

Digital transformation of community health and social services for ageing cohorts

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Abstract: Municipalities in the European Union are ageing fast. However, achieving societal and environmental change with a focus on the development of an age-friendly environment, ambient assisted living, eHealth, public spaces that facilitate active ageing and wellbeing for all generations and social support networks for older adults with declining functional capacities represent a major challenge for European municipalities. Additionally, developing and financing smart social infrastructure to support a growing number of older adults with declining functional capacities so that they can postpone moving to a nursing home and live longer in the community is a major challenge for European municipalities. Social innovations for the digital transformation of health care and social care delivery systems can help older adults live autonomously and independently in their own communities and postpone or even avoid entering a nursing home. The innovations will lead to a more efficient combination of the existing societal resources in the communities for fulfilling the health care and social needs of the ageing members of the society who are dependent on the help of others due to illness or functional decline. On the supply side, new scientific (optimisation of the supply networks), organisational (self-managed communities) and technological innovations, such as robotics, domotics, CPS based on the Internet of Things and cloud computing, offer new utilities and create new businesses for the supply of goods and services to older people and also provide new job opportunities for young people. The aim of this paper is to consider the development and financing of community and smart social infrastructure and present the case for Slovenia.

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Keywords: ambient assisted living, lifetime neighbourhood, independent living, assisted living, housing with care, health care, long-term care, ageing population

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1 INTRODUCTION

Population projections across European Union (EU) countries show that the share of elder adults with declining functional capacities, who are largely dependent on the help of others and in need of long-term care services, will triple in the next 40 years (Eurostat, 2019). Telehealth which allows for real-time condition monitoring of older adults living in their own homes and offer access to medical services and care support to ageing population will be an expected to present growing share of European silver economy. The challenge faced by EU member states with growing share of seniors in (80 +) in their populations is how to provide health care and social care services and develop sustainable supply systems. The ageing societies will maintain and improve the quality of life for a growing number of older adults with declining functional capacities by deploying technological solutions developed as Ambient Assisted Living Technologies. These technologies

are based on Wireless Sensors Network embedded in Cyber-Physical Systems using the Internet of Things as an infrastructure. Telecare technologies for condition monitoring supported by ambient intelligence will enable older adults to live in their own homes longer before moving to the specialised facilities within their communities and therefore postponing or even preventing relocation to a nursing home. The growing number of residents with sarcopenia experience decreased mobility and frailty due to the decline in functional capacities. Due to sarcopenia and cognitive decline older residents have difficulties with performing the necessary activities of daily living, suffer from loneliness and are exposed to the risk of falls. The central gap found in the literature review is the lack of the common standard for Telecare systems and lack of standardised datasets for measurement and recording of patterns of physical and cognitive decline, and how physical decline influences, the events leading to ill health and disability. An analysis of the

current situation also shows that the ageing population is a driving expenditure for health care (HC) and long-term care (LTC), without a visible improvement in the elderly's quality of life. The healthcare industry consumes 3–9% of GDP in EU member states, and this divide is unacceptably large with growing inequities. Providing adequate healthcare services for the increasing number of ageing people is a crucial issue, and one of the answers, given contemporary technological advancements, is ambient assisted living technologies and ambient intelligence. Health and care services in Europe are undergoing changes to adapt systems to the growing demand caused by ageing and the increase in the number of individuals with chronic diseases.

A common vision of integrated care needs to be established in times of digitisation. The question that arises is what contributions can emerging technologies bring to achieving better social care and health care and how can policy help foster this interaction of technology used and achieved to lead to greater freedom and healthier years for the ageing population. There needs to be a better understanding of who the user of the technology is, as it might not always be an older person.

