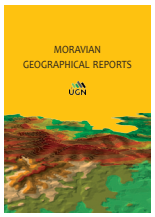

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The sustainability of social care in Slovakia: Modelling the existing network of residential social facilities for future senior populations

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Abstract:

The possible availability of residential long-term care for seniors in the regions of Slovakia in the period to 2040 is evaluated in this contribution. The study identifies risk in the availability of residential care concerning the future development of the senior population. To highlight the potential risk for regions, three model projections are used. A factor analysis with two-by-two classifications was employed to identify the risk in the regions in terms of the availability of residential care. Due to the expanding senior population in Slovakia, maintaining the current capacity of residential facilities would significantly deteriorate the availability of social services. If the current ratio of residential care capacity to the size of the senior population is maintained, the number of beds will have to increase by 56% by 2040. Demographic ageing is a current challenge for public policy and requires searching for solutions to ensure the quality of social care for the elderly in every society. Our research shows that the risk in the regions of Slovakia varies depending on the existing capacity of residential facilities and the forecasted senior population.

Keywords: *seniors, population ageing, social care, residential facilities, modelling, regions, Slovakia*

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1. Introduction

Knowledge of population development, demographic processes, and their impact on the functioning of individual spheres of the state are essential to ensure sound financial investment. Therefore, there is a current research interest concentrated on solving problems caused by growth in the senior population. Population ageing is a global problem, with intensive ageing processes recorded in almost all developed countries. There is an ongoing demand for reliable data and performance criteria as the elderly industry expands and diversifies.

The world's population is ageing rapidly. The 2019 Revision of the World Population records that the population aged 65 and over is growing faster than all other age groups. One in seven people in the world will be over the age of 65 (14%) by 2040, an increase from one in 11 in 2019 (9%). In addition, Šprocha et al. (2019) report that one in four people in Slovakia will be over age 65 by 2040, an increase from one in six in 2019. Based on the medium scenario population forecast for Slovakia, the proportion of seniors is expected to be 26%, with more than 1.4 million people who may eventually need special care. Evidence of an increasing longevity accompanied by an extended period of good health is scarce (Beard et al., 2016). The senior population will need a corresponding network of social and health facilities with supportive fields or ambulance services. Many countries are already resisting political or fiscal pressures on public health, pensions, and social protection systems for a growing elderly population. The problem is the increasing number and proportion of seniors in the population and increasing life expectancy. The forecast of Šprocha et al. (2019) reported an increase in the population of 80-year-olds in Slovakia from the current 3.4% to 8.4% by 2040, and the number of 100-years-olds will grow more than six times.

Thus, we observe that decreased fertility and improved survival into old age contribute to ageing. We record improvements in life expectancy at birth and even more rapid advances in life expectancy at older ages. According to the development of the Slovak population's mortality rates, by 2040 the life expectancy at birth could increase by four years for men and almost three years for women. Similarly, at the age of 65, there will be a continuously extended life

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expectancy, so future seniors in 2040 could face nearly 18 years for men and more than 21 years for women (Šprocha and Ďurček, 2019). The situation is similar in the neighbouring Czech Republic, Poland and Hungary and other post-socialist countries (Kačerová et al., 2012; Šidlo et al., 2020).

The increase in the senior population implies immediately the availability and sustainability of social and health care. Moreover, services for the elderly aged 65 and over are already in high demand and expected by seniors (Szebehely and Trydegard, 2011). Slovakia provides several forms of social care for seniors, and the Ministry of Labour, Social Affairs and Family offers a regional overview of social service providers through a central register.

The worrying statistics and prognoses led to this investigation of current and future senior aged care in Slovakia. The research focuses on long-term residential care for seniors in social facilities with 24-hour care. It is uncertain if the current network of residential facilities in the regions of Slovakia will be sufficient because of the growing senior population. This paper will review the current and prospective availability of residential care in the districts of the Slovak Republic. The research explicitly models the availability of social services for seniors based on the forecast senior populations in Slovak regions by 2040. The population redistribution in these regions is influenced by migration and natural population movements (Bezák, 2011; Novotný, 2011, 2012; Pregi and Novotný, 2019). These influence changes in the population age structure, the size of human capital and demands for social services in different districts. Therefore, the ultimate research results will establish the sustainability of the social facilities' current capacities that provide residential care to the changing senior populations in the regions of Slovakia. We will thus identify the regional risks involved in the future development of the senior population and the availability of residential care.

2. Theoretical framework

Demographic changes since the mid-twentieth century have been triggered by the so-called 'age of ageing' (Magnus, 2009). Longer life expectancy and advancement in health services have led to increasing senior populations (Zainol and Pettit, 2016). Demographically, the concurrent fall in fertility rates and increase in life expectancy is resulting in a gradual increase in the proportion of seniors in many countries' populations. This change increases the burden on the economically productive population to fund sustainable social security programs, especially to cover pensions and senior social care. Studies of the impact of these changes in different societal areas have subsequently increased.

Although population ageing is a global phenomenon, data from the 2019 Revision of the UN World Population Prospects indicates that the situation in European countries is the most difficult (Phillips and Feng, 2017; Benítez-Aurioles, 2018; Li et al., 2019; Kluge et al., 2019). Moreover, the latest EUROPOP2019 population forecasts indicate that the ageing rate is increasing. Hewitt (2008), therefore, declares that a 'demographic time bomb' is ticking away in Europe, and preoccupation with the sustainability of seniors' social care in social debates is growing. A shrinking young labour force and a growing pool of elderly and retired is seriously threatening the long-term financial sustainability of public social and health insurance funds (Carr, 2007; Lin et al., 2010; Tediosi and Gabriele, 2010; Feng et al., 2012; Rechel et al., 2013; Beard et al., 2016; Woo, 2018).

A growing senior population increases the demand for social services and the costs of social care provision. Therefore, the availability of social services in state territories becomes a primary efficiency provision, which forms an essential part of this research. Vaňková and Vavrek (2021) evaluated the availability of social services and factors affecting accessibility in districts of the Czech Republic, and they also emphasise the state's responsibilities for ensuring the availability of social services, having established powers in the areas of planning, coordination and evaluation. Social policy, public funding, and regional local conditions represent strategic resources affecting the availability of social services.

The spatial distribution of the senior population and institutional social care for the seniors in Slovakia has regional specifics, reflecting the different levels of population ageing. In line with Šprocha and Ďurček (2019), the senior population has the highest representation especially in western and central Slovakia, except in the surroundings of Bratislava and the northern districts. The opposite situation is seen especially in the East Slovak districts with a significant concentration of the Roma population (Šprocha and Bleha, 2017; Nestorová Dická, 2021) and the north of central Slovakia. The outlook for 2040 predicts an increase in the senior population in all regions of Slovakia, especially in the regions where a smaller representation of this population today is registered. A reversal of the trends of the senior population can also be observed in urban and rural environments. Bleha et al. (2020) state that urban populations are older on average and age faster than rural areas. Until 2012, the Slovak senior population was dominant in the rural areas. At the present, population ageing is a common feature of all regions, but in the urban environment, the increase is evident, especially in larger cities with over 50,000 population. This situation is also copied by the level of equipment of institutional residential social care for the seniors. This situation then also reflects on the level of equipment for institutional residential social care. Today, there is an expanded network of social facilities with higher capacities in regions with larger urban cores and senior populations. Regions of self-governing cities have the highest representation but it is also seen in districts such as Medzilaborce and Myjava, where the level of the senior population was already well above the Slovak average at the beginning of the millennium.

The Supreme Audit Office of the Slovak Republic (SAO SR) published its final report on senior social services in 2018. Their report stressed that senior residential care demand in Slovakia exceeded the current placement capacity. Moreover, the waiting-list is growing exponentially. Vitorino et al. (2013) and Del Duca et al. (2012) consider seniors with advanced age a strong predictor of institutionalisation. The risk of functional incapacity and the development of chronic diseases in the elderly is greater. For that reason, we claim that the risk of institutionalisation at most doubles with every decade.

On the other hand, healthy ageing is a global priority, so it is essential to identify the determinants of healthy ageing. In line with Klusmann et al. (2021), such modifiable determinants may draw on improvements in the health care system, improvements in the built environment, or they may pertain to improving one's behaviour to promote healthy ageing outcomes. To support people to age healthily, however, policies and programs must translate the knowledge that a certain change in behaviour is important for healthy ageing. Because

of WHO's 2015 world report on ageing and health, "healthy ageing" is defined as the "ongoing process of developing and maintaining the functional ability that enables wellbeing in older age". This definition distinguishes the three domains of healthy ageing: intrinsic capacity, functional ability, and environments, as biopsychosocial components of healthy ageing. WHO describes this functional ability (to meet their basic needs; to learn, grow and make decisions; to be mobile; to build and maintain relationships; to contribute to society) as being formed by interactions between intrinsic capacity and environmental characteristics (Rudnicka et al., 2020). The intrinsic capacity includes the mental and physical capacities of a person. The environmental characteristics are related to home, community, and society. Using Halfon and Forrest (2018), the research on a theoretical framework of life course health development (LCHD) is demonstrating how complex developmental processes integrate a range of behavioural, social, and environmental influences that modify gene expression, modulate physiological and behavioural function, and dynamically shape different pathways of health production.

Szüdi et al. (2016) add that historical, demographic, economic and political factors have forced the need to transform care services for seniors in Slovakia. According to Ludvigh Cintulová and Buzalová (2021), the fundamental changes in social services in Slovakia are based on the historical development of social services, the legislative framework, reflecting changes in funding, social quality standards and provision of human resources, the functionality and sustainability of social services. Similarly, amendments have also impacted the following planning, development and management of social services, which have had both positive and negative impacts on the current state of social services. The authors then indicated the negative impacts emanating from unstable political and economic situations, law changes, regional differences in public resources, social and human capital, and the lack of connection between senior health and social care.

The social services sector in Slovakia today does legislate Act No. 448 of 2008. This act provides the entry of non-public social service providers into the Slovak market. Repková and Brichtová (2011) noted that the previous reform did not make it possible to finance a non-public provider from public sources. Receivers of social services can now choose providers established by the municipality, a higher territorial region or from the non-public sector by civil associations, not-for-profit organisations, the church or even a company limited by shares. Adoption of this 2008 law in Slovakia led to long-term residential care for the seniors performed in the "facility for the seniors", which in research debate (e.g. Chappell et al., 2004; Lestage et al., 2008; Munyisia et al., 2011; Lim et al., 2013; Nikmat et al., 2015; Berg, 2021) are often referred to as a Care home, Nursing home or Residential care home. The names of these facilities may vary slightly from country to country. The development of the system of social care for the seniors in Slovakia has been presented elsewhere in more detail: see Káčerová et al. (2021), Ludvigh Cintulová and Buzalová (2021), Lukáčová and Novotná (2020), Kubalčíková et al. (2017), Szüdi et al. (2016), Kačerová et al. (2013), Krajňáková (2009).

