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Paths to Subjective Poverty Among Midlife and Older Russian-Speaking Migrants: A Data Mining Approach Using the General Unary Hypotheses Automaton

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ABSTRACT

In the Nordic countries, older migrants experience higher poverty rates compared with the majority population. Research on this issue highlights a gap in understanding the complex interplay of ageing, migration and poverty risks. Using the General Unary Hypotheses Automaton (GUHA) data mining approach, we identified various factor combinations that contribute to subjective poverty experiences. We analysed data from the 2019 Care, Health, and Ageing of the Russian-Speaking Minority (CHARM) study in Finland ($N = 1082$, 57% men), which covers migration-related, socio-demographic, health and behavioural domains. Our findings reveal 37 distinct paths to subjective poverty involving 13 factors, including health limitations, multi-morbidity, receipt of housing benefit, religious affiliation, poor self-rated health, immigration age of 36–55, discrimination and living alone. While health-related factors predominated, our results highlight the intersection of multiple disadvantages in shaping subjective poverty, providing new insights on the dynamics of migrant poverty.

1 | Introduction

Two key demographic trends, ageing and migration, are currently shaping Western European societies, both of which are related to poverty (Karl and Torres 2015). In older migrants, poverty arises at the intersection of both phenomena. Gilleard and Higgs (2020) have emphasised the cumulative (dis)advantages of ageing in the context of social divisions. Conversely, migration might amplify existing disadvantages and inequalities, intersecting with various structures in different ways depending on age (Liversage and Jakobsen 2016).

Compared with other European countries, the modern pension schemes of the Nordic countries have successfully contributed to substantially lowering poverty levels among older adults (Nygård et al. 2017). There are, however, indications that the social protection systems in the Nordic countries fare less well among populations with a migrant background. Utilising register data from Denmark and Sweden, Gustafsson et al. (2022) showed that poverty among older migrants is to some extent related to individual-level characteristics, such as age, gender, education, family and employment status. Moreover, structural circumstances like discrimination, higher unemployment rates among migrants and labour market disadvantages play a substantial role in shaping poverty risks (Gustafsson et al. 2022). The authors also list two factors that appear more contextual: residential status when aged 55 or older and year of arrival. However, the interplay of structural circumstances in migration contexts differs between countries and even within a single country as well as over time (Gustafsson et al. 2022). Yet, a persistent international trend evident in the Nordic countries and elsewhere in Europe is that migrants face a significantly higher risk of unemployment in midlife compared with the majority population (Jakobsen and Pedersen 2017). A Danish study found that the disparity in employment rates between individuals born in Denmark and migrants was more pronounced among women than men (Jakobsen and Pedersen 2017). The observation regarding the more vulnerable labour market status of migrant women is supported by a recent review, which also found that they fare worse in many health indicators compared with migrant men and the majority population (Debesay et al. 2022). Jakobsen and Pedersen (2017) have additionally noted that in many cases, migrants do not have a sufficiently long duration of residence to qualify for full coverage by social security programmes in old age.

1.1 | Defining and Measuring Poverty

Scholars have conceptualised poverty in multiple ways, influenced by prior scientific research and the practical necessities of policymaking. Classical approaches to defining poverty include multidimensional and one-dimensional poverty, as well as absolute and relative poverty, each with its own set of complexities, such as inherent biases when measuring poverty that account for within-household inequalities (Tavares and Betti 2024). Broader perspectives on poverty tend to emphasise the need for holistic research approaches that encompass a wide range of objective and subjective indicators of poverty. Holistic empirical analyses hold the promise of offering deeper insights into the multifaceted dimensions of deprivation experienced in a subjective and/or objective manner by individuals and communities (Mannila and Kainu 2020).

However, both objective and subjective measures of poverty tend to be limited to one's economic situation (Zdeněk and Lososová 2020). Objective measures typically define a poverty threshold without regard for the opinions of the household or the individual. In contrast, the basis for subjective measures are the respondents' perceptions of their economic situation (Szukiełojć-Bieńkuńska et al. 2022). Zdeněk and Lososová (2020) have identified discrepancies between objective poverty measures and individual perceptions of poverty, arguing for more research on subjective aspects of poverty. In a similar vein, Želinský et al. (2021) argue that subjective poverty may reflect changes in societies that are not captured by official poverty indicators.

Subjective measures of poverty are typically based on how people perceive their well-being (Nandori 2011). People can be directly asked to define themselves as poor/not poor without any reference to external definitions. In cases of indirect measurement, respondents assess their situation vis-à-vis individuals who experience poverty. Self-assessment captures an experiential aspect of poverty, intertwined with a comparison of one's own circumstances to visual displays of wealth and income by others (Nygård et al. 2017). Subjective poverty, reflecting experienced hardship, emphasises the consequences of economic deprivation, showcasing an individual's and a household's self-reported struggles to afford essentials.

Notably, meeting a normatively defined poverty threshold in terms of income does not guarantee an absence of hardship, and experiencing hardship does not necessarily correlate with income levels (Carr 2021). The experience of poverty among migrants has been reported globally, challenging the implications of assimilation theory (Kazemipur and Halli 2001), which suggests that migrants over time manage to diminish the language and cultural barriers and improve their occupational skills, leading to upward mobility. The reality is more complex, however, particularly in the face of economic, social and cultural challenges influencing migrant integration. Upward mobility may be hindered by labour market dynamics (Kazemipur and Halli 2001). As newcomers, migrants' earnings are lower than the earnings of their majority population counterparts. Some scholars have emphasised migrants' personal qualities, such as a motivation and ambition to work harder and longer than non-migrants, as a means for them to achieve upward mobility in 10–15 years (Kazemipur and Halli 2001). Earlier research from Finland, however, has emphasised structural features of the labour market that lead to unstable working careers, resulting from the marginal positioning of migrant labour as a buffer against economic fluctuations (Forsander 2003).

Ageing introduces additional complexities to the social location of a migrant, resisting easy theoretical formulations (Liversage and Jakobsen 2016). Old-age poverty has been a prominent phenomenon with different dynamics than those affecting the working-age population. Liversage and Jakobsen (2016) have used the cumulative (dis)advantages perspective, as developed by Dannefer (2003), to explain how differences in certain characteristics (e.g., health or economic status) grow over time. Cumulative disadvantages over one's life course, influenced by differences in education, skills and language, contribute to growing inequalities between migrants and the majority population. Diversity among migrant populations, coupled with the varying life course patterns that individuals experience as they age, complicates the application of particular theories and necessitates alternative explanations (McDonald 2011). Poverty associated with migration intersects with various societal structures in unique ways across different age groups. The diverse experiences of older migrants call for an approach devoid of preconceived hypotheses, allowing for an exploration of patterns and individual variations within the realms of migration and ageing.

In this study, we analysed population-based survey data collected from Russian-speaking migrants aged 50 years or older and living in Finland, with the aim being to improve the understanding of poverty risks related to migratory background, particularly in midlife and older age. According to Statistics of Finland (n.d.), Russian-speaking migrants are the largest migrant group in Finland, accounting for 19.5% of all migrants. Reflecting our interest in individual experiences, we investigated various combinations of factors that form paths associated with the experience of subjective poverty in the study population. Our analysis utilised data mining, employing the General Unary Hypotheses Automaton (GUHA) method (Hajek 2003) for this purpose.