The EIP on AHA prescribes five steps for setting up an effective European scaling-up strategy. The first three constitute the “what to scale up” element, to facilitate scaling up of good practices while the remaining two constitute approaches and instructions that explain “how to scale up”. These steps are shown in the following figure:

Social innovation plays an important role here: Applied to the healthcare system, it creates social value with an effective impact on society while aggregating needs and interests, increasing civic participation and strengthening social cohesion. This paper will address (i) the fragmentation of institutional capacities and actors' efforts in delivering healthcare services to the elderly, (ii) the lack of integration and coordination of existing innovative ICT tools for healthcare provision, usually tested and implemented in isolation and (iii) the lack of a shared vision across PAs on how to effectively face this changing health demand pattern in an integrated and social innovative way. This paper aims to contribute to the creation of an effective transnational ecosystem for the application of social innovation in integrated healthcare services for the ageing population in EU member states through a joint collaboration network and a shared strategy translated into regional and national action plans, implemented and monitored in pilots in telemedicine and accessibility to healthcare facilities, once innovative approaches have been tested and backed by an ICT decision support system. EU member states face a demographic decline and an ageing population. The rapid digitalisation of services presents an opportunity for improved autonomy and participation in the community of older adults. One of the solutions recommended by the EU is the digital transformation of healthcare and social care services provided in the community. The increased use of digital tools has shown the opportunities offered by digitalisation. The UN Decade of Healthy Ageing has brought demographic change issues and opportunities under the spotlight. The WHO Decade of Healthy Ageing has highlighted four main priorities:

- To achieve the sustainability of health and care in an ageing Europe,
- Development of intergenerational policies,
- the promotion of a socio-economic case for an ageing society and
- the role of technology and its application in the improvement of the conditions of the older people and their carers.

In the last decade, several EU research and innovation programmes, such as the H2020, AAL Programme, EIP on AHA and the MYBL, have developed advanced innovative solutions in areas such as independent living, age-friendly smart homes and living environments, social robotics and integrated health and care solutions. However, the market adoption of such digital solutions is lacking. Many barriers need to be overcome to facilitate the uptake of innovative digital solutions, such as more funding for innovation, new models for public procurements and a reduction in bureaucracy.

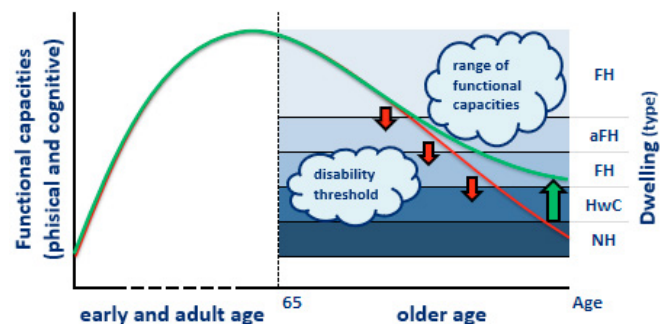


Figure 1. Dynamics of functional decline and disability thresholds

A multidisciplinary approach needs to be taken, such as ecosystems, to successfully engage with innovative companies. Ecosystems developed around the innovation quadruple helix need to be strengthened. Public investments in development of smart social infrastructure in functional regions for servicing the elderly (Drobne and Bogataj, 2013) influence housing market (Drobne and Bogataj, 2017) and land valuation (Bogataj, Suban and Drobne, 2011).

Older adults are diverse group due to dynamics of functional decline and frailty. Generally we can divide them in active adults, frail adults, disabled adults and adults with mild, medium and severe dementia

European institutions are studying key characteristics that can contribute to the uptake of AHA solutions in the European market by highlighting the trends in financing and procurement mechanisms, such as pre-commercial procurement and innovation procurement. Alternatives to public procurement have also been mentioned, including outcome-based financing models, value-based care and personal budgets. There is a lack of Studies have revealed that there exists a digital divide between young and old cohorts, which has become more visible recently and how it challenges

our right to participation and self-determination in older age. The aim of the digital transformation of services is to ensure that service providers will bring services to the homes of older adults living in the community. The rationale is that efficient digitalisation of health and care services will facilitate independent living for the growing number of older adults and postpone or even avoid their moving to a nursing home. To achieve this goal, the digital transformation of health and social infrastructure is required. The second requirement is an increase in internet usage among older adults. Older people who live alone in a community are at higher risk of isolation and lack access to necessary services. Although an increasing number of older persons use online services, many still have difficulties access numerous online services due to lack of digital skills to meet their basic needs or remain socially engaged.