Lukačová and Novotná (2020) record that the facilities for seniors in Slovakia most identify with the term 'Residential home care'. These facilities provide long-term residential services with nursing care and a diverse range of services under "one roof", with a maximum of 40 social service recipients in one facility building. There were 486 residential facilities (RF) for seniors with a total capacity of 19,529 placements registered in Slovakia at the end of 2019. Šídlo and Křesťanová (2018) considered that the development of RF capacities depends on the number and proportion of seniors, on their health status, their housing, economic situation, and disposable income, and eventually on the extent of family support and/or other forms of social support.

The process of population ageing in Slovakia and its regions is a changeless and currently relatively dynamically deepening phenomenon. Šprocha and Ďurček (2019) point to the continuous persistence of low fertility, declining reproductive potential, and continuing prolongation of life with slight migratory increases and the existence of significant intergenerational inequalities in the age structure of the Slovak population. The results of all known domestic (Šprocha et al. 2019) and foreign population forecasts (EUROPOP, 2019) confirm the continuation of ageing. Šprocha and Ďurček (2019) assess in detail the dynamics and level of aging from a regional perspective in Slovakia and with a view to 2040.

3. Data and Methods

Research results reported in this study are based on data publicly available from the Ministry of Labour, Social Affairs and Family of Slovakia, Demographic Research Centre INFOSTAT and the Statistical Office of Slovakia. The fundamental indicators map seniors' residential care based on knowledge of the existing capacity of RF, the age structure of seniors in the region with projections to 2040. The future development of the investigated phenomena, according to Šídlová Kunstová and Šídlo (2016), is 'estimated by considering the interaction between two groups of variables: input assumptions which can cover the 'what if' scenarios in the model characteristics described below, and these may not be realistic, and the expected development in the population number and structure provided by initial senior population forecasts'. According to the baseline scenario variant, the researchers used population forecasts with a 2040 medium-term view at the LAU1 level compiled by Šprocha et al. (2019). Šídlo et al. (2020) consider this baseline scenario variant as the most likely scenario to estimate the composition of the population by age.

The fundamental spatial research unit is at the LAU1 level, covering the districts of Slovakia. For the needs of the research, Bezák (1996, 2001) suggested merging the curious city districts of Bratislava and Košice into two separate regions. Hence, the set of basic spatial units consisted of 72 districts, which are diverse in population size or spatial size. Outside Bratislava and Košice, the districts of Prešov, Nitra and Žilina have more than 150,000 inhabitants. On the other hand, small districts have less than 20 thousand inhabitants: Banská Štiavnica, Turčianske Teplice and Medzilaborce. Bezák (1996, 1997) pointed out this regional inequality and injustice. The data needed for this regional analysis is only available for these spatial units. Model projections of the availability of social services at the lower levels of the landscape's regional structure raise the profile of the actual situation in particular regions. It provides opportunities to seek solutions to the following state.

The research procedures adopted for the study's requirements are divided into two key stages. The initial research phase predicted the capacity of seniors' RF in Slovakia based on knowledge of the existing capacity in

the region and the development of the senior population. This analysis focused on creating model projections of the availability of seniors' long-term residential care through the existing capacities of RF for senior population changes in the regions by 2040. The observation used three models designed by Šídlová Kunstová and Šídlo (2016) and Šídlo and Křesťanová (2018). In addition, Bleha et al. (2018) consider that the results of population forecasts are, and will be, important in planning several spheres of societal functioning, especially economic and social development, labour market and pensioner's security schemes.

The creation of model projections with a medium-term estimate required forecasts of the senior population and the current number of capacities in the RF for the districts of Slovakia:

1. Model "A" assumes that the current network of residential facilities and their capacities in the region will be maintained throughout the projection. The basis of the model is an estimate of how much the theoretical number of seniors per bed in the RF will increase. The model indicates a changed demand from potential customers per bed. The number of clients vying for each available bed varies depending on quantitative shifts in the number of seniors by age;
2. The second model, "B", assumes that the proportion of seniors placed in RF is maintained throughout the projection period, i.e. the rate of service users in the region. The basis is an estimate of what the region's total capacity should be if the same proportion of seniors should be served as recorded at the 2018 projection outset; and
3. Model "C" is based, similarly to model B, on the assumption of maintaining the share of the placed senior population in the number of seniors in the relevant region of Slovakia, but not the population aged 65 and over as a whole, but individual shares regarding age categories. As in the previous model, it is based on maintaining constant age proportions of clients served in RF to the corresponding senior population but in individual age categories. This model can assume that the results better reflect the changes in the senior age structure. Hence, they will indicate a greater need for additional places in RF. Model C more accurately estimates the total capacity required for RF in a region. Specific age groups of clients in model C are expressed by the "weight" for each age group in RF.

The proportions of placed clients with respect to the age categories of seniors obtained from field surveys are given in the explanations with the mathematical formulas of models (1)–(3). The field surveys carried out by the authors themselves have taken place over the years 2019 and 2020. Ninety-six subjects (21%) out of 486 facilities for seniors in Slovakia were addressed to provide the required information. For the sake of representativeness, the random selection was managed in terms of representation according to the capacity of the facility, rural-urban and equal representation from the regions of western, central, and eastern Slovakia. Only 64 entities (13%) provided the requested information. Finally, the data set met the condition of representativeness. The obtained representation of clients according to age categories in the facilities was the basis for determining the rate of service users from the relevant age categories of seniors in the districts of Slovakia (3'). Thus, the created weights representing the rates of service users according to the clients' ages were assuming 100% occupancy of the facilities in the region.

The study investigated model predictions for the age of the seniors in the following two variants: a = 65+ and a = 75+. A two-option solution to the problem stems from the high probability that numerically strong generations (born in the 1970s – pro-natal measures of the previous political regime) will live to an even older age. Concurrently, 'Health at a glance: Europe (2020)' suggests that the population of Slovakia can expect to live free of disability for approximately four years after reaching senior age. This trend is expected to continue, so the senior population will live in health for several years. Studies also testify to improved seniors' health status and consequent prolongation of healthy years in senior age without the need for social or health care (e.g. Jagger et al., 2008; Welsh et al., 2021; Newton, 2021; Santos et al., 2021). The following weights of older peoples' age groups proposed for the option 75+ are based on the previous trends and predictions of decreasing rates of service users of younger seniors in the RF. Therefore, the weight of a2svk1 was a significant reduction, but not zero, assuming that a small proportion of younger seniors would need social care. The magnitude of the weight reduction value a_{2svk1} was then evenly distributed to the weights a_{2svk2}, a_{2svk3} and a_{2svk4}.

$$M_A^{y,r} = \frac{PS_a^{y,r}}{k^{y=2018,r}} \quad (1)$$

$$M_B^{y,r} = PS_a^{y,r} . \frac{k^{y=2018,r}}{PS_a^{y=2018,r}} \quad (2)$$

$$M_C^{y,r} = \sum_{i=1}^{n} PS_{ai}^{y,r} . w_{ai}^{y=2018,r} \quad (3)$$

$$w_{ai}^{y=2018,r} = \frac{a_{Svk,i} . k^{y=2018,r}}{PS_{ai}^{y=2018,r}} \quad (3')$$

where:

$M_A^{y,r}$ = Model A in year y in region r;

$M_B^{y,r}$ = Model B in year y in region r;

$M_C^{y,r}$ = Model C in year y in region r;

Y = 2018, … , 2040 and r = 1, ... , 72;

$PS_a^{y,r}$ = number of seniors (a_1 = 65+, a_2 = 75+) in year y in region r;

$k^{y,r}$ = capacity in year y = 2018 in region r;

$PS_a^{y=2018,r}$ = number of seniors (a_1 = 65+, a_2 = 75+) in year y = 2018 in region r;

$w_{ai}^{y=2018,r}$ = weight share of seniors by age groups ai (a_1 = 65–74, a_2 = 75–84, a_3 = 85–94, a_4 = 95+) in y = 2018 in region r;

$a_{Svk,i}$ = expected proportion of age groups in residential facilities in Slovakia (a_{1svk1} = 0.196, a_{1svk2} = 0.445, a_{1svk3} = 0.296, a_{1svk4} = 0.063; a_{2svk1} = 0.10, a_{2svk2} = 0.48, a_{2svk3} = 0.33, a_{2svk4} = 0.09);

$PS_{ai}^{y=2018,r}$ = number of seniors in year y = 2018 in region r in age groups.

The second stage of the study incorporates the analysis of selected indicators obtained from the three models by multivariate statistical methods. The research further focuses on the delimitation of 'risky propositions' for regions that may be at risk of providing available residential care for the senior population in 2040. The selection of fundamental variables then differentiates the regions' risks

in available social services. Table 1 provides an overview of the indicators used and calculation methods. The input data matrix contained information for the 72 regions (LAU1) and five selected indicators. The indicators were first normalised by the MIN-MAX method. Normalisation enables a combination of indicators with different units of measurement and different scales. The formula comprises: v_i is the normalised value of the indicator in the $< 0,1 >$ range; v_j is the indicator's value in a particular grid, and min_v and max_v are the minimum and maximum values of that indicator (Hendl, 2012). The calculation for the given type of indicators was used because all indicators were of the minimum type (5).

$$v_j' = \frac{v_j - min_v}{max_v - min_v} \quad (5)$$

The input indicators for mutual linear dependence were tested in the next step before applying the factor analysis. Bartlett's and Kaiser–Meyer–Olkin (KMO) tests were used to test the relevance of the input variables for factor analysis. The significance of Bartlett's test ($p < 0.001$) and the KMO value (65+ = 0.68; 75+ = 0.67) support the adequacy of the factor analysis. The factors were extracted based on Principal Component Analysis (PCA) with Varimax rotation with Kaiser Normalisation. Obtaining principal components depends on the decomposition of the covariance matrix. Once the covariance matrix is determined (Nestorová Dická et al., 2019), eigenvalues are calculated, indicating the degree of total variance explanation represented by each component. Results show that the principal component with the highest value is more representative than the others. The principal component represents preferentially by all the variables mentioned above. The calculations were performed in the software of the PASW Statistics 18.0.0.

The loadings for each of the five indicators derived from the first principal component were then used as weighting criteria in an algebraic equation to calculate a factorial score for each region in Slovakia. The factor score represents a new dimension of the original indicators, which uses the factor weights of all the original features for the relevant common factor (Lubyová and Vojtková 2014). The PCA method has been used to estimate the factor matrix, from which two factors were extracted for both variants. Factors together explain up to 86% of the total variability of the input data for variant 65+, 84% for 75+. The results indicate that based on five indicators, at least two risk-security continuums exist, which in their way represent different levels of need for residential solution care. Loading scores of two factors were assigned to a two-by-two classification ranging from 'high risk' to 'low risk,' thus mapping a four-fold typology of districts (see Fig. 1). Adoption of this two-dimensional concept enables regional classification. Both factors allow to be used separately and together. The two-dimensional approach offers a direct method for monitoring changes between districts. Only regions at 'extreme risk' or 'extreme non-risk' along both factors should be considered the two extremes of the risk-security continuum spectrum.

4. Results of modelling demand for residential facilities for seniors through 2040

Changes in the reproductive behaviours of the population of Slovakia, an increased life expectancy, and shifts in the largest age groups compared to the post-war period, have created a situation with more elderly people in the population of Slovakia today than children under the age of 14. Population forecasts, such as Šprocha et al. (2019), now

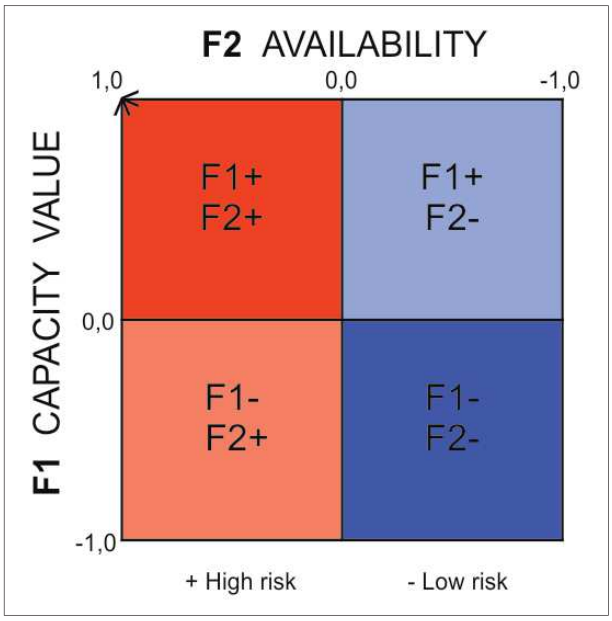

Fig. 1: Typification according to the intensity of the influence of risk factors
Sources: MLSAF SR (2018); SO SR (2018); Šprocha et al. (2019); authors' calculations

Indicator description	Design Calculation
Change in the demand of seniors for a bed in RF	$M_A^{y=2040,r} - M_A^{y=2018,r}$
Change in RF capacity	$M_B^{y=2040,r} - k^{y=2018,r}$
Change in RF capacity according to the age of the clients	$M_C^{y=2040,r} - k^{y=2018,r}$
Relative change in RF capacity according to the age of clients	$\frac{M_C^{y=2018,r}}{k^{y=2018,r}}$
The concentration of RF capacity per built-up area	$\frac{k^{y=2018,r}}{ZP^{y=2018,r}}$

Tab. 1: Indicators used for multidimensional statistical methods
Note: $P^{y=2040,r}$ = Population in year y = 2040 in region r; $ZP^{y=2018,r}$ = built-up area in km^2 in years y = 2018 in region r; RF = Residential Facilities

indicate a significant acceleration in the growth of the senior population in Slovakia. The persisting trend in increased life expectancy of both men and women in Slovakia has resulted in more people living to a superior age, i.e. people who are likely to be more dependent on social and health care. The "oldest-old" population (80+) has increased by more than 70% since the beginning of the millennium, and 2040 forecasts predict almost 2.5-fold further growth, where every 12th person will be over 80 (see Fig. 2). Similarly, the realised field survey of the representation of age categories showed high rates of service users for seniors over the age of 80 as high-potential clients of long-term care in the RF. The social sector is also responding to this development by continuously improving the availability of long-term care in RF (Fig. 3). In addition, Ludwigh Sintulova and Buzalova (2021) indicate that 2008 was the breakthrough year in developing social services in Slovakia. Act 448/2008 legislated new social service tasks to municipalities, regional stakeholders, and social services providers. It remains questionable, however, whether social support in Slovakia will be sufficient, considering current predictions of its increasing senior population.

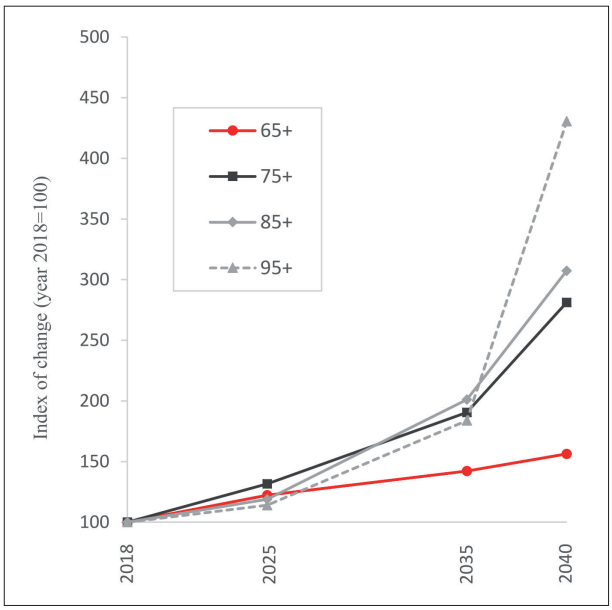

Fig. 2: Expected people in selected senior age categories, Slovakia, 2018–2040
Source: Šprocha et al. (2019); authors' elaboration

The implementation of the 2008 reform resulted in significant changes in the RF network and bed capacity (see Figs. 3–5). Kačerová et al. (2013) noticed that after 2009, the founders of the facilities adjusted the number of beds to the current needs - the number of applicants. The reduction of capacities in the regions of Slovakia affected the adoption of several measures:

1. The introduction of a care allowance for family members, which also solved the situation of rising unemployment during the financial crisis of 2008 and, at the same time, long-term unemployment of the elderly population;
2. Preference for informal care over formal residential social care within the maximum use of the efforts of the individuals and their families to solve the situation; and
3. Transfer of the competencies of social care for the seniors to municipalities that were not prepared in this regard, due to funding or qualified employees in the social care area.

The renewed increase in capacity was caused only by de-institutionalisation in the social services system, which significantly expanded the network of facilities, especially non-public providers, after 2011. In the case of Slovakia, de-institutionalisation started later than in other European welfare states, as part of a radical transformation from one social services model to another (Kubalčíková et al., 2017). The reforms aimed to improve the quality-of-care services, create sustainable financing mechanisms, and increase social inclusion.

Due to the implemented social care reform, which also allowed the non-governmental sector to enter the market for social service providers, the availability of long-term care for the senior population in Slovakia has gradually improved. Although these entities own 49% of current facilities, these have less capacity and provide care for only 39.9 % of seniors at 7,800 placements. Figure 4 shows an improvement of availability since 2015 so that numbers of seniors per bed have stabilised. This was influenced by gross (RF) capacity and an only slight increase in the senior population. In

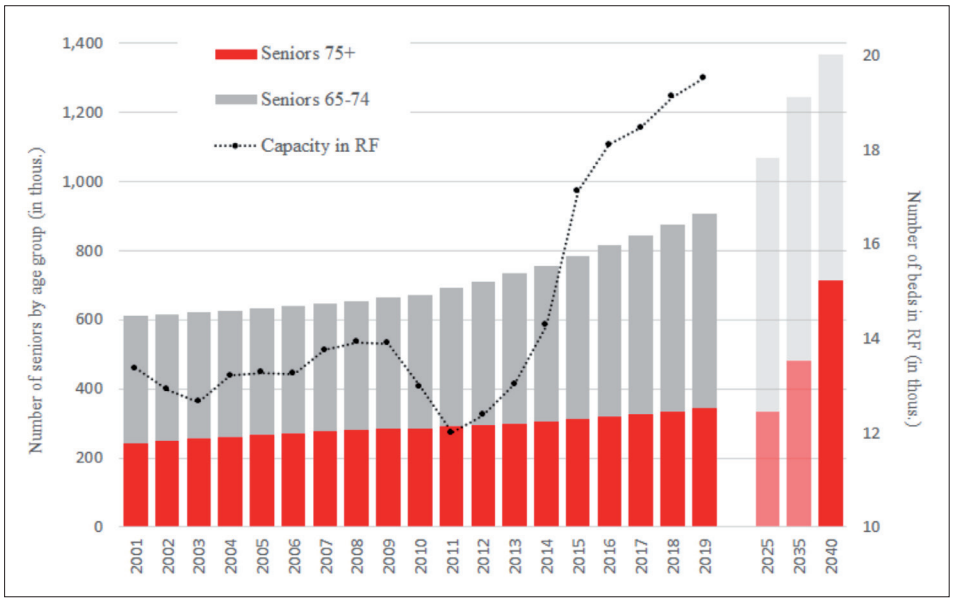

Fig. 3: Trend of seniors and capacity in residential facilities, Slovakia, 2001–2040
Source: SO SR, (2018); Šprocha et al. (2019); authors' elaboration

Slovakia, about 46 people aged 65+ are registered per one RF bed, 18 people are aged 75+. A similar development record in the indicator of amenities standards exists. Šídlo and Křesťanová (2018) base their indicator on data by the number of persons in need of help, their age, level of disability and non-separate, and therefore represent the recommended number of beds in RF per thousand people. For example, if there were 17 beds per 1,000 senior people over 65 years in 2011, today it is almost 22beds, equating to 57 beds per 1,000 people for 75+ seniors (see Fig. 5). In addition, SAO SR (2018) quotes an increasing number of pending applications each year. Although the situation

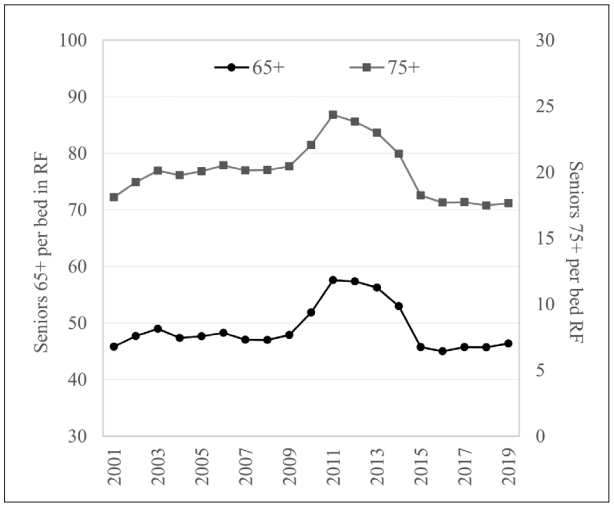

Fig. 4: Trend in the index of space availability, age 65+ and 75+, Slovakia, 2001–2019
Source: SO SR (2020); authors' elaboration

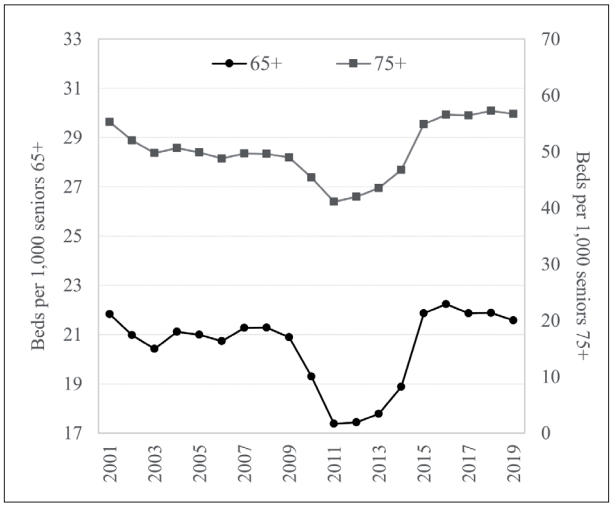

Fig. 5: Trend in amenities standards, age 65+ and 75+, Slovakia, 2001–2019
Source: SO SR (2020); authors' elaboration

