DESIGN OF THE PILOT ACTION IN BRATISLAVA

Deliverable D.T3.3.1

Version 1
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1. Introduction

This document, Design of the Pilot Action in Bratislava, presents the procedure of preparing the testing of AP-NURSE devices in Social Care Centre Bratislava, as part of Output O.T3.2 – Pilot testing of AP-NURSE – persons suffering from Parkinson´s disease in Care Centre Bratislava" and deliverable D.T3.3.1. It starts with the overview of the AP-NURSE monitoring tool, continues with the objectives of testing, definition of indicators and the last chapter deals with the defined procedures.

2. AP-nurse monitoring tool

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 AP-NURSE monitoring tool was designed by the Slovak University of Technology in Bratislava (hereinafter STU or PP4) in WP T2 based on the needs of caregivers and patients collected in WP T1. To provide flexibility for home use and medical applications, the development of AP-NURSE is divided to two branches, AP-NURSE Home and Care, three hardware platforms (In-house ESP8266, M5stack and Waspmote) and 6 physical versions (AP1, AP2, AP4, AP6, AP7 and AP8). More information on these devices can be found in D.T2.2.5.

3. Objectives of the testing

The aim of the pilot is to verify the AP-NURSE monitoring tool for patients suffering from Parkinson's and Alzheimer's diseases and to simplify the work of caregivers in institutional care. Within this implementation plan we have set the following objectives:

1. To test the AP-NURSE smart monitoring tool in Social Care Centre Petržalka in Bratislava.
2. To test the information system designed to collect data from AP-NURSE devices.
3. Collect feedback from the caregivers and the representatives with the centre.
4. On the basis of feedback from caregivers, further improvement of the system.
5. Determine whether the system has improved the work of caregivers (e.g. in terms of reducing the time needed to respond).
6. Identify areas of further development and conditions to be used in care centres.

3.1.1. Location and geographical information

The pilot testing will be held in the Social Care Centre Petržalka (SCC) in the Bratislava region, which is one of the administrative region of Slovakia, including the capital city Bratislava. The Bratislava region has an area of 2 053 m2 and as for 2018, a population of 659 598 people. Although it is the smallest region of

Slovakia by area, it does not have the lowest population. The largest city is Bratislava (425,459) and the second largest is Pezinok (21,334). The region has a high level of urbanization (83.2%). The population consists of 91.2% Slovaks, 4.6% Hungarians and 1.6% Czechs. The map of Slovakia with the highlighted Bratislava region is shown in Figure 1.

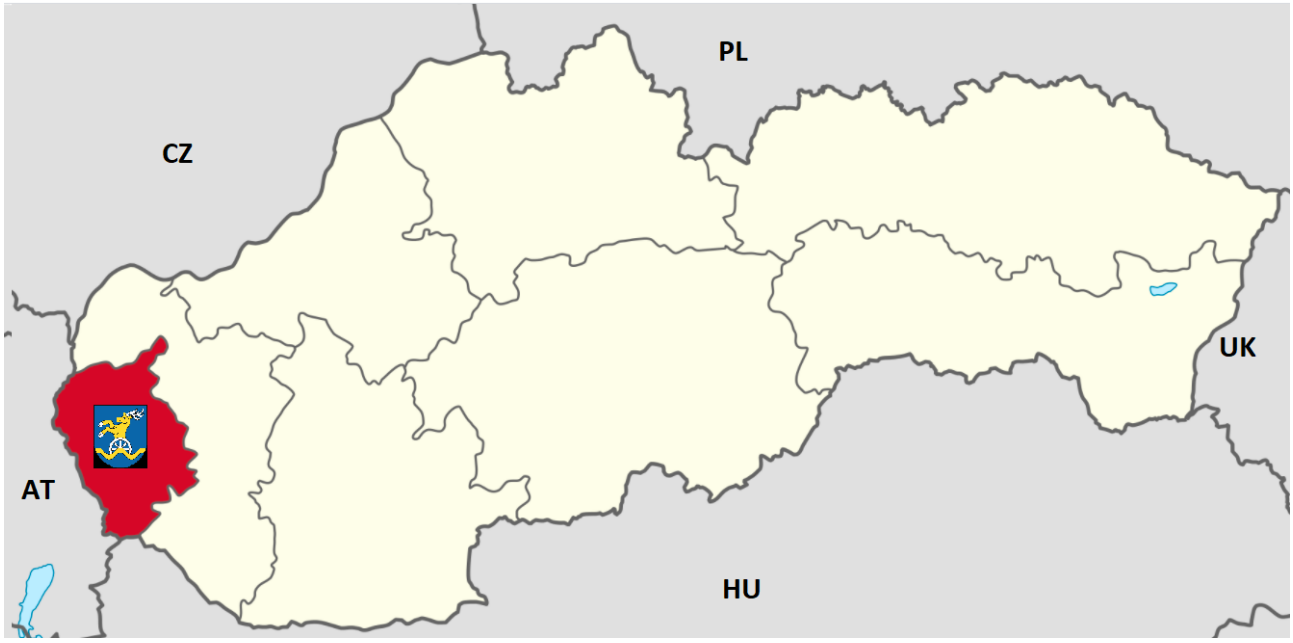

Figure 1: Map of Slovakia and the Bratislava region

The Social Care Centre Petržalka is located in the Petržalka district of the Capital city of Bratislava. It is a budgetary organization of the city district Petržalka, established to provide professional social, technical and material assistance in the field of social services. The centre was set up by Resolution no 12 of 01/03/2003 by the local council of the Bratislava - Petržalka city. It is located in the Mlynarovičova 23 street and is connected with its revenues and expenditures to the budget of the founder, the city district of Bratislava – Petržalka. The centre provides social services in accordance with the Act. no. 448/2008 on social services and Generally binding regulations of the Bratislava - Petržalka district on the provision of social services. The Centre is a provider of social services related to professional, service activities, or other activities or a set of these activities, which are aimed at:

1. to prevent the emergence of an unfavourable social situation, to solve an unfavourable social situation or to alleviate the unfavourable social situation of a natural person
2. maintaining, renewing or developing the ability of a person to lead an independent life and to support his or her integration into society,
3. ensuring the necessary conditions for satisfying the basic living needs of a person, solving the crisis social situation of a person
4. prevention of social exclusion of individuals
5. provides social service to a person who is dependent on the help of another people, due to unfavourable health condition or age.

Figure 2: The building of the Social Care Centre Petržalka

3.2. Demographic information

The Social Care Centre Bratislava is involved in caregiving of elderly people with a broad range of diseases. The total capacity of the Centre is 30 people. As for the March 2021, there are 23 female and 7 male clients in the centre. 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 most frequent post-traumatic diseases of clients is stroke, but there are also patients who suffer from cancer or post-surgery recovery. The Social Cere Centre employs a total staff of 21 people, including 14 caregivers, 2 administrative staff (the manager of the centre and the manager of the logistics), 2 cleaning ladies, 2 kitchen staff and a carpenter.

3.3. Needs of the target population

The target population of the AP-NURSE devices are patients suffering from Alzheimer´s, Parkinson´s disease or frail elderly as well as nurses, professional caregivers or family members, who take care of these patients.

In case of the AP-NURSE Home solution, the users are those individuals who are taking care of patients suffering from the Parkinson´s and Alzheimer´s diseases living in their home environment. These people could be family members of the patients or professionals employed for such care giving. In case of the AP-NURSE Care solution, the users are the personnel employed at care centres, either responsible for care giving or medical treatment of the patients. The users of the stored data could be neurologists, psychologists, general practitioners, specialists and experts in the treatment of Parkinson´s and Alzheimer´s diseases as well as data analysts, IT specialists and experts in machine learning and artificial intelligence.