“We need to clarify the place of older persons and their rights in a growing digitalised society.” – Dubravka Šuica, EU Commission Vice-President for Democracy and Demography

Many of the challenges that 65+ population face in the context of digital transformation reflect wider societal issues that are prevalent “offline”, including ageism, lack of respect for the autonomy of older persons and lack of consultation with them. This is why speakers at the event also agreed on the need to strengthen older persons’ rights and adopt an approach based on rights of older adults in development of ageing policies including all the rights that the EU and iEU member states are committed to. It is important to work with older adults cocreate solutions. Most important is that policymakers respect the principle of equality and non-discrimination when gathering data to capture the realities of older persons.

Several participants also spoke about the need for the EU to engage with UN processes to secure equal rights in old age. In the frame of the UN Open-Ended Working Group on Ageing, the conclusions of this conference has contributed to the global debate on how to strengthen the protection of our human rights when we are older.

The Innovation Union was un the recent past past most important research and innovation policy. The plan is deloped so that it contains over 30 action points and had the following three aims:

- make Europe into a world-class science performer,
- remove obstacles to innovation such as expensive patenting, market fragmentation, slow standard-setting and skills shortages and
- revolutionise the way public and private sectors work together, notably through Innovation Partnerships between the European institutions, national and regional authorities and business.

It is unclear how to best finance the digital transformation of health and social infrastructure, including smart homes, which will accommodate the functional decline of older residents, and how to bring telecare and telehealth services to the homes of older adults with declining functional capacities. The development of digital social infrastructure for the support of long-term care in the community is the priority of many EU

member states. The development of efficient and effective health and care networks in communities supporting elderly residents with declining functional abilities has become a very topical issue in recent years.

The key concern in the funding debate is how residents can finance their living expenses and additional housing costs and how much of these need to be financed by public funds or public insurance schemes so that a properly built environment can be provided. To respond to this challenge, the EU Commission and the member states published a series of recommendations and acts, but not much has been written about how to adapt built-up areas to the needs of the ageing population of municipalities. In order to preserve a vital society in vital European regions, it is necessary to develop new economic and social programmes to develop new accommodation and care programme options and a new type of facility management in urban areas. The housing needs of older people will be satisfied if apartments are specially designed to fulfil their physical, emotional, recreational, health and social needs. In the current arrangement of European Union EU member states are responsible for the planning, financing and management of social protection systems for the ageing population. In their reform efforts, the European Commission has recommended three long-term objectives to the Member States that need to be implemented in parallel:

- a) to ensure good access to healthcare and social services as well as a better urban infrastructure for these services,
- b) improve the quality of care while building in an optimal way a network of care and
- (c) to ensure the sustainability of funding, especially, the sustainable financing of the older population (EC, 2014).

The ageing of the European population increases the number of people dependent on the help of others to carry out their daily activities and, at the same time, influences the demand patterns of built spaces due to the different needs of older citizens with respect to free movement in apartments and contact with the environment. The reason behind this is the reduction in the functional capacities of elderly people who wish to stay as long as possible in their own homes and the obstacles of their built environment, which prevent them from living independently.

Therefore, municipalities should deliver the following digitally supported programmes:

- development of integrated care,
- development of independent living solutions,
- development of age-friendly environments,
- development of urban facility management for the maintenance of a safe environment,
- development of a prescription adherence programme,
- development of a falls prevention programme and
- development of lifespan health promotion and prevention of age-related frailty and disease programmes.

2 LITERATURE REVIEW

2.1 Development of integrated care

Digital health technologies to support health processes are used in wide variety of health care applications. This technologies have potential to effectively support healthcare transformation is widely accepted (Baltaxe, E. et al., 2019). However, the wide-scale implementation of digital health tools is uneven in EU member states and other developed countries. Integrated health and care programmes for older people living at home include a diverse variety of intervention components.