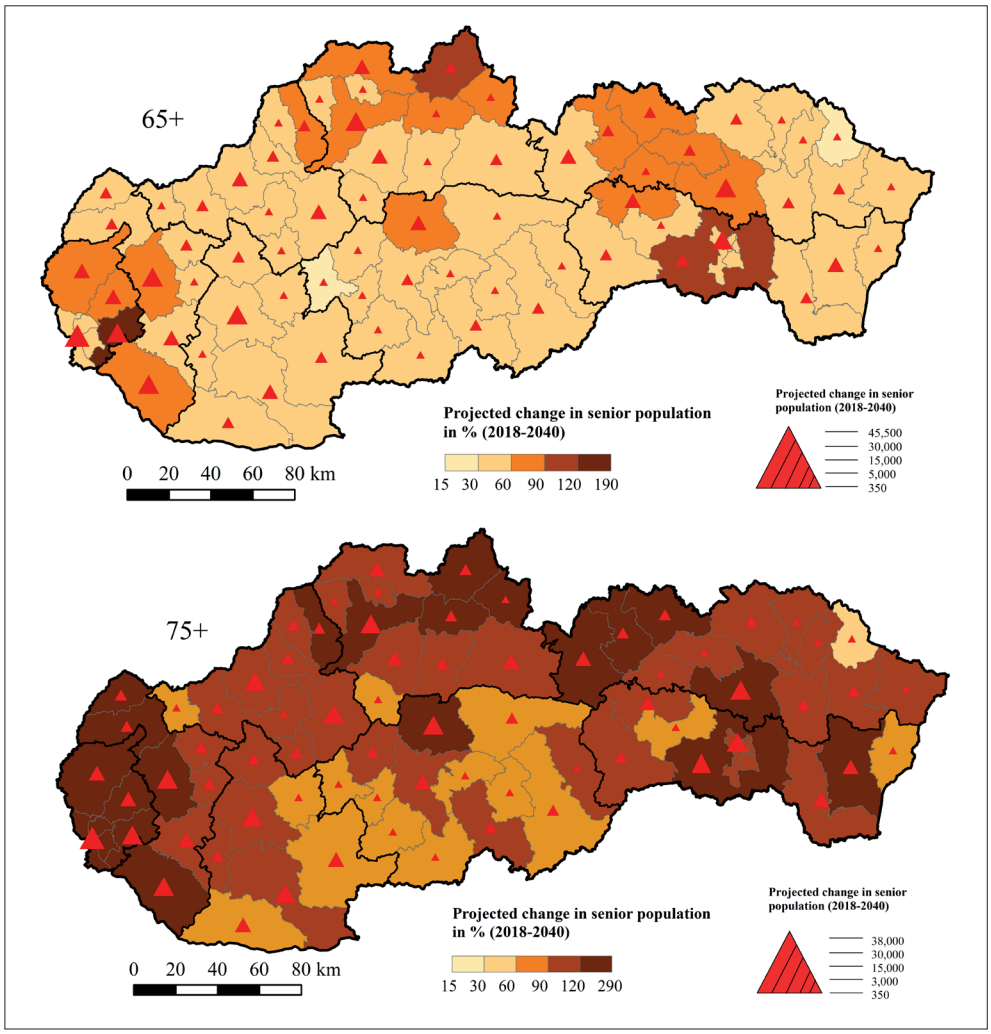

Fig. 6: Estimated population change of seniors in the regions of Slovakia, 2018–2040
Sources: SO SR (2018); Šprocha et al. (2019); authors' elaboration

has improved, it is still unsatisfactory, and it is necessary to consider expanding the RF network or supporting other forms of social care.

The model projections seek to estimate the Slovak capacity and availability of residential care in 2040. The models of Šídlová et al. (2016) indicate how regional capacities should change, taking the grown senior population into account, so that the input assumptions are preserved. The model projection calculations confirmed the changing availability of residential care due to the projected constant increase in the senior population (see Fig. 6). The proposed projections model is based on monitoring the two leading indicators. Model A works with the rate of seniors per bed, while the other models work on calculated estimated capacity.

Model A results emphasise the changing availability of social services with subsequent senior population development while maintaining current RF capacity in Slovak regions (see Fig. 7). Future demographic development predicts continued ageing processes and consequent deterioration in service availability, i.e. 25-person increase in the number of 65+ seniors per bed and a 19-person increase in the 75+ age group (see Fig. 8). These increases also suggest that there will be potentially 54% more seniors over 65 per bed and 95% over 75 than today.

The current and projected geographical differences in population ageing and senior population sizes are reflected in the emergence of significant differences in the availability of residential social services in Slovakia from a regional perspective (see Figs. 9 and 11). This availability is expected to deteriorate in most Slovak districts, with maintained current capacity. At the beginning of the projection, more than 120 seniors were registered per bed in the Sobrance, Tvrdošín, Bánovce n/B and Malacky districts. This set will increase from four to fourteen districts by 2040. A favourable situation, however, is expected only in six districts (Medzilaborce, Skalica, Komárno, Krupina, Galanta and Bardejov). The ratio of current capacity to seniors there is most balanced. In one particular case, the Senec district has the most significant senior increase from 48 registered in 2018 to almost 140 seniors for each bed at the end of the screening. The demographic development of the district has long been influenced by processes of suburbanisation (Novotný, 2016; Švéda et al., 2016; Švéda, 2011). The population is still relatively young, with a significant proportion of people born during the 1970s, and these will reach senior age by the end of the projection. A similar situation occurs in the 75+ category, where accessibility improves significantly because of the smaller population in this age group. Again, a particular case is the Senec

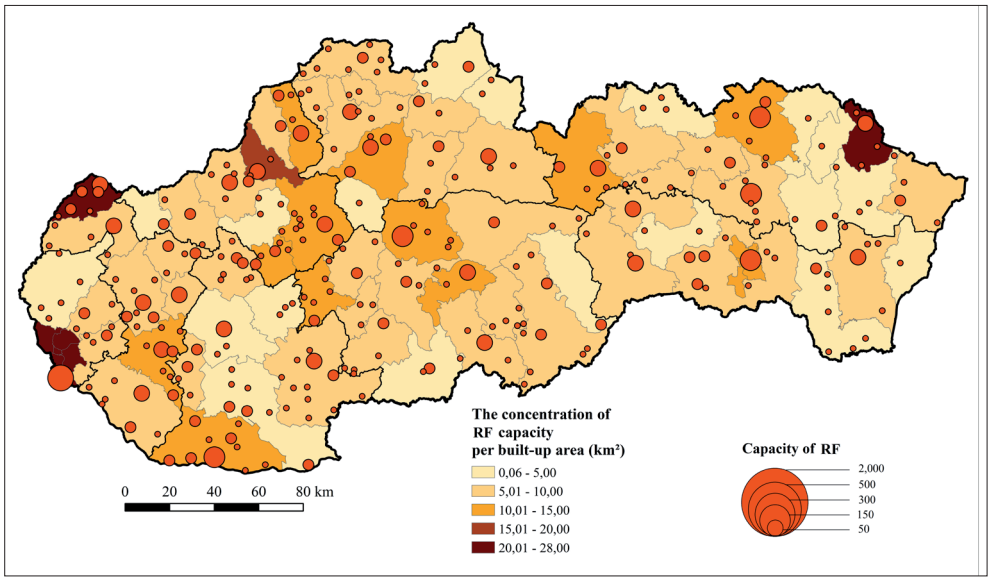

Fig. 7: The concentration of residential facilities capacity in Slovak regions
Source: MLSAF SR (2018); SO SR, (2018); authors' elaboration

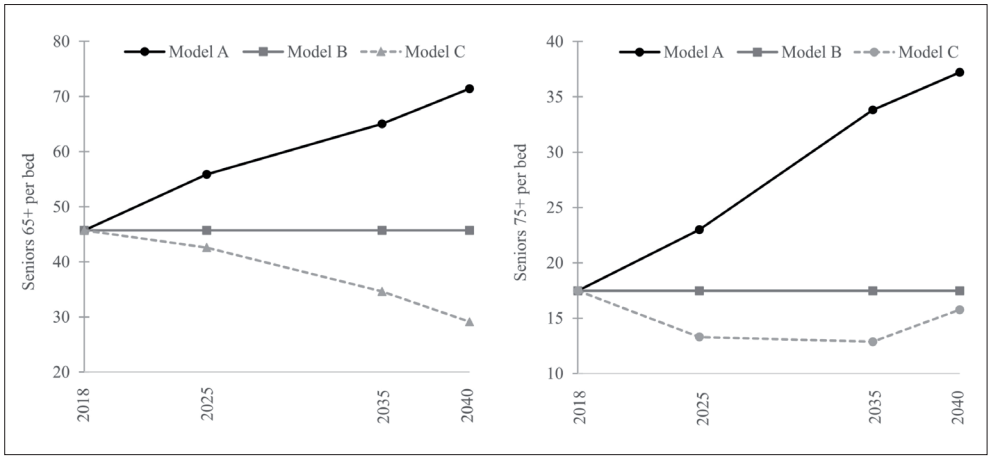

Fig. 8: Model estimates of the future number of seniors (65+ on the left, 75+ on the right) per one bed in residential facilities, Slovakia, 2018–2040. Sources: MLSAF SR (2018); SO SR, (2018); Šprocha et al., (2019); authors' calculations