Data mining and particularly the GUHA method allowed us to conduct explorative data analysis for the purpose of considering the complexity of having a migratory background from an intersectional perspective. Migrants, even those coming from the same country and speaking the same language, do not form a homogenous population: people have various reasons for migrating and various types of legal statuses, and the different immigration statuses (labour migrant, family migrant and humanitarian migrant) tend to entitle persons to different social rights (Eugster 2018). In the context of Russian speakers in Finland, variations in immigration status stem from particular features related to the fall of the Soviet Union, which has shaped the emergence of the contemporary minority of Russian speakers. First, a large proportion of Russian speakers moved to Finland through a so-called repatriation programme that was available during the years 1990–2011 (Mähönen et al. 2015). Their immigration status, that of 'returnee migrant', was created in 1990 and was related to being recognised as belonging to a population that the Soviet Union had classified as Finns. Such people, termed in the Finnish context 'Ingrian Finns', are descendants of ancient Finnish settlers who established communities in Russian territory during past centuries (Varjonen et al. 2013). In addition to Ingrian Finns, who were predominantly Russian speakers, a diverse group of Russian speakers originating from several different former Soviet republics have settled in Finland at various points in time either for employment opportunities or marital reasons (Viimaranta et al. 2018).

In addition to variation in the structural issues shaping migration and settlement processes, important features related to the contexts of ageing and old age add diversity to people's life circumstances (Nash 2021). Indeed, the heterogeneity among migrants highlights the complexity of the term 'migrant'. The theoretical framework of intersectionality can explain how multiple social categories, such as race, gender, ability and class, interact in shaping devalued social locations that exist amidst intersecting relations of inequality (Nash 2021). Individual migrant experiences often go unacknowledged in research and practice (KC et al. 2023). Therefore, studying subjective experiences of poverty using representative data offers a valuable contribution to the literature, emphasising the intersection of ageing and migration.

Our study approached this complexity by employing the GUHA data mining method to conduct an exploratory analysis of the survey data. Studying poverty with this approach is akin to posing an old question with the hope of finding new directions in research, as this type of explorative study allows us to identify patterns, trends and associations without a predefined hypothesis.

2 | Methods

2.1 | Data Sources

The data derive from the 'Care, Health and Ageing of the Russian-Speaking Minority' (CHARM) study conducted among Russian-speaking migrants aged 50 and over residing in Finland. A random sample of 3000 individuals who had registered Russian as their first language was selected from the Digital and Population Data Services Agency registry, which contains information on all permanent residents in Finland. The data were collected in 2019 using structured questionnaires via a postal survey with an online response option; however, only approximately 8% of persons chose to use this method (Kemppainen et al. 2023). The questionnaire was provided in both Russian and Finnish. It encompassed several dimensions, including socio-economic status, health and well-being, experiences with public services, access to various types of care, subjective experiences and feelings, such as life satisfaction and social relationships, and the use of digital technology. The dataset consisted of 1082 individuals (mean age 63.2 years), 57% of whom were men, resulting in a 36% response rate. To address potential biases, survey weighting was applied, while also considering sex-based stratification in the sample. Non-response bias was corrected by using auxiliary information from national registers, including sex, age, income, pensions, unemployment and region.

Additionally, neighbourhood-level information was obtained from Statistics Finland Paavo Postal Code Area Statistics (n.d.), which makes it possible to compare similar international administrative units (such as ZIP codes in the United States or NUTS regions in the EU) that have been used for research purposes (Kemppainen et al. 2023; Glushkova et al. 2025).

2.2 | Dependent Variable

We approached the topic by utilising a subjective definition of poverty. The subjective indicator of poverty captures ordinary people's evaluations of their economic resources, defining poverty as the feeling of not having enough to get by (Hagenaars and de Vos 1988; Nygård et al. 2017). This approach operates under the assumption that expressions of sufficiency or insufficiency are associated with the same welfare levels for everybody (Hagenaars and de Vos 1988). We employed a specific question, asking participants to finish the sentence 'my household is financially getting along…', by choosing from among four available response categories: 'with great effort', 'with some effort', 'quite easily' or 'very easily'. We designated the first category, 'with great effort', as indicative of poverty. This distinction allowed us to differentiate between individuals who are reportedly getting by only with significant difficulties and the situation of others (Nygård et al. 2017).

2.3 | Independent Variables

The study examined 53 independent variables across multiple domains to understand factors related to subjective poverty. The variables are summarised below, with descriptive chi-squared analysis results presented in Table 2.

2.3.1 | Socio-Demographic Characteristics

Variables in this domain include age (categorised as under or over 65 years), sex, marital status, education level (in the country of origin and in Finland), religious affiliation and citizenship status to best capture the participants' demographic backgrounds. Housing type, living situation (alone or with others) and geographical area were also analysed.

2.3.2 | Socio-Economic Status

Household income (categorised by range), occupational class and employment status capture participants' economic conditions. Additionally, specific questions addressed financial hardship. Participants were asked whether they were 'afraid that the family will run out of food', whether they had 'received food aid' and whether they had 'cut down expenses on medication due to a shortage of money'.

2.3.3 | Migration-Related Factors

Variables included age at migration, reason for migration (e.g., remigration), year of migration and proficiency in Finnish or Swedish, reflecting aspects of migration history that could affect adaptation and economic outcomes. Participants were also asked, 'How often have you visited your country of origin in the last 12 months?' to capture the extent of ongoing ties with their country of origin.

2.3.4 | Subjective Experiences and Sense of Belonging

Questions were added to the analysis that assessed participants' sense of belonging to Finnish, Russian and local Russian-speaking communities, as well as their connections to family, friends and professional groups in both Finland and their country of origin. Participants were also asked about any experiences of discrimination.

2.3.5 | Life Satisfaction and Social Relationships

Life satisfaction indicators measured participants' satisfaction with their health, coping ability, standard of living, relationships and self-image. A social network score, based on interaction frequency with relatives and friends, was also included. Additionally, participants were asked about the frequency of visits to their country of origin.

2.3.6 | Health and Well-Being

Health indicators included self-rated health, BMI, multimorbidity and limitations on daily activities due to health issues. Smoking and alcohol use were included to explore behavioural factors.

3 | Data Analysis

3.1 | Features of GUHA

Data mining is a method for identifying meaningful relationships, associations and structures within a dataset. The GUHA method is a data mining technique that utilises mathematical logical formalism to find various regularities or patterns in datasets (Hajek 2003; Rauch and Simunek 2019; Turunen and Dolos 2021; Máša and Rauch 2024; Nosraty et al. 2025). It functions similarly to unsupervised data analysis, identifying inherent patterns within user-defined constraints. It classifies association statements as either TRUE or FALSE, with TRUE indicating data-supported associations (paths) (Turunen and Dolos 2021; Máša and Rauch 2024; Nosraty et al. 2025).

GUHA analysis is performed on a data matrix where rows represent cases (individual observations) and columns represent attributes, that is, specific variables or characteristics of those cases (e.g., income or education level). We used LISp-Miner software, an independent implementation of the GUHA method, which allows users to specify parameters influencing the results. A key advantage of GUHA is its ability to systematically detect small yet statistically significant associations within large, complex datasets by using logical attributes. Unlike the traditional Apriori algorithm, which focuses on frequent item sets based on support and confidence measures, GUHA explores all possible relationships and retains only those that meet user-defined, statistically significant criteria. This enables the identification of nuanced, context-specific associations, making it particularly suitable for analysing complex social phenomena, such as subjective poverty (Máša and Rauch 2024; Kaushik et al. 2023). More recently, other implementations of GUHA, such as the Python-based CleverMiner, have also been introduced (Rauch et al. 2020).

