity of a region affects seniors' perception of their surroundings.

Study Design

To investigate the above hypotheses, a quantitative study design using a questionnaire survey was employed. The study is focused on the differences in the perception of the surroundings of residences by urban and rural seniors concerning their characteristics. The selection of environmental factors for investigation was informed by previous studies[18,19] and deep interviews conducted in 2021 with local seniors.[4] The factors selected were urban tissue[19] (crossings, sidewalk maintenance), urban scene (benches, traffic), and safety (fears, street lighting quality).

The pilot areas cover two regions of the Czech Republic, Hradec Kralove (HK) and Ostrava (OV). Ostrava is a polycentric industrial city with few transport issues and poor pedestrian conditions. Hradec Kralove represents a historic city with a strong center, good pedestrian conditions, and medium transport issues.[20] As a counterbalance to urban conditions, rural municipalities were surveyed. Rural municipalities have populations below 5000 inhabitants or a population density below 150 inhabitants/km^2.[21] Furthermore, a cluster analysis based on demographic, socioeconomic, transport conditions, and municipal features from census data identified four main types of rural municipalities. "Mountain villages" are characterized by important relief changes, higher unemployment, fewer natives, low urban density, less agriculture use, and a peripheral position. "Typical villages" contain a higher proportion of religious people, large families, natives, and low unemployment. "Disappearing villages" experience population decline, an aging population, and lower levels of education. "Prosperous villages" are significantly increasing their population and are characterized by higher population density, a higher share of agricultural land, and moderate terrain. Two cities represent the fifth group.

The respondents comprised seniors aged 65 years and above living in two pilot areas and were selected by quota sampling. The number of respondents was set as follows: 230 seniors from the HK region (the city of Hradec Kralove and nearby rural municipalities) and 260 from the OV region (the city of Ostrava and nearby rural municipalities). This represents 0.3% of the senior population in each region. Stratification consists of age groups, gender, territorial coverage, and urbanization based on the census data. Thus, despite the small available sample, we covered various socioeconomic and geographical conditions.

The questionnaire survey was conducted in the spring of 2022 by the Research Agency STEM/MARK (https://www.stemmark.cz/about-us/), involving 30 trained interviewers. The interviewers' work was subsequently checked by recontacting 30% of the respondents. Data were collected through face-to-face interviews in the field (PAPI) or online questionnaires (CAWI). Concerning the target group of seniors, the PAPI technique prevailed (85.6%). An additional small PAPI survey was conducted after the first round of data collection to balance the required quota shares. Ultimately, the set minimum quotas for the regions were slightly exceeded. The survey sample consisted of 536 participants, of which 242 lived in the HK region, and 294 lived in the OV region.

Questionnaire

The questionnaire had two parts. The first part collected the respondents' characteristics, including gender, age, physical activity level, and social status. Regarding age, respondents were categorized into five age groups (65–69, 70–74, 75–79, 80–84, and 85 years and above). The Czech Statistical Office also uses five-year intervals for reporting data on seniors.[22] Their personal physical activity levels were assessed as active (eg conducting sports), moderate (eg walking), or very limited. Regarding social status, the questionnaire included three options: whether the respondent lives alone, with someone, or in a residential facility. Given the limited number of respondents living in residential social care facilities

(only 11), they were excluded from the analysis. The final research sample included 525 older adults (225 men and 300 women).

The second part focused on the respondent's place of residence. Respondents were asked to state their residential address and evaluate selected attributes of the environment around them. Further, seven attributes (statements) were given to assess the residential surroundings:

(A) Most of the streets have well-maintained sidewalks
(B) The traffic volume is high
(C) Abundant usable benches are available

Table 1 Characteristics of the Final Sample of Respondents (n=525)

Variable	Total		HK Region		OV Region	
	n	%	n	%	n	%
Gender						
Male	225	42.9	106	45.7	119	40.6
Female	300	57.1	126	54.3	174	59.4
Age						
65–69	155	29.5	69	29.7	86	29.4
70–74	142	27.0	61	26.3	81	27.6
75–79	130	24.8	54	23.3	76	25.9
80–84	73	13.9	30	12.9	43	14.7
85+	25	4.8	18	7.8	7	2.4
SocStatus						
Alone	214	40.8	92	39.7	122	41.6
With someone	311	59.2	140	60.3	171	58.4
PhyActivity						
Active	83	15.8	49	21.1	34	11.6
Moderate	318	60.6	146	62.9	172	58.7
Very limited	124	23.6	37	15.9	87	29.7
Urbanization						
Mountain village	25	4.8	10	4.3	15	5.1
Typical village	37	7.0	8	3.4	29	9.9
Disappearing village	45	8.6	25	10.8	20	6.8
Prosperous village	43	8.2	27	11.6	16	5.5
City	375	71.4	162	69.8	213	72.7
Region						
HK	232	44.2	232	100.0	0	0.0
OV	293	55.8	0	0.0	293	100.0

Abbreviations: HK, Hradec Kralove; OV, Ostrava; SocStatus, Social Status; PhyActivity, Physical Activity; n, number.

(D) Pedestrian crossings and traffic lights are sufficient for me to cross a street safely
(E) The streets are well-lit at night
(F) Sidewalks are not well maintained in winter, so I often have to stay at home
(G) Going out in the evening is dangerous

The respondents rated the statements on a four-point Likert scale (1 = strongly agree, 2 = rather agree, 3 = rather disagree, 4 = strongly disagree).

Prior to the questionnaire survey, a pilot study (18 respondents) was conducted in pilot areas to ensure an understanding of the questions, length of survey, operationalization, and the method of results processing. A small adaptation of some questions and a reorganization of options were performed according to the pilot study results.

Data Analysis

The effects of gender, age, social status, physical activity, region, and urbanization on the perception of the surroundings were assessed using multiple ordinal regression with cumulative logits and proportional odds. Ordinal regression has been used in previous studies examining seniors and their outdoor physical activity.[23,24] In our case, the dependent ordinal variables were individual factors of environmental perception represented by statements (ordinal scale items) A to G in the questionnaire. All these statements were aligned for analysis purposes so that higher values indicated potential barriers for seniors, ie, reverse items B, F, and G were re-coded. There were seven ordinal regression models, each containing six explanatory categorical variables. Statistical analyses were performed using R software.[25]

The perception of the surroundings naturally depends on the local geographical and urban conditions. Geocoded answers were interpolated using the Inverse Distance Weighting method, and the spatial extent was limited to 500 m using the ArcGIS software. The maps enabled the assessment of the prevailing perception of the investigated factor in each location and its local variability.

Results

Summary Statistics and Maps

Table 1 presents the composition of respondents in the final sample according to the investigated characteristics. Of the sample, 375 (71.4%) respondents lived in the city, while 150 (28.6%) lived in villages. Compared to the Czech population of seniors, the age category 85+ was less represented in the sample (5% vs 9%).[22] Table 1 also shows the composition of respondents in the selected regions. There were relatively more respondents with limited physical activity in the OV region (OV: 29.7% vs HK: 15.9%). There were no significant differences between the areas in the other characteristics.