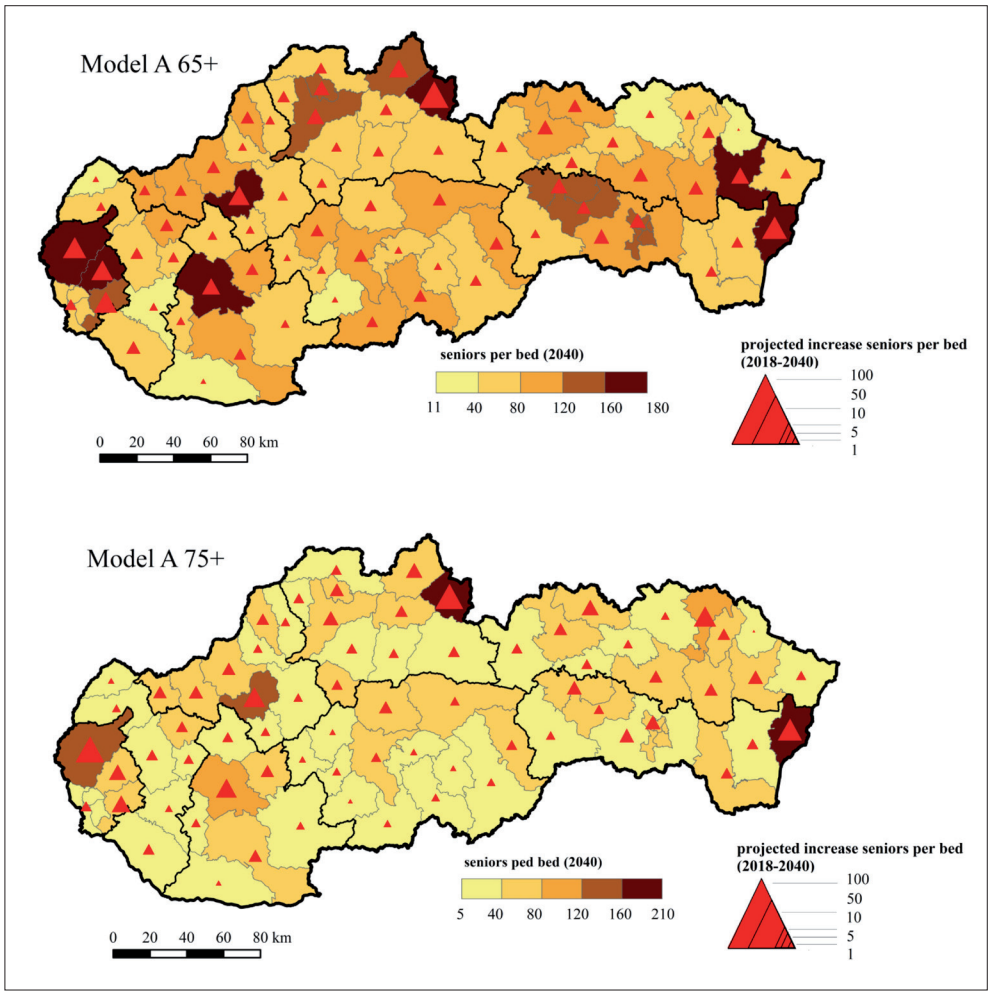

Fig. 9: Availability of residential social services for seniors from a regional perspective, Model A, Slovakia, 2018–2040
Source: MLSAF SR (2018); SO SR, (2018); Šprocha et al., (2019); authors' elaboration

district and the Malacky and Svidník districts, where a more than 2.5-fold increase in the number of seniors over 75 years is expected per bed, because of this significant increase in the number of seniors at the end of the forecast.

Model B maintains the rate of RF service users throughout the entire projection period. Its results suggest an increase in capacity following the intensity of the growing senior population. At the current senior population and RF capacity ratio, the proportion of 65+ placed clients is approximately 2.2% and 5.7% for the 75+ group. Forecasts of the senior population are grown in Slovakia supports the model prediction of a reasonable rate of increase in RF beds. The size of the proposed capacity affects the following:

1. Growth in the senior population, excluding possible changes in the age structure of clients;
2. Changes in senior's health status;
3. Prolongation of the age of seniors without health limitations; and
4. Expanded forms of non-residential care.

The maintained rate of service users also results in the proposed capacity numbers, where the number of RF beds for the 65+ population would increase by an average of 490 beds per year and for 75+'s up to 980. In the first half of the projection, growth rates are more intense (see Fig. 10), which is interfered with by the forecasts of the expansion of the senior population. Regional estimates present the potential capacity at 10,800 higher for the case of65+ years older people, and up to 21,600 beds for the group 75+, at the end of the projection. Suggested capacity is increased by up to 56% and 113% than in 2018 for the 65+ and 75+ groups, respectively.

Constant rates of service users also vary significantly from region to region. Variability is influenced by the input assumptions of existing capacity and the number of seniors. The rate of service users in the areas varies from 3.3 to 102.0, with 75+ users comprising 7.8 – 227.7 per 1,000 seniors. Extreme values indicate an unequal level in the existing RF network and senior population size (see Appendix 3). For example, the Medzilaborce, and Sobrance extreme regions are affected by the uneven development of population ageing and consequent formation of RF networks. Therefore, the proposed potential capacities in the region depend on their constants (see Fig. 11). Model B proposes over double capacity in Senec, Námestovo, Košice-okolie and Pezinok districts by 2040. In the annual view, a high average annual increase of more than 15 beds per year was recorded for the following districts: Bratislava, Senec, Dunajska Streda, Galanta, Komarno and Skalica. Except for Senec, these already have a higher concentration of RF capacity. Still, the forecast increase in the senior population influences the recommended higher number of capacities in these regions.

Similar situations with different intensities occur in both 65+ and 75+ variants. While variant 65+ in Model B predicts over double RF capacity in four districts, this exists in the75+ group in up to 50 districts. An annual view further shows

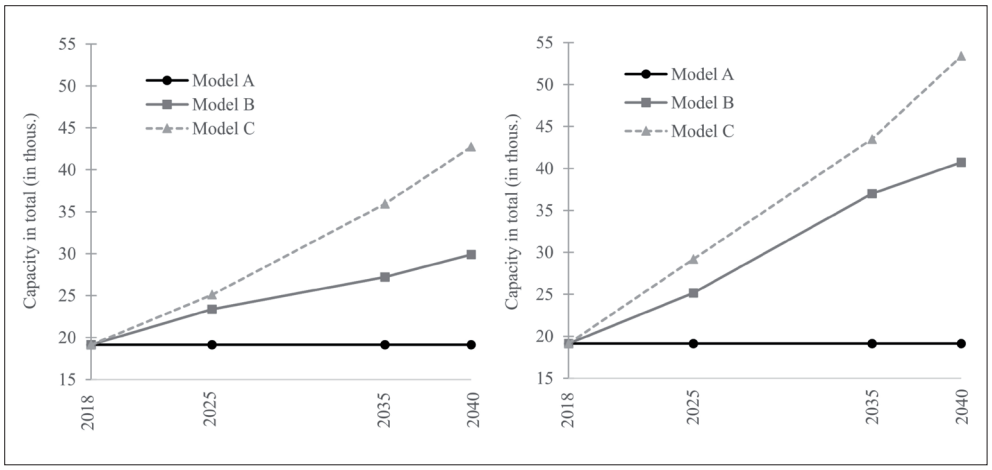

Fig. 10: Model estimates of trends in future potential residential facility capacities for seniors (65+ on the left, 75+ on the right), Slovakia, 2018–2040. Sources: SO SR, (2018); Šprocha et al., (2019); authors' elaboration

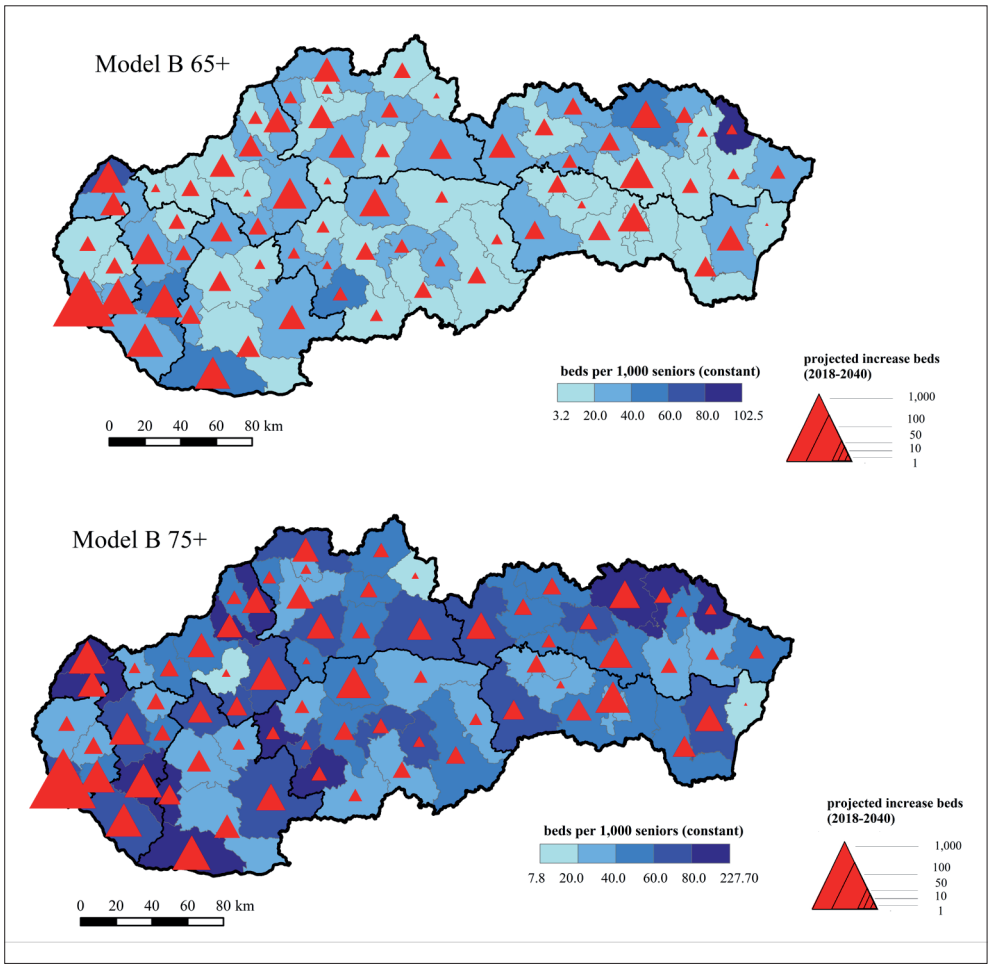

Fig. 11: Model estimates for trends in the future potential residential facility capacities for seniors, Model B, Slovakia, 2018–2040. Sources: MLSAF SR (2018); SO SR, (2018); Šprocha et al., (2019); authors' elaboration

that option 65+ has high annual increases in six districts and that this is up to 24 districts for the 75+'s. They require an increase of over 300 beds during the projection period.

Model C is an improved projection that employs a constant ratio of clients to the number of seniors in the individual age groups. The potential capacity growth is even more significant and influential. Compared to model B, model C proposes an increase of places by more than 12,700 for 65+ seniors and 75+ (see Fig. 10). Since the rate of service users in Slovak RF differs by age groups and model C approximates the real estimated need, while maintaining the level of availability, this capacity should reach up to 42,700 places for variant 65+ and up to 53,400 for variant 75+, regarding the rising senior population in the highest age groups.

