



FINAL VERSION OF THE MONITORING GRID

D.T2.5.4

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1. Introduction

The current development of a growing and aging population in Austria will continue in the future. On the one hand, migration gains of around 30,000 to 35,000 annually lead to an increase in population. On the other hand, in addition to the stagnating birth rate and increasing life expectancy, the strong birth cohorts, which are gradually changing into retirement age, are responsible for the aging process. According to this, the population of Austria will grow from 8.84 million (2018) by 7% to 9.43 million by 2040 and by 2080 finally by 12% to 9.93. The share of the population 65+ will increase from 18.8% (2018) to 29.3% (2080) in the next six decades.¹

This demographic development has very important effects on the health and social system. One of these effects is the pressure on public spending.² It is therefore important to react to these developments as quickly and as early as possible. One way to reduce costs in this area is to implement digital tools that enable older people to live a longer life at home,³ which is one of the aims of the niCE-life project: *“The main objective of the niCE-life project is to advance social innovations in health and care practice and support social integration and independent living of frail elderly suffering from different stages of cognitive deficits and chronic diseases through the (...) development and testing of novel technical ICT-based support solution (...)”*⁴

One of these tools is the here presented Monitoring Grid. The Monitoring Grid allows the monitoring of frailty factors, both from a functional, social and clinical perspective and shall enable the monitoring team to detect early signs of deterioration of health and social conditions. It is based on long-term experience of e-Care network of Bologna, extended based on other EU good practices and adapted to the local conditions and needs of elderly in Austria. Different measures to be performed based on different types of frailty were not defined, since if the health condition deteriorates, measures individually tailored to the person must be initiated. The implementation of these measures takes place after personal contact and individual agreement with the persons concerned. Instead, special combination options were worked out, which require urgent observation of the participant if they occur.

The present document aims to collect the most important information about of how the Monitoring Grid was developed. It consists of two thematic parts.

Initially, it gives an overview of the Monitoring Grid. The overview, which also presents the target group, is divided into three chapters. First “2.1 Modifications of the Monitoring Grid” shows the changes that were implemented upon review by other partners and discussion with local stakeholders. In a next step the concept on which the technical development is based is presented. The last point of the overview presents the home emergency call and the connection to the monitoring grid. In the needs analysis, the older people expressed the need to contact the monitoring team by themselves. For this reason, the Home Emergency Call of the Samaritan Burgenland Department of Home Care has been expanded to include another button.

Second, the technical development will be described. This includes, among other things, the features and the functionality. Screenshots of the web application have been made for better understanding.

¹

https://www.statistik.at/web_de/statistiken/menschen_und_gesellschaft/bevoelkerung/demographische_prognosen/bevoelkerungsprognosen/index.html#index1

² https://news.wko.at/news/oesterreich/Demografische_Entwicklung_in_Oesterreich.html

³ C. Fiori, The eCare Network in Bologna: No longer home alone, page 285, Italy, 2014.

⁴ Application form: CE1581 niCE-life Version: 2, page 28, 2019

2. Overview of the Monitoring Grid

The Monitoring Grid is a simple monitoring tool, which shall enable the monitoring team to detect early signs of deterioration of health and social conditions and consequently enable older people to live independently at home as long as possible. In this respect, it represents the basis for weekly calls. These calls serve to identify a deterioration in mental and physical health as quickly as possible. This means, it not only pursues the goal of recognizing a deterioration in the state of health as quickly as possible, it also intends to manage and facilitate phone interviews with frail elderly people, thus constituting a true "guide" to handle phone interviews.

The development and elaboration of the Monitoring Grid in Austria is based on the Monitoring Grid that is part of the eCare network in Bologna⁵. Like Bologna, we have divided the Monitoring Grid into three frailty factors (clinical, functional, social) and worked out some combinations, which enable the monitoring team to detect early signs of deterioration of health and social conditions.

Furthermore, the Monitoring Grid was extended based on other EU good practices: Like Herzmobil Tirol, we also use the telephone as the only means of communication. This route was chosen because the phone is widely accepted in Austria. The EU project "modulAAR - Ein modulares skalierbares AAL System als Lifestyle Element für Silver-Ager bis zu betreutem Wohnen" (2012-2015), identified difficulties of the older Austrian population in handling modern technology. This has also been confirmed by Halmdienst and Schmidt, who see the most sceptical attitude in the context of monitoring and surveillance technologies.⁶ For this reason, the simplest method of data collection - the phone - was chosen. And for this reason too, we decided against a tablet which is used by the Remote Care Helsinki.

In order to increase the acceptance of the Monitoring Grid in Austria, it was adapted to the prevailing conditions and the literature used in Austria: The functional factors are based on the activities of daily living (ADLs), which play a major role in the care assessment in Austria. Further data that are essential in Austria as part of the nursing process are the Care level and prescription fee exemption. Care level is important in order to be able to assess the degree of need for care and prescription fee exemption is important to be able to assess the financial situation. In addition, as part of the needs analysis, which was part of WP 1, the need to be able to contact the monitoring team was also expressed. For this reason, the Home emergency call provided by the Samaritan Burgenland Department of Home Care will be expanded by another button.

The target group of the Monitoring Grid consists of all 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)

The third criterion is accordingly not mandatory.

⁵ C. Fiori, The eCare Network in Bologna: No longer home alone, page 285, Italy, 2014.

⁶ N. Halmdienst und M. Schmidt, Digitale Kompetenz der Generation 50+ in Österreich, page 11, 2018.

2.1. Modifications of the Monitoring Grid

Upon review by other partners and discussion with local stakeholders from Higher education and research, other NGOs and Local/ Regional Public Authority the following changes in the concept and the technical development have been made:

2.1.1. Modifications in the concept

The following changes have been made to personal data

- Address and phone number was added to the interviewee's data and to family doctor
- Care level was adapted: "No care level" was added
- Information about the interview (Interviewer, Interview date, duration of the call, personal assessment of the call) was part of the personal data. These 4 points are now the last point of an interview (after social factors).
- The order of some requested data has been changed

2.1.2. Technical modifications in general

- A secured connection HTTPS was established (self-signed cert)
- Ability of the system to automatic redirect all HTTP requests to HTTPS
- Change in person list: all action possibilities (Add interview, Analysis, Edit personal data, Create user account for the interviewee, Delete person) are included in the dropdown menu
- There are now 3 types of user:
 1. "Admin", which has permission to see all data and to create an unlimited number of "interviewers". In this regard settings of admin account were added: Password and user name can be changed.
 2. "Interviewer" only has permission to manage assigned interviews and to edit his/ her own information (Password and user name can be changed).
 3. "Interviewees" also can have an account to see their own data (it can be created immediately or at any time later): The password can be changed by the admin or the logged in user can change the password himself. Username is generated by the system (name + number). The interviewees have only access to their own information. Activities like create new person/ see information about another person are blocked.
- Extension to the German language and Definition of German as default language
- Some fields have been redefined from fields that **MUST** be filled in to fields that **CAN** be filled in: Last visit of the hospital before participation of the Monitoring Grid, Last fall before participation of the Monitoring Grid, Reason of the visit of the hospital before participation of the Monitoring Grid, Nursing Care at home, Family doctor name + address + phone number, Last employment.
- Information about the interview (Interviewer, Interview date, duration of the call, personal assessment of the call) was part of personal data. These 4 points are now the last point of an interview under the headline "interview data" (after social factors).
- "Duration of the call" and "Reason of the visit of the hospital before participation of the Monitoring Grid" have been converted into a text field.
- Order of some data (personal data, clinical factors) has been changed.
- The possibility for comments was added to "skin changes", all questions in functional factors and all questions in social factors.
- Combinations, as described in 2.2.7 Combinations, have been added.

- New interview with existing person: Another column has been added which contains information about answer from the last interview
- Table with comment overview was added
- Automatic calculation of duration of the call was added

2.1.3. Technical modifications of the charts

- Charts for functional factors and social factors were added.
- Line “total sum” has been removed for better clarity and some lines in general got a new colour. The lines now have more contrast to the other lines.
- A legend has been added above all diagrams: “The more points, the worse is the state of health”
- The background of all diagrams has been marked in colour: progression from green to red shall make the critical areas visible at a glance.
- Line diagrams for clinical, functional and social factors: the line for the total sum has been removed and the scaling of the Y-axis was set to 0-100 (50 for social factors).

2.2. Presentation of the concept of the Monitoring Grid

As mentioned in the introduction, one of the aims of the Monitoring Grid is to identify a deterioration in mental and physical health of elderly persons as quickly as possible. To ensure this, the residential area managers call the elderly once a week. The Monitoring Grid provides the basis for the telephone calls and the evaluation.

To be able to collect and evaluate the data effectively, a distinction is made between the following categories: ⁷

1. Personal data
2. Medical history
3. Clinical factors
4. Functional factors
5. Social factors
6. Interview data

As you can see in the figures 3 - 5, the possible answers in the categories “clinical factors”, “functional factors” and “social factors” are assigned to points. The more points the interviewee gains, the worse is the state of health. Points from 0 - healthy, no limitations, ... - until 100 (50 for social factors) - ill, great limitations, ... - can be reached per item. The figures also show that the different items in each category are assigned to a different number of points. It is necessary to weight the points. Some item will have more impact on the health status than others.

For example:

Person XY says:

- Yes, she has a serious heart and respiratory disease -> 100 points
- Yes, she has diabetes, but only mild one -> 50 points

This means after answering these two questions, the person gets 150 points from the system.

In the following chapter the categories are described in more detail:

⁷ Samaritan Burgenland Department of Home Care, “Project “niCE-life”: D.T2.5.2 Review of the “Monitoring Grid” and EU good practise,” Austria, 2020



2.2.1. Category “Personal data”

The first category is the category of the personal data of the interviewee, which are shown in the figure below:

1	Personal Data Interviewee		Comments	Further help
1.1	Name of the interviewee	Name, adress and telephone number		enter once
1.2	Date since which the interviewee is using the monitoring grid	Date		enter once
1.3	Date of birth	Date		enter once
1.4	Nursing Care at home (Name of the organisation)	Name of the Organisation		inquire every 6 months
1.5	Family doctor	Name, adress and telephone number		inquire every 6 months
1.6	Care level	Drop Down (No care level + 1-7)		inquire every 6 months
1.7	Highest completed level of education	Drop Down		enter once
1.8	Exemption of the prescription fee	Yes/ No		inquire every 6 months
1.9	Living will available	Yes/ No		inquire every 6 months
1.10	Last employment	Name		enter once
1.11	Person of trust	Name, adress and telephone number		inquire every 6 months

Figure 1: Personal data

Some of the above items are self-explanatory, others will be briefly described in the following passage:

- **1.1 Name of the interviewee:** The name is only mentioned in the context of data collection. Evaluations that may be published are created anonymously. The name of the interviewee only needs to be entered once (this is also true for “1.2 Date since which the interviewee is using the Monitoring Grid”, “1.3 Date of birth”, “1.7 Highest completed level of education”, “1.10 Last employment”). This is data, that does not change. The information for the others should be requested every 6 months.
- **1.6 Care level:** In Austria, the need for care is measured by the care level. This is why this is important for us.
- **1.8 Exemption of the prescription fee:** This is an indicator of income. In Austria, people get a prescription under certain conditions. One of these requirements is low income.
- **1.11 Person of trust:** This information is important if something happens during the phone call. In an emergency case the residential area manager has in addition to the “1.4 Family doctor” contact and the “1.5 Nursing Care at home” contact also the contact dates of the person of trust.



2.2.2. Category “Medical history”

The following figure shows the requested data in the category “medical history”:

2	Medical history		Comments	
2.1	Last visit of the hospital before participation of the Monitoring Grid	Date	Reason	enter once
2.2	Last fall before participation of the Monitoring Grid	Date		enter once

Figure 2: Medical history

These two indicators “2.1 Last visit of the hospital before participation” and “2.2 Last fall” are important for assessing the participant’s state of health.



2.2.3. Category “Clinical factors”

3	Clinical factors	Yes, serious	Yes, mild	No	Don't know/ Not relevant	Comments
3.1	Heart and respiratory disease	100	50	0	0	Type of disease
3.2	Chronic disease, e.g. Diabetes, Hypertension	100	50	0	0	Type of disease
3.3	Mental Diseases, e.g Depression	100	50	0	0	Type of disease
3.4	Diseases with frequent visits of the hospital	100	50	0	0	Type of disease
3.5	Further diseases (Does this disease result in serious suffering for you? Yes -> Yes, serious (100) No -> Yes, mild (50))	100	50	0	0	Which?
3.6	Medication (With more than 4 drugs -> Yes, serious With less or equal 4 drugs -> Yes, mild (50))	100	50	0	0	Which?
3.7	Chronic pain	100	50	0	0	Localisation
3.8	Skin changes	50		0		
3.9	Wounds	75	50	0	0	
3.10	Were you in the hospital last week?	100	50	0	0	Reason
3.11	Were you at the family doctor last week?	100	50	0	0	Reason
3.12	Do you regularly measure your blood pressure? (only if the person has indicated that he/ she has high/ low blood pressure)	0		10	0	Values/ Results
3.13	Do you regularly measure your blood sugar? (only if the person has indicated that he/ she has diabetes)	0		10	0	Values/ Results

Figure 3: Clinical factors



The answer options are “Yes, serious”, “Yes, mild”, “No”, “Don’t know, not relevant”. Depending on which answer is given the respondents gain more or less points. In addition, there is a field available in which the residential area manager can fill in some comments.

The clinical factors ask about the physical state of health from the elderly (figure 3). The older person is specifically asked whether he or she suffers from one or more of the following diseases and also how serious the disease is:

- 3.1 Heart and respiratory diseases
- 3.2 Chronic diseases
- 3.3 Mental diseases
- 3.4 Diseases with frequent visits of the hospital
- 3.5 Further diseases: In order to be able to differentiate between “Yes, serious” and “Yes, mild”, the following question will be asked: Does this disease result in serious suffering for you? If this question is answered with yes, the disease is a serious one and the asked person gets 100 points. If it is answered with, the disease is a mild one and the asked person gets 50 points.
- 3.6 Medication: If the asked person is taking more than 4 drugs, the answer option “Yes, serious” should be selected. The person gets 100 points. If the person is taking less or equal 4 drugs, the answer option “Yes, mild” should be selected. The person gets 50 points.
- 3.7 Chronic pain: If the interviewee suffers from severe pain, the person gets 100 points. Otherwise she/ he gets 50 or 0 points.
- 3.8 Skin changes: If the interviewee perceives skin changes, she/ he gets 50 points, otherwise 0 points.
- 3.9 Wounds: If the person questioned has severe wounds, she/ he gets 75 points, otherwise 50 or 0 points.
- 3.10 Were you in the hospital last week?: When the respondent has been in the hospital for a serious problem, the person gets 100 points. If the respondent has been in the hospital for a check-up or something like this, she/ he gets 50 points. If the respondent has not been in the hospital, she/ he gets 0 points.
- 3.11 Where you at the family doctor last week?: See 3.10
- 3.12 Do you regularly measure your blood pressure?: This question has only to be answered, if the interviewee stated in the question 3.2 Chronic disease, that she suffers from high/ low blood pressure. If she/ he regularly measures her/ his blood pressure, the person gets 0 points. If she/ he does not, 10 points are awarded.
- 3.13 Do you regularly measure you blