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niCE-life

GUIDEBOOK FOR LOCAL AUTHORITIES FOR THE INTRODUCTION OF TECHNICAL SOLUTIONS AND HEALTH AND CARE MODEL

Deliverable O.T4.2

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1. Introduction

This guidebook is based on the results of the niCE-life project, which was carried out by 10 project partners in six countries from July 2019 to June 2022. "*The niCE-life project aims to foster social inclusion and care coordination of frail elderly (…) through development of transnationally applicable model of health and care services for frail elderly (…) by using progressive key enabling technologies (…) to prevent frailty, enhance quality of care and support their independent living, social contacts and assistance continuity after hospital discharges*."[1] In order to achieve this aim, six digital tools, which were combined into a model of health and care services for frail elderly, were developed (WP T2[2]) and tested (WP T3) in the above-mentioned project period based on a theoretical development of important content (WP T1). In order to implement and establish these developed tools in practice and not only in the countries that act as project partners within the framework of the project, various instruments such as six local action plans (one for each partner country) were developed in Working Package T4. Another instrument to be able to support the sustainable implementation of the developed tools and also the developed health and care model in a region is the present guidebook. In addition to providing assistance for successful implementation, the guidebook should also allow a transnational transfer of knowledge to the municipalities and regions not involved in the project.

The guidebook presented here firstly provides an overview of best practice tested solutions for the improvement of health and care for frail elderly. The tools developed were combined into a model of health and care services, which will be presented in the next step. The local action plans developed in the last working package, which are intended to make a further contribution to maintaining the sustainability of the project results, are then briefly presented. Finally, a detailed roadmap for the introduction of the health and care model and supporting technical solutions is presented.

[1] niCE-life (2019): Application Form. Page 2.

[2] WP T = Working Package Thematic

2. Overview of developed and tested solutions

2.1 AP Nurse

2.1.1 Need for digital solutions

Population aging is currently a topical issue for several European regions. This trend in the society also represents a significant burden on the social system. The situation is unsustainable in the long run, and therefore strategic documents and policies aimed at coordination or mitigating the effects of this adverse social development should be developed and implemented. This is also the case of the Bratislava-Petržalka district, which is, out of 17 districts, the one with the highest population and has an area of 28.68 km^2. The average age of the city's population is gradually increasing and so does the share of the post-productive ones in the total population. Petržalka's population is gradually aging and while in 2006 - the average age of the population was 37.06 years, in 2016 it was already 41.44 years. Currently, about 13,000 pensioners live in the Bratislava-Petržalka district, which represents 13% of the total population of the district. In addition, approximately 15.5 % of the population of Bratislava region is above 65y and a large share of these people suffer from cognitive diseases, such as Parkinson´s or Alzheimer´s disease, and/or require social care due to high age. In the Bratislava region, there exist 25 care centres and 3 special geriatric clinics.

There exist tools that can increase the quality and availability of social services for the elderly and reduce the risk of social exclusion of this target group. The tools can be preventive or remedial. Preventive tools are those that prevent the emergence of problems related to the socialization of the elderly, such as. lack of contact with other people, lack of opportunities for self-realization and lack of relevant information. Corrective tools come into play only if preventive measures were absent, not properly chosen, or not sufficiently effective. One of the possible options for preventive tools could be the implementation of intelligent monitoring tools that can easy caregivimg, collect the parameters of the environment of patints and frail elderly and can provide alert in case of hazardous or critical events requiring immediate intervention.

2.1.2 Key features of AP-NURSE

AP-NURSE is a simple and modular monitoring tool designed for patients suffering from Alzheimer's and Parkinson's disease for home and medical application encompassing ambient sensors, which can monitor activity patterns, gas, temperature and other aspects. Its aim is to simplify the work of caregivers or nurses by monitoring basic interactions of the patient with the environment during night or job duties and provide fast alert about possible dangers and support independent living of frail elderly.

The main goal of the tool is to increase the quality of the caregiving services by utilizing smart assistance. Monitoring of the patient´s living environment may minimize the consequences of harmful events by fast notification of the caregiving personnel, can provide continual data for a health progress evaluation and may decrease the level of stress of the caregiving personnel.

The development of the AP-NURSE units is divided into two branches based on the proposed systems (Home and Care). The main features of AP-NURSE Home and Care are shown in AP-NURSE Home is a device designed for home use (with potential also to care centres) comprising a simple design, low price, notifications through a bracelet worn by the caregiver but with a potential to provided data to an information system for later data analysis. AP-NURSE Care is a more robust and complex device designed for use in care centres with affordable price, IS data collection feature applicable in multi-patient environment. The features of AP-NURSE Home and Care are shown in **Fehler! Verweisquelle konnte nicht gefunden werden.**.

	AP-NURSE Home	AP-NURSE Care
Home use	✓	✗
Use in care centres	✗	✓
Simple design	✓	✗
Low-cost	✓	⚖
PC based monitoring	✓	✓
Bracelet notifications	✗	✗
IS Data collection	✓	✓

Table 1: Features of AP-NURSE Home and Care

AP-NURSE has been developed using three technological platforms:

- In-house solution using the ESP8266 microcontroller, covering the whole design process from design to PCB manufacturing
- Stackable solution using the M5Stack modular platform
- Special design using the Waspmote platform, developed for low power consumption applications

To provide flexibility, several versions of AP-NURSE were developed:

- AP1 version is meant to be placed under the bed of mobile patients or clients of care centres, to monitor basic movement around the room, noise and patient's movement in the bed.
- AP2 is designated to monitor the doors to the bathroom of mobile patients or clients of care centres. Opening the door will trigger the sensor and based on the time delay and optional noise sensor will trigger the alert.
- AP4 should be placed in common places, such as stairways or hallways, to monitor mostly movement during the night, or for monitoring of forbidden areas.
- AP6 is designed to be used in a kitchen like environment, aimed mostly on gases and smoke.

The versions of AP-NURSE and the configuration of sensors are shown in **Fehler! Verweisquelle konnte nicht gefunden werden.** and the showcase of AP1 and AP4 units is shown in **Figure 1**: Showcase of AP1 and AP4 units .

AP version	Movement	Barriere	Force	Gas	Temp.	Light
AP1						
AP2						
AP4						
AP6						
AP7						

Table 2: Versions of AP-NURSE and the configurations of sensors

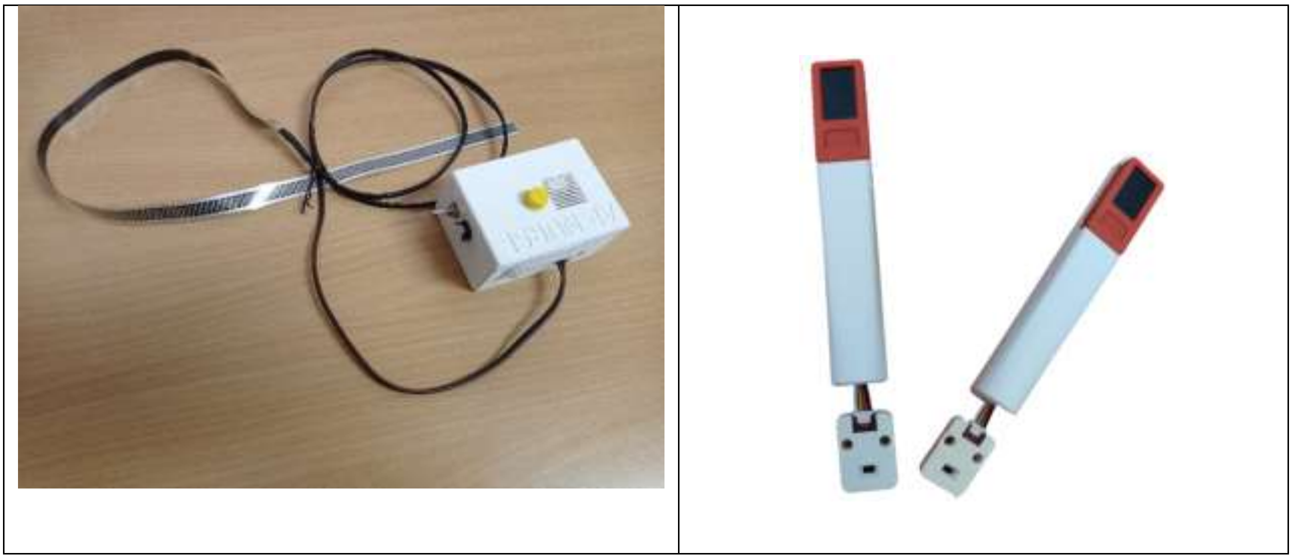

Figure 1: Showcase of AP1 and AP4 units

The flowchart of AP-NURSE is shown in **Fehler! Verweisquelle konnte nicht gefunden werden.**. The AP-NURSE devices consist of a sensor board with connected configuration od sensors and a microcontroller that is connected to the WiFi network. It collects The micrcontroler, which can be ESP8266, ESP32 or Waspmote, communicates with the server. The server is designed in the programming API, which allows the client web application, in our case the Information System (IS), to communicate with the server based on requests and responses. The Information system serves to provide notifications from the AP-NURSE devices through the web browser, to ease and accelerate the response of caregivers to dangerous events. If notification appears the caregiver should check the condition of the monitored patient himself or ask for help by clicking the "Help needed" option. Subsequently, if the patient has been checked, the caregiver can resolve the notification either as a correct notification or a false alarm. There exist 3 levels of notification. System status indicates normal condition, when no alert notification occurred. In case of a sensor unit generated alert notification the system status shows normal or critical condition alert with further alert details. Examples of alarms are shown in **Fehler! Verweisquelle konnte nicht gefunden werden.**