Figure 8 (above) shows the development trends for the A and C Models and depicts that the indicator of the number of seniors for one bed in Model C records the opposite trend to model A. This highlights a decrease in the number of seniors vying for one place in RF to below 30 in the 65+ group and 16 in the 75+'s. Šídlo and Křesťanová (2018)

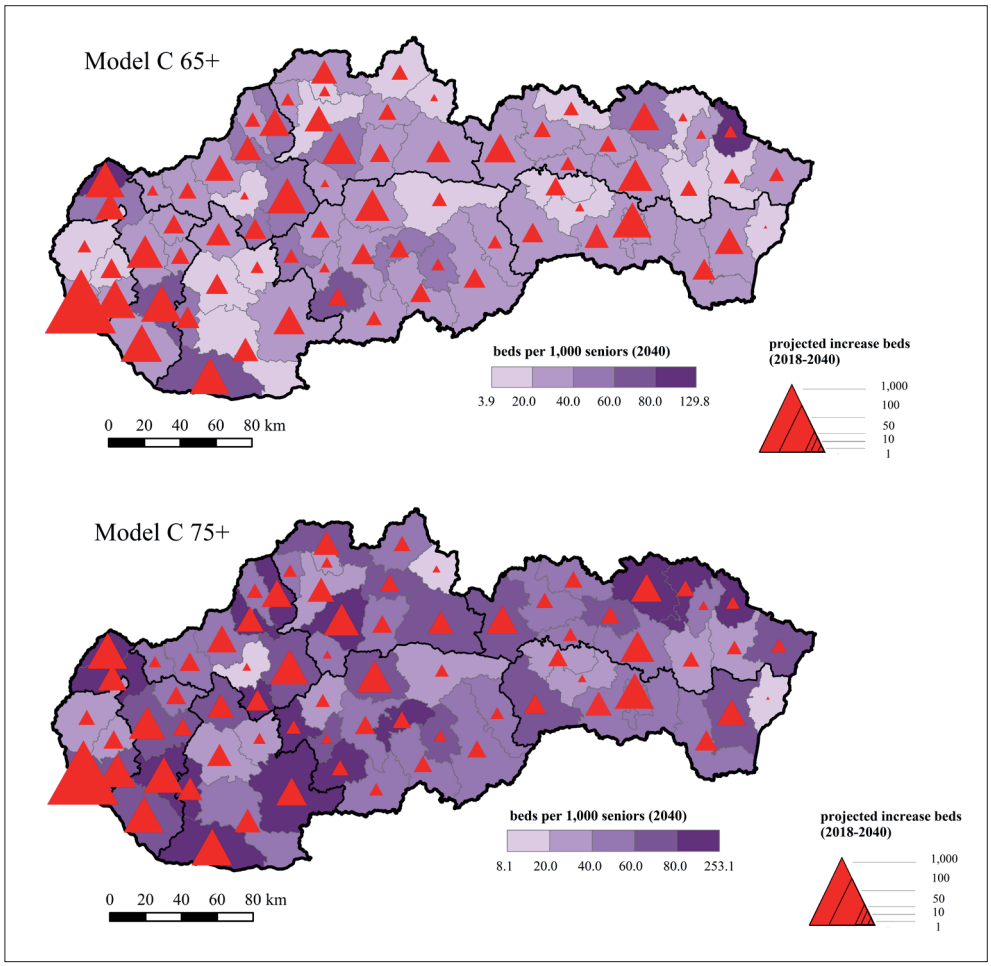

Fig. 12: Model estimates for trends in the future potential residential facility capacities for seniors, Model C, Slovakia, 2018–2040. Source: MLSAF SR (2018); SO SR, (2018); Šprocha et al., (2019); authors' elaboration

support that this decrease indicates what changes will occur in the age structure of older people, with an increase in the proportion of seniors who will most need social services. The model's application aims to increase capacity to reduce the overall proportion of placed seniors, i.e. fewer seniors vying for a bed in the RF. Proposed values are again diverse from a regional viewpoint, and the availability in regions where the number of beds per senior is the lowest is unsatisfactory. The results reflect the input assumptions – set the weights/ constants of service users according to age groups from the start of the projection - and therefore suggest an increase in capacity. Thus, the capacity increases in some regions should be even higher to meet at least the national the average number of beds for seniors (see Appendix 1).

Regional estimations of the three models were used as an input matrix in a factor analysis (see Appendix 2). Extraction of factors using PCA and calculation of eigenvalues showed that two main factors were obtained for the first (65+) and second (75+) variants. For 65+, the first factor accounted for 53% of the variance, and the second 33%. The combined factors account for over 86% of the variance in the original input data. For 75+, the first factor provided almost 54% of the variance, and the second 31%. The combined factors account for 84% of the variance in the original input data.

The factor loadings show two important groups regarding the availability of residential care for seniors in the future. The first factor is RF capacity because it is saturated with models B and C indicators. The second factor then indicates the availability of RF service because it is saturated with the results of model A. According to the two-by-two classification, factor scores (see Appendix 3) were used to typify regions regarding the future availability of residential long-term care. The terms were assigned two categories: "high risk" and "low risk". The spatial units are divided into four types of regions determining the future risk of availability of residential care (see Fig. 13).

Region types A, and B, have high positive values for the first RF capacity factor and a high level of capacity concentration. These regions will need a significant increase in available beds for the ongoing rise in the senior population, while maintaining the current rate of service users. The types differ in the level of availability of the social service while maintaining the current capacity of the RF and, at the same time, the intensity of increasing the proposed capacity. Type A has a high risk of worsening service availability while maintaining current capacity and needs significant capacity increases, with an almost 3-fold increase by 2040 while still maintaining today's level of service. As for type B, the availability of the current RF network will not significantly degrade, but maintaining the availability level requires an increase in the RF capacities regarding expanding to the senior population by the forecast.

Region types C, and D, have high negative values of the first RF capacity factor. Estimates of models B and C point to a less significant expansion of capacity, with forecasting just moderate expansion of the senior population while maintaining the current service users rate. It must be emphasised, however, that the lower proposed capacity

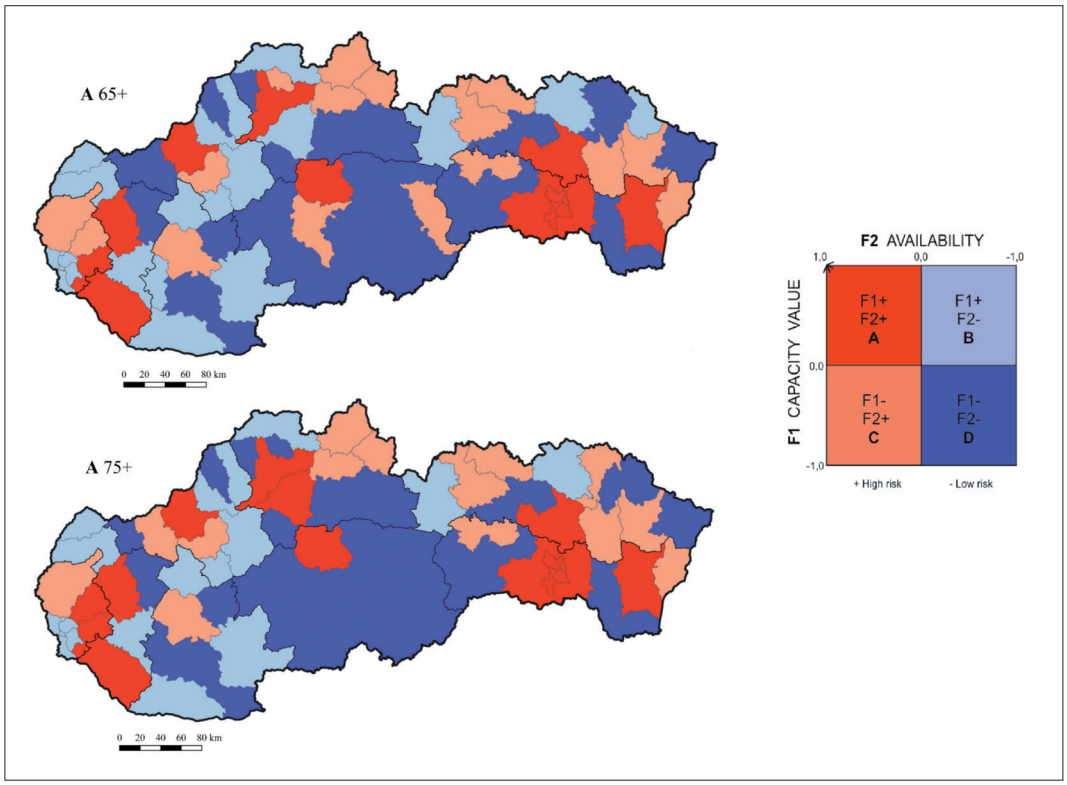

Fig. 13: Typification of regions Slovakia according to the intensity of the influence of risk factors
Source: MLSAF SR (2018); SO SR (2018); Šprocha et al., (2019); authors' elaboration

is associated with the current lower rate of service users for seniors. Like regional Types A and B, these differ in the level of service availability. Type D does not pose a significant worsening in the current availability. Despite the lower regional capacity concentration, this is due to a less important increasing senior population. The long-term effects of population ageing are a significant senior population already formed today in the region, and forecasts do not assume a future increasing senior group. In contrast, the C type with a very low-capacity concentration represents a high risk of worsening in availability while maintaining the current state of RF, with more than two-fold the projected increase in capacity in the region by 2040. In the region there is a need to improve the availability of social services for seniors significantly. The network will be unsatisfactory and require a significant increase in capacity to improve service availability.

All region types demonstrate the need to solve problems emanating from growth in the senior population and the availability of social services, but to varying degrees. The 'high risk' are types A and C because they show a significant increase in the senior population. There will be a significant worsening in social services availability unless capacity increases. In contrast, 'low risk' are types B and D. These regions have minor risks and require less problem-solving than other regions.

5. Discussion

In the short term, Slovakia will lose its status as a relatively 'young population' in the European Union states (Fihel and Okólski, 2019; Bartosovic et al., 2017; Káčerová and Ondačková, 2015; Šprocha and Ďurček, 2019). This is due to the rapid growth in the senior population, which will significantly exceed the child population. Šídlo et al. (2020) report that the expansion of the senior population in Slovakia is faster, for example, than in northern and western European countries. In addition, the SO SR (2019) records that 2018 was a breakthrough year in Slovak population ageing. The number and proportion of seniors exceeded the number and proportion of children for the first time in Slovakia's history. The number of seniors in 2040 is expected to increase the number recorded in 2018 by 56% and then by 75% by 2050.

This fact confirms the interest of many studies (e.g. Wang and Tsay, 2012; Tsutsui and Muramatsu, 2007; Fujisawa and Colombo, 2009) devoted to the growing demand for healthy, social, and family services for the seniors. Slovakia currently registers insufficiently secured residential long-term care, as the number of applicants increases each year (SAO SR, 2018). Krajňaková (2009) adds that the uncovered capacity needs for social service facilities are an objective consequence of the unfavourable state of health of the population of Slovakia.

The situation in Slovakia, however, is somewhat more favourable than for example in the Czech Republic. The existing Slovak RF network has 48 seniors for each place compared to the Czech number of 54 seniors (Šídlo and Křesťanová, 2018)[1]. There was a similar estimate of 71 Slovak seniors by 2040 compared to 76 in the Czech Republic, considering the current capacities in RF of the countries. Kačerová and Ondačková (2015) reported that these differences are related to the delayed onset of ageing

[1] Research in the Czech Republic (Šídlo and Křesťanová, 2018) is focused only on a selected type of facility for seniors: without beds, or Homes with a special regime for the Seniors. Research in Slovakia is similarly oriented, but in the data of individual facilities, there may be beds intended for a special regime.

processes typical of the more conservative countries such as Slovakia and Poland. Šídlo et al. (2020) obtained similar results in assessing population ageing from a retrospective and prospective perspective.