Table 2 presents the seven investigated factors of the perception of surroundings, including the achieved sample means. Most respondents identified that the streets had good lighting at night (Lightings: M = 1.77) and that the sidewalks were well maintained (Sidewalks: M = 1.93). A worse rating (ie above the middle of the rating scale) was observed for the perception of traffic density (Traffic: M = 2.73) and the number of benches (Benches: M = 2.70). However, they were still below level 3 (rather disagree) on average. Sample standard deviations showed proportional behavior – the standard deviation corresponds to a mean, where the largest variability of perception is associated with the greatest mean rating (but with a negative meaning). Not all respondents completed all key items in the questionnaire, as shown in the last column of Table 2. In further analyses, we used all available data.

Table 3 shows the sample means values of the factors of perception of surroundings according to gender and age. The biggest difference in sample means between male and female seniors was in the perception of the danger of going out in the evening (2.00 vs 2.26). In contrast, the smallest difference was in the perception of traffic density (2.75 vs 2.72). Concerning the increasing age of the respondents, a slight increase in mean values was visible only for the last item (danger). In Table 3, the values of the sample means are supplemented by the values of the standard deviations, which range between 0.61 and 0.99.

Table 4 presents the sample means values of the factors of perception of surroundings according to social status and physical activity. The largest difference between seniors living alone and those living with someone was in the perception

Table 2 Perception of the Surroundings of the Residence: Sample Means (and Standard Deviations)

Factor	Description of the Residence Surroundings	M (SD)	n
Sidewalks	Most of the streets have well-maintained sidewalks	1.93 (0.79)	523
Traffic	The traffic volume is low	2.73 (0.95)	520
Benches	Abundant usable benches are available	2.70 (0.89)	522
Crossings	Pedestrian crossings and traffic lights are sufficient	2.43 (0.91)	523
Lightings	The streets are well-lit at night	1.77 (0.67)	521
Winter	Sidewalks are well maintained in winter	2.16 (0.86)	522
Danger	Go out in the evening is not dangerous	2.14 (0.85)	520

Abbreviations: M, mean; SD, standard deviation; n, number of responses.

Table 3 Perception of the Surroundings of the Residence by Demographic Variables: Sample Means (and Standard Deviations)

Factor	Gender		Age Category				
	Male	Female	65–69	70–74	75–79	80–84	85+
Sidewalks	1.84 (0.78)	1.99 (0.79)	1.89 (0.79)	1.92 (0.74)	2.00 (0.86)	1.90 (0.75)	1.83 (0.70)
Traffic	2.75 (0.97)	2.72 (0.93)	2.72 (0.94)	2.75 (0.95)	2.67 (0.98)	2.86 (0.90)	2.70 (0.97)
Benches	2.68 (0.88)	2.73 (0.89)	2.60 (0.93)	2.80 (0.85)	2.82 (0.87)	2.56 (0.87)	2.67 (0.92)
Crossings	2.39 (0.88)	2.46 (0.92)	2.36 (0.90)	2.54 (0.92)	2.48 (0.92)	2.35 (0.86)	2.21 (0.88)
Lightings	1.73 (0.67)	1.79 (0.66)	1.73 (0.70)	1.78 (0.62)	1.75 (0.71)	1.87 (0.61)	1.71 (0.75)
Winter	2.08 (0.84)	2.21 (0.87)	1.99 (0.89)	2.15 (0.76)	2.26 (0.90)	2.24 (0.85)	2.42 (0.88)
Danger	2.00 (0.80)	2.26 (0.88)	2.08 (0.86)	2.04 (0.80)	2.16 (0.84)	2.34 (0.89)	2.48 (0.99)

Table 4 Perception of the Surroundings of the Residence by Determinants: Sample Means (and Standard Deviations)

Factor	SocStatus	PhyActivity			
	Alone	With Someone	Active	Moderate	Very Limited
Sidewalks	1.96 (0.86)	1.90 (0.74)	1.66 (0.69)	1.93 (0.79)	2.08 (0.80)
Traffic	2.75 (0.95)	2.72 (0.95)	2.83 (0.88)	2.75 (0.98)	2.63 (0.88)
Benches	2.61 (0.91)	2.77 (0.86)	2.57 (0.90)	2.67 (0.87)	2.90 (0.89)
Crossings	2.32 (0.86)	2.50 (0.93)	2.31 (0.90)	2.41 (0.92)	2.54 (0.88)
Lightings	1.82 (0.65)	1.73 (0.68)	1.48 (0.61)	1.78 (0.64)	1.93 (0.71)
Winter	2.27 (0.87)	2.07 (0.84)	1.84 (0.86)	2.09 (0.80)	2.54 (0.87)
Danger	2.33 (0.87)	2.02 (0.82)	1.95 (0.86)	2.09 (0.81)	2.41 (0.90)

Abbreviations: SocStatus, Social Status; PhyActivity, Physical Activity.

Table 5 Perception of the Surroundings of the Residence by Location Variables: Sample Means (and Standard Deviations)

Factor	Urbanization					Region	
	City	MountV	TypicV	DisapV	ProspV	HK	OV
Sidewalks	1.89 (0.76)	2.52 (0.87)	2.22 (0.92)	1.73 (0.62)	1.83 (0.82)	1.71 (0.76)	2.09 (0.77)
Traffic	3.01 (0.86)	1.72 (0.79)	2.38 (0.72)	1.87 (0.76)	2.10 (0.71)	2.69 (1.04)	2.77 (0.86)
Benches	2.61 (0.88)	2.88 (0.88)	3.32 (0.58)	2.56 (0.84)	3.10 (0.94)	2.66 (0.88)	2.74 (0.89)
Crossings	2.20 (0.81)	3.60 (0.58)	3.22 (0.67)	2.96 (0.74)	2.55 (1.06)	2.40 (0.94)	2.45 (0.88)
Lightings	1.71 (0.66)	1.88 (0.73)	2.11 (0.61)	1.80 (0.59)	1.86 (0.75)	1.63 (0.60)	1.87 (0.70)
Winter	2.10 (0.82)	2.36 (0.95)	2.19 (0.84)	1.96 (0.93)	2.71 (0.87)	1.94 (0.84)	2.32 (0.84)
Danger	2.20 (0.87)	1.92 (0.83)	2.27 (0.73)	1.62 (0.65)	2.27 (0.87)	1.87 (0.78)	2.36 (0.85)

Abbreviations: MountV, mountain village; TypicV, typical village; DisapV, disappeared village; ProspV, prosperous village; HK, Hradec Kralove; OV, Ostrava.

of the danger of going out in the evening (2.33 vs 2.02). In contrast, the smallest difference was in the perception of traffic density (2.75 vs 2.72). Active seniors and seniors with very limited mobility differed the most in their perception of the quality of winter sidewalk maintenance (1.84 vs 2.54), and, conversely, the least in their perception of traffic density (2.83 vs 2.63). Similar to Tables 2–4 shows the values of the corresponding standard deviations in parentheses.

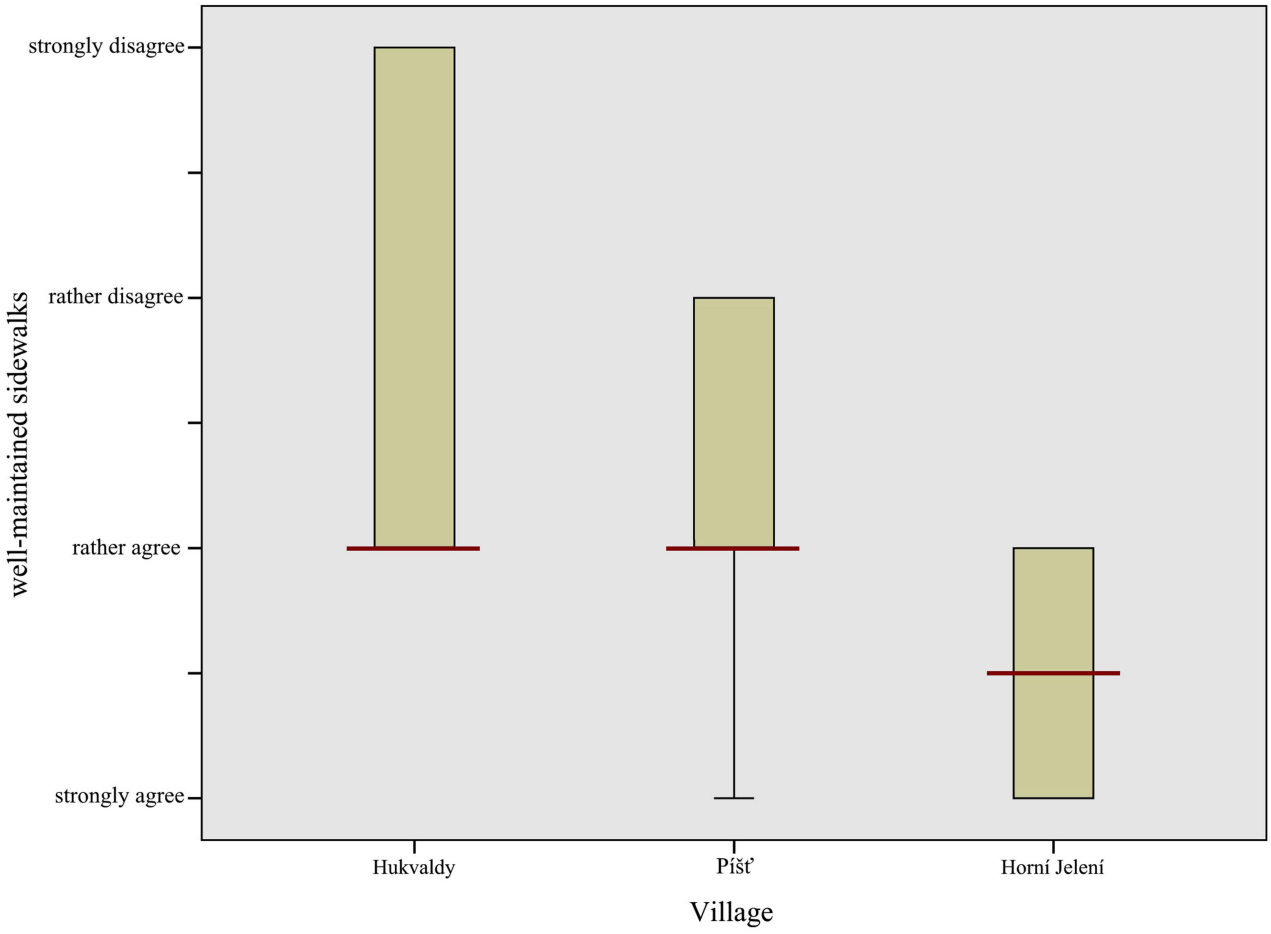

Figure 2 (Variability of Sidewalk) – Variability in the evaluation of sidewalk maintenance in three typical villages.

Finally, Table 5 shows the sample mean values of the factors of perception of surroundings according to urbanization and region. The differences in sample means between regions range from 0.05 (Crossings) to 0.49 (Danger), and the differences in sample standard deviations between regions range from 0 (Winter) to 0.18 (Traffic). The variability in the sample mean values because of urbanization was more pronounced.

Evaluation of the surroundings in various types of villages is complex because of the variability of local conditions within each cluster type. Figure 2 illustrates the differences in respondents' opinions in three typical villages, highlighting the challenges in assessing surroundings.

The different perceptions of the surroundings are influenced by individual features and objective local conditions. Some factors exhibit high local variability in seniors' assessments, indicating the dominance of individual perception based on factors such as health and activity or some differences in local experience. Contrastingly, other factors create a certain spatial cluster of similar evaluations where respondents' assessments coincide, indicating clearly classified areas. A typical example of the first group was the availability of benches in HK, where answers oscillated strongly over short distances (Figure 3).

The second group includes factors such as the maintenance of sidewalks (Figure 4), traffic density, and danger. In Ostrava, residents share similar opinions about sidewalk maintenance in major populated areas, mainly positive evaluation, while on borders or in industrial areas, negative evaluation dominated. Interestingly, the evaluation of Jistebnik (the cluster in the lower-left corner of Figure 4) is highly variable.

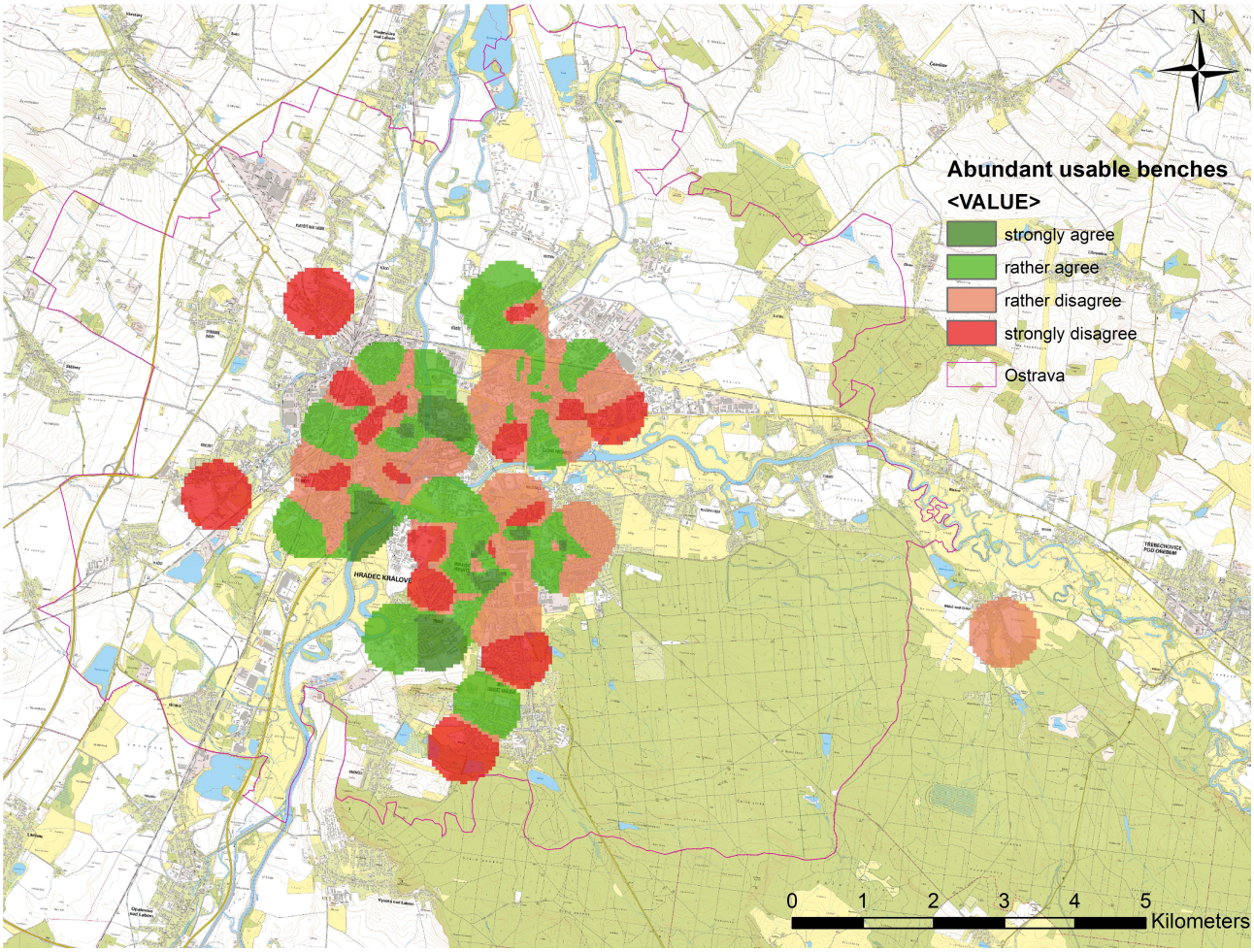

Figure 3 (Average answer Hradec Kralove) – Average answer regarding the number of usable benches in Hradec Kralove.

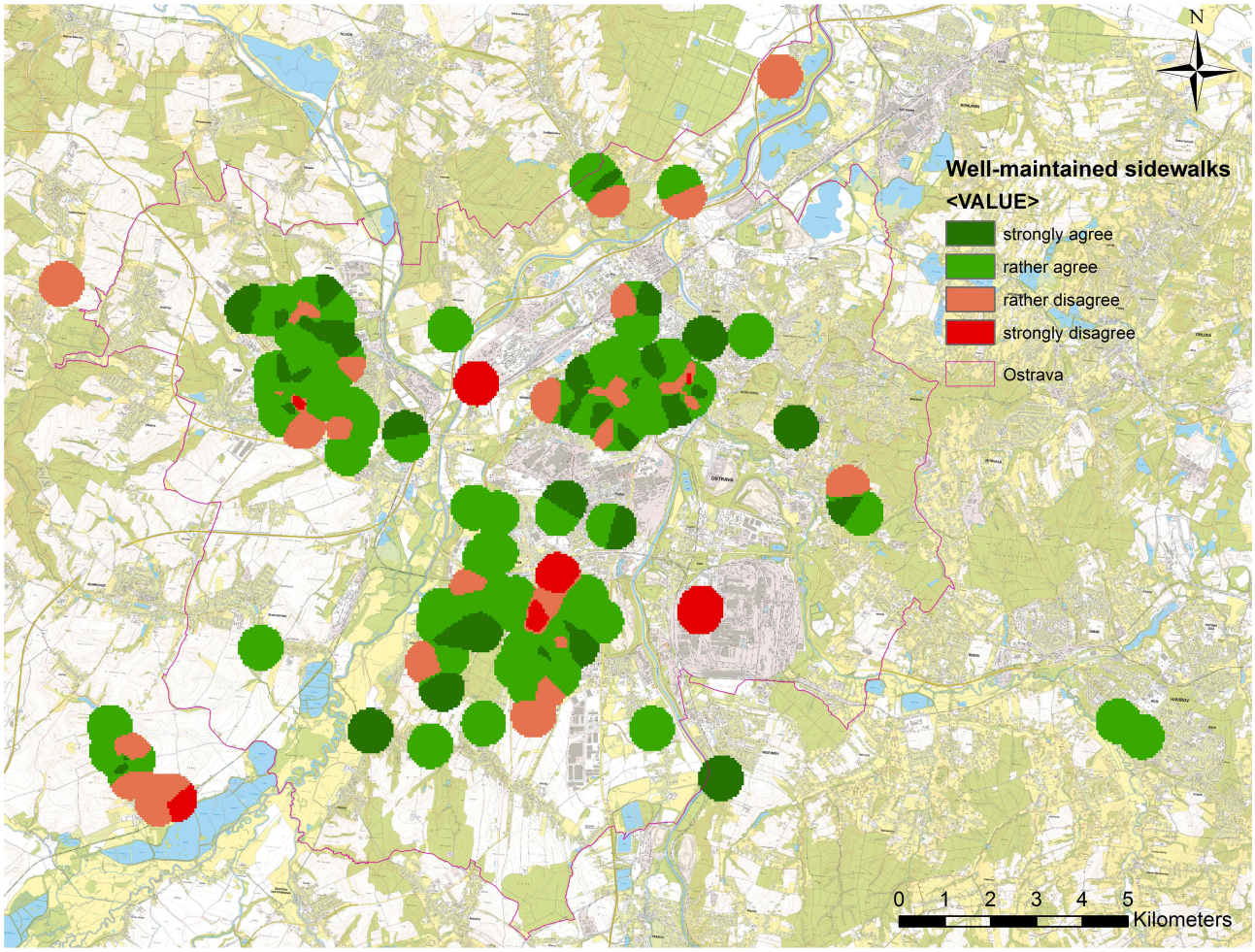

Figure 4 (Average answer Ostrava) – Average answer regarding the maintenance of sidewalks in Ostrava and surroundings.