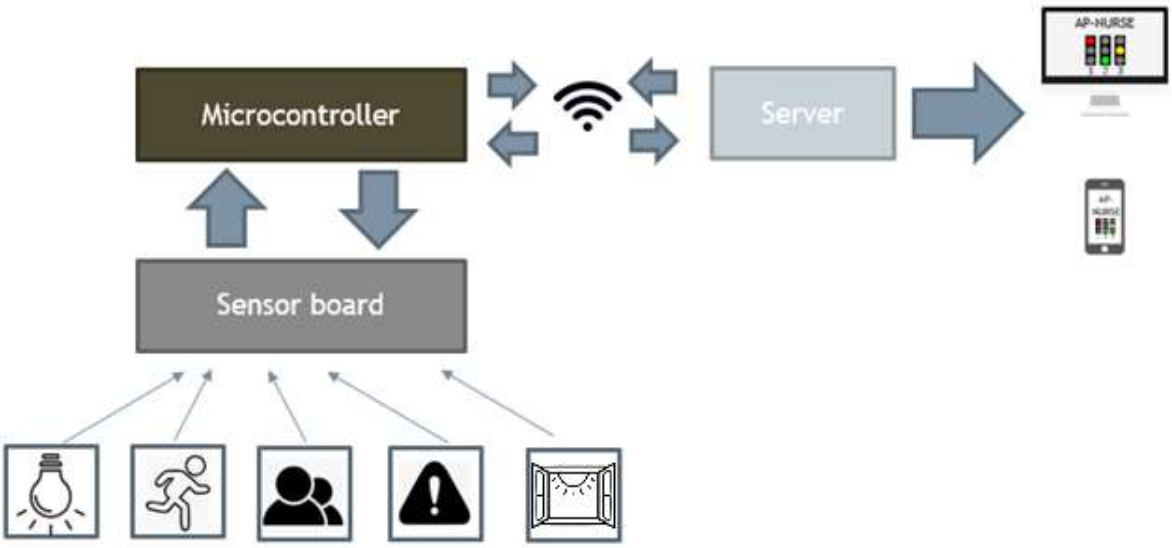

Figure 2: Flowchart of AP-NURSE

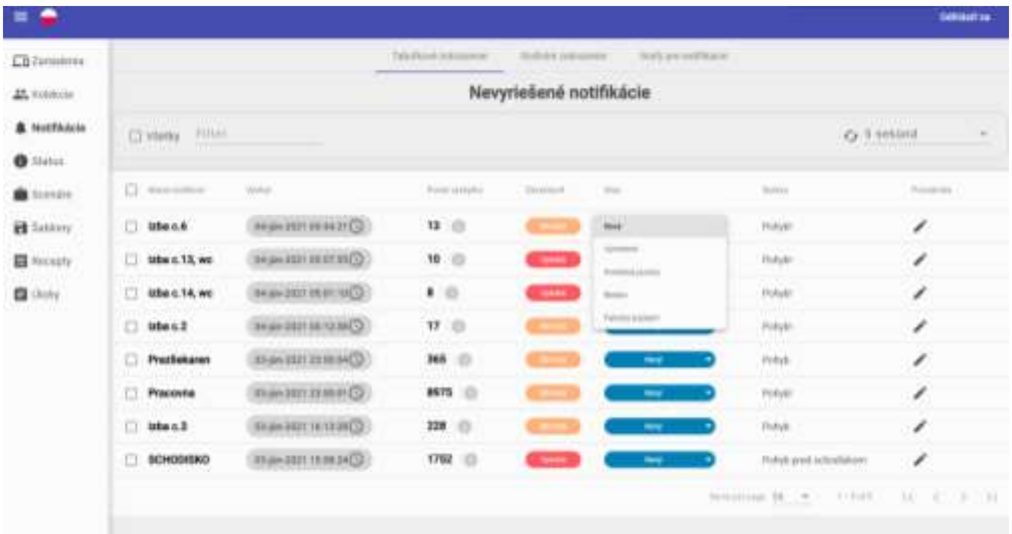

Figure 3: Example of alarms from the ingormation system

2.1.3 Testing of AP-NURSE

The aim of the pilot testigs of the AP-NURSE monitoring tool was to eavaluate its features for patients suffering from Dementia, Parkinson´s diseases and Alzheimer's diseases and whether it can simplify the work of caregivers in institutional care. This pilots have eight objectives:

1. Install the AP-NURSE smart monitoring tool in Social Care Centre Petržalka in Bratislava and Social Care Home Warsaw and maintain in operation as long as possible, but at least two months without interruption.
2. To test the information system designed to collect data from AP-NURSE devices.
3. Train the selected personnel of the Centre to be able to use the information system and the AP-NURSE devices, maintain the nodes in operation and to provide sufficient feedback.

4. Collect feedback from the caregivers and the representatives of the Centre.
5. On the basis of feedback from caregivers, further improve the system.
6. Collect and analyse operational data from the devices.
7. Determine whether the system has improved the work of caregivers
8. Identify areas of further development and conditions to be used in the care Centre.

The testing in real environment was performed Social Care Centre Bratislava and Social Care Home Warsaw, Poland. In Wasaw, the pilot testing was implemented in the Social Care Home (SCH), a part of the Alzheimer’s Centre. The Alzheimer's Centre has been operating in its current form since 1 June 2011. It consists of a Social Care Home and a Day Care Home. The Social Care Home is a co-educational facility for 120 chronically ill people, especially those suffering from dementia, including Alzheimer's disease. The range of services provided includes 24-hour care, nursing and care activities, provision of food (three meals a day, including diets), health, psychological, pastoral and social care.The Day Care Centre is a day care centre for residents of Warsaw diagnosed with Alzheimer's disease or/and other dementia syndrome. The aim of the activities of the Day Care Centre is to provide the widest possible support to the sick and their families by creating safe and friendly conditions for them to improve their well-being and increase their level of independent functioning in everyday life.

In Bratislava the pilot test was implemented in the Social Care Centre Petržalka, located in Bratislava, Slovakia. The Social Care Centre Petržalka is involved in caregiving of elderly people with a broad range of diseases. The total capacity of the Centre is 30 people. The clients are accommodated in single or double rooms, based on their age, disease, mobility, and daily activity pattern. The age of clients ranges between 63 and 100 years, with the average age of clients 82 years, out of which the average age of female clients is 83 years, and the average age of male clients is 80 years. In general, the centre is involved in the treatment of mobile, partially mobile, and immobile patients with chronical and post-traumatic diseases of low and intermediate severity. The chronical diseases include mainly Parkinson´s and Alzheimer’s disease, diabetes, dementia, hypertension, asthma, and pulmonary diseases.

The total numbers of users and monitoring targets involved in the pilots are shown in **Fehler! Verweisquelle konnte nicht gefunden werden.** and the total number of installed devices in **Table 3**: Total number of users and monitoring targets involved in the pilots

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Pilot	Patients	Older adults	Formal Caregivers	Informal Caregivers	Professionals
Warsaw	117/35	117	13	0	8
Bratislava	30/13	20 2	7	0	3

Table 3: Total number of users and monitoring targets involved in the pilots

AP-NURSE version	Installed in Warsaw	Installed in Bratislava
AP1-H	9	8
AP1-M	8	-
AP1-W	5	-
AP2-H	-	2

AP2-M	13	-
AP4-H	8	3
AP4-M	1	-
AP4-W	1	-
AP6-H	-	1
AP6-M	-	1
AP6-W	3	-
TOTAL	48	15

Table 4: Total number of installed devices in the pilots

The local indicators for the pilot were defined based on the set objectives and in cooperation with the involved project partners. There are shown in **Fehler! Verweisquelle konnte nicht gefunden werden.**. In terms of technology acceptance and usability a tailored questionnaire was created using the *LimeSurvey* online open platform. The technology reliability of AP-NURSE was evaluated using electronic forms to monitor the status of devices. In these status monitoring forms two criteria were evaluated, whether the devices are online and whether it sends and receives the data packages correctly. In terms of the accuracy a wider dialogue with the caregivers was required. Their responses were collected in a 2-weeks bases covering data from all night shifts in the investigated period. The role of the caregivers was to confirm or refute the correctness of the notifications. The usability was evaluated based on the quality of gathered data from the devices.

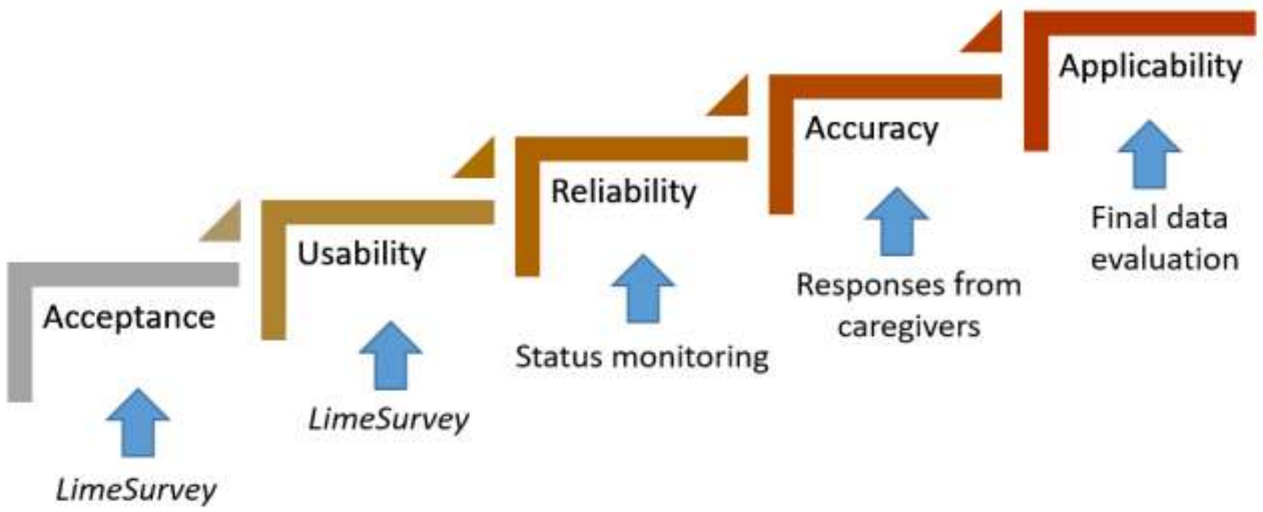

Figure 4: Local indicators used in the testing procedure:

The evaluate these indicators the following success criteria were defined:

- Acceptance -> confirmed by 60 % respondents
- Usability - > confirmed by 70 % respondents
- Reliability -> operational 70 % of the time (50-70 % limited performance)

- Accuracy -> Rate of false alarms < 20 %
- Applicability-> Confirmation of a specific event from at least 2 sensors or 1 sensor and caregivers

The summary of testing indicators in Bratislava and Warsaw are shown in **Fehler! Verweisquelle konnte nicht gefunden werden.** and **Table 5**: Summary of testing indicators in Bratislava

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Version	AP1-H	AP2-H	AP2-M	AP4-M	AP6-H	AP6-M
Acceptance	✓	✓	✓	✓	✓	✓
Usability	✓	✓	✓	✓	✓	✓
Reliability	✓	✗	✗	✓	✗	✗
Accuracy	✓	✗	✗	✓	✗	✗
Applicability	✓	✗	✗	✓	✗	✗
Decision	Passed	Failed	Failed	Passed	Failed	Failed

Table 5: Summary of testing indicators in Bratislava

Version	AP1	AP2	AP4	AP6
Acceptance	✓	✓	✓	✗
Usability	✓	✓	✓	✗
Reliability	✓	✗	✓	✗
Accuracy	✓	✗	✓	✗
Applicability	✓	✗	✓	✗
Decision	Passed	Failed	Passed	Failed

Table 6: Summary of testing indicators in Warsaw

In both Bratislava and Warsaw AP1 and AP4 met all criteria and passed the indicators. AP2 and AP6 met only the acceptance and the usability indicators. Nevertheless, there is a space for improvement for also devices that met all requirements. For commercialization it will be necessary to improve their accuracy and reliability to exceed at least 95%. Unfortunately, the remaining devices failed the evaluation, however these devices after some modifications and upgrades, can be further tested and used in practice. The most important finding is that the majority of caregivers had positive thoughts about the AP-NURSE system. In the online questionnaire, their claimed that AP-NURSE “eased the control of clients”, “increased their safety”, “gives a better overview of what is happening in SCC”, “is able to promptly handle dangerous situations” or “it shortens the reaction times of the staff in case of an event”. At the same time, the caregivers claimed that there were some outages of the system and they would require sound notifications. Regarding the maximal price of the AP-NURSE system the respondents claimed prices in a range between

500 -1 200 € with the average price of 892 € and the median of 1000 €. As it was in case of the Warsaw pilot, it is not possible to judge, whether the respondents claimed the price of one devices or the whole system.

2.1.4 Sustainability of AP-NURSE

We consider the current technical level reached as TRL-6 or TRL-7. Anyhow to reach the market introduction several TRL levels (TRL 7-9) need to be reached to finalize the tool. As other IoT devices, AP-NURSE tools may be offered as standalone product or could be delivered as a service. Clearly, the standalone offer is more suitable for the home applications and the service approach seems to be more sustainable for the institutionalized customers.

Based on the thought experiment related to the implementation of AP-NURSE solution in the Bratislava region, we assume the potential to implement the AP-NURSE solutions as relevant where the density of the relevant institutions and the number of frail elderlies allow the sustainable and cost-effective first implementation of AP-NURSE system. The further exploitation of the system can then be performed also in the more rural villages and regions with a lower density of inhabitants. Two pricing strategies were developed in respect to the investment cost availability. The critical number of installations allowing the startup of real commercial activity was determined to 8 parallel implementations with 50 devices each without the need of continuous support.

2.2 GPS Tracking

European society is characterised by a general increase in the population over 65. This demographic trend is also correlated with a general increase in the number of frail elderly people who need support, which public care organisations are not always able to provide, especially in a period in which social and health spending is conditioned by the debts of some European countries. Cognitive and neurodegenerative disorders, such as dementia, are among the conditions of fragility that have the greatest impact on the quality of life of the elderly and their caregivers, and in addition to affecting the health of the older people, they represent a major challenge for social and health care systems that need to find more effective solutions for managing these situations. The experimentation of gps tracking technology in the context of Treviso, supported by an innovative care model, goes in this direction. The context of the Veneto Region, where Treviso is located, is in fact characterized by a high incidence of dementia, for example on the basis of the resident population as of 31.12.2017, subjects affected by dementia were 66,147, (https://demenze.regione.veneto.it/PDTA/dati), while the index of ageing stands at 169.2.

Thanks to the niCE-life project, the team tried to understand to what extent the technological solution based on gps-tracking is able to support the older people by guaranteeing a better quality of life, increasing the level of safety and providing more information on the state of health. At the same time, the experimentation aimed to understand the role of gps tracking technology in supporting formal and informal caregivers, who directly bear a large part of the burden of care.

Before describing the features of the implemented technology, it is appropriate to outline the characteristics of the pilot site. It has been implemented in the territory of Treviso and neighbouring municipalities and it has been articulated in three different scenarios, respectively a nursing home, a cohousing and the houses of the elderly citizens involved thanks to the homecare services present on the territory. These three areas of implementation allowed us to make assessments about the scenarios and target groups where gps tracking technology is most effective. The target group consisted of citizens over 65 with cognitive impairment or at risk of developing it.

The GPS-based tracking tool was implemented during 2021 through the activities of the pilot site in Treviso. The technological ecosystem experimented in the framework of the niCE-life Project consists of some fundamental elements. First of all, as the pivot of the system, there is a smart bracelet, designed specifically for the seniors and equipped with useful features both in terms of safety and health. In terms of safety, the wristband is able to perform the following functions: - detecting the position of the person wearing the bracelet; - automatically detecting falls and generating alerts; - defining safety perimeters within which the project participant can move; - pressing the emergency button to generate alarms. With regard to health, the available functions are: -sleep monitoring; -physical activity monitoring; -heart rate monitoring. All these data collected by the smart bracelets are then shared with another cornerstone of the technological ecosystem, the monitoring platform, through which caregivers can support senior citizens wearing the bracelet.

Figure 5: Illustration of the smart bracelet

Short presentation of results of testing

During the implementation of the pilot site three different tools were used to understand the impact of the project on the different target groups involved.

Concerning seniors, the project team decided to use the European Quality of Life 5 Dimensions 3 Level (EQ-5D-3L) questionnaire, which measures subjectively perceived quality and helped us to understand the impact of the niCElife project on senior citizens.

This instrument consists of a descriptive EQ-5D and an EQ visual analogue scale (EQ VAS):

- The descriptive EQ-5D-3L system considers 5 dimensions (1 item each), each of which is assigned 3 answer options (levels): no problems, some problems, extreme problems.
- The EQ VAS consists of a vertical 100 points visual scale. Zero points represent the worst possible state of health, while 100 points represent the best possible state of health.
- The analysis of this indicator allowed us to understand that, while there is no significant change in general level, the project had an impact in a specific dimension of the instrument, namely anxiety and depression. The project target was to improve this dimension by at least 10% and this was achieved with an increase of 13.04%.Aim? Benefits

Regarding the assessment of the impact on another relevant target group, caregivers, the project team decided to implement a different instrument, namely the Zarit Burden Interview. This indicator is a widely used interview to assess the consequences that the care burden of an elderly person with chronic or degenerative diseases has on the caregiver. To understand the impact of the project, the Zarit Burden Interview was implemented at the beginning and at the end of the activities of the pilot site in Treviso. A total of 26 caregivers were involved, as 5 participants left the project before having used the technology for the minimum time defined by the ISRAA team. The aim, regarding this target group, was to decrease the care burden by at least 10%. This was indeed achieved, with even better results in the implementation scenario in the participants' homes.

Finally, the third evaluation tool used was a set of open-ended questions aimed at gaining a better understanding of the participants' experience, but also of the initiative's prospects for sustainability. With regard to the problems encountered during the project, participants indicated the following: Difficulties of using the solution with people with severe dementia; Negative correlation with depression; Failure to wear a wristband in the presence of a carer; Lack of integration between the service network; Low battery life; Inaccurate gps signal. Regarding the benefits of the trial, participants reported the following: Increased level of safety, plenty of information on the health of older people, serenity for the carer and the elderly person, usefulness of the fall detection function, useful to avoid dangerous exits from the nursing home. The last aspect examined by the open-ended questions is sustainability. In fact, 36% of the participants were willing to incur an economic cost to use the service developed by the project.

Figure 6: Locations of the testing

2.3 Monitoring Grid

The Monitoring Grid is a simple monitoring tool, which aims to enable older people to live at home for as long as possible. In order to be able to support this goal, the Monitoring Grid consists of a standardized questionnaire, which is available to a trained monitoring team for regular telephone calls with older people in order to be able to observe the development of the mental and physical state of health. The standardized questionnaire can be adapted and supplemented at any time and is divided into three categories, namely clinical, functional and social factors. The answers of the respective interviewees are entered into the Monitoring Grid by the monitoring team. This then evaluates the answers entered, displays them graphically and thus enables the monitoring team to recognize a deterioration in the state of health at an early stage and to initiate appropriate, targeted measures.

As part of the pilot action, which was carried out in Burgenland from April to September 2021, the **Monitoring Grid was tested** in practice. Three residential area managers of the Samaritan Burgenland Department of Home Care called 10 to 13 elderly people once a week and used the Monitoring Grid to observe the development of their state of health. The target group of the pilot action were primarily people

1. who live in Burgenland,
2. are over 75 years old,
3. and have a home emergency call from the Samaritan Burgenland Department of Home Care (in the event that they also want to contact the monitoring team). This third criterion was accordingly not mandatory.