The regional results of the three model projections estimate different levels of residential care needs for seniors in 2040. There are significant differences between the regions of Slovakia, however, due to different levels of population ageing (Kačerová et al., 2012) and the uneven concentration of capacities RF in regions (Gavurova, 2016). This study identified regions with 'high risk' for the availability of residential care in 2040. These include both those with a high level of concentration beds in RF, and those with low levels such as Košice, Košice-Okolie, Senec, Dunajská Streda, Banská Bystrica, Sobrance, Tvrdošín, Humenné, Malacky, Bánovce n/B and Svidník. In addition, Krajňaková (2009) reported that regions with less intensive family and kinship relationships have more significant social service amenities, and areas with a high level of family solidarity and belonging have fewer amenities. This author emphasises that the following factors influence the unevenness in regional social services: level of urbanisation, age, qualifications, professional, the social structure of the population, the degree of implementation of traditional family care functions for the seniors, or sociological changes taking place in society (e.g. disintegration of multigenerational family coexistence). Šprocha and Ďurček (2019) consider that these regions will exhibit a higher rate of population ageing by the end of 2040. Regional differences in population ageing are also caused by long-term migration trends, especially younger inhabitants migrating to cities and suburbs. This is mainly influenced by the concentration of employment opportunities and locations with economic and social benefits (Kačerová et al., 2012). Novotny and Pregi (2019) confirmed that this selective migration considers age and educational level.

Regions of Slovakia identified at less risk in the study included Medzilaborce, Rožňava, Skalica, Poltár, Žarnovica and Banská Štiavnica. These districts have a suitable RF network because of more intense action population ageing processes (Bucher, 2012; Šprocha and Ďurček, 2019). In these results, one can also observe a more favourable state in the capacities of RF in regions where there is preferred home care to institutional care, due to higher unemployment of people over the age of 50. Later, the restatement of the law and its transformation led to the modernisation of social services, new forms of institutional care services, including home care, and home care is being replaced by care by the residential sector for the seniors (Ludvigh Cintulová and Buzalová, 2021). The model projections enable an individual approach to each region and proposed opportunities for the further development of social services for seniors in various forms, so that the supply is sufficient and suitable for the population ageing level.

The research on a possible load of RF for seniors in the regions of Slovakia also has several limits or restrictions. The age structure of RF clients may change in the future. Despite the existing evidence of prolongation of the healthy period after the age of 65 of life in Slovakia (OECD, 2020), it is difficult to predict the future demand for social care due to the age of the senior. The application of two-variant modelling of care availability also follows from the above. Variant 75+ is determined by the prolonged age of a self-sufficient senior, i.e. without the need for social care. Variant 65+ determines the possibility of a braking or reversal of processes related to the extension of the age of a senior without health restrictions caused by, e.g. the current spread of Covid19, which the population of the elderly is most affected by (Šprocha, 2021).

The use of current rates of service users for the seniors in the regions of Slovakia also has its limits. The research points to an increase or reduction of residential facilities' capacity for the seniors about maintaining the current rate of service users. At the same time, we do not know whether the existing network of RF in the regions is satisfactory. Suppose the national values of the rate of service users (see Fig. 4) represent the minimum standard. In that case, more than one-third of the districts of Slovakia today have insufficient capacity in RF concerning the population of seniors. Model projections of future availability assumes maintaining the current situation in the regions of Slovakia. Still, there is no guarantee that the current capacity in the RF is sufficient. An example is the districts of Tvrdošín and Sobrance (Fig. 9), where the number of beds in the facilities is meagre. Kačerová et al. (2013) similarly pointed to the under-designed nature of these districts of Slovakia in the availability of residential social services, which was already registered in 2010. According to these authors, the impact of the different demand for residential services in Slovakia is determined by the factor of population religiosity and the resulting stronger pro-family behaviours. At the same time, a significant increase in the senior population is expected in the future. Demographic forecasts point to elderly seniors (80-year-olds) who usually participate in higher use of residential facilities and, therefore, the need for further development. Typifying districts by the risk of availability to social care consider these limits.

There are also some restrictions to using districts (LAU1) as spatial units. The choice of research units resulted from the authorities' Self-governing Region guidelines for placing a senior in a facility as close as possible to their place of residence. Field research (additionally a survey via local web portals: Self-governing Region) indicates that more than 90% of clients come from the facility's district. Kacerova et al. (2021) add that seniors need to have a suitable facility with a suitable form of service as close as possible to their place of residence. It can be perceived that demand and supply meet in the market through the way of optimisation decisions of subjects. The interest is the smallest possible distance between the place of residence and the residential facility, also about family ties and the financial demands of the service. The possible migration of seniors within the districts of Slovakia is low if it occurs due to the lack of RF beds in the region.

Modelling care availability is also limited by uncertainty towards the family, i.e. informal care (Hatar, 2012). The second demographic transition caused severe changes in the population of Slovakia (e.g. a significant increase in one-person households or cohabitation, a decrease in the economically productive population), which are rather a barrier to further expansion of informal care in the form of intergenerational solidarity. Despite the mentioned limitations, we consider the research results relevant to the current and future state of the client service rate concerning the ongoing processes of expansion of the senior population, as well as the state of the existing network of facilities for seniors in the regions of Slovakia.

Our study results do not relate to some strict adherence to the proposed regional opportunities; instead, they indicate risk in the availability of social services and the urgency of a timely resolution to the situation. Residential care is just

one form of social care for seniors. One of the possibilities for helping seniors is developing and supporting active ageing. In addition, Kaščáková and Martinkovičová (2019) support our consideration that older adults in Slovakia are ageing 'in the spirit of ageing well'. These authors add that the following factors are important: high senior subjective well-being; promoting independence; creating community programs to improve and maintain physical activity; and supporting education. Finally, Slovakia's Active Aging Index has gradually increased (UNECE, 2019). Slovakia, however, ranks only 7th from the bottom on the European Union countries list. The state is improving its position, and it is four positions higher than in 2014 (Bartosovic et al., 2017). The onset of these trends, together with the improvement of the health status (Health Outlook: Europe, 2020) or quality of life for seniors (e.g. Madziková et al., 2015; Soósová, 2016; Rišová and Pouš, 2018), has a significant impact in solving the risks in residential care availability.

6. Conclusions

Modelling the phenomena that await us soon is extremely important. This study focuses on long-term residential social care requirements, and the model projections are significantly influenced by forecasted population ageing. Moreover, from the economic to the social factors, the public sector should be able to derive much from such predictions. Demographic ageing is a current challenge for public policy and requires searching for solutions to ensure the quality of social care for the elderly in every society. For this reason, there is pressure on the political system to ensure sufficient availability of social services close to where people need services due to their age or health status. The social support network for the seniors must be continuously adapted to the demands of society. At the same time, the residential sector supports need to be permanently planned (Matei et al., 2018) from a temporal and spatial perspective, so that they cope with ageing dynamics and the spatial distribution of the clusters of senior people.

The research pointed to an impending regional shortage of opportunities for residential long-term care for seniors in the future. Therefore, it is necessary to ensure adequate development of facilities and social services, for cases, according to Krajňaková (2009), where the provision of other types of social services is impossible or insufficient, whether concerning the health status, age, or social needs of the citizens eligible. The government authorities should look for ways to cope with a changing population structure, as increasing life expectancy is associated with higher demand for residential care for the seniors and spatial differences in the supply of care for the seniors. The state is fully aware of the current situation. It is tackling the sustainability of social assistance, primarily by supporting home care services to prevent the placement of seniors in residential facilities and providing financial support for the construction, procurement, or renovation of residential facilities. Concurrent with the expansion of residential facilities for an ageing population, the sustainability concept is also gaining more prominence in senior care studies (Yuan et al., 2019). Economic, environmental, and social sustainability play an important role.

Field findings in selected residential facilities also indicated full occupancy, with different waiting lists for placement in the facility. In response to the urgent need for more age-specific spaces, these facilities for the elderly are already experiencing a significant increase in number and capacity in Slovakia. From a regional perspective, the supply of residential social services is uneven and insufficient. The unstable political and economic situation during the Covid-19 pandemic is hindering the further development of social services. The current legislative changes in Slovakia contribute to creating different conditions for social services providers - state and non-state. In addition, the future financing of social services is unclear and unstable, which leads to stagnation in the development of residential facilities for seniors in Slovakia.

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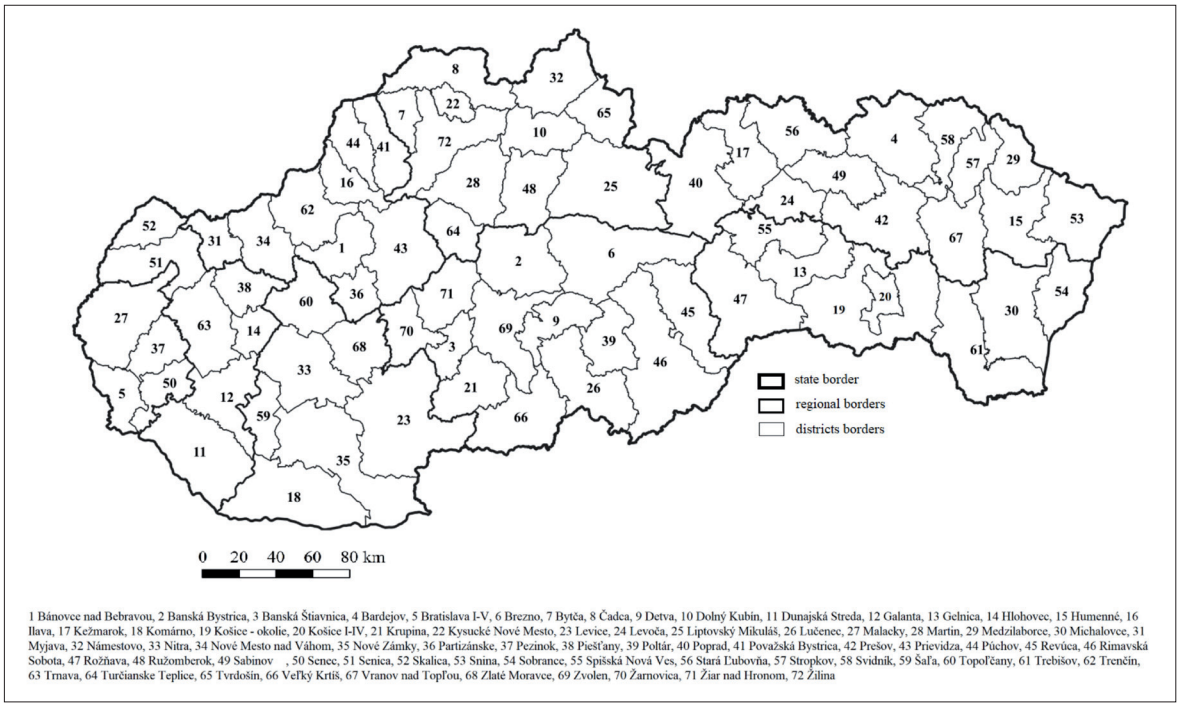
Appendices