Ordinal Regression Results

Table 6 summarizes the resulting p-values of the likelihood ratio tests based on ordinal regression. Each row in the table corresponds to the regression model. Gender has two statistically significant effects on perception: it influences the

Table 6 Multiple Ordinal Regression Results for Evaluating the Influence of Gender, Age, Social Status, Physical Activity, Urbanization, and Region on the Perception of the Surroundings: p-values of the Likelihood Ratio Tests

Factor	Gender	Age	SocStatus	PhyActivity	Urbanization	Region	n
Sidewalks	0.032	0.944	0.801	0.012	0.002	<0.001	523
Traffic	0.977	0.829	0.559	0.939	<0.001	0.681	520
Benches	0.286	0.121	0.009	0.141	<0.001	0.765	522
Crossings	0.265	0.302	0.041	0.735	<0.001	0.787	523
Lightings	0.780	0.572	0.137	0.001	0.031	0.004	521
Winter	0.588	0.510	0.181	<0.001	0.002	<0.001	522
Danger	0.014	0.146	0.006	0.144	<0.001	<0.001	520

Abbreviations: SocStatus, Social Status; PhyActivity, Physical Activity; n, number.

perception of the quality of sidewalks (p = 0.032) and the degree of danger (p = 0.014) in the residential area of seniors. However, age does not have a statistically significant effect on the perception of surroundings (p-values ranging from 0.121 to 0.944). The statistical significance of social status manifested in the perception of the number of benches (p = 0.009), crossings (p = 0.041), and the degree of danger (p = 0.006). Physical activity had a significant effect on item evaluations related to sidewalk quality (p = 0.012), lighting (p = 0.001), and winter maintenance (p < 0.001).

The perception of the surroundings differed significantly between the two regions examined for the four factors: sidewalks, lighting, winter, and danger (see Table 6). The urbanization level had a statistically significant effect on all factors of the perception of surroundings.

Table 7 shows the odds ratios (OR) against the reference categories (Gender: Male, Age: 65–69, SocStatus: Alone, PhyActivity: Active, Urbanization: City, Region: HK). Note that OR > 1 indicates a greater chance of a higher but worse evaluation in the given group of respondents compared to the reference category. Analogously, OR < 1 indicates a lower chance of a worse rating in the given group of respondents compared to the reference category. Regarding Gender, we found two statistically significant results (Sidewalks and Danger). The related OR values demonstrate that the probability of higher values, indicating disagreement with the given statement, was higher for women than for men. Specifically, women rated sidewalks worse and perceived the danger of traveling in the evening more strongly.

Seniors living with someone expressed more negative opinions about the availability of benches and crosswalks (see OR estimates 1.58 and 1.43 in Table 7). Furthermore, compared to seniors who live alone, they perceived night-time dangers as less of a problem (OR: 0.61). With deteriorating physical activity, seniors rated the quality of sidewalks, sufficient lighting, and winter maintenance of sidewalks more critically.

The data demonstrate that seniors living outside cities perceived traffic density as less problematic than those living in cities (Table 7 and Figures 5, 6). However, they were more aware of the insufficiency of pedestrian crossings. Regarding the sufficient number of benches, statistically different results were obtained for typical and prosperous villages compared to cities (Table 7). Respondents in these village types welcomed more benches. However, in some villages,

Table 7 Multiple Ordinal Regression Results for Evaluating the Influence of Gender, Age, and Social Status on the Perception of the Surroundings: Odds Ratios (OR)

Variables	Si	Tr	Be	Cr	Li	Wi	Da
Gender: Female	1.46**	1.00	1.19	1.21	1.05	1.10	1.53**
Age: 70–74	0.93	1.13	1.46*	1.40	1.05	1.32	0.83
Age: 75–79	1.01	1.13	1.51*	1.14	0.80	1.35	0.99
Age: 80–84	0.81	1.39	0.91	1.12	1.21	1.15	1.31
Age: 85+	0.86	1.24	0.88	0.60	0.71	1.82	2.42*
SocStatus: With somebody	1.05	1.11	1.58***	1.43**	0.76	0.79	0.61***
PhyActivity: Moderate	1.77**	0.92	1.07	1.03	2.35***	1.66**	1.23
PhyActivity: Limited	2.48***	0.94	1.63	1.22	2.78***	3.31***	1.77*
Urbanization: MountV	4.24***	0.05***	1.77	29.67***	1.70	1.61	0.52
Urbanization: TypicV	1.41	0.27***	3.59***	8.81***	2.73***	0.75	0.96
Urbanization: DisapV.	0.69	0.07***	0.71	4.92***	1.47	0.68	0.26***
Urbanization: ProspV	0.83	0.15***	2.91***	2.06**	1.53	2.97***	1.05
Region: OV	2.40***	1.07	1.05	0.95	1.70***	2.39***	3.21***

Notes: ***, **, and *indicate statistical significance at the 1%, 5%, and 10% significance levels, respectively.
Abbreviations: Si, Sidewalks; Tr, Traffic; Be, Benches; Cr, Crossings; Li, Lightings; Wi, Winter; Da, Danger; SocStatus, Social Status; PhyActivity, Physical Activity; MountV, mountain village; TypicV, typical village; DisapV, disappeared village; ProspV, prosperous village; OV, Ostrava.

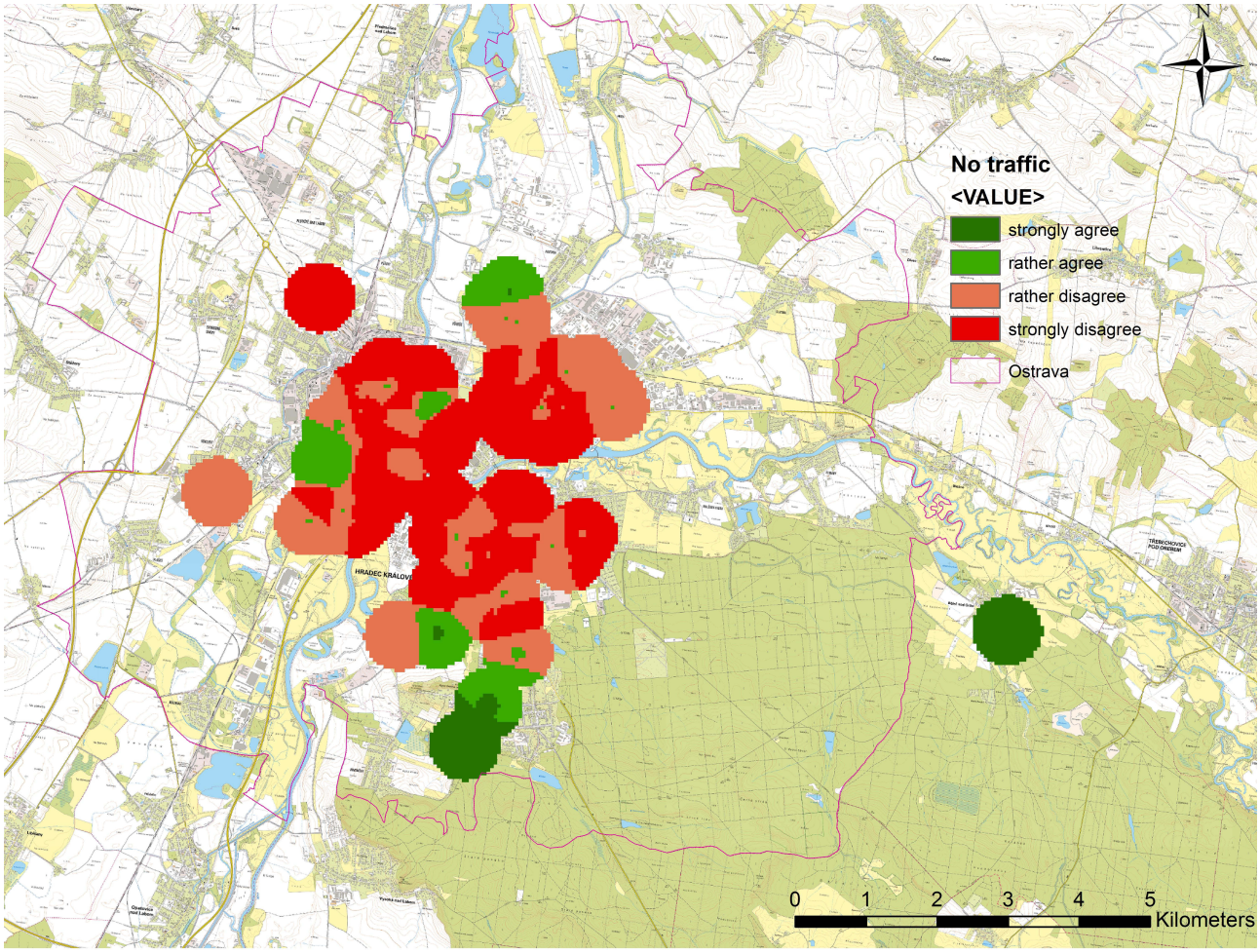

Figure 5 (Perception of no traffic problems–Hradec Kralove) – Perception of no_traffic_problem in Hradec Kralove.

the perception is unique, confirming actual deficiency (eg Jistebník, Figure 7), while in others, perceptions differ (eg České Meziříčí, Figure 8).

Interestingly, respondents perceived the greatest safety in disappearing villages (OR: 0.26). The other village types did not differ significantly from the cities regarding the danger factor.

The influence of the region was manifested in four factors regarding the perception of the surroundings, with the OV region performing worse than the HK region (Table 7). Respondents from the OV region rated sidewalks, lighting, and winter maintenance as significantly worse and perceived a higher risk of going out in the evening.

Table 8 shows when the data supported the stated hypotheses (marked with an "x" symbol). To summarize, Hypothesis H1b (age effect) was not confirmed. Hypotheses H1a, H2a, and H2b were partially confirmed but were in the minority. Hypothesis H3b was confirmed for most factors. Finally, H3a (urbanization effect) was fully confirmed.

Discussion

The findings of this study suggest that the dominant factor influencing perceived mobility is urbanization, including the type of locality, its maturity, and available amenities. The perception of the surroundings differed significantly between the two regions for the factors examined: sidewalks, lighting, winter, and danger. Women rated the condition of the sidewalks as worse and perceived the danger of going out in the evening more strongly. Physical activity significantly affected sidewalk quality, lighting, and winter maintenance evaluation.

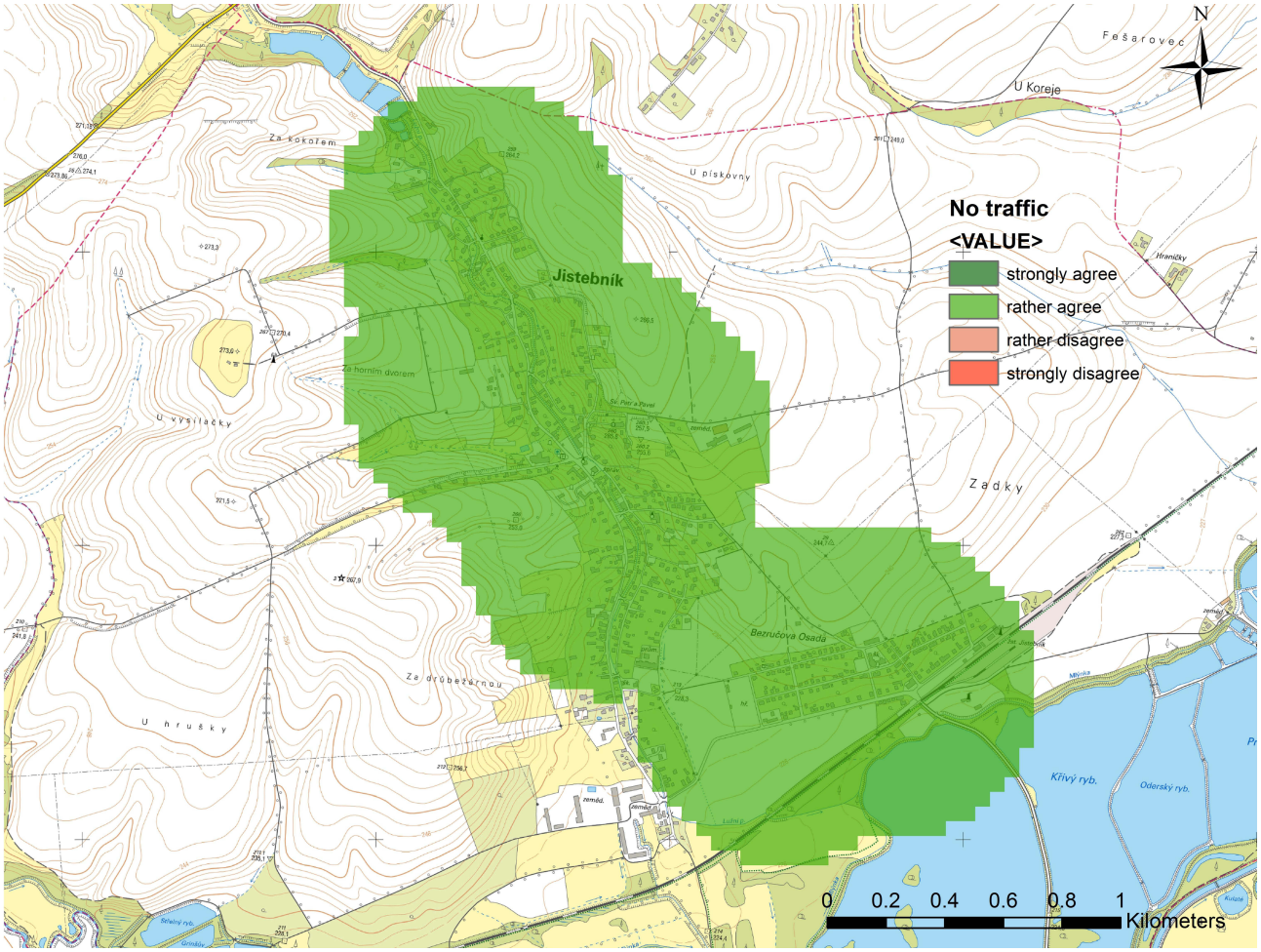

Figure 6 (Perception of no traffic problems–Jistebnik) – Perception of no_traffic_problem in Jistebník.