Overall, the outcome of the testing was very positive. The interviewers rated the Monitoring Grid as (very) easy to use. The (technical) acceptance was given by both the interviewers and the older people. In addition, by participating in the pilot action, both the fear of the elderly and the subjectively felt loneliness could be reduced. Furthermore, the following **strengths** were identified:

- Regular contact with the elderly: “someone cares”.
- Regular health checks enable a quick response to changes.
- Providing older people with up-to-date information (e.g. care allowance, therapy options ...).
- Collection of a comprehensive anamnesis, which is particularly helpful for later treatments, for example individual planning of moving into a nursing home.
- The older people's subjective sense of security is increased.

In addition to the strengths, it was of course also possible to develop some **potentials for improvement:**

- Technical improvement potentials, eg photos of the participants and summaries of the last discussions should be added.
- Questions about mental illnesses should be worked out more intensively.
- Building trust requires personal contact (feedback from both older people and interviewers).
- As part of the pilot action, the use of the Monitoring Grid was only possible with the help of the intranet of the Samaritan Burgenland due to technical circumstances. As a result, the reliability of the Monitoring Grid was dependent on the internet connection.
- Adaptation of the target group (even slight cognitive impairments influence the outcome of the conversation).

The knowledge gained during the pilot action was subsequently incorporated into the local action plan for Austria, which is summarized below. Detailed information can be found in the deliverables of WP T3 and WP T4.

2.4 Digital tool for frail

Figure 7: Screenshot of YouBOS

In the province of Bologna there are about 880.0000 citizens. Over 65 seniors represent almost 30% of the population in some areas. City average is 27%. The majority of them are women (without relatives or friends living nearby). One-person households are > 51%, of which 33% are populated by people over 65 (about 10.000 men and 25.000 women). You BOS is a web platform dedicated to frail seniors and their caregivers not particularly able to the use of the digital. The objective of the web platform is to take care of the frail seniors, often isolated, and help them by using digital tools to discover new relational models. The **tool aims** to connect people, social health workers and volunteers in the third sector to promote the creation of a community to support the more frails, facilitating the maintenance of their autonomy and improving their quality of life. YouBOS has been designed as a tool to facilitate the access mainly of the seniors and their caregivers to needed information and support through the use of the content published on the website platform. The tool at the same time invites the elderly to take an active part and thus co-create the contents of the platform through specific thematic areas. The possibility to interact directly through a forum with other users serves to maintain relationships between peers and be able to ask questions of interest to experts and the editorial staff of the platform, thus receiving answers to their needs.

The **YouBOS platform contents** are organized as described as follows, each section incorporates audio-visual content produced under a collaborative approach with the eCare community.

- a connecting Blog, moderate by an editor who interacts with the users;
- "The expert's corner area" which will transmit live on channel or in asynchronous mode uploading the video on the web portal, giving the possibility so far to collect the questions by the users and forecast the subsequent replies;
- The creation of "thematic areas" such as for example the "Laboratorio del Fare" (Lab for sharing) where the users contributions are published, "Restare Attivi" (Need to stay active) there are loaded gentle exercise videos, workout, "Parole fra noi" (between the words) in which are explained daily complex terms usually in a foreign language like english.

The platform is accessible online and is mobile responsive. The platform is organized in different areas where it is also possible to publish multimedia material, the integration with different technologies to ensure the access to a widest possible audience is also expected. You can comment in each area and decide whether to receive notifications of the published contents. The user has the possibility, by using YouBOS, to find the events, the organizations and social health services present in the territory. The search is realised through a geolocation map or through some search filters such as geographical area and typology.

According to the Italian Law Decree 76/20 (Misure urgenti per la semplificazione e l'innovazione digitale), access to the platform is allowed through SPID, the Public Digital Identity System that guarantees all citizens and businesses a single, secure and protected access to the digital services of the Public Administration. The user will set up her/his own profile and can decide to highlight the contents of his interest, such as collecting events organized on the territory to his liking, and activating a notification to be notified in time of the start of the activity etc.

Combating the digital divide but also ageism is a duty of all nations because it means combating inequalities in access to the rights of individuals. The main challenge of YouBOS is to demonstrate that upskilling digital competence of elderly people is possible and contributes to strength their social inclusion. With this aim we have created a virtual community to promote the creation of new relationships, to share contents, activities and events carried out by voluntary organizations on the territory, taking care of the frail seniors, often isolated, helping them by using digital tools to discover new relational models.

The tool YouBOS (www.bolognasolidale.it) that has been deployed, was conceived to facilitate the access mainly for the seniors and their caregivers to the needed information and support them through the use of the content published on the website platform. The tool at the same time invites the elderly to take an active part and thus co-create the contents of the platform through specific thematic areas. The possibility to interact directly through a forum with other users serves to maintain relationships between peers and be able to ask questions to experts and the editorial staff of the platform, thus receiving answers to their needs.

Below, some useful links that can support on the use of YouBOS are reported:

- YouBOS Portal: https://www.bolognasolidale.it
- Video Tutorial on YouBOS (link)
- Users' Guideline on how to use YouBOS (link)

Short presentation of results of testing

The data were analyzed by using four kinds of psychometric tests:

1. YouBOS usability – UT AUT (for all participants)
2. Wellness perception - EQ 5D 3L (for all participants)
3. Loneliness perception – UCLA (for elders participants)
4. Care responsibility and burden – ZARIT (for caregivers)

Compared results between the tool usability and the wellness perception

The elderly participants that accepted the delivery of the psychometric tests were 29. For 24 of them the health quality perceived is excellent. In three cases it is intermediate and for the remaining two cases is poor. For 13 participants the tool is acceptable and usable, while for 5 of them it becomes problematic and for 11 of them it is really difficult to use. The elderly participants in the last observation were 21. For 16 of them the health quality perceived remains excellent; in one case is intermediate and for the other four cases is poor. Compared with the precedent observation, nine participants left the experimentation; for three of them the health quality perceived improved. The elders that perceive their health quality has intermediate have decreased from three to one; on the contrary the number of elders that perceive their health quality as poor have increased from two to four.

For 15 elders the tool is considered acceptable and usable, compared to the initial eight, for five of them it remains problematic and only one still considers its usage difficult. Apart from the elders that left the experimentation, probably due to the difficulties and problems in using the tool, it can be said that an evolution in its acceptance can be observed.

Nine caregivers who participated accepted the delivery of psychometric tests. For all of them the health quality perceived is excellent. For three caregivers the tool is acceptable, for six of them is considered problematic. From the initial observation it seems to emerge that the health quality perception is indifferent and not related to the usage of the tool, that the caregivers themselves view as difficultly usable and even problematic. In the final observation the perception of health quality remains excellent, but an improvement in the usage of the tool, which passes from problematic to acceptable and usable, is observed for four caregivers. In the final observation there is a shift towards positive levels of health quality and acceptability of the tool. For 25 participants over 30 the quality of health is great, and 22 of them consider the tool as acceptable and usable. Only eight participants are in the low range of acceptability of the tool.

Compared results between the tool usability and the loneliness perception

The elders that perceived themselves as definitely in solitude are 12 out of 29, 15 of them feel alone and two do not, these two are also the ones that consider the tool difficult. Among the ones that feel definitely alone the degree of acceptance of the tool is diversified, as well as among the ones which have an intermediate perceived solitude: 11 of them find the tool difficult, five of them find it problematic. In conclusion, an increased and better utilization of the tool seems to contextually decrease the level of loneliness.

In the final observation, three caregivers have a higher care burden that in the initial observation, but the perceived health quality remains excellent. This brings to the conclusion that the higher usage and acceptance of the tool determined the preservation of the health status perceived, despite the increasing care responsibility and burden.

2.5 Care for frail

Care for Frail is a simple tool to securely share health documents needed to organize and provide home health care for frail elderly people who have been discharged from the hospital but whose condition requires additional health care provided at home.

The current practice of planning and organizing care for a patient discharged from hospital who requires follow-up home health care is based on paper medical documents, which Care for Frail replaces with a module for secure sharing of medical documents within the telemedicine communication platform of the University Hospital Olomouc. The patient or his/her family does not have to save one report for the first visit to the Home Care Agency and go to the district doctor with the other one, the medication according to the report can also be prescribed remotely and an e-prescription can be sent to the patient. Home Care Agency staff do not have to transcribe paper care vouchers into their work sw programs, nor do they have to travel to GPs with the paperwork and waste time in GP waiting rooms. They can then spend this time effectively working directly with clients.

The practitioner can use the platform to connect with a medical specialist if needed. From home, the patient can request a remote consultation with the GP via the platform, and in general this option gives patients a feeling of greater security and comfort. A well-compensated health condition of the elderly also allows him to stay longer in his natural environment, thus not requiring a longer period of time or a residential social service at all.

Telemedicine in the form of a telecommunication platform can also be useful at the meeting point and the intersection of social and health services, which has long been a problem area in the Czech environment.

After testing in University Hospital Olomouc, Care for Frail online tool is positively evaluated by the experts involved. Indeed, from an expert perspective, all the professionals involved say that the system has made their work easier. The experts also provided us with valuable suggestions for improvements/corrections and listed the pros and cons of the system, which will be incorporated into future versions of the system to make it increasingly useful for them to work with it. Importantly, none of the experts pointed out any major problem or blocking factor and the points they made were aimed at improving the user experience and feedback of the system. This is logical and the system needs to be further evaluated and refactored, and after a few iterations, most such improvements will be in place.

2.6 Intelligent Monitoring Tool

The developed tool, the so-called Intelligent Monitoring Tool (IMT), is an AI powered server-side information system designed for non-invasive, comfortable and cost effective sleep analysis and monitoring patients suffering from a variety of neurodegenerative disorders such as Alzheimer, Parkinson and many others. The principle of the tool is based on a combination of state-of-the-art AI algorithms and modern wearable technologies, which are often used as design, smart software and health sensors. The design and development of the tool was carried out with regard to:

- simplicity and comfort of the use,
- user friendliness for patients and experts,
- minimizing the necessary technical skills of experts,
- easy interpretability, accuracy, reliable and of sleep analysis reports,
- low purchase costs, security and easy implementation.