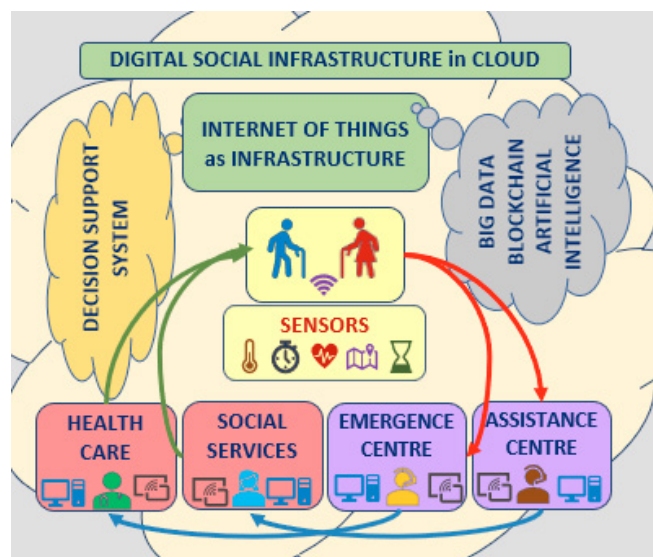


Figure 2. Smart City digital platform supporting integrated health and care services using sensors for monitoring of daily activities of older adults connected to emergence and assistance centre

2.2 Development of independent living solutions

Baig et al. (2019) published A Systematic Review of Wearable Sensors and IoT-Based Monitoring Applications for Older Adults with a Focus on Ageing Population and Independent Living. Home ownership is important factor in social security of older adults (Bogataj, 2013). Age-friendly property taxation (Bogataj, McDonnell, Bogataj, 2016) and development of reverse mortgage schemes (Bogataj, McDonnell & Bogataj, 2015) can improve home ownership among older adults (Bogataj, Rogelj, Bogataj and Drobez, 2020). Development of smart homes improve value of housing real estate (Bogataj, Suban, and Drobne, 2011) and facilitate growth in ageing regions (Bogataj, Bogataj and Drobne, 2020). When developing functional regions (Drobne and Bogataj, 2013) for servicing ageing population development of ambient assisted living in lifetime neighbourhoods is one of possible solutions (Bogataj, Rogelj, Drobez and Salaj, 2020). Investments in telecare and ambient assisted living capacities can reduce the delays (Bogataj and Bogataj, 2004) in provision of services and emergency interventions (Bogataj and Bogataj, 2007). Integration of telecare services in smart home can facilitate timely provision of integrated health and care services to older adults living in the community (Colnar, Dimovski, Grah, Rogelj and Bogataj, 2020). Digital transformation of health and care services can improve coordination of different services and supply networks and lower the costs of provision of services and improve affordability and quality of senior living in lifetime neighbourhoods (Bogataj and Bogataj, 2001)

For long term projections regarding required capacities of facilities supporting digital community health and social services for ageing cohorts (Rogelj and Bogataj, 2018a) decisionmakers can use multiple decrement approach (Rogelj and Bogataj, 2018b). Municipalities can use multiple decrement model for long-term planning of investments in digital transformation of community health and social services for ageing cohorts (Rogelj, Drobez, Kavsek and Bogataj, 2019; Rogelj and Bogataj, 2020a) and supporting social infrastructure (Rogelj and Bogataj, 2019). On of possible solutions in the kontekst of digital transformation is development of smart lifetime neighbourhoods (Rogelj and Bogataj, 2020b). When studying availability of human resources dynamics of internal migration (Janez, Bogataj and Drobne, 2016) and daily commuting should be taken into the account (Janez, Drobne and Bogataj, 2018).

2.3 Development of age-friendly environments

For the development of age-friendly environments, the study by Wood (2017) provides evidence of the strong relationship between adequate housing and the health of older people, which shows an extremely strong contingency. Studies have clearly presented the relationship between inadequate housing and the increase in falls, cardiovascular diseases and the mental health of older residents. Research confirms that specialised housing for older people improves the physical and mental health of residents and reduces the cost of health services, even in half.

3.1 Obligation of municipalities to organise and co-finance home assistance

Home assistance (homecare) is a social welfare service intended for beneficiaries who have their own dwelling and proper living conditions in their own living environment but are not able to care and provide for themselves and their relatives cannot provide proper care for them due to their age or serious disability. In the context of municipality-level homecare, there are various forms of organised assistance and support to replace, at least for a specific period of time, the need for institutional care in a nursing home. The service should be person centered therefore adapted to the needs of each beneficiary and includes assistance with basic daily tasks, household assistance and assistance in maintaining social contacts.