In this study, the GUHA method was applied to identify factors (φ), that is, categories of attributes and the different combinations of them (multi-factors or paths) associated with subjective poverty (ψ). *Paths* refer to structured associations between multiple factors (φ) and the outcome of interest (ψ). The paths reflect how various conditions tend to co-occur in the data and are determined through GUHA's logical and statistical framework. Thus, φ and ψ represent logical associations describing specific conditions within the data. With the GUHA method, each attribute in the dataset (or variable) is divided into categories (e.g., receipt of housing benefit versus no receipt of housing benefit), and logical combinations of those (factors) are analysed to identify any associations with subjective poverty as the outcome of interest.

The GUHA method is based on a first-order logical language, with each category of attributes and quantifiers forming the basic building blocks. Unlike classical logic, which uses only two quantifiers, 'all' and 'exists', the GUHA method incorporates a broader set of quantifiers known as generalised quantifiers. They express more nuanced statistical relationships in the data, such as

'Attribute category P appears often',

'Attribute category P occurs more often than average' and

'Attribute category P and attribute category Q almost always exclude each other'.

The generalised quantifiers are central to GUHA's approach and allow the method to capture complex probabilistic associations that extend beyond simple logical truths. The LISp-Miner software currently supports 21 such quantifiers. They include, for instance Above Average Quantifier, which evaluates whether a condition (φ) is associated with an outcome (ψ) at a rate significantly higher than average, and Fisher Quantifier, which uses statistical testing (Fisher's exact test) to verify the strength of association.

In our analysis, φ refers to specific combinations of attribute categories (e.g., receiving a housing benefit), whereas ψ represents the presence of subjective poverty. These quantifiers are used to identify patterns in which φ and ψ co-occur more frequently than expected by chance, thus revealing statistically meaningful 'paths' that help us understand subjective poverty.

Table 1 illustrates the contingency structure used to evaluate how frequently specific combinations of conditions (φ) and outcomes (ψ) occur in the dataset. The analysis involves contingency tables where each cell counts the number of occurrences of various combinations of multi-factors (φ and ψ). The contingency table's structure (Table 1) includes counts for the following instances:

$a = \varphi$ and ψ are both true.

$b = \varphi$ is true, ψ is false.

$c = \varphi$ is false, ψ is true.

$d =$ both φ and ψ are false.

The analysis focuses on associations where a is sufficiently large (BASE) and the strength of the association exceeds the average (measured by frequency coefficient p). Indeed, the parameter p, or frequency coefficient, expresses the prevalence of that association and the magnitude of the dependence compared with the mean. For example, a relationship is considered significant if subjective poverty occurs at least n times more often for individuals meeting specific conditions, such as receipt of housing support. The BASE value (also called support) should be large enough; otherwise, the result will have low general significance. In the contingency table, this value is marked with the symbol a. Thus, a necessary condition for a certain dependency to be valid in the data is that a is at least the size of the BASE value.

We applied the Above Average Quantifier and Fisher Quantifier to identify what paths or combinations of multi-factors (φ) are most strongly related to our outcome (ψ) of subjective poverty. The relationships ($\varphi \approx \psi$) are statistically significant according to Fisher's one-sided exact test. For the Above Average Quantifier, the condition $v\ (\varphi \approx \psi) = \text{TRUE}$ holds when $a/(a+b) \geq ((1+p)(a+c))/m$ (see Table 1), with $p > 0$ and $\text{BASE} \leq a$. This result indicates that ψ is at least $p+1$ times more common among those meeting φ than in the overall dataset. The BASE value indicates the minimum number of cases where both the predicate and outcome co-occur.

TABLE 1 | Contingency table produced using a Boolean-valued data matrix.

	Ψ (subjective poverty)	Not-ψ	Row total
φ	a	b	$r = a + b$
Not-φ	c	d	$s = c + d$
Column total	$k = a + c$	$l = b + d$	$m = a + b + c + d$

The Fisher Quantifier applies statistical significance, verified by Fisher's exact test, where the condition for truth is as follows:

$ad > bc$ (see Table 1) and

$$\sum_{i=1}^{\min\{b,c\}} \frac{r!s!k!l!}{m!(a+1)!(b-1)!(c-1)!(d+1)!} \leq \alpha, \text{ where } 0 < \alpha \leq 0.5.$$

Where α represents a significance threshold, ensuring the reliability of the detected relationships. A lower α indicates stronger reliability. This study used $\alpha = 0.001$.

Based on the above quantifiers, LISp-Miner software was used to evaluate thousands of potential associations but only retained those deemed TRUE. This logical-statistical framework made it possible to identify the key paths that characterise how certain conditions (φ) are meaningfully linked to the experience of subjective poverty (ψ).

3.2 | Details of the Analysis

In this study, we selected 'with great effort' as the reference category for subjective poverty. The parameters were determined based on both the dataset characteristics and research goals.

We applied the one-sided Fisher test, setting the BASE value at 30, the Above Average Quantifier at $p = 0.4$ and the Fisher Quantifier at $\alpha = 0.001$. The BASE value represented the minimum number of cases in which both the predicate and outcome occurred simultaneously. Those parameters were chosen because 96 participants (8.9%) reported experiencing subjective poverty at the 'with great effort' level.

Additionally, following the approach outlined by Piché et al. (2014), we used Bayesian statistical methods to interpret patterns via the posterior probability distributions of the generalised quantifier parameters. In our analysis, the Above Average Quantifier and the Fisher Quantifier served as generalised quantifiers, which define the formal conditions for determining statistically significant associations between attribute categories and subjective poverty. This approach allowed us to quantify the certainty of the detected relationships in the data.

We explored associations between the independent variables and subjective poverty using Pearson's chi-squared test of independence in IBM SPSS Statistics 29.0, applying a significance level of $p < 0.05$. This descriptive analysis, summarised in Table 2, provided an initial overview of the data. Data mining was then conducted using LISp-Miner software.

4 | Results

The prevalence of subjective poverty was 8.9%. Among those experiencing subjective poverty, 61.3% had a household income of less than 1000 euros per month (Table 2). The chi-squared test for independent variables revealed associations

TABLE 2 | Distribution of subjective poverty based on socio-demographic factors, socio-economic status, migration-related factors, subjective experiences and sense of belonging, life satisfaction and social relationships, and health and well-being (cross-tabulated percentages and chi-squared tests).

Variables	Poverty	No poverty	Chi-squared	Variables	Poverty	No poverty	Chi-squared
Subjective poverty	8.9	91.1		Subjective poverty	8.9	91.1	
Socio-demographic factors				*Migration-related factors*			
Age (years)			0.93	Age at migration/years			0.08
< 65 years	61.1	60.6		3–35	20.7	20.5	
65 years or over	38.9	39.4		36–55	68.5	59.3	
Sex			0.18	56–83	10.9	20.3	
Men	50.5	57.7		Reason for moving to Finland			0.03
Women	49.5	42.3		Other reason	58.5	47.0	
Marital status			< 0.001	Remigration (Ingrian Finns)	41.5	53.0	
Not married	41.5	23.5		Moving year			0.01
Married to a Finn	58.5	76.5		Before 2001	65.2	51.7	
Married to some other nationality				After 2001	34.8	48.3	
Education level in the country of origin			0.55	Local language skills (Finnish or Swedish)			0.12
Higher education	54.3	51.5		None	16.1	11.0	
No education and lower education	45.7	48.9		Basic skills	75.9	74.3	
Education in Finland			0.59	Good skills	8.0	14.6	
No education in Finland	61.1	63.9		How often have you visited your country of origin in last 12 months?	0.0	0.0	0.16
Some education	38.9	36.4		More than three times	35.5	36.8	
Finnish citizenship			0.91	One to two times	36.6	43.4	
Yes	48.4	49.0		Never	28.0	19.8	
No	51.6	51.0		*Subjective experiences and sense of belonging*			
Religious affiliation			0.08	Sense of belonging to Finns			0.26
Affiliated	80.6	72.1		Not at all	15.5	11.6	
Not affiliated	19.4	27.9		Somewhat	58.3	61.1	

(Continues)

TABLE 2 | (Continued)

Variables	Poverty	No poverty	Chi-squared	Variables	Poverty	No poverty	Chi-squared
Living with relatives			0.41	Strongly	26.2	21.3	
Living alone	66.3	57.3		Sense of belonging to Russians			1.00
Living with one person	28.4	33.4		Not at all	8.5	8.5	
Living with two persons	5.3	7.9		Somewhat	41.5	41.5	
Living with three persons	0.0	1.0		Strongly	50.0	50.1	
Living with four persons	0.0	3.0		Sense of belonging to Russian-speaking people living in Finland			0.58
Region			0.02	Not at all	18.3	14.1	
Helsinki-Uusimaa	52.6	37.4		Somewhat	54.9	56.9	
Southern Finland	29.5	34.1		Strongly	26.8	29.0	
Western Finland	7.4	12.1		Sense of belonging to migrants			0.02
Northern and Eastern of Finland	10.5	16.5		Not at all	61.7	50.9	
Housing type			< 0.001	Somewhat	30.9	45.6	
Own or partial ownership	25.5	43.5		Strongly	7.4	3.5	
Rented	68.1	55.5		Sense of belonging to Ingrian Finns			0.05
Elderly housing	6.4	0.9		Not at all	33.3	27.8	
Daily use of internet			0.68	Somewhat	39.7	48.4	
Less than daily use	86.2	87.6		Strongly	26.9	23.8	
Daily use	13.8	12.4		Sense of belonging to your family and friends in Finland			0.93
Socio-economic status				Not at all	5.1	4.2	
Occupational class			0.74	Somewhat	17.7	19.9	
Upper-level non-manual, self-employed	35.8	42.5		Strongly	77.2	75.9	
Lower-level non-manual	18.9	16.6		Sense of belonging to your family and friends in your country of origin			0.37
Manual worker	38.9	35.5		Not at all	8.6	8.2	
Other	3.2	2.1		Somewhat	24.7	32.3	

(Continues)

TABLE 2 | (Continued)

Variables	Poverty	No poverty	Chi-squared	Variables	Poverty	No poverty	Chi-squared
Household income per month (euros)			< 0.001	Strongly	66.7	59.5	
< 1000	61.3	27.1		Sense of belonging to current or former professional community or colleagues			0.35
1000–1450	26.9	24.5		Not at all	30.8	25.3	
1500–1999	6.5	16.2		Somewhat	39.7	48.2	
2000–2490	4.3	12.7		Strongly	29.5	26.5	
> 2500	1.1	13.6		Sense of belonging to your neighbourhood			< 0.001
Employment status			< 0.001	Not at all	32.1	27.9	
Employed	22.1	41.1		Somewhat	44.4	60.1	
Unemployed	26.3	13.7		Strongly	23.5	12.0	
Retired	34.7	33.3		Sense of belonging to hobby club or society			0.31
Other	12.6	6.2		Not at all	42.7	43.0	
Afraid that family will run out of food			< 0.001	Somewhat	37.3	40.8	
Yes	40.3	3.3		Strongly	20.0	16.2	
No	59.7	96.7		Sense of belonging to people of your own age			0.50
Received food aid			< 0.001	Not at all	28.4	26.5	
Yes	60.5	25.1		Somewhat	51.9	58.0	
No	39.5	74.9		Strongly	19.8	15.5	
Cut down the expenses on medication due to shortage of money				Sense of belonging to church or religious group			0.04
Yes	65.8	22.3	< 0.001	Not at all	55.7	67.3	
No	34.2	77.7		Somewhat	29.1	24.7	
Receipt of housing benefit			< 0.001	Strongly	15.2	8.1	
Yes	73.6	43.0		Sense of belonging to any other group			0.41
No	26.4	57.0		Not at all	87.5	89.3	

(Continues)

TABLE 2 | (Continued)

Variables	Poverty	No poverty	Chi-squared	Variables	Poverty	No poverty	Chi-squared
Receipt of income support			< 0.001	Somewhat	2.5	5.2	
Yes	55.7	40.0		Strongly	10.0	5.5	
No	44.3	60.0		Experienced any discrimination			< 0.001
Life satisfaction and social relationships				Never	30.5	49.3	
Satisfaction with your own health			< 0.001	Sometimes	46.3	43.7	
Dissatisfied	38.0	14.3		Often	23.2	7.0	
Cannot say	46.7	51.4		*Health and well-being*			
Satisfied	15.2	34.3		Self-rated health			< 0.001
Satisfaction with your coping ability			< 0.001	Suboptimal	23.7	41.9	
Dissatisfied	24.4	5.7		Good	76.3	58.1	
Cannot say	37.8	27.3		Body mass index (BMI)			0.44
Satisfied	37.8	67.0		Underweight (BMI < 19)	25.8	27.8	
Satisfaction with yourself			< 0.001	Healthy weight (BMI = 19–25)	74.2	72.1	
Dissatisfied	17.4	8.4		Overweight (BMI > 25)			
Cannot say	43.0	34.7		Participation in any activities			0.65
Satisfied	39.5	56.9		Yes	66.2	59.6	
Satisfaction with your relationships			< 0.001	No	33.8	40.4	
Dissatisfied	14.9	3.0		Multi-morbidity			0.13
Cannot say	24.1	21.0		No	11.6	17.8	
Satisfied	60.9	76.0		Yes	88.4	82.2	
Satisfaction with your standard of living			< 0.001	Limitations to daily life due to health problems			< 0.001
Dissatisfied	50.5	7.2		Yes	88.0	64.3	
Cannot say	37.6	39.4		No	12.0	35.7	
Satisfied	11.8	53.4		Smoking			0.71

(Continues)

TABLE 2 | (Continued)

Variables	Poverty	No poverty	Chi-squared
Social network[a]			0.76
Score 12>	38.9	37.1	
Score 13–30	61.1	62.9	
Regular	19.4	16.5	
Past smoker	31.2	34.5	
Never smoked	49.5	49.0	
Alcohol use			0.14
Never	26.6	22.7	
Once a month	33.0	36.1	
Two to four times per month	33.0	26.4	
More than two times per week	7.4	14.8	

Note: Subjective poverty was dichotomised for this descriptive analysis. The lowest response category was classified as 'subjective poverty', whereas the remaining categories were grouped as 'no poverty'. The table presents percentage distributions across the different categories.
[a]Social network score: score based on questions about how many relatives and friends live in Finland or abroad: How many of your relatives do you talk to or meet at least once per month? How many of your relatives do you find it easy to talk to about private matters? How many close relatives do you have that you can easily ask for help? How many of your friends do you talk to or meet at least once per month? How many of your friends do you find it easy to talk to about private matters? How many close friends do you have that you can easily ask for help? How many of those close friends were born in Finland?

between most factors and subjective poverty (Table 2). Notably, age, sex, occupational class, proficiency in the local language (Finnish or Swedish), living arrangements, social network and several aspects related to a sense of belonging showed no significant associations (Table 2). However, the sense of belonging to a church or religious group, to a neighbourhood, to Ingrian Finns or to migrants in general, and any experiences of discrimination were associated with subjective poverty (Table 2).

During the extensive process of searching for multiple factors using the GUHA method, we tested approximately 7.2 million contingency tables (verifications). We identified 37 paths that included unique factors (representing each category of variables); within those paths, 13 factors were associated with subjective poverty in the study population (Table 3).

The selected factors appearing along those paths included health-related factors, economic deprivation and social and cultural factors. Health-related factors include limitations on daily life due to health problems, multi-morbidity, poor self-rated health and appearing consistently on many paths. Limitations to daily life due to health problems appeared with the factor of age among those less than 65 years old, indicating a compounded vulnerability when health problems occur already in midlife. Economic deprivation included household income less than 1000 euros per month, needing to cut expenses on medication because of a shortage of money, living in a rented property and receipt of housing benefit were central to pathways leading to subjective poverty. Those factors were exacerbated by health issues or living alone. A religious affiliation, being between the ages of 36 and 55 at the time of immigration, living alone, use of the internet and occasional experiences of discrimination appeared along the paths as well. Experiences of discrimination, particularly in conjunction with health problems or low income, were identified as a significant factor along the paths to subjective poverty. Table 3 presents the selected factors, the number of repetitions and the substance of each path.

Bayesian analysis of the identified paths was also done when conducting the GUHA analysis. Bayesian analysis of the paths indicated a high level of certainty, around 99%, and that poverty is 1.11–1.84 times more prevalent among individuals who fulfil the criteria outlined in Table 3 for each path.

5 | Discussion

This study employed the GUHA data mining approach to uncover shared criteria contributing to subjective poverty among midlife and older Russian-speaking migrants in Finland. The GUHA method allowed for exploratory, data-driven analysis, making it possible to identify statistically significant associations between numerous independent factors and subjective poverty. The approach is particularly novel in its ability to reveal diverse paths across various life domains, highlighting complex associations that traditional hypothesis-driven methods might overlook. The method, akin to inductive case-oriented analysis in qualitative methods, stands out for its absence of predefined hypotheses. Consequently, the approach aims to

TABLE 3 | Paths to subjective poverty.

Combinations of factors along each GUHA path to subjective poverty				***N*[a]**	**Conf. level[b]**
Poor self-rated health (8)	Limitations to daily life due to health problems (21)			67	1.19
Multi-morbidity (17)	Poor *self*-rated health	Limitations to daily life due to health problems		65	1.16
Has a religious affiliation (9)	Limitations to daily life due to health problems			65	1.19
Multi-morbidity	Has a religious affiliation	Limitations to daily life due to health problems		61	1.18
Receipt of housing benefit (13)				67	1.37
Daily use of internet (8)	Poor self-rated health	Limitations on daily life due to health problems		56	1.16
Daily use of internet	Has a religious affiliation	Limitations on daily life due to health problems		54	1.13
Daily use of internet	Multi-morbidity	Poor self-rated health	Limitations to daily life due to health problems	54	1.15
Living in a rented property (3)	Receipt of housing benefit			54	1.18
Living in a rented property	Multi-morbidity	Limitations to daily life due to health problems		53	1.16
Living alone (2)	Limitations to daily life due to health problems			52	1.14
Daily use of internet	Multi-morbidity	Has a religious affiliation	Limitations to daily life due to health problems	51	1.11
Age 36–55 when immigrated (4)	Limitations on daily life due to health problems			55	1.22
Poor self-rated health	Has a religious affiliation	Limitations to daily life due to health problems		55	1.23
Sometimes experienced discrimination (4)	Has a religious affiliation			51	1.13
Age 36–55 when immigrated	Poor self-rated health			52	1.17
Multi-morbidity	Poor self-rated health	Has a religious affiliation	Limitations to daily life due to health problems	53	1.21
Receipt of housing benefit	Multi-morbidity			61	1.37
Age less than 65 (1)	Limitations to daily life due to health problems			50	1.14

(Continues)

TABLE 3 | (Continued)

Combinations of factors along each GUHA path to subjective poverty			***N***[a]	**Conf. level**[b]
Age 36–55 when immigrated	Multi-morbidity	Limitations to daily life due to health problems	53	1.23
Receipt of housing benefit	Daily use of internet		60	1.47
Living in a rented property	Receipt of housing benefit	Multi-morbidity	50	1.20
Age 36–55 when immigrated	Multi-morbidity	Poor self-rated health	50	1.42
Receipt of housing benefit	Limitations to daily life due to health problems		56	1.43
Receipt of housing benefit	Daily use of internet		54	1.47
Sometimes experienced discrimination	Multi-morbidity	Limitations to daily life due to health problems	53	1.34
Sometimes experienced discrimination	Limitations to daily life due to health problems		56	1.36
Receipt of housing benefit	Has a religious affiliation		54	1.40
Receipt of housing benefit	Multi-morbidity	Limitations to daily life due to health problems	54	1.43
Household income less than 1000 euros per month (2)			57	1.63
Receipt of housing benefit	Daily use of internet	Multi-morbidity	54	1.47
Living alone	Receipt of housing benefit		51	1.44
Receipt of housing benefit	Multi-morbidity	Has a religious affiliation	51	1.45
Receipt of housing benefit	Daily use of internet	Limitations to daily life due to health problems	50	1.55
Household income less than 1000 euros per month	Multi-morbidity		51	1.61
Cut expenses on medication because of a shortage of money (1)			50	1.84
Sometimes experienced discrimination	Multi-morbidity	Poor self-rated health	53	1.21

Note: Each path consists of a combination of up to four or fewer factors (variable categories) significantly associated with subjective poverty. The number in brackets indicates how frequently the attribute appears across all identified paths.
[a]*n* shows the number of individuals on each path.
[b]The Bayesian statistical model for each path is presented as the confidence level. The Bayesian confidence level (CL) shows that with 99% certainty, subjective poverty is at least n times more prevalent among individuals who meet all conditions on the given path.

enhance quantitative analysis by incorporating case-oriented methodologies and supplementing variable-oriented approaches (Ragin 2004).

Our study revealed that factors contributing to the paths to subjective poverty predominantly centre on the health domain. However, economic deprivation and social and demographic migration factors also attracted attention along the paths.

The key health-related factors identified were limitations to daily life due to health problems, poor self-rated health and multi-morbidity. While health-related factors have been observed in previous studies (Tucker-Seeley et al. 2013), the unique combination of factors identified in our study underscores the strength of this methodological approach.

Our findings revealed that limitations to daily life due to health problems consistently emerge along paths leading to experiences of subjective poverty. The findings align with earlier research demonstrating that individuals with disabilities require more financial resources to meet basic needs than those without disabilities (She and Livermore 2007). A particularly noteworthy finding was that the factor occurs in combination with being younger than 65 years of age. Facing disability at an age younger than 65 years can exacerbate certain challenges, such as limited access to resources, employment discrimination or limited job opportunities, leading to an increase in healthcare needs (She and Livermore 2007). Moreover, this finding paves the way for discussion of the fact that health problems can result in the need to apply for a disability pension, which can serve as an important precursor to poverty. However, a previous Finnish study indicated that Russian-speaking migrants have lower disability pension uptake compared with the majority population (Haider and Salonen 2023). Consequently, such individuals might have more unmet health needs and face more difficulties, leading to experiences of subjective poverty (Çilenti et al. 2021; Lebano et al. 2020). A bi-directional relationship exists between disability and poverty: while disability increases the risk of poverty, poverty in turn raises the likelihood of developing disabilities due to limited access to health care, poor nutrition and chronic stress (Çilenti et al. 2021; Lebano et al. 2020). The findings underscore the importance of integrated health and social policies aimed at preventing economic hardship among those with chronic health conditions.

Multi-morbidity was one of the health-related factors impacting the paths to subjective poverty. In the United States, Mehta and Elo (2012) have applied theories related to migration and health to study the phenomenon, arguing that Russian migrants do not constitute a random sample of the overall Russian population, as migrants are supposedly positively selected for better health and other advantageous traits. However, their study found that Russian migrants exhibited poorer health compared with the US-born population. Yet, their health was comparatively better than that of Russians who had stayed in Russia. Our findings suggest that regardless of the prevalence of multi-morbidity, it is associated with subjective poverty. Additionally, our results emphasise that multi-morbidity is closely linked to economic hardship, reinforcing prior findings that poor health can reduce earning potential and increase medical expenses (Mehta and Elo 2012). This finding highlights the economic vulnerability of chronically ill migrants and underscores the importance of affordable healthcare policies.

Our study confirms a strong association between self-rated health and economic deprivation as one of the indicators of poverty, consistent with the neo-material perspective on economic well-being (Li and Mutchler 2022). This perspective highlights how financial hardship directly impacts health, particularly through dietary insufficiency and inadequate nutrition, unsafe housing and living conditions, and unmet medical needs (Li and Mutchler 2019). Our results further support the psychosocial theory on income and health, which posits that perceived economic stress negatively affects well-being, even when basic needs are met. Moreover, the psychosocial view of income and health underscores the impact of perceived stress due to insufficient economic resources, adversely affecting health. However, Tucker-Seeley et al. (2013) have highlighted that while financial hardship significantly correlates with lower self-rated health, the presence of psychological distress does not attenuate this association.

In our study, the key economic predictors of subjective poverty were receipt of housing benefit, household income of less than 1000 euros per month, cutting medication expenses due to financial constraints, and living in rented housing.

Whether or not migrants receive a housing benefit also forms a coherent and reasonable pattern contributing to experiences of subjective poverty among migrants, particularly when accompanied by health-related criteria or living alone. In Finland, a housing benefit is a form of means-tested social assistance for low-income individuals or families (Kela, n.d.). In our study, the combination of living alone and receipt of housing benefit, indicators of not having sufficient income, appeared along the path to poverty. Our findings demonstrate an association between subjective and objective indicators of poverty, not only in terms of receiving a housing benefit but also notably in terms of having a household income of less than 1000 euros per month, another objective indicator of poverty. Our study illuminates this association, particularly when combined with living alone or with health-related criteria.

Social and demographic migration factors also featured prominently along the paths to subjective poverty, as age at the time of migration, religious affiliation, living alone and experiences of discrimination. Being between the age of 35 and 55 at the time of migration was another factor that appeared on the paths to subjective poverty. Assimilation hinges on various factors, such as social class, time of arrival and the context of reception, leading to more of a non-linear assimilation process (Berry and Sam 2016). Age at the time of immigration can shape an individual's acculturation strategy. Younger migrants may strive for greater integration, actively embracing facets of the new culture. In contrast, older migrants may be more inclined to remain apart from the mainstream culture, holding onto their original culture more steadfastly. Furthermore, disparities in adapting to the new society and culture can be explained by Erikson's psychosocial development theory, which asserts that the timing of major life events, such as immigration, can impact an individual's developmental strategy (Berry and Sam 2016).

The challenges faced by midlife adults, such as difficulties in acquiring a new language, employment hurdles, age-based discrimination and unrecognised qualifications, may influence their acculturation strategy and subsequently affect their development at such a life stage (Berry and Sam 2016).

Midlife migrants, compared with younger migrants, may employ different coping strategies in response to stressors stemming from adapting to a new culture. The strategies result in varied forms of adaptation, particularly influenced by pre-existing factors like health conditions (Berry and Sam 2016).

This finding highlights the importance of understanding the complex process of migration, adapting to a new culture and ageing. Age at the time of migration has proven an important factor related to poverty among migrants in Sweden (Gustafsson et al. 2022). Age at the time of migration additionally serves as an indicator of the significance of the duration of residence with respect to one's pension level (Gustafsson et al. 2022).

Experiences of discrimination also feature prominently along the paths to subjective poverty, particularly when accompanied at times by one or several health-related criteria. Previous studies have demonstrated that perceived discrimination can exacerbate the effects of poverty on physical and mental health (Fuller-Rowell et al. 2012). Discrimination can also create barriers to employment, education, health care and housing, causing a migrant to become further entrenched in poverty.

Our findings indicate that religious affiliation is associated with subjective poverty and accompanied by health-related problems or receiving income support. Understanding the relationship between religious affiliation, seen as a dimension of cultural identity, and poverty requires considering the interplay between social, economic and individual factors (Schweiger 2019). At the micro level, Schweiger (2019) discusses how religion might assist people in coping with poverty in daily life, highlighting the potential positive contributions of religious institutions and groups through support networks, such as local soup kitchens or social services. Skirbekk and Navarro (2021) have also found that belonging to certain religions might protect individuals from psychological distress. Tuhkanen (2021) has noted that understanding the role of religion in the acculturation of Russian migrants in Finland requires examining other social and psychological factors as well, such as discrimination, identification and adaptation. However, our dataset revealed an association between religious affiliation and health-related issues as individual factors along the path to subjective poverty. Yet, we cannot conclusively demonstrate causality or the direction of the association. Notably, when the paths were accompanied by the receipt of housing benefit, an objective indicator of poverty, the likelihood of such an association increased.

Our study demonstrates the strength of the GUHA data mining method in revealing complex, multi-factorial pathways to subjective poverty. The GUHA approach allowed us to analyse 7.2 million contingency tables, uncovering 37 distinct paths that would be difficult to detect using traditional statistical methods. The method thus provides valuable insights into multidimensional social phenomena, particularly in populations where individual experiences vary widely.

However, like all data mining techniques, the GUHA method is susceptible to overfitting, meaning that not all identified patterns may be generalised to other populations. Therefore, whereas our findings offer important exploratory insights, they should be interpreted with caution and validated through additional research.

6 | Conclusions

Our study highlights the complex web of factors that accumulate over time and contribute to subjective poverty among midlife and older Russian-speaking migrants. It suggests new directions for poverty research, emphasising the need to consider the intricate dynamics between factors influencing subjective poverty. Our findings underscore the interconnected roles of health and economic and demographic migration factors, besides just discrimination, in shaping experiences of poverty within an older migrant population, while at the same time acknowledging the population's inherent heterogeneity.

Author Contributions

A.K. and S.W. participated in the data collection. L.N., E.T., A.K. and S.W. collaborated on the study's design. L.N. authored the first draft of the manuscript. L.N. and E.T. conducted the analysis and interpreted the results. L.N., E.T., A.K. and S.W., helped with the development of the discussion. Tables were created by L.N., S.W. and A.K., supervised the project. All authors have critically reviewed the manuscript. Each author has made substantial contributions to the study's design, interpretation of the results and manuscript development and has agreed to be listed as an author of the manuscript.

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The authors have nothing to report.

Ethics Statement

The study protocol received approval from the Ethical Review Board in the Humanities and Social and Behavioural Sciences at the University of Helsinki (#6/2019).

Consent

Informed consent was obtained from all the participants. Participation in the study was voluntary, and all participants were explicitly informed of their right to withdraw from the study at any time without facing consequences.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data are available upon reasonable request from the research team. The data are not publicly available due to general data protection guidelines.

Peer Review

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1111/imig.70053.

References

Berry, J. W., and D. L. Sam, eds. 2016. *The Cambridge Handbook of Acculturation Psychology*. 2nd ed. Cambridge University Press; Cambridge Core. https://doi.org/10.1017/CBO9781316219218.

Carr, S. C. 2021. "Setting "Poverty Thresholds": Whose Experience Counts?" *Sustainability Science* 16, no. 1: 31–36. https://doi.org/10.1007/s11625-020-00859-x.

Çilenti, K., S. Rask, M. Elovainio, et al. 2021. "Use of Health Services and Unmet Need Among Adults of Russian, Somali, and Kurdish Origin in Finland." *International Journal of Environmental Research and Public Health* 18, no. 5: 2229. https://doi.org/10.3390/ijerph18052229.

Dannefer, D. 2003. "Cumulative Advantage/Disadvantage and the Life Course: Cross-Fertilizing Age and Social Science Theory." *Journals of Gerontology. Series B, Psychological Sciences and Social Sciences* 58, no. 6: P327–P337. https://doi.org/10.1093/geronb/58.6.S327.

Debesay, J., L. Nortvedt, and B. Langhammer. 2022. "Social Inequalities and Health Among Older Immigrant Women in the Nordic Countries: An Integrative Review." *SAGE Open Nursing* 8: 23779608221084960. https://doi.org/10.1177/23779608221084962.

Eugster, B. 2018. "Immigrants and Poverty, and Conditionality of Immigrants' Social Rights." *Journal of European Social Policy* 28, no. 5: 452–470. https://doi.org/10.1177/0958928717753580.

Forsander, A. 2003. "Insiders or Outsiders Within? Immigrants in the Finnish Labor Market." *Finnish Yearbook of Population Research* 39: 55–72. https://doi.org/10.23979/fypr.44984.

Fuller-Rowell, T. E., G. W. Evans, and A. D. Ong. 2012. "Poverty and Health: The Mediating Role of Perceived Discrimination." *Psychological Science* 23, no. 7: 734–739. https://doi.org/10.1177/0956797612439720.

Gilleard, C. J., and P. Higgs. 2020. *Social Divisions and Later Life: Difference, Diversity and Inequality*, edited by C. Gilleard. Policy Press.

Glushkova, T., L. Kemppainen, A. Kouvonen, S. Wrede, I. Pietilä, and T. Kemppainen. 2025. "Migration and Diverse Belongings in a Neighbourhood Context: Population-Based Study of Older Russian-Speaking Migrants in Finland." *Population, Space and Place* 31: e2877. https://doi.org/10.1002/psp.2877.

Gustafsson, B., V. Jakobsen, H. Mac Innes, P. J. Pedersen, and T. Österberg. 2022. "Older Immigrants—New Poverty Risk in Scandinavian Welfare States?" *Journal of Ethnic and Migration Studies* 48, no. 19: 4648–4669. https://doi.org/10.1080/1369183X.2021.2011176.

Hagenaars, A., and K. de Vos. 1988. "The Definition and Measurement of Poverty." *Journal of Human Resources* 23, no. 2: 211–221. https://doi.org/10.2307/145776.

Haider, W., and L. Salonen. 2023. "Disability Pension and Sociodemographic & Work-Related Risk Factors Among 2.3 Million Migrants and Natives in Finland (2011–2019): A Prospective Population Study." *BMC Public Health* 23, no. 1: 1977. https://doi.org/10.1186/s12889-023-16880-5.

Hajek, P. 2003. "Briefly on the GUHA Method of Data Mining." *Journal of Telecommunications and Information Technology* 13: 112–114.

Jakobsen, V., and P. J. Pedersen. 2017. "Poverty Risk Among Older Immigrants in a Scandinavian Welfare State." *European Journal of Social Security* 19, no. 3: 242–262. https://doi.org/10.1177/1388262717725937.

Karl, U., and S. Torres. 2015. *Ageing in Contexts of Migration*. 1st ed. Routledge. https://doi.org/10.4324/9781315817606.

Kaushik, M., R. Sharma, I. Fister Jr., and D. Draheim. 2023. "Numerical Association Rule Mining: A Systematic Literature Review." arXiv Preprint, arXiv:2307.00662.

Kazemipur, A., and S. S. Halli. 2001. "Immigrants and "New Poverty": The Case of Canada." *International Migration Review* 35, no. 4: 1129–1156. http://www.jstor.org/stable/3092005.

KC, S., K. Clarke, and M. Seppänen. 2023. *A Scoping Review on Ageing Migrants in Finland Through the Lens of Intersectionality and Vulnerability*. Helsinki University Press. https://doaj.org/article/05be892c57d64a04b58908744b3c28e5.

Kela. n.d. *Income Limits for General Housing Allowance*. Kela. Accessed October 15, 2023. https://www.kela.fi/general-housing-allowance-income-limits.

Kemppainen, L., T. Kemppainen, T. Fokkema, S. Wrede, and A. Kouvonen. 2023. "Neighbourhood Ethnic Density, Local Language Skills, and Loneliness Among Older Migrants—A Population-Based Study on Russian Speakers in Finland." *International Journal of Environmental Research and Public Health* 20, no. 2: 1117. https://doi.org/10.3390/ijerph20021117.

Lebano, A., S. Hamed, H. Bradby, et al. 2020. "Migrants' and Refugees' Health Status and Healthcare in Europe: A Scoping Literature Review." *BMC Public Health* 20, no. 1: 1039. https://doi.org/10.1186/s12889-020-08749-8.

Li, Y., and J. E. Mutchler. 2019. "Do Consequences of Hardship Narrow in Later Life? The Impact of Hardship on Self-Rated Health Among Older Adults." *Annals of Epidemiology* 37: 4–9. https://doi.org/10.1016/j.annepidem.2019.08.002.

Li, Y., and J. E. Mutchler. 2022. "Poverty and Self-Rated Health in Later Life: The Mediating Role of Material Hardship." *Social Science Quarterly* 103, no. 3: 521–533. https://doi.org/10.1111/ssqu.13166.

Liversage, A., and V. Jakobsen. 2016. "Unskilled, Foreign, and Old: A Life Course Perspective on Immigrant Poverty." *GeroPsych: The Journal of Gerontopsychology and Geriatric Psychiatry* 29, no. 2: 93–103. https://doi.org/10.1024/1662-9647/a000146.