Organizations such as the World Health Organization and the European Union advocate for age-friendly environments, often interpreted as barrier-free environments. However, clear guidelines and measures for implementing age-friendly features are lacking.[26] These findings are consistent with research conducted with a similar objective[27–31] demonstrating the factors of urbanization and their importance. Generally, residents of the outer suburbs had less access to amenities than those living in the inner city. Significant differences were confirmed between cities and rural municipalities. This study highlights the advantages and challenges of monitoring the implementation of urban policies. Urban transportation and infrastructure policies intended to promote healthy, livable cities require evidence-based targets to measure the levels of (and disparities in) policy implementation.[32] However, rural municipalities should substantially increase their interest in developing a more comfortable and safe environment for their older residents, namely in factors such as the availability of pedestrian crossings, benches, and improved lighting. An analysis revealed that people's allocation, influenced by their ability to move around and whether they live alone, is an important attribute.[33] Physical access and walkability reflect the design of a neighborhood as well as personal factors.

Older adults often face mobility limitations and difficulty engaging in outdoor activities because of physical functioning issues.[34] Walking is the critical travel mode in the spatial mobility of many seniors. Elderly people often experience accessibility problems in outdoor environments caused by walking barriers, such as narrow pavements, uneven surfaces, high curbs, poor crosswalks,[35] high gradients, missing traffic islands, high traffic speeds,[36] unsafe neighborhoods, mixed cycling/pedestrian paths, and poor maintenance.[27] External and temporal factors, such as weather, lighting, and tree shadows, as well as the frequency and properties of urban equipment (eg benches with good handles,

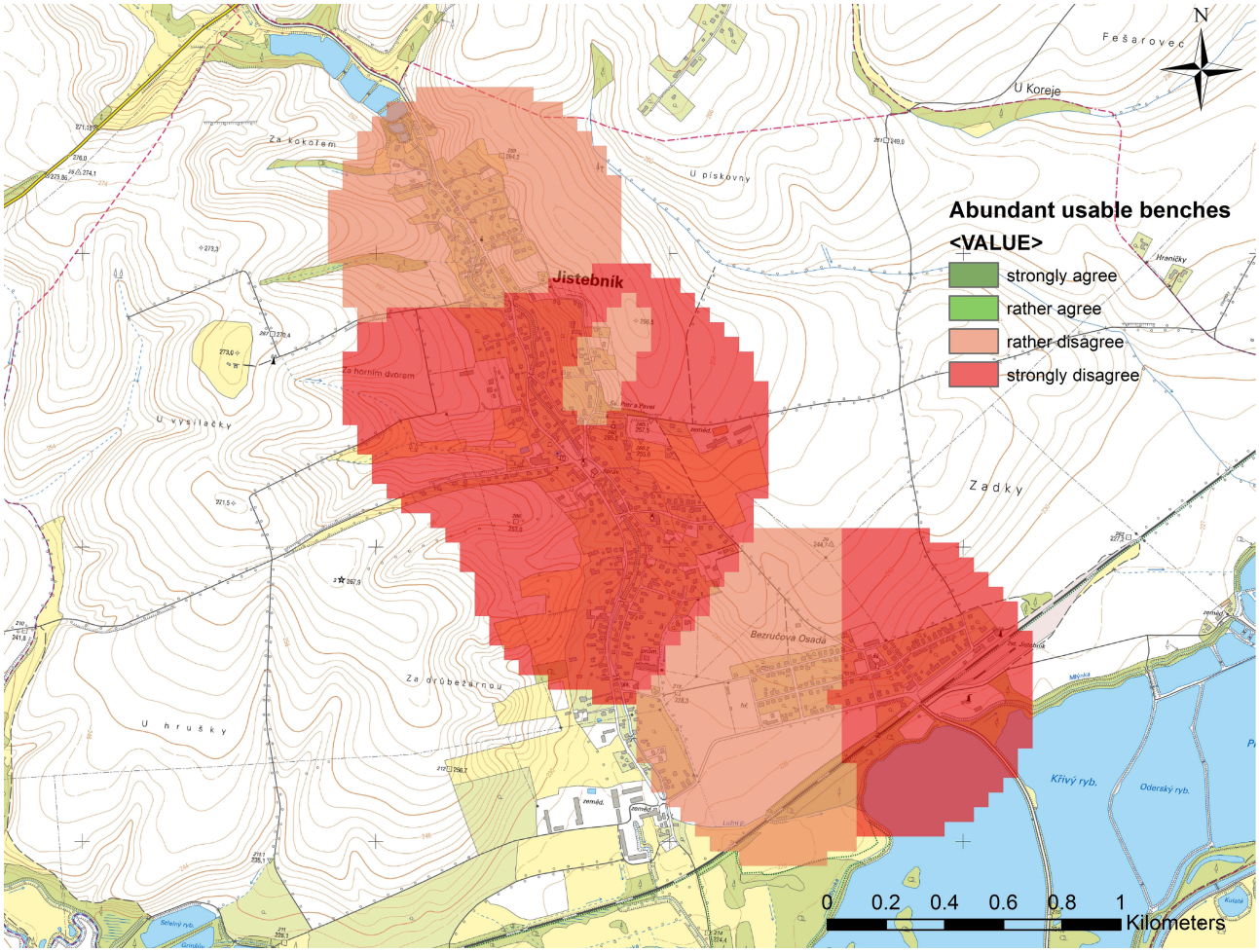

Figure 7 (Availability of benches–Jistebnik) – Availability of benches in prosperous villages: Jistebník.

handrails, and toilets), are also important for specific groups of older adults. The willingness to walk and route selection are also influenced by aesthetic factors.

This understanding should be reflected in local and national legislation, traffic policies, technological advancements, societal values, and lifestyles. Further research is needed to better understand the relationship between mobility and community participation and to assist policymakers and city and transportation planners in developing strategies for age-friendly environments within the community. This includes the needs of older people with mobility limitations. Overall, the associations between environmental factors hindering or facilitating outdoor mobility and physical activity have been demonstrated in previous studies, especially in immediate home neighborhoods. However, the definitions of access to destinations and their operationalization, prevalence, and correlations vary greatly across different studies. Combining self-reports with more objective measures of the environment can be complementary in future studies.

Study Limitation

This study has some limitations. The respondents were seniors from two regions of the Czech Republic, which cannot fully cover a diversity of urban, socioeconomic, and geographical conditions. Rural municipalities were represented by only ten villages (selected according to their urban trajectory and geographical position) with 150 respondents. This may not eliminate specific geographical and human conditions. Although we endeavoured to ensure that the age representation of seniors corresponded to the Czech senior population, the oldest age category, 85+, was less represented. This may

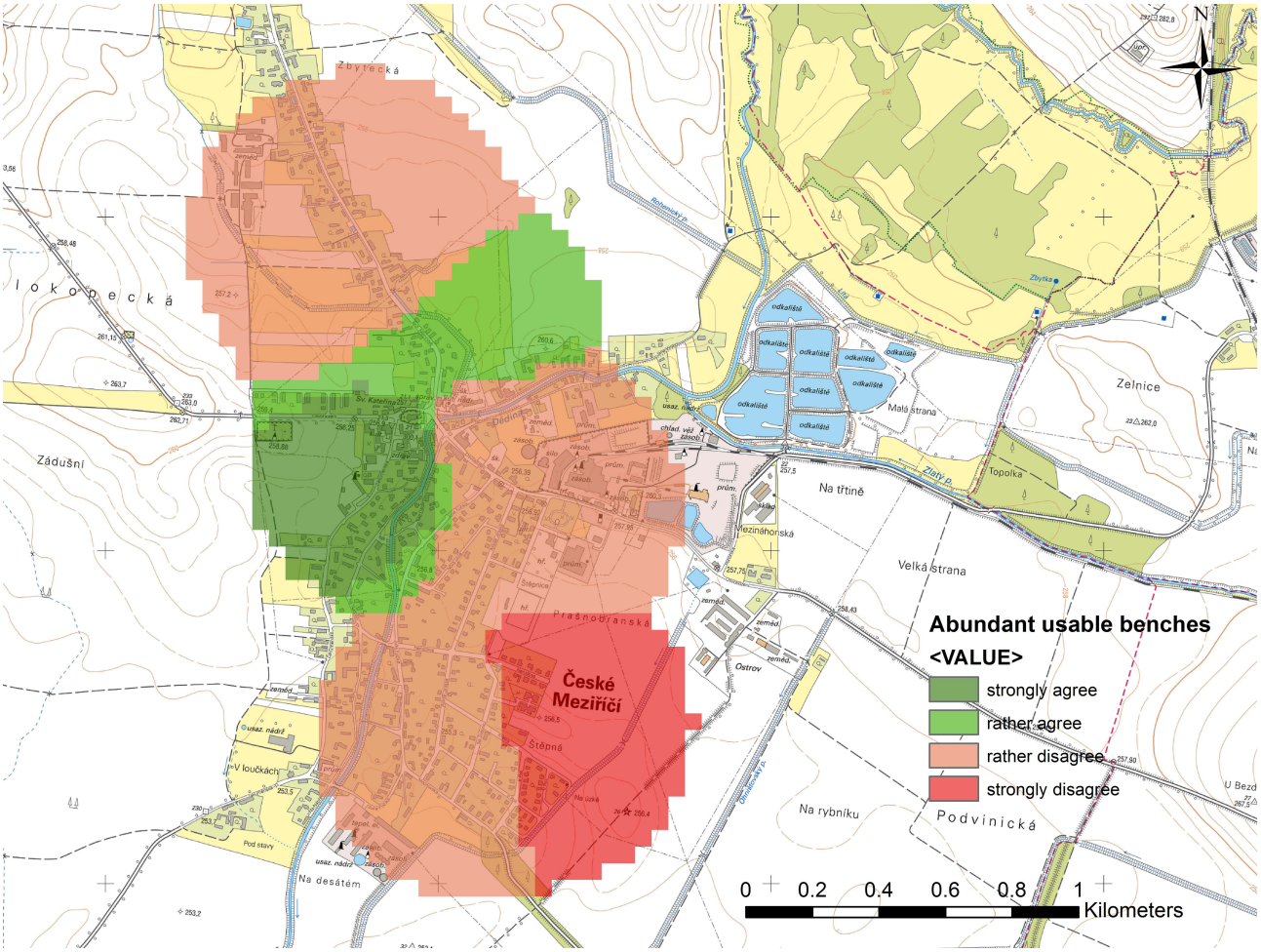

Figure 8 (Availability of benches–Ceske Mezirici) – Availability of benches in prosperous villages: České Meziříčí.

have slightly skewed the results presented. Moreover, our study did not focus on the effect of education. Furthermore, each factor in the perceived environment was measured by only one item. Conversely, the questionnaire survey results were supplemented with a geographical representation using maps.

Table 8 Hypothesis Evaluation

Hypothesis	Si	Tr	Be	Cr	Li	Wi	Da	Supported
H1a (Gender)	x						x	2/7
H1b (Age)								0/7
H2a (SocStatus)			x	x			x	3/7
H2b (PhyActivity)	x				x	x		3/7
H3a (Urbanization)		x	x	x	x	x	x	x 7/7
H3b (Region)		x				x	x	x 4/7

Abbreviations: Si, Sidewalks; Tr, Traffic; Be, Benches; Cr, Crossings; Li, Lightings; Wi, Winter; Da, Danger; SocStatus, Social Status; PhyActivity, Physical Activity.

Conclusion

Urbanization, including the type of locality, maturity, and amenities, is the dominant factor influencing perceived mobility, and the perception of surroundings differed significantly between the two regions examined for sidewalk quality, lighting, winter maintenance, and danger. While most current studies focus on cities, this study highlights the situation in rural municipalities, considering their types (mountain, typical, disappearing, and prosperous villages). Substantially worse pedestrian conditions in availability of pedestrian crossings, benches, and lighting were recognized in rural municipalities (typical villages) versus cities. Therefore, local government should pay more attention to improving seniors' conditions.

Women rated the condition of sidewalks as worse and expressed a stronger perception of danger when going out in the evening. Surprisingly, the overall effect of age was not confirmed. Physical activity significantly affected sidewalk quality, lighting, and winter maintenance evaluation. Seniors' social status and level of physical activity partially affected their perception of their surroundings. Mobility plays a crucial role in enabling older adults to engage in out-of-home activities and participate in their communities. Understanding the complexity of mobility and the spatial locations relevant for older persons concerning potential barriers and facilitators for mobility aids in planning and adapting neighborhood environments to promote active and healthy aging in place.

This study makes a novel contribution to the literature by investigating the influence of urbanization, region, and physical activity on the perception of mobility among seniors, shedding light on the factors that shape the perception of their surroundings and informing strategies for age-friendly environments.

Adherence to Ethical Standards

The study was approved by the Ethical Committee for Science of the University of Hradec Kralove on November 14, 2021, as No. 14/2021. This Ethical Committee also Approved that in the study, all participants will be signing informed written consent, which is a part of the research.

Consent to Participate

All study participants returned signed consent forms by pressing the "agree to participate" button before the study's commencement to participate in the research.

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Disclosure

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