Appendix 1: Administrative divisions of Slovakia
Sources: Ministry of Interior of the Slovak Republic: NC of SR no. 221/1996 C. l. on the territorial and administrative organization of the Slovak Republic

Districts of Slovakia (LAU1)	Variant 65+		Variant 75+		Districts of Slovakia (LAU1)	Variant 65+		Variant 75+	
	F1	F2	F1	F2		F1	F2	F1	F2
Bánovce n/B	– 1.1	1.1	– 1.0	1.2	Pezinok	0.0	2.2	0.1	1.7
Banská Bystrica	1.0	0.2	1.2	0.5	Piešťany	– 0.4	– 0.1	– 0.3	– 0.1
Banská Štiavnica	– 0.7	– 0.9	– 0.7	– 0.8	Poltár	– 0.6	– 1.2	– 0.7	– 1.3
Bardejov	0.7	– 0.7	0.6	– 0.7	Poprad	0.6	– 0.1	0.7	0.0
Bratislava I–V	5.5	– 0.3	5.7	– 0.2	Považská Bystrica	0.8	– 0.4	0.7	– 0.4
Brezno	– 0.8	– 0.5	– 0.8	– 0.8	Prešov	0.8	0.4	0.7	0.3
Bytča	– 0.5	– 0.2	– 0.5	– 0.3	Prievidza	1.3	– 0.6	1.3	– 0.5
Čadca	0.2	– 0.2	0.2	– 0.2	Púchov	– 0.6	0.0	– 0.5	0.0
Detva	– 0.2	– 1.0	– 0.2	– 0.9	Revúca	– 0.7	0.1	– 0.7	– 0.1
Dolný Kubín	– 0.3	0.2	– 0.2	0.3	Rimavská Sobota	– 0.5	– 0.4	– 0.6	– 0.6
Dunajská Streda	1.4	1.1	1.3	1.0	Rožňava	– 0.3	– 0.5	– 0.3	– 0.5
Galanta	1.4	– 0.3	1.4	– 0.3	Ružomberok	– 0.3	– 0.4	– 0.2	– 0.3
Gelnica	– 1.0	– 0.2	– 1.0	– 0.6	Sabinov	– 0.3	– 0.6	– 0.4	– 0.8
Hlohovec	– 0.3	– 0.4	– 0.3	– 0.4	Senec	2.2	4.1	1.9	3.5
Humenné	– 0.6	0.8	– 0.5	0.6	Senica	0.4	– 0.2	0.4	– 0.2
Ilava	0.5	– 0.9	0.6	– 0.8	Skalica	2.1	– 1.3	2.1	– 1.3
Kežmarok	– 0.4	0.4	– 0.4	0.1	Snina	– 0.5	– 0.6	– 0.6	– 0.6
Komárno	1.2	– 1.2	1.2	– 1.2	Sobrance	– 1.5	1.4	– 1.4	1.2
Košice-okolie	0.5	1.0	0.3	0.4	Spišská Nová Ves	– 0.3	0.4	– 0.3	0.3
Košice I–IV	1.1	0.5	1.2	0.6	Stará Ľubovňa	– 0.4	0.4	– 0.4	0.8
Krupina	– 0.4	– 1.0	– 0.4	– 1.0	Stropkov	– 0.9	– 0.4	– 0.9	– 0.4
Kysucké N. Mesto	– 0.7	0.1	– 0.7	0.0	Svidník	– 0.7	– 0.1	– 0.7	1.5
Levice	0.1	– 0.6	0.2	– 0.4	Šaľa	0.0	– 0.4	0.0	– 0.2
Levoča	– 0.5	0.0	– 0.5	– 0.2	Topoľčany	0.0	– 0.6	0.1	– 0.5
Liptovský Mikuláš	– 0.1	– 0.3	0.0	– 0.2	Trebišov	– 0.3	– 0.2	– 0.4	– 0.2
Lučenec	– 0.4	– 0.2	– 0.5	– 0.6	Trenčín	0.3	0.1	0.3	0.3
Malacky	– 0.6	2.3	– 0.6	3.3	Trnava	0.9	0.2	0.9	0.2
Martin	0.9	0.0	0.9	0.2	Turčianske Teplice	– 1.0	– 0.6	– 1.0	– 0.5
Medzilaborce	0.0	– 2.6	– 0.1	– 2.7	Tvrdošín	– 1.1	3.3	– 0.9	3.2
Michalovce	0.2	0.1	0.2	0.1	Veľký Krtíš	– 0.8	– 0.4	– 0.8	– 0.6
Myjava	– 0.8	– 0.3	– 0.8	0.0	Vranov n/T	– 0.6	0.2	– 0.6	0.1
Námestovo	– 0.4	1.6	– 0.3	1.2	Zlaté Moravce	– 0.9	– 0.3	– 0.9	– 0.2
Nitra	– 0.3	0.9	– 0.3	1.3	Zvolen	– 0.2	0.1	– 0.2	– 0.2
Nové Mesto n/V	– 0.5	– 0.2	– 0.5	0.1	Žarnovica	– 0.5	– 1.2	– 0.5	– 1.1
Nové Zámky	– 0.2	– 0.1	– 0.2	0.0	Žiarn/H	– 0.5	– 0.3	– 0.5	– 0.8
Partizánske	0.2	– 0.9	0.2	– 0.8	Žilina	0.1	0.7	0.1	0.5

Appendix 3: Factor scores for districts of Slovakia in variants 65+ and 75+
Sources: MLSAF SR (2018); SO SR, (2018); Šprocha et al., (2019); authors' calculations

Districts of Slovakia (LAU1)	Seniors per bed						Beds per 1,000 seniors			
	65+			75+			65+		75+	
	ModelA	ModelB	ModelC	ModelA	ModelB	ModelC	ModelB	ModelC	ModelB	ModelC
Bánovce n/B	244	168	121	130	63	60	6	8	16	17
Banská Bystrica	75	47	31	44	17	15	21	32	58	65
Banská Štiavnica	51	38	28	26	14	14	27	36	71	74
Bardejov	38	24	19	20	9	9	41	52	105	113
Bratislava I–V	67	43	28	35	16	14	23	36	61	71
Brezno	111	82	52	47	34	32	12	19	30	31
Bytča	78	49	38	37	18	17	20	26	55	58
Čadca	65	40	32	33	15	14	25	32	67	71
Detva	43	32	20	21	13	11	31	49	79	94
Dolný Kubín	72	44	33	40	17	15	23	30	58	66
Dunajská Streda	75	41	26	36	15	13	24	38	67	80
Galanta	38	24	17	19	9	8	42	60	114	130
Gelnica	124	88	59	52	36	33	11	17	28	30
Hlohovec	65	45	32	34	17	15	22	31	58	65
Humenné	165	111	61	72	40	35	9	16	25	28
Ilava	44	30	21	24	12	10	34	48	86	95
Kežmarok	103	58	47	48	21	21	17	21	47	47
Komárno	26	19	14	13	7	7	53	72	137	151
Košice-okolie	104	54	33	40	21	20	18	30	48	51
Košice I–IV	120	78	49	62	29	24	13	20	35	42
Krupina	27	20	13	12	8	7	50	77	125	144
Kysucké N.Mesto	120	77	58	58	29	27	13	17	34	37
Levice	49	36	26	26	14	12	28	38	73	81
Levoča	74	45	34	35	18	17	22	29	57	60
Lipt. Mikuláš	62	42	32	36	17	15	24	31	60	66
Lučenec	97	65	38	38	26	25	15	26	39	40
Malacky	214	119	124	157	42	38	8	8	24	26
Martin	59	40	24	33	16	12	25	41	63	86
Medzilaborce	11	10	8	6	4	4	102	130	228	253
Michalovce	70	44	32	36	16	15	23	31	63	65
Myjava	87	66	48	50	26	22	15	21	39	45
Námestovo	134	68	53	63	25	22	15	19	40	45
Nitra	162	105	88	100	40	36	9	11	25	28
Nové Mesto n/V	82	57	49	53	23	20	18	20	44	49
Nové Zámky	95	67	50	50	26	24	15	20	39	41
Partizánske	51	36	24	27	14	12	28	41	70	82
Pezinok	174	92	51	76	33	28	11	20	30	36
Piešťany	98	68	42	47	27	24	15	24	37	42
Poltár	46	35	24	21	14	13	29	42	72	74
Poprad	67	44	28	34	16	14	23	36	63	70
Pov. Bystrica	44	27	19	24	11	9	37	52	93	106
Prešov	96	56	39	48	23	21	18	25	44	48
Prievidza	55	37	24	28	14	13	27	41	70	78
Púchov	90	60	44	46	23	21	17	23	44	49

Appendix 2: continuation on the next page

Districts of Slovakia (LAU1)	Seniors per bed						Beds per 1,000 seniors			
	65+			75+			65+		75+	
	ModelA	ModelB	ModelC	ModelA	ModelB	ModelC	ModelB	ModelC	ModelB	ModelC
Revúca	107	74	42	43	26	24	14	24	38	41
Rimavská Sobota	79	55	34	32	21	21	18	29	47	48
Rožňava	53	37	27	28	14	13	27	37	71	76
Ružomberok	79	57	33	37	21	18	18	30	48	55
Sabinov	62	38	33	30	15	15	26	31	65	67
Senec	139	48	27	65	17	15	21	36	58	67
Senica	45	29	19	22	10	9	35	52	99	108
Skalica	21	13	9	11	5	4	77	112	212	243
Snina	63	42	33	32	17	16	24	30	59	62
Sobrance	410	303	251	210	128	122	3	4	8	8
Spišská N. Ves	120	74	56	62	28	27	13	18	35	37
Stará Ľubovňa	83	48	53	62	19	18	21	19	54	55
Stropkov	80	51	44	41	19	21	19	23	53	48
Svidník	48	30	81	85	12	11	33	12	84	88
Šaľa	46	32	24	26	12	10	32	42	84	101
Topoľčany	53	38	29	31	14	13	26	34	70	77
Trebišov	77	52	40	40	20	20	19	25	49	51
Trenčín	92	61	41	51	24	21	16	25	41	48
Trnava	69	43	30	36	16	14	23	33	63	69
Turč. Teplice	80	60	46	42	25	22	17	22	41	45
Tvrdošín	378	232	152	191	81	71	4	7	12	14
Veľký Krtíš	87	63	37	35	25	23	16	27	40	43
Vranov n/T	113	73	54	55	28	26	14	18	36	38
Zlaté Moravce	104	77	54	56	31	28	13	19	33	36
Zvolen	97	63	36	41	24	22	16	27	41	45
Žarnovica	41	32	22	20	12	12	31	46	80	87
Žiar n/H	105	74	33	35	29	27	14	30	34	37
Žilina	131	81	55	64	30	29	12	18	33	35
SLOVAKIA	**71**	**46**	**32**	**37**	**18**	**16**	**22**	**31**	**57**	**64**

Appendix 2: Availability of residential social services for seniors by model A, B and C for LAU1 Slovak regions, 2040
Sources: MLSAF SR (2018); SO SR, (2018); Šprocha et al., (2019); authors' calculations