Mähönen, T. A., S. Varjonen, N. Prindiville, L. Arnold, and I. Jasinskaja-Lahti. 2015. "Boundaries of National Belonging in Ingrian Finnish Return Migration: A Multi-Level Perspective." *Nordic Journal of Migration Research* 5: 126–134. https://doi.org/10.1515/njmr-2015-0018.

Mannila, S., and M. Kainu. 2020. "Social Distinctions in Contemporary Russia." In *Poverty and Confidence in Russia*, 1st ed. Taylor & Francis. https://doi.org/10.4324/9781003029298.

Máša, P., and J. Rauch. 2024. "A Novel Algorithm for Mining Couples of Enhanced Association Rules Based on the Number of Output Couples and Its Application." *Journal of Intelligent Information System* 62: 431–458. https://doi.org/10.1007/s10844-023-00820-1.

McDonald, L. 2011. "Theorising About Ageing, Family and Immigration." *Ageing and Society* 31, no. 7: 1180–1201. https://doi.org/10.1017/S0144686X11000511.

Mehta, N. K., and I. T. Elo. 2012. "Migrant Selection and the Health of U.S. Immigrants From the Former Soviet Union." *Demography* 49, no. 2: 425–447. https://doi.org/10.1007/s13524-012-0099-7.

Nandori, E. S. 2011. "Subjective Poverty and Its Relation to Objective Poverty Concepts in Hungary." *Social Indicators Research* 102, no. 3: 537–556. https://doi.org/10.1007/s11205-010-9743-z.

Nash, P. 2021. "Social Divisions & Later Life Chris Gilleard and Paul Higgs, Policy Press, Cheltenham, UK, 2020, 000pp., Pbk £00, ISBN 13: 978 1 4473 3860 4." *Ageing and Society* 41, no. 9: 2188–2190 Cambridge Core. https://doi.org/10.1017/S0144686X21000866.

Nosraty, L., E. Turunen, S. Kyrönlahti, C. H. Nygård, P. KC, and S. Neupane. 2025. "Application of GUHA Data Mining Method in Cohort Data to Explore Paths Associated With Premature Death: A 29-Year Follow-Up Study." *BMC Medical Research Methodology* 25: 20. https://doi.org/10.1186/s12874-025-02477-6.

Nygård, M., C. Härtull, A. Wentjärvi, and S. Jungerstam. 2017. "Poverty and Old Age in Scandinavia: A Problem of Gendered Injustice? Evidence From the 2010 GERDA Survey in Finland and Sweden." *Social Indicators Research* 132, no. 2: 681–698. https://doi.org/10.1007/s11205-016-1313-6.

Piché, R., M. Järvenpää, E. Turunen, and M. Šimůnek. 2014. “Bayesian Analysis of GUHA Hypotheses.” *Journal of Intelligent Information Systems* 42, no. 1: 47–73. https://doi.org/10.1007/s10844-013-0255-6.

Ragin, C. C. 2004. “Turning the Tables: How Case-Oriented Research Challenges Variable-Oriented Research.” In *Rethinking Social Inquiry: Diverse Tools, Shared Standards*, 123–138. Rowman & Littlefield Publishers.

Rauch, J., and M. Simunek. 2019. “Data Mining With Histograms and Domain Knowledge—Case Studies and Considerations.” *Fundamenta Informaticae* 166, no. 4: 349–378. https://doi.org/10.3233/FI-2019-1805.

Rauch, J., M. Šimůnek, D. Chudán, and P. Máša. 2020. “CleverMiner: GUHA and Python.” In *Mechanizing Hypothesis Formation*, edited by J. Rauch, M. Šimůnek, D. Chudán, and P. Máša. Chapman and Hall/CRC. https://doi.org/10.1201/9781003091448-17.

Schweiger, G. 2019. “Religion and Poverty.” *Palgrave Communications* 5, no. 1: 59. https://doi.org/10.1057/s41599-019-0272-3.

She, P., and G. A. Livermore. 2007. “Material Hardship, Poverty, and Disability Among Working-Age Adults.” *Social Science Quarterly (Wiley-Blackwell)* 88, no. 4: 970–989. https://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=27355866&site=ehost-live&scope=site.

Skirbekk, V., and J. Navarro. 2021. “Poverty and Religious Affiliation Worldwide, 1970–2010.” In *Global Political Demography: The Politics of Population Change*, edited by A. Goerres and P. Vanhuysse, 93–116. Springer International Publishing. https://doi.org/10.1007/978-3-030-73065-9_4.

Statistics Finland Paavo Postal Code Area Statistics. n.d. “Statistics Finland Paavo Postal Code Area Statistics [Dataset].” Accessed October 18, 2022. https://www.stat.fi/tup/paavo/index_en.html.

Statistics of Finland. n.d. “Foreign-Language Speakers. Population Structure [Dataset].” Accessed November 2023. https://www.tilastokeskus.fi/tup/maahanmuutto/maahanmuuttajat_vaestossa/vieraskieliset_en.html.

Szukiełojć-Bieńkuńska, A., T. Piasecki, and A. Bieńkuńska. 2022. “Measuring Objective and Subjective Aspects of Poverty. Discussion of Different Approaches and Measurement Methods Based on the Polish EU-SILC Survey.” https://api.semanticscholar.org/CorpusID:252689860.

Tavares, F. F., and G. Betti. 2024. “Gender Differences in Multidimensional Poverty in Brazil: A Fuzzy Approach.” *Social Indicators Research* 175: 385–422. https://doi.org/10.1007/s11205-024-03312-z.

Tucker-Seeley, R. D., A. E. Harley, A. M. Stoddard, and G. G. Sorensen. 2013. “Financial Hardship and Self-Rated Health Among Low-Income Housing Residents.” *Health Education & Behavior: The Official Publication of the Society for Public Health Education* 40, no. 4: 442–448. https://doi.org/10.1177/1090198112463021.

Tuhkanen, L. 2021. *The Role of Religion, Identity and Discrimination in the Acculturation of Russian-Speakers Living in Finland*. School of Slavonic and East European Studies University College London. https://discovery.ucl.ac.uk/id/eprint/10136238/1/Liisa_Tuhkanen_PhD_thesis_2021.pdf.

Turunen, E., and K. Dolos. 2021. “Revealing Driver's Natural Behavior—A GUHA Data Mining Approach.” *Mathematics* 9, no. 15: 1818. https://doi.org/10.3390/math9151818.

Varjonen, S., L. Arnold, and I. Jasinskaja-Lahti. 2013. “‘We're Finns Here, and Russians There’: A Longitudinal Study on Ethnic Identity Construction in the Context of Ethnic Migration.” *Discourse & Society* 24, no. 1: 110–134. https://doi.org/10.1177/0957926512463632.

Viimaranta, H., E. Protassova, and A. Mustajoki. 2018. “Russian-Speakers in Finland. The Ambiguities of a Growing Minority.” *Revue D'études Comparatives Est-Ouest* 4, no. 4: 95–128. https://doi.org/10.3917/receo1.494.0095.

Zdeněk, R., and J. Lososová. 2020. “Objective and Subjective Poverty of Households in Czech Regions.” *Demografie* 61: 175–185.

Želinský, T., M. Mysíková, and T. I. Garner. 2021. “Trends in Subjective Income Poverty Rates in the European Union.” *European Journal of Development Research* 34: 2493–2516. https://api.semanticscholar.org/CorpusID:236861271.