3. IDENTIFIED RESEARCH GAPS

The research challenges regarding digital transformation of community health and social services for ageing cohorts are similar to those for urban health. There is an insufficient understanding of the effects of digital technologies supporting community health and social services for ageing cohortson on the various dimensions of inequity and exclusion that affect older adults and influence transition to a nursing home. Thus, more research to support evidence is needed on how the physical, cognitive and social capacities of older adults can be supported by digital transformation of community health and social services and how they can affect the health and well-being of older adults living in the community. Notwithstanding the numerous difficulties in evaluating community-based initiatives, more evidence of effectiveness, research,

feasibility studies are necessary to further develop scientific knowledge, improve practice and persuade policymakers to support these initiatives when appropriate. In the literature review, we have identified the following gaps:

1. How to optimally locate public service centres (Drobne and Bogataj, 2015).
2. How to attract skilled human resources (Janez, Bogataj and Drobne, 2016) from functional region (Janez, Drobne and Bogataj, 2018).
3. How additional investments in capacities of social infrastructure influence the reduction of delays in care networks. (Bogataj and Bogataj, 2007).
4. How to manage health and care networks coordination (Bogataj, and Bogataj, 2001). To minimise the lead times perturbations in distribution networks. (Bogataj, and Bogataj, 2004) on total market area (Bogataj and Usenik, 2005).
5. How all above influences probability of transitions between different care settings.

CONCLUSION

Technologies and digitally supported HC and long-term care services, social infrastructure, ambient intelligence technologies, assistance centres, and different types of environments – family environments and age-friendly environments – influence the disability threshold, the time when the disability threshold is reached by residents with declining functional capacities and the optimal time of migration to a more suitable and safer age-friendly environments to prevent events leading to ill health and disability and, therefore, can prevent migration to institutional care in a nursing home.

Elderly people may receive intensive long-term care only in long-term care facilities. If municipalities do not develop proper community assisted-living facilities, almost half of the elderly will be disappointed, because they will have to come to terms with going to a nursing home.

REFERENCES

- Arnaert, A., Klooster, J., and Chow, V.. (2007). Attitudes toward Videotelephones - An Exploratory Study of Older Adults with Depression. *Journal of Gerontological Nursing*, 33(9), 5–13.
- Bogataj, L., and Bogataj, M. (2007). The study of optimal additional investments in capacities for reduction of delays in value chain. *International Journal of Production Economics*, 108(1–2), 281–290.
- Bogataj, M., and Bogataj, L. (2001). Supply chain coordination in spatial games. *International Journal of Production Economics*, 71(1–3), 277–285.
- Bogataj, M., and Bogataj, L. (2004). On the compact presentation of the lead times perturbations in distribution networks. *International Journal of Production Economics*, 88(2), 145–155.
- Bogataj, M., and Usenik, J. (2005). Fuzzy approach to the spatial games in the total market area. *International Journal of Production Economics*, 93–4, 493–503.
- Bogataj, M., Suban, D. T., and Drobne, S. (2011). Regression-fuzzy approach to land valuation. *Central European Journal of Operations Research*, 19(3), 253–265.
- Boge, K. and Salaj, A.T. (2017), Practice vs theory: short term financials trumps long-term value creation, *Journal of Corporate Real Estate*, 19 (3), 186-204.
- Brand, D., Reed F. D., Morley M. D., Erath T. G., and Novak M. D.. (2020). A Survey Assessing Privacy Concerns of Smart-Home Services Provided to Individuals with Disabilities. *Behavior Analysis in Practice*, 13(1), 11–21.
- Chi, N.-C., and Demiris, G. (2015). A Systematic Review of Telehealth Tools and Interventions to Support Family Caregivers. *Journal of Telemedicine and Telecare*, 21(1), 37–44.
- Cimperman, M., Brencic M. M., and Trkman P. (2016). Analyzing Older Users' Home Telehealth Services Acceptance Behavior-Applying an Extended UTAUT Model. *International Journal of Medical Informatics*, 90, 22–31.
- Council of the European Union, Social Protection Committee. (2014). *Adequate social protection for long-term-care needs in an ageing society*, Brussels: SPC.
- Damant, J., Knapp, M., Freddolino, P., and Lombard, D. (2017). Effects of Digital Engagement on the Quality of Life of Older People. *Health & Social Care in the Community*, 25(6), 1679–1703.
- Doyle, J., Kealy, A., Loane, J., Walsh, L., O'Mullane, B., Flynn, C., Macfarlane A., Bortz, B., Knapp R. B., and Bond, R. (2014). An Integrated Home-Based Self-Management System to Support the Wellbeing of Older Adults. *Journal of Ambient Intelligence and Smart Environments*, 6(4), 359–83.
- Drobne, S., and Bogataj, M. (2013). Evaluating Functional Regions for Servicing the Elderly. V L. Z. Stirn, J. Zerovnik, J. Povh, S. Drobne, & A. Lisec (Ur.), Sor'13 Proceedings: The 12th International Symposium on Operational Research in Slovenia (str. 331–336). Slovenian Society Informatika Section Operational Research.
- Drobne, S., and Bogataj, M. (2015). Optimal Allocation of Public Service Centres in the Central Places of Functional Regions. *Ifac Paperonline*, 48(3), 2362–2367.
- Drobne, S., and Bogataj, M. (2017). The impact of public investments in facilities on the potential housing market for older persons. *Facilities*, 35(7–8), 422–435.
- Duh Stojmenova, E., Guna, J., Pogacnik, M., and Sodnik, J. (2016). Applications of Paper and Interactive Prototypes in Designing Telecare Services for Older Adults. *Journal of Medical Systems*, 40(4), 92.
- Egede, L. E., Walker, R. J., Payne, E. H., Knapp, R. G., Acierno, R., and Frueh, B. C.. (2018). Effect of Psychotherapy for Depression via Home Telehealth on Glycemic Control in Adults with Type 2 Diabetes: Subgroup Analysis of a Randomized Clinical Trial. *Journal of Telemedicine and Telecare*, 24(9), 596–602.