The needs of the target population were collected through target meetings and an electronic questionnaire using the LimeSurvey online platform. The questioner consisted of 65 questions focusing on the type of the diseases of treated patients/clients, the experience of the caregivers with IoT (internet of things) solutions, their needs and requirements specific to their treated patients/clients. The survey has been completed by 6 users representing 3 institutions, the Petržalka Municipal District of Bratislava, The University Hospital Olomouc and the Municipality of Olomouc City. Among them, 3 institutions are involved in the care of patients suffering from frail elderly and 3 have experience with all listed chronical diseases (Alzheimer

disease, Parkinson's disease and Frailty elderly). Regarding the behaviour of treated patients, the partners responded that their patients live in their own reality, lost, without or in limited contact with their environment. They also suffer from confusion, loss of self-care, need of an accompanying person and separation. Two out of six respondent claimed that they already have experience with IoT solutions. Five out of six respondent claimed that they would use IoT solutions for monitoring the conditions of their patients / clients in the future. The results showed that the users of the IoT solution will prefer the combination of motion (5 counts), sound (4), gas (4), temperature (4), pressure (3) light (2), humidity (2) and the opening/closing event (2) sensors.

Five out of six respondents found the IoT solution important to provide sound notifications both to the patient and the care giver. Only 33 % of respondents think that it is appropriate to notify only the care giver. In case of system that provides notification on a smartphone or PC/laptop, normal behaviour of the patient should be signalized by green light on the screen. Abnormal condition of the patient should be signalized by yellow light on the screen, with modest alarm beep and by message on mobile phone. In some cases, it would be preferable to provide a map to the location where the behaviour was observed. The critical condition should be signalized by red light, strong alarm and by message to pager/smart phone. It would be also important to provide information on the patient, i.e. name, room number, map.

3.4. Partners involved and role in pilot

In this pilot testing of the AP-NURSE devices the following partners will be involved with the following responsibilities:

Slovak University of Technology in Bratislava (PP4)

- Leader of the Pilot
- Development, laboratory testing and prototype production of AP-NURSE devices
- Management of the physical testing
- Installation of devices in dedicated rooms
- Collection of data from the testing
- Training of personnel and caregivers
- Preparation of an informed content for the users of AP-NURSE Devices
- Preparation of a summary report from the pilot action

Petržalka municipality (PP1)

- Providing information on needs of patients and caregivers
- Assignment of a care centre under its supervision for testing
- Ensuring compliance with legal and intellectual property rights

Social Care Centre Petržalka (under the jurisdiction of PP1)

- Providing information on needs of patients and caregivers
- Making the centre available for testing
- Anonymized assignment of patients for testing
- Support in installation and data collection

3.5. Technologies and technical solution

In this pilot the AP-NURSE technology is tested. The development of the AP-NURSE units is divided into two branches based on the proposed systems (Home and Care). The AP-NURSE Home and Care prototypes were developed based on the former deliverables D.T2.2.1 – D.T2.2.5. The main features of AP-NURSE Home and Care are shown in Table 1. 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.

Table 2: Features of AP-NURSE Home and Care

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

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.
- AP7 is designed to be placed in the room of mobile patients, similar to AP1, however in various locations, not under the bed.
- AP8 is designed to identify falling down of a patient/client out of the wheelchair.

Each device has its preferred field of application and its real use depends on the needs of patients and caregivers in the final destination. The AP-NURSE devices can be combined with each other, and based on the IS data collection features, user defined scenarios of notifications can be set, which ease the work of caregivers, minimize the risk of patients and summarize data for further analysis of the progress of the disease. More information on the versions of the AP-NURSE devices can be found in the D. T2.2.5 deliverable.

3.6. Use Cases and target users

3.6.1. Deployment of devices

The first phase of the pilot testing of AP-NURSE in Social Care Centre Petržalka involves the AP-NURSE Home and the AP-NURSE Care M5stack platforms. Even though, AP-NURSE Home is designed for home use with providing notifications through a bracelet worn by the caregiver, it also makes possible utilizing the Information System (IS) primary developed for the AP-NURSE Care solution. Therefore, both platforms involved in the pilot testing will be configured to communicate through the IS. The deployment of devices will be carried out based on the map of the Social Care centre shown in Figure 3 and Figure 4, the standard daily routines of clients and caregivers and the type of patients. The devices will be deployed on both floors and the notifications will be visualised in the status monitors on the nurses´ desks on both floors. Based on their availability for clients, the premisses of the Social Care Centre Petržalka can be categorized as follows:

- PR – Patients 'rooms
  - Rooms of mobile and immobile patients/clients
  - With or without restroom
  - One or two patients/clients in one room
  - Black & White zone
- CP – Common places for patients
  - Area where the movement of patients/clients is not limited during the day
  - Both patients/clients and caregivers may be present
  - Corridor, kitchen for patients, staircase, saloon
  - Blue zone
- RP – Restricted areas for patients
  - Areas restricted for patients
  - Only caregivers are allowed to enter
  - Cloakroom, kitchen, laundry, washroom, warehouse, maintenance area
  - Red zone
- ET – Exit to outside premises
  - Doors to outside premises restricted to patients
  - Doors to areas, which can be access by patients upon approval of caregivers
  - Including emergency exits
  - Orange zone
- Other premises
  - Areas where the patients can access the caregivers

- CD – Caregivers´ desk
- CR – Caregivers´ room
- DO – Director´s office
- Green zone

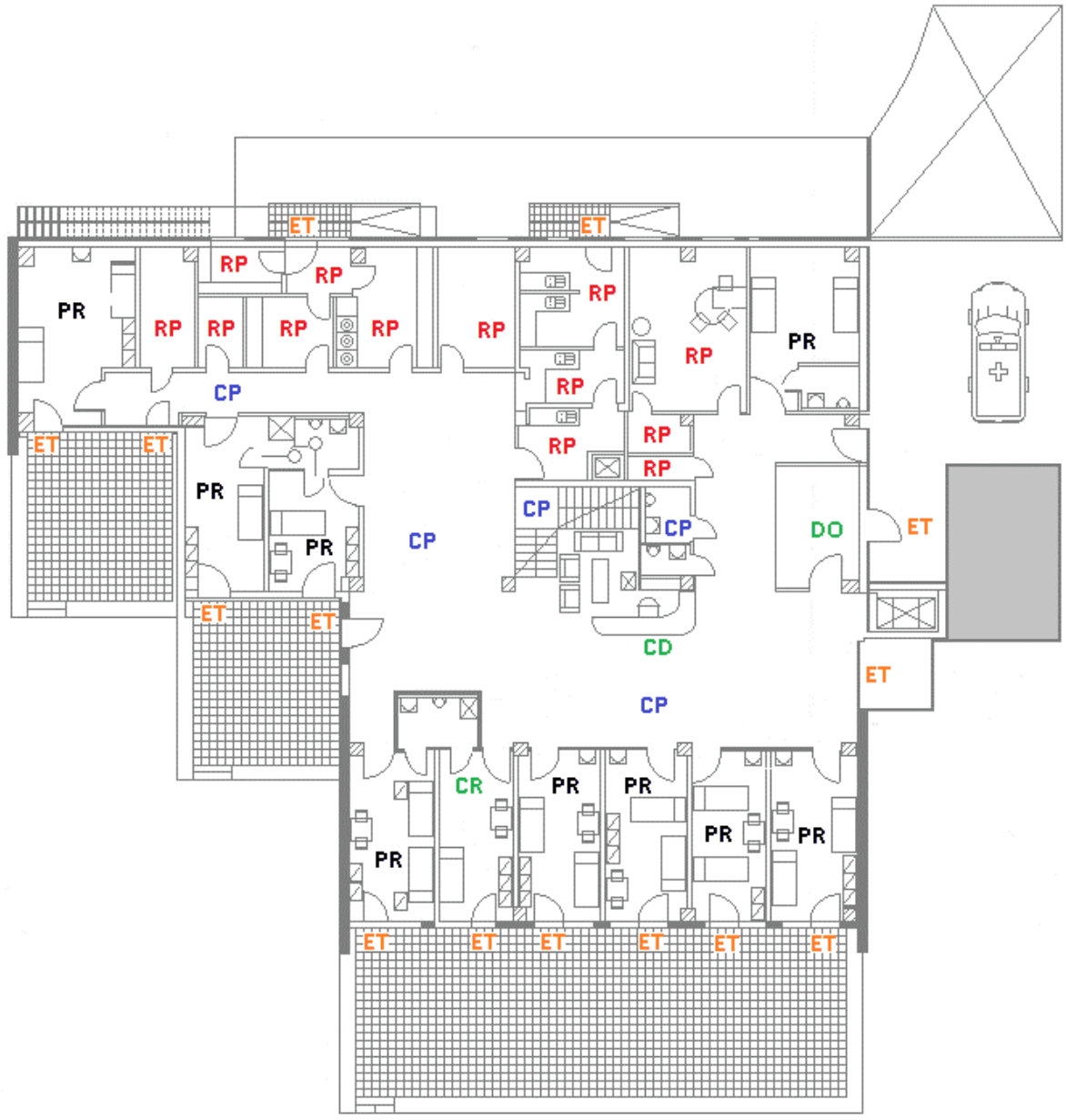

Figure 3. AP-NURSE Home monitoring layout grid in Social Care Centre Petržalka – first floor

Figure 4. AP-NURSE Home monitoring layout grid in Social Care Centre Petržalka - second floor

3.6.2. Target users

The target users in this pilot are the patients/clients and the caregivers in the Social Care Centre Petržalka, who can be divided to the following categories:

1. Mobile patients/clients
    a. Monitoring of patients in their room (PR)
    b. Monitoring of patients in common areas (CP)
    c. Notifying the personnel if patients enter the restricted areas (RP) or the exits (ET)
    d. Notifying the personnel if the patients/clients got stock in the restroom
2. Immobile patients/clients
    a. Monitoring of patients in their room (PR)
    b. Notifying the personnel if a person enters the room of immobile patients/clients
    c. Notifying the personnel if the patient/clients falls from the bed
3. Personnel
    a. Provide alert regarding the activity patterns of patients/clients
    b. Providing alert in case of a danger
    c. Collecting data for further analysis
    d. Management of day/night regimes
4. Vistiors
    a. Due to COVID-19 restrictions, no visitors are allowed to enter the premises

4. Definition of local indicators

The developed technology goals are defined in D.T.2.2.3 where the functional and event test are defined. All these tests and requirements were derived from the feedback questionnaires of the project partners that have broad experience with the care about the frail elderly. The goals were set such manner, that developed devices will should enhance the quality life of caregivers and caretakers for the patients. The possible use of Lime survey system can be utilized in the future for the collection of additional indicators from care centers. Reliability of the technology can be measured by evaluating the days without malfunction, representing the number of days of operation not requiring intervention.

Table 3: AP-NURSE indicators

Evaluation Goal	Indicator	Measure	Measurement Tool	Data Collection Timing
AP-Nurse is accepted	Technology acceptance	Percentage of interviewers	Tailored *LimeSurvey* online questionnaire	Intermediate and exit questionnaire
AP-Nurse is easy to use	Usability on the part of the interviewer	Percentage of interviewers	Tailored *LimeSurvey* online questionnaire	Intermediate and exit questionnaire
AP-Nurse is reliable	Technology reliability	Days without malfunction	Google form to monitor the status of devices	updated on weekly basis

5. Procedures

5.1. Legal and ethical assessment

The AP-NURSE devices were developed by the STU team (WP4) be in line with all applicable legal and ethical rules. The functionality of devices as well as the data collection do not require identification of the test persons and only anonymized and encrypted data are transferred, thus issues of GDPR do not apply. The testing procedure was developed in strong cooperation with the legal department of the interested party, to minimize and even eliminate any legal and ethical issue.

5.2. User recruitment and consent procedures

Based on common discussions between PP4, PP1 and the representatives of the Social Care Centre Petržalka, the recruitment of test persons will be performed by the representatives of SCC Petržalka and the STU team, based on the specification and the functionality of AP-NURSE devices selected for testing. The recruitment will include at least 10 test persons, consisting of mobile and immobile patients as well as caregivers. All processes included in the testing procedure for which legal and ethical assessment may apply will be included in the Informed Consent between STU and the Social Care Centre Petržalka and will be summarized in D.T.3.3.2.

5.3. Procurement

Since the AP-NURSE device were developed and constructed in WP.T2, the pilot action does not require additional procurement.

5.4. Installation procedures

Installation of AP-NURSE technical solutions will be done by the STU staff during the initial phase of the pilot testing in SCC Petržalka. According the proposed plan, this will take place in April-May 2021. The devices will be installed in dedicated rooms of patients, common areas and restricted areas, based on the specifications of the SCC Petržalka. The installation of nodes will be performed without the presence of patients in the rooms. The initial threshold values for notification will be set up based on the methodology and achieved results during laboratory testing. The dedicated server for the Information System will be installed by the STU staff outside the premises of SCC Petržalka. The WiFi network allowing the connection of AP-NURSE devices will be put into operation in SCC Petržalka by the STU staff. To provide notifications to caregivers through the Information System, two system monitors will be installed in SCC Petržalka at the nurses´ desk on the first and the second floor.

5.5. User training and support

The training and the support will start with initial briefing between the STU team (PP4) and the caregivers and the representatives of SCC Petržalka, before the installation of devices. Due to Covid-19 pandemic, this will be performed online and the briefing will be recorded for to have the materials available for caregivers who could not attend the meeting, due to their work duties. The aim of this briefing will be to inform the caregivers about the basic functions of the AP-NURSE devices. After the installation of all AP-NURSE components, the caregiving personnel will be trained again by the STU staff. This training will focus on the use of devices and the IS system. PP4 will also provide a simple manual in English language. The STU staff will be available for maintenance 7 days after all devices have been installed. After this period, support will be given by phone or through email. In case of available funding and in case of necessity, STU staff could come to the centre to solve the identified problem, which cannot be solved remotely.

5.6. Operation procedure

The operation procedure will be derived from the initial briefing and the training provided by the STU staff and will be included in deliverable D.T3.3.3. It will include the steps for the installation, operation, dismounting of devices and troubleshooting. The operation of devices will be also demonstrated by the STU staff during the 7+7 days' time period allocated to be present at SSC Petržalka.

5.7. Termination procedure

As stated in the informed consent between STU and SSC Petržalka, the representatives of SSC Petržalka can withdraw their consent and therefore terminate the pilot action at any time. Otherwise the devices

will be used at least 2 months from their installation, until they are operational and the prolongation of their operation does not require additional financial expenses.

5.8. Evaluation procedures

To collect feedback, electronic questionnaire will be developed by STU and fulfilled by the representatives of SCC Petržalka. Based on the achieved feedback, teleconference will be organised, where so far uncovered aspects of the pilot testing could be discussed.

5.9. Data management procedure

Notifications and operation data from the connected devices are stored in the information system and are available for subsequent analyses. The collected data are anonym, therefore they cannot directly identify the test persons and are in line with GDPR and the data protection policies of interested parties. Data related to sleep patterns and frequency of notifications will be made available only to partners of the Integer CE NiCE-Life project and the staff of SCC Petržalka for the purpose of the deliverable D.T1.2.3 – "Analysis of the statistical data and interoperability of data". Sharing of data beyond the scope of the Intereg CE niCE-Life project cannot be done without the written consent of SCC Petržalka and STU.

5.10. Planning

The time plan of the pilot testing in Social Care Centre Petržalka is shown in Figure 4.

		2021											
Deliverable	**Content of the deliverble**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
D.3.3.1	*Design of the pilot action in Bratislava*	■	■	■									
D.3.3.2	*Engagement of test persons and consideration of legal aspects*			■	■								
D.3.3.3	*Report from briefing and training of test persons, home care givers and nurses*				■								
D.3.3.4	*Installation and testing of technical devices and applications*				■	■							
D.3.3.5	*Collection and analysis of feedback from test and support persons*					■	■	■	■	■	■		
D.3.3.6	*Summary report from the pilot action in Bratislava*									■	■	■	

Figure 4. Time plan of the pilot testing in SCC Petržalka