After a thorough analysis during the initial design of IMT, the GENEActive actigraph manufactured by Activinsights was selected as used wearable sensor. The main reasons for its choice include:

- presence of sensor for measurement of required data types,
- recording the acquired time-series data in raw form,
- physical dimensions, price-quality ratio, long-life battery,
- sufficiently large internal storage, water and dust resistance.

The actigraph is used to acquire data that predicate about the course of patient sleep. The monitored types of data include triaxial acceleration, light intensity and body temperature. The combination of these time series can be used to determine sleep quality and to find certain patterns in the data indicating the presence of sleep disorders.

The acquired data are safely downloaded from the actigraph (at the next patient visit) using a special software and docking station, which is purchased together with the actigraphs from the same company. Thereafter, the expert uploads the data to an AI power server-side application, where analysis is performed.

The AI powered server-side application is used to store data securely, subsequent analysis of the data and allows to easy interpretation of results to an expert who also has an overview of all his patients. The expert can perform operations related to editing, displayings or deleting patient data. From this perspective, the application also serves as a kind of information system. The design and control of the application are designed to be as user frinedly as possible and with regard to the minimal requirement of technology knowledge. The server-side application is based on the Django framework and the prerequisite for running it is the presence of a Python interpreter and several other frameworks used for data analysis. The application does not require powerful hardware and can be run quite easily even on desktop computers that meet the minimum technical requirements.

Use case: The proposed use-case can be characterised as follows from a high-level perspective:

1. A patient at risk of sleep disorder receives an actigraph from a doctor (as mentioned, it can be a prodromal marker of developing a neurodegenerative disease such as PD/AD, etc.).
2. The patient wears it for a few days while sleeping, as prescribed by the doctor, to acquire a large enough number of data sample that can be analysed by the sleep monitoring system to find patterns in data describing potential sleep-related problems and to assess and/or monitor sleep quality in order to detect the onset of a sleep disorder early.

3. The actigraph is then taken to the doctor for processing and prediction/assessment. Finally, the pacient receives a detailed report of the sleep from the physician, who will take appropriate action.
4. The sleep report is based on the combination of analysis of the sleep monitoring system and the physician expertise of the physician.

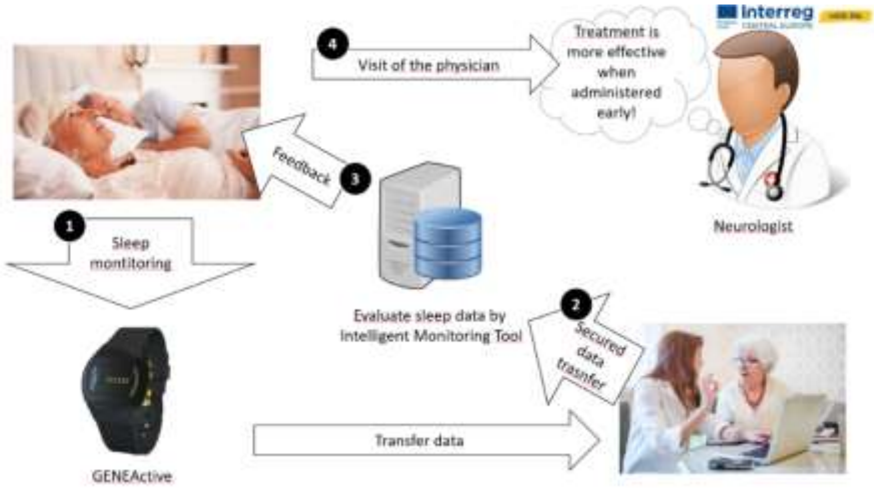

Figure 8: The model use case of Intelligent Monitoring Tool described above.

Aims and benefits

In the scope of a niCE-life project, the tool for online sleep monitoring, called the Intelligent Monitoring Tool (IMT), has been developed. The aim of IMT, which leverages the use of GENEActive actigraph, signal preprocessing, and state-of-the-art artificial intelligence algorithms, is to identifiy sleep disorders, that may be early markers of the neurodegenerative diseases such as Parkinson's disease. The tool can also be used for monitoring sleep apnea.

The incidence of neurodegenerative diseases is more common in the elderly. Due to the expected demographic trends[3], there will be an extreme increase in the number of seniors and thus a significant increase in the number of patients with these diseases. This will result in extreme pressure on health and social care not only for capacity but also for economic reasons. As a result, there may be a situation where proper care cannot be provided to all who need it. Unless an effective drug is discovered, structural changes will have to be made in health and social care facilities. One possible change is the use of e-health and modern technologies to improve the quality of care and the quality of life of the patient. The IMT tool has the same goal. It has great potential in improving the quality of care. It allows, based on the analysis of data acquired during sleep, to detect certain patterns that indicate the presence of a neurodegenerative disease in the prodromal phase. Thus, physicians have the opportunity to initate early treatment, which is more effective than late use. The result is an increase in the patient's quality of life, his possible longer participation in the work process and a delay in the onset of serve symptoms. All of this in combination creates a positive effect on the patient's, health and social care economy situation. Another major advantage that IMT provides is the convenience of its use, its low cost and practically unlimited number of actigraphs according to the requirements of the organization. Based on the characteristics described, there is a strong presumption of a positive contribution of this tool to the quality of health and social care, given the current trend of population aging and the increase in the incidence of neurodegenerative diseases.

The benefits of the IMT can be summarized as follows:

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[3] KISS, MONIKA, 2022, Demographic Outlook for the European Union [online]. European Parliamentary Research Service. [Accessed 20 May 2022]. Available from: https://www.europarl.europa.eu/RegData/etudes/STUD/2021/690528/EPRS_STU(2021)690528_EN.pdf

- costs effective tool for early diagnosis of sleep disorders, easy and convenient to use
- possibility of application in new domain (sleep apnea and next),
- provides accurate and reliable analyses.

Short presentation of results of testing

In total, the pilot action invlolved participants from 3 regions and 4 institutions across 2 countries:

- Samariterbund Burgenland (AT111 NUTS level 3; Weppersdorf, Burgenland, Austria) - 8 participants
- University Hospital Olomouc (CZ071 NUTS level 3; Olomouc, Czech Republic) – 10 participants
- Central European Institute of Technology (CEITEC) and St. Anne‘s University Hospital Brno (FNUSA) – 20 participants

Each participant in the experiment was asked to complete a questionnaire. In it, he answered the set questions, which are listed below. Participants were able to express their opinion, for example, on the comfort of wearing the actigraph and on the tool as a whole. We set a goal in advance to achieve at least 80% positive responses in all responses. This target was significantly exceeded in all cases. A detailed graph of positivity for each question can be seen in the graph below.

1. The kit I received has interfered with my everyday routine.
2. The kit I received has invaded my privacy.
3. The kit has been explained to me sufficiently.
4. The kit has made me feel uncomfortable, e.g., physically or emotionally.
5. I am concerned about the level of expertise of the individuals who monitor my status via the kit.
6. The kit makes me worried about the confidentiality of the private information being exchanged through it.
7. The kit allows the people looking after me, to better monitor me and my condition.

In total, 4 experts also participated in the testing phase of the IMT. Similar questionaries was filled by each expert that participated in the pilot action. The questionarie contain the following questions:

1. Has the system made it easier for you to monitor sleep disorders?
2. To what extent do you think the system is reliable.
3. How complicated is it for you to use the system?
4. Would you like to use the system for a longer period?
5. What is the maximum price (in EUR) you would pay for this system.
6. Is it comfortable to work with the system (is it user friendly)?

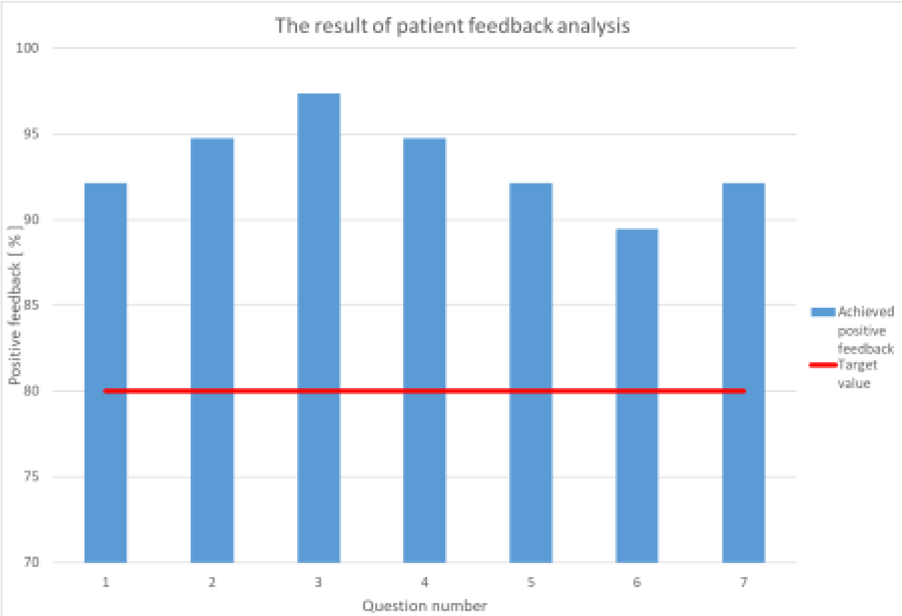

Figure 9: Graph contains an overview of positive feedback of each question in the participant questionaire.

In conclusion, the developer IMT tool in scope of the niCE-life project has the potential to help address the situation in the health and social care that will arise from an aging population which is associated with increasing of the incidence of neurodegenerative diseases. It consists of software and hardware. Funds are only needed to purchase physical equipment, which must be purchased from the manufacturer (abot 220 € per piece). The AI powered server-side application can be run on a desktop computer that meets the minimum HW and SW requirements. The tool was tested in a pilot action involving 4 experts and 38 volunteers from 4 organizations in 2 countries (Czech Republic and Australia). All of them were subsequently asked to complete questionnaire. The vast majority of them considered the developed tool to be very beneficial. Furthermore, with the help of the Faculty Hospital of Olomouc was identified one new application of the systém – monitoring of the sleep apnea.

3. Presentation of the health and care model

The project niCE-life seeks to respond to the challenge of an ageing European population. It develops tools to support the quality of life of frail elderly people, with special attention to people suffering from neurodegenerative diseases in all stages. Some of the tools developed can bring a better quality of life not only to the elderly person himself, but also to his family or other informal as well as formal caregivers. These tools may by their nature support the frail elderly or his environment throughout his life, at all stages of decline in functional capacity and an increased likelihood of suffering from one or even more chronic diseases, some tools will best support the frail elderly at a particular stage of his life when he needs a certain pre-determined level of support for his life.

The tools developed within niCE-life are addressing medical record keeping, information sharing between professionals and care providers; remote care, remote consultation and remote monitoring of an older person's health and safety, data analysis, including with machine learning technologies, and the use of data to improve the effectiveness of treatment and care. The AP-Nurse and the GPS-based tracing tool allow remote monitoring of the frail person's safety, and the Monitorig Grid allows remote monitoring of their health status. The Care for Frail enables information sharing between professionals and better coordination of their work. The Sleep monitoring platform uses machine learning techniques to detect sleep disorders, which can be an early sign of neurodegenerative diseases such as Parkinson's and Alzheimer's. YouBos platform aims to help seniors acquire basic digital skills and reduce their isolation through social interaction in a virtual environment. It can thus be instrumental in familiarising seniors with digital technologies and in convincing them to use other digital tools and services. In order to be able to match appropriate tools to appropriate life stages/situations, we need to specify these categories. For this purpose, we will use the Clinical Frailty Scale.

Clinical Frailty Scale (CFS) is used commonly to assess frailty. The CFS is utilized to predict the outcomes of older people hospitalized with acute illnesses. The CFS is commonly used to predict health outcomes that are significantly associated are mortality, comorbidity, functional decline, mobility, and cognitive decline.

Figure 10:
Clinical Frailty Scale

In our model, we classified the nine levels of CFS into three levels of support need.

- Low need of help includes CFS level 1 – 4.
- Moderate level of support need includes CFS 5 – 6.
- High level of support need includes CFS level 7 – 9.

We can think of model as a menu of tools to support the frail elderly at different stages of frailty progression/ the need for a certain level of support. A frail senior whose situation requires a low level of support can use tools such as YouBOS for reducing isolation, the Intelligent Monitoring tool for preventing the development of Parkinson's disease or Care for Frail for facilitating the organisation of home health care and The Monitoring Grid to monitor health and social status of indepently living elderly. The frail elderly with a moderate level of help need can then be offered GPS location tools or AP NURSE for home use. Care for Frail and Monitoring Grid can be further used in this group. For the frail elderly in the group with the highest dependency rate, we can then offer AP NURSE for residential use.

This model is shown in the following figure.

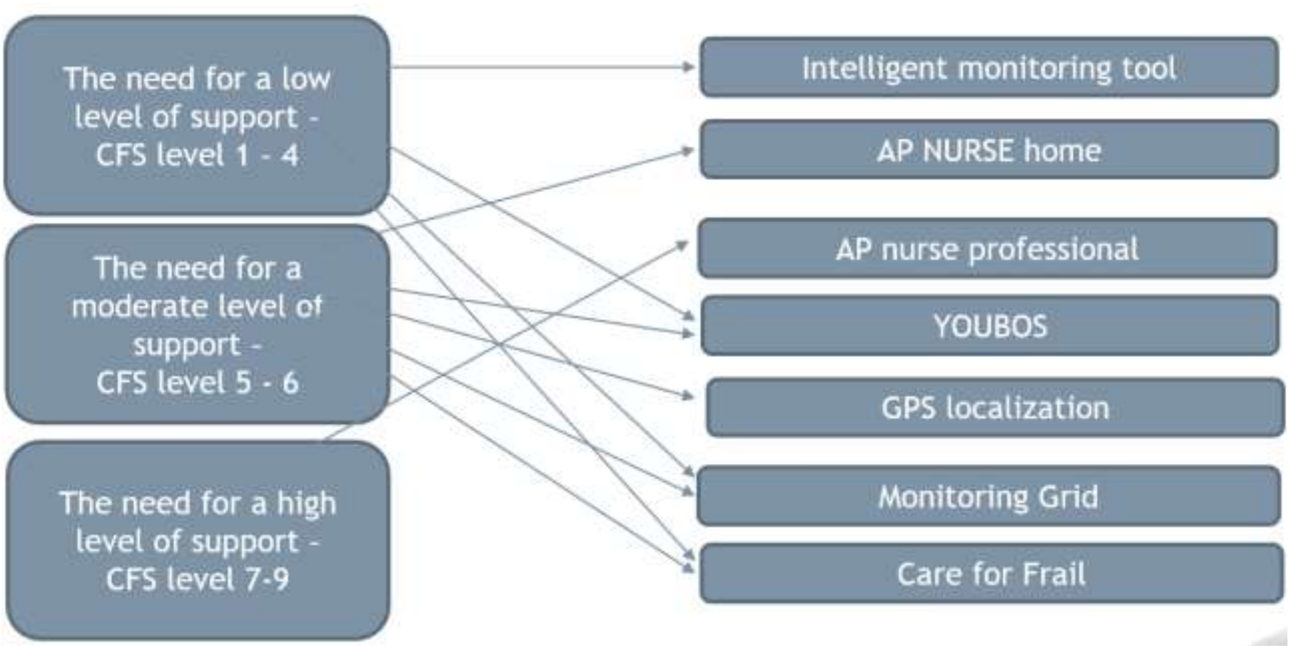

Figure 11: Health and care model developed in the niCE-life project

4. Outline of developed local action plans

A brief overview of the local action plans developed is given below. Detailed information can be found in the final versions of the respective local action plans (D.T4.1.4).

4.1 Austria

Short name of actions	Action 1: Enable implementation and further development of the model by stakeholders	Action 2: Support for a targeted exchange of information by strengthening interdisciplinary cooperation
Background	According to the results of the pilot action, the needs of elderlies identified in WP T1 can be served with the developed tools. Implementation and further development of the tools require the support of relevant stakeholders.	▪ The success of the “Bologna eCare Network” is primarily based on interdisciplinary cooperation, both during the development phase and in the course of operational implementation. ▪ A regulated flow of information enables a targeted use of resources.
Actions	1. Identification of relevant stakeholders 2. Needs-oriented contact with relevant stakeholders 3. Involvement and training of relevant stakeholders	1. Defining a leadership 2. Development of guidelines to optimize the exchange of information involving all those affected 3. Develop the ability to aggregate and retrieve all data 4. Create opportunities for personal exchange of information 5. Formative and summative evaluation
Players involved	Political decision-makers, operational organizations in the health and social sector, experts, future users, technicians	Political decision-makers, actors in the health and social sector/ stakeholders from action 1, experts
Timeframe	July 2022 - ongoing	July 2022 - July 2025
Technical resources (if relevant)	-	material and human resources for the development of the platform
Personell resources	See “players involved”	See “players involved”
Finanical resources (if relevant)	Personnel costs, external expert costs, technical development costs, overhead costs, equipment costs	Personnel costs, external expert costs, travel and administration costs, technical development costs, overhead costs
Funding sources	National and European funding	National and European funding

4.2 Czech Republic

Short name of actions	Action 1: Enhancement interdisciplinary cooperation between stakeholders	Action 2: Supporting the integration and further development of the IMT.
Background	Behind the success of several eHealth and telemedicine systems on which the niCE-life project is based, and hence on which the transfer of so-called "best practices" has taken place, is the fact that their design and development was carried out by a multidisciplinary team with contributions from many stakeholders. In order to maximise the impact of the IMT system, it is essential that scientists, neurologists, patients, regional/city representatives, insurance companies, HTA (Health Technology Assessment) agencies, etc. collaborate in its integration or further development/adaptation.	The IMT tool has been developed and tested in collaboration with St. Anne's University Hospital in Brno and the Central European Institute of Technology (CEITEC MU). In this collaboration, the potential of the tool for early diagnosis of diseases with Lewy bodies (e.g. PPN) has been verified. In the next step, the tool can be integrated into further studies or its functionality can be verified in other diseases.
Actions	The BUT team plans to take advantage of the activities organized by Brno Municipality, especially the meeting of the Memorandum of cooperation for eHealth and telemedicine to present the IMT, to get feedback on IMT 's functionality. These activities will also be utilized to gain new contacts with stakeholders.	Representatives of the Brno Municipality, representatives of departments of hospitals in Brno or in general in the South Moravian Region who use/are interested in using online monitoring of sleep disorders.
Players involved	Representatives of Brno Municipality, the South Moravian Region, the Ministry of Health of the Czech Republic, insurance companies, hospitals, patients, universities, research institutes, telemedicine centres.	Representatives of the Brno Municipality, representatives of departments of hospitals in Brno or in general in the South Moravian Region who use/are interested in using online monitoring of sleep disorders.
Timeframe	January 2022 - indeterminate	January 2022 - indeterminate
Technical resources (if relevant)	Personal attendance at meetings is expected. In the event that in-person participation is not possible (e.g. due to epidemiological conditions), the meeting will be held online using common technical means such as a laptop, smartphone, etc.	Common ICT resources.
Personell resources	In addition to the interested stakeholders, members of the BUT team will participate in the activities.	In addition to the interested stakeholders, members of the BUT team will participate in the activities.
Finanical resources (if relevant)	There may be minor costs associated with transport or maintenance/purchase of ICT.	There may be costs associated with the propagation of the IMT instrument.

Funding sources	Costs (spaces, energy) associated with the organisation of the meeting Memorandum of Cooperation for the e-Health and telemedicine are covered by the Brno Municipality. Costs associated with other events will be covered by the niCE-life project, or from other funds of the Brno University of Technology.	The costs will be covered by the niCE-life project or other BUT funds.

4.3 Italy (Region Bologna)

Short name of actions	**Action 1: Participate and learn about YouBOS**
Background	With the objective of promoting the use of the portal YouBOS (www.bolognasolidale.it) a series of meetings have been organized with Associations and Patronages of the elderly. The final aim is to include the use of the YouBOS portal among the criteria for evaluating the projects presented in the context of the Call for ideas and within the partnership of the submitted projects.
Actions	Presentation of the tool YouBOS and its opportunities
Players involved	Associations and Patronages of the elderly
Timeframe	January-June 2022
Technical resources (if relevant)	
Personell resources	1 operator from LHA, 1 operator from Lepida, 1 participant in the experimentation
Finanical resources (if relevant)	Videoconferencing platform provided by Lepida
Funding sources	

4.4 Italy (Region Treviso)

Short name of actions	Action 1: Promoting greater coordination between institutional actors	Action 2: Sharing the model with potential beneficiaries
Background	The experimentation taught the project team an important lesson, namely that the involvement of citizens and caregivers who are potential beneficiaries of the initiative is a difficult task, especially when considering the so-called "hard to reach", i.e. that part of the elderly population which for numerous reasons has more difficulties in accessing services. A more structured alliance and greater sharing among the relevant actors could help this process.	The difficulties in involving senior citizens and their caregivers in the trial made it clear that the implementation of these innovative technologies can be more effective with an early involvement of the identified target groups.
Actions	It is planned to present the results of the experimentation to the stakeholders, combined with a group reflection on how greater coordination can amplify the impact of these initiatives on the territory.	Presentation of the tool tested in Treviso to elderly, informal and formal caregivers. Through the sharing of the outcomes the perspectives of sustainability of the project will be investigated with the three target groups.
Players involved	▪ Municipality of Treviso ▪ ULSS 2 Marca Trevigiana ▪ Veneto Region	▪ elderly ▪ formal caregivers ▪ informal caregivers
Timeframe	January-June 2022	January-June 2022
Technical resources (if relevant)		
Personell resources	2 members of the ISRAA project team	2 members of the ISRAA project team
Finanical resources (if relevant)		
Funding sources	FESR - Interreg Central Europe	FESR - Interreg Central Europe

4.5 Poland

Short name of actions	Action 1: exchange of information and strengthening of cooperation between institutional actors
Background	The target population for AP-NURSE devices are patients with Alzheimer's, Parkinson's or frail elderly, as well as nurses, professional carers or family members who care for these patients.
Actions	1. Identification of relevant stakeholders 2. Needs-oriented contact with relevant stakeholders 3. Involvement and training of relevant stakeholders
Players involved	▪ Walfare and Projects Department ▪ City of Warsaw ▪ Warsaw Family Support Centre ▪ Social welfare homes concerned
Timeframe	July 2022 - ongoing
Technical resources (if relevant)	-
Personell resources	▪ policy makers ▪ city management ▪ experts ▪ non-governmental organisations in the health and social sector dedicated to helping people in need of support and care
Finanical resources (if relevant)	▪ Personnel costs ▪ external expert costs ▪ equipment costs ▪ technical development costs
Funding sources	National (regional) and European funding

4.6 Slovakia

Short name of actions	Action 1: Digital connection and effective communication between caregivers and elderly people
Background	Over the last 10 years the average age of citizens in the Petržalka region increased by 4 years. 13% of the Petržalka region are seniors, a significant part of which lives alone or requires social care To ease the caregiving in centres, to increase the safety of patients and to support independent living of elderly, digital solutions should be implemented.
Actions	▪ Identification of the needs of caregivers in the Social Care Centre Bratislava ▪ Implementation of the AP-NURSE tool in the caregiving of patients in the Social Care Centre Petržalka ▪ Implementation of the „Care for frail“ for people released from the hospital ▪ Identification of mechanisms and procedures for the deployment of these devices and platforms in real practice, based on testing results
Players involved	▪ Petržalka Municipality ▪ Slovak University of Technology in Bratislava ▪ University of Cyril and Method
Timeframe	January 2021-January 2022
Technical resources (if relevant)	
Personell resources	11 people from the STU team, people from municipality of Petržalka
Finanical resources (if relevant)	
Funding sources	

4.7 Slovenia

Short name of actions	Action 1: Stakeholder networking and the establishment of an informal network	Action 2: 2. Developing an tailored approach to inform and educate the elderly and their caregivers for the use of ICT and identification of good practice examples
Background	Given the current situation in the field of nursing and social care and the available services and capacities, NIJZ believes that the most appropriate approach for Slovenia is to connect stakeholders and raise digital health literacy as the most appropriate initial activities.	There is well-functioning cooperation between municipal authorities, public institutions and non-governmental organizations in some municipialities in slovenia. The engagement of retired volunteers, organized through extensive network of pensioners' associations, could be extended and increased. In addition to building community capacity.
Actions	Establishment of the local/regional informal network of stakeholders, presentation of current achievements, searching after synergies and common challenges; Organization of meetings with stakeholders, presentation of Nice-life pilot projects; Identification of opportunities and gaps in existing collaboration.	The network members will discuss the pilot project examples of good practice which are identified. Respecting the needs of elderly in eastern Slovenia, the network member will develop a proposal for the tailored approach aimed at building community capacity to target appropriately the digital and health literacy of frail elderly and their caregivers. This approach will have two main goals: to increase digital and health literacy of elderly and to increase the engagement and social contacts of elderly and their caregivers.
Players involved	Ljudska univerza (Community college), pensioners' associations, CSD-center for social services, community health care center, community nurse and center for health promotion, local/municipality authorities, local ICT provider, NGOs, nursing homes for elderly, family doctors, hospital long term care department.	Caregivers, family members / relatives, social workers, volunteers, health professionals, representatives of the local public authority.
Timeframe	May- December 2022	June-December 2022
Technical resources (if relevant)	The approach constitutes of standard communication procedures: personal contact, telephone and video calls, e-mails. We assume that all the necessary and basic communication tools are available. In case of the insufficient digital skills for the use of current video communications appliances and programmes, the network members will assure the necessary support to each other's. This will be the part of the on-going learning process in actual situation, which will increase the	ICT appliances (smart phones, PCs etc.) and internet access

	coherence of the group and also raise the digital literacy and skills. The additional ICT tool will be developed in the next phase of the local collaboration.	
Personell resources	Assuring sufficient personal resource is the most challenging issue, because all available human resources, including retired health professionals, have been reallocated to manage the current epidemiological situation. Although the increasing volume of evidences indicate the increasing need for additional social and health services, deterioration of mental and general health and social isolation. Personnel resources needed could be partly ensured from existing resources, by performing the similar activities only in otherwise organized manner.	Representatives of the network member organizations, family members/caregivers, representatives of public authorities, helth professionals.
Finanical resources (if relevant)	Financial resources are needed for ICT support and maintenance.	Resources needed for the facilities where meetings and workshops take place, catering for the participants; resources for the ICT equipment, programme development and maintaining.
Funding sources	Apart from existing financial resources, additional resources could be ensured by local authorities, projects and in a long term from helth and social insurance funds.	Prospective funding needs to be dedicated according to the results of the actions. Potential resources could be ensured by local authorities, projects and in a long term from helth and social insurance funds

5. Roadmap for the introduction of the health and care model

Based on the individual local action plans, the following steps can be taken for a sustainable local and regional introduction of the tools and model of health and care services developed.

5.1 Step 1: Consideration of local framework conditions

In order to be able to sustainably implement the results of the niCE-life project, which primarily concern the developed tools and the subsequently developed health and care model, in a region, the local framework conditions of the target region must first be clarified.

Ethical, legal, political and technical aspects must be taken into account here:

From an **ethical perspective**, it is important that the interests of all parties involved are taken into account and that possible damage is kept to a minimum. The main goal of the niCE-life project is "*to foster social inclusion and care coordination of frail elderly (…) through development of transnationally applicable model of health and care services for frail elderly (…) by using progressive key enabling technologies to prevent frailty, enhance quality of care and support their independent living, social contacts and assistance continuity after hospital discharges*". This means that a particularly vulnerable group of people, namely older people, represent the target group of the niCE-life project. For this reason, ethical framework conditions must be considered and it is recommended to have the developed instruments checked by an ethics committee before implementation.

Before implementing the model of health and care services for frail elderly or individual tools developed as part of the niCE-life project, it is of course essential to clarify the local **legal framework**. The following laws play a particularly important role here:

- Nursing home laws, since, for example, AP-Nurse can also be used in a nursing home,
- General Data Protection Regulation (GDPR), since, for example, the Monitoring Grid collects, stores and uses sensitive and generally personal data such as names, addresses and health data.
- Statutory telemedicine and telecare or digitization regulations, since some of the tools developed, such as the Care for Frail platform and also the Monitoring Grid, represent telemedicine/telecare tools.

In order to be able to make the implementation successful and, above all, sustainable, it is also necessary to take the **political** goals and demands into account. Policy makers may not necessarily have a formal relationship with the planned actions, but they certainly have opportunities, directly or indirectly, to influence the process. There are no standard solutions here. Different interests and specific political risks must be taken into account and appropriate measures must be developed. The range of critical political issues extends from the question of benefits, costs, various side effects, social and ecological effects to cultural and aesthetic questions.

Since the niCE-life project aims in particular to improve the nursing and medical situation for older people with the help of digitization, the **technical conditions** must also be determined. Here, for example, the development and implementation status of technologies in the health and social sectors of the target region must be taken into account.

Last but not least, it should of course be agreed whether any further approvals are necessary for the implementation. If cooperation partners are also involved in the realization of the project results achieved in a region, the above framework conditions must also be regulated in the cooperation agreements.

5.2 Step 2: Clarification of the required resources

Now that the framework conditions of the respective region/country in which the health and care model or even individual instruments of the model are to be implemented have been clarified, the required resources are to be presented in a second step. Above all, the financial, human and technical resources must be determined.

First of all, the **financial resources** must be clarified by planning the costs and working out any financing options that may be required. All the costs incurred are listed in the cost plan. The aim of cost planning is to create cost transparency by breaking down the costs of all work packages into personnel costs, material costs (e.g. materials that are required) and other costs (such as overhead costs), to show cost drivers and to show a specific sum as a planned budget for the project. In addition, it is advisable to carry out a cost-benefit analysis to determine whether the result (benefit) justifies the effort (cost). This can also be helpful in facilitating any financing. Financing can be realized, for example, through national or EU funding as part of a project or with the help of private organizations. A PPP model (Public Private Partnership) can also be considered. In addition, of course, there is also the possibility of relieving the provider of the instrument that is to be implemented by introducing deductibles. This means that the model or individual tools are not offered to the users completely free of charge, but that they assume a deductible of a certain amount.

Other resources required are **human resources**. In this context, it must be clarified which skills/knowledge and personal experience are required. Is there enough know-how available for the planned implementation or do other experts have to be brought on board. It is also advisable to find out about successful implementations of similar instruments at home or abroad and to integrate the responsible persons into the implementation process as support. When selecting the human resources, the availability of the individual specialists and the available budget must of course be taken into account.

In order to be able to establish the developed health and care model or individual developed technologies in practice, the procurement and use of **technical resources** is necessary. Which technical resources are required depends on the respective tool.

5.3 Step 3: Review status quo

Now that the necessary framework conditions have been described and the necessary resources have been presented, the next step is to assess the status quo of the region in which the implementation is planned. In particular, this means determining which existing **capacities and assets** are available and can be used for sustainable implementation, as well as identifying the **barriers or constraints** that could stand in the way of the successful implementation of the planned measures. In the course of this, both political and technical circumstances should be taken into account.

With regard to the **political aspects**, it is particularly important to clarify which strategic goals the political decision-makers are pursuing and whether the technologies developed in the niCE-life project may support the achievement of these. In addition, it is advisable to include any existing concepts and future plans at the political level in the implementation, thereby increasing the chances of successful implementation. Furthermore, possible dissenting voices should also be considered in this phase in order to be prepared for them in the further course and to be able to possibly refute them or at least put them into perspective.

The second point to be clarified is the extent to which **digitization** has progressed in the respective region. Is digitization going in a direction that is compatible with the planned measures, or is a completely different path being taken in the target region. Despite other goals for the region, can the planned tools be helpful and implemented? In addition, it is advisable to clarify whether existing technologies can be used and whether the new tools to be implemented can be connected to the existing tools.

Additionally, to support a successful implementation, it is necessary to conduct a **supply and demand analysis** to see if the developed tools can address the local needs of the population of the target region.

This means that the needs of the population in the target region should first be identified: What is needed locally? Can the tools meet the needs? If so, do the tools to be implemented still have to be adapted to local needs or framework conditions, or can they be adopted without changes?

Once the status quo has been established and all existing capacities and assets as well as barriers or contraints are visible, it is now essential to involve important stakeholders in the further implementation steps. This is described in the following step 4: stakeholder management.

5.4 Step 4: Stakeholdermanagement

An active involvement of relevant stakeholders is a key element to ensure a relevant impact of the niCE-life project at local and regional level. In this step it is important to share responsibility, power and resources with people, communities and partners involved in order to ensure sustainability.

For this purpose, it is first important to identify key stakeholders and their **interests** and **needs** in order to see who is directly or indirectly affected by the planned measures. Who could benefit from the planned steps and what can the concrete expectations and fears look like. In addition, it is also helpful to show who has how much **influence** on the success of the planned measures. This gives a good picture of the influences, the possible supporters and the likely opponents and serves as the basis for the planning of measures. However, it should also be noted that not all stakeholders can commit to every co-creation activity or being involved in a whole process, but their input may be invaluable. It is important to find easy ways to allow people to be involved in a 'light touch' way - it may lead to more substantial involvement.

As has now become apparent, all stakeholders are different. In order to win these for further implementation, it is essential to develop a stakeholder-oriented core message, which is used as part of the communication strategy. Essential steps, which are essential in the development of a communication strategy, are the content of step 5, which is described below.

5.5 Step 5: Communication and implementation plan

Now that the needs, expectations and possible influences have been analyzed, a **communication plan** can be developed that takes into account the wishes and goals of the individual stakeholders. This should include, among other things, the key media and messages that are to be used to address the various stakeholders. It is also essential that frequent and target meetings and events with stakeholders and elderly themselves are organised. Because we should not expect people to come to us. It is more effective to find out where people already are, and go to them personally. Written media such as e-mails only share information, but do not build relationships. This requires human-to-human contact and can be achieved, for example, through workshops or focus groups.

In addition to the communication plan, it is also helpful to develop an implementation plan that describes the individual necessary measures and is based on the data collected up to now (framework conditions, necessary resources, status quo, stakeholders) and of course also includes them. In addition to this already existing data, the implementation plan should define the goals, plan for possible risks, determine milestones and assign responsibilities and tasks to individual team members and describe the planned measures. The **realization** of the implementation plan can begin with a kick-off event. This will be described in the next step 6.

5.6 Step 6: Kick off

The kick-off event takes place after the project has been planned and before the actual implementation begins. The event enables a first personal contact between the participants. Above all, the stakeholders identified in the previous steps, who are advantageous for sustainable implementation, as well as the public, and especially the older generation, should be invited in order to create awareness here as well. Since sometimes getting started is the hardest part, it is also important to identify and invite some catalysts to support the activities to begin to grow. This kick-off meeting is intended to provide the necessary motivational boost and to ensure that the individual stakeholders identify with the planned measures and goals. Communicated content should include the presentation of the project goals, an explanation of the project benefits and of the implementation plan.

5.7 Step 7: Implementation

Of course, the implementation of the planned tools in the target region does not begin with Step 7, but with Step 1, where the necessary framework conditions were defined. Now, however, the actual and externally visible realization of the implementation plan developed in step 5 starts. The implementation phase is an ongoing process in which the respective tools to be established in practice are successively integrated into the target region. In this phase at the latest, the failures of earlier phases become apparent, such as a lack of fit, compatibility, performance, functional reliability or usability. The goals of the implementation phase include:

- Implementation of the planned measures by an implementation team. This implementation team is responsible, among other things, for coordinating day-to-day tasks, regular monitoring, obtaining feedback, incorporation feedback and documentation. Deciding who to involve in conversations can be a snowball effect. Often key voices will go undetected at first but through building relationships you will find connections with more people to involve.
- Promotion of acceptance of the measures to be implemented by those involved and affected
- Creation of the technical operational and functional safety of the tools or the entire model
- Instruction/training of future users
- Possible adaptation of the formal organization as well as the management and performance processes
- Ongoing internal and external communication of the results of the implementation

5.8 Step 8: Formative und summative Evaluation

The implementation phase is accompanied by ongoing monitoring and formative evaluation. Formative evaluation is the assessment and improvement of a process, which takes place within predefined time periods and predefined criteria. As part of the formative evaluation, based on the (interim) results achieved, interventions or corrections to ongoing measures are carried out in order to increase the probability of goal achievement. The formative evaluation can either be carried out by the operationally active implementation team or an independent monitoring team can be set up. In any case, the formative evaluation is accompanied by regular communication and the regular derivation of recommendations for further action.

After successful implementation, it is also recommended to carry out a summative evaluation. The aim here is the final evaluation or verification of the degree of fulfillment. The summative evaluation is therefore a form of outcome evaluation that only makes a comparison between the postulated and the achieved target state. The summative evaluation thus serves to ensure quality. The results can be used later for the targeted adjustment of the implemented tools/model.

6. Conclusion

The main aim of the niCE-life project is to find (digital) solutions in order to be able to react quickly to the challenges associated with demographic change. This means that the following goals in particular have guided the development of the digital tools:

- Promoting the social inclusion of older people
- Prevention of frailty
- Enhancement of quality of care
- Support for independent living of older people (in their own home)
- Ensuring continuity after hospital discharges

As the results of the various and very extensive tests of all the tools developed in the niCE-life project have shown, the use of these instruments enables a contribution to one or more of the above-mentioned goals.

This guidebook was developed to enable a transnational transfer of the knowledge acquired in the course of project implementation to other municipalities and regions not involved in the project. The guidebook presented here provides an overview of best practice tested solutions for the improvement of health and care for the frail elderlies and offers a detailed roadmap for the introduction of the health and care model and supporting technical solutions. However, it should be noted that the roadmap described above only recommends the suggested steps. This is by no means an exhaustive list, rather the implementation of individual tools or the entire model should be adapted to the target region.

In addition, the importance of the stakeholders should be emphasized again. In the course of project implementation, it quickly became clear that the success of a project depends on stakeholder participation and approval. The earlier stakeholders are involved in the implementation of a project, the sooner sustainability can be guaranteed. Of course, this fact is nothing new and is actually well known, but in many projects stakeholders are often involved too late in project development. In order to support the early involvement of key stakeholders, this guidebook focuses on the involvement of stakeholders in every project phase and would like to emphasize the importance of stakeholders once again.

For what concerns the lesson learnt, the pandemic has shown that the elderly people are constantly at risk of isolation and inequality. It is therefore necessary to imagine new forms of relationship but also new professions that can capture the attention of the elderly and support them in a non-invasive way, by proposing the maintenance of their usual interests and at the same time providing the necessary help to keep up with the changes imposed by technology and progress.

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