- Ganyo, M., Dunn, M., and Hope, T. (2011). Ethical Issues in the Use of Fall Detectors. *Ageing & Society*, 31, 1350–67.
- Golant, S. M. (2017). A Theoretical Model to Explain the Smart Technology Adoption Behaviors of Elder Consumers (Elderadopt). *Journal of Aging Studies*, 42(8), 56–73.
- Harlock, J. et al. (no date). Challenges in integrating health and social care: the Better Care Fund in England, *Journal of Health Services Research & Policy*.
- Hennessy, J. L., and Rodrigues A. (2019). Economic Impacts of Changing Technologies on New Zealand Homecare Delivery. *Journal of Enabling Technologies*, 13(3), 188–200.
- Huang, C.-N., and Chan, C.-T.. (2014). A ZigBee-Based Location-Aware Fall Detection System for Improving Elderly Telecare. *International Journal of Environmental Research and Public Health*, 11(4), 4233–48.
- Huang, J.-C. (2011). Application of Grey System Theory in Telecare. *Computers in Biology and Medicine*, 41(5), 302–6.
- Janez, P., Bogataj, M., & Drobne, S. (2016). Impact of the Real Estate Taxation and Municipal Revenue on Dynamics of Internal Migration: Case Study for City Municipal of Ljubljana. *Geodetski Vestnik*, 60(4), 644–684.
- Janez, P., Drobne, S., & Bogataj, M. (2018). Forecasting Dynamics of Daily Commuting to Work to Other Municipality in the Case of Changing Taxation Policies. V E. Viles, M. Ormazabal, & A. Lleo (Ur.), *Closing the Gap Between Practice and Research in Industrial Engineering* (str. 105–112). Springer International Publishing Ag.
- Johnson, M. J., Sobrepera, M. J., Kina, E., and Mendonca, R. (2019). Design of an Affordable Socially Assistive Robot for Remote Health and Function Monitoring and Prognostication. *International Journal of Prognostics and Health Management*, 10.
- Karlsen, C., Moe C. E., Haraldstad K., and Thygesen, E. (2019). Caring by Telecare? A Hermeneutic Study of Experiences among Older Adults and Their Family Caregivers“. *Journal of Clinical Nursing*, 28(7–8), 1300–1313.
- Kim, M. J., Cho M. E., and Jun H. J. (2020). Developing Design Solutions for Smart Homes Through User-Centered Scenarios. *Frontiers in Psychology*, 11, 335.
- Kovacic, D., & Bogataj, M. (2017). Net Present Value Evaluation of Energy Production and Consumption in Repeated Reverse Logistics. *Technological and Economic Development of Economy*, 23(6), 877–894.
- Levin, K. A. et al. (2019). Implementing a step down intermediate care service, *Journal of Integrated Care*, 27(4), 276–284.
- Lu, J.-F., Chen, C.-M., and Hsu, C.-Y. (2019). Effect of Home Telehealth Care on Blood Pressure Control: A Public Healthcare Centre Model. *Journal of Telemedicine and Telecare*, 25(1), 35–45.
- Nakrem, S., Solbjør M., Pettersen, I. N., and Kleiven, H. H. (2018). Care Relationships at Stake? Home Healthcare Professionals’ Experiences with Digital Medicine Dispensers - a Qualitative Study“. *Bmc Health Services Research*, 18, 26.
- Perez, L. M. et al. (2019). A Community Program of Integrated Care for Frail Older Adults: plus AGIL Barcelona, *Journal of Nutrition Health & Aging*, 23(8), 710–716.
- Rogelj, V., & Bogataj, D. (2018a). Planning and financing the home and facility-based care using the multiple decrement approach. *Journal of Decision Systems*, 27, 132–143.
- Rogelj, V., & Bogataj, D. (2018b). Planning the home and facility-based care dynamics using the multiple decrement approach: The case study for Slovenia. *Ifac Papersonline*, 51(11), 1004–1009.
- Rogelj, V., & Bogataj, D. (2019). Social infrastructure of Silver Economy: Literature review and Research agenda. *Ifac Papersonline*, 52(13), 2680–2685.
- Rogelj, V., & Bogataj, D. (2020a). Ambient Assisted Living Technologies and Environments: Literature review and research agenda. 2020 7th International Conference on Control, Decision and Information Technologies (Codit’20), Vol 1, 762–767.
- Rogelj, V., & Bogataj, D. (2020b). Smart Lifetime Neighbourhoods: Literature Review and Research Agenda. *Ifac Papersonline*, 53(2), 16902–16907.
- Rogelj, V., Drobez, E., Kavsek, M., & Bogataj, D. (2019). Capacity Planning for Ambient Assisted Living. *Ifac Papersonline*, 52(19), 265–270.
- Rogelj, Valerija, & Bogataj, D. (2018b). Planning the home and facility-based care dynamics using the multiple decrement approach: The case study for Slovenia. *IFAC-PapersOnLine*, 51(11), 1004–1009.
- Rogelj, Valerija, & Bogataj, D. (2019). Social infrastructure of Silver Economy: Literature review and Research agenda. *IFAC-PapersOnLine*, 52(13), 2680–2685.
- Rogelj, Valerija, & Bogataj, D. (2020a). Smart Lifetime Neighbourhoods: Literature Review and Research Agenda. *IFAC-PapersOnLine*, 53(2), 16902–16907.
- Sadeghmoghadam, L., Babadi, S. A., Noghabi, A. D., Nazari S., and Farhadi A. (2019). Effect of Telenursing on Aging Perception of Iranian Older Adults. *Educational Gerontology*, 45(7), 476–82.
- Saeed, N., Manzoor, M., and Khosravi, P. (2020). An Exploration of Usability Issues in Telecare Monitoring Systems and Possible Solutions: A Systematic Literature Review. *Disability and Rehabilitation-Assistive Technology*, 15(3), 271–81.
- Sanyal, C., Stolee, P., Juzwishin, D., and Husereau, D. (2018). Economic Evaluations of EHealth Technologies: A Systematic Review. *Plos One*, 13(6), e0198112.
- Schneider, J. E., Cooper, J., Scheibling C., and Parikh A. (2020). Economic Evaluation of Passive Monitoring Technology for Seniors. *Ageing Clinical and Experimental Research*, 32(7), 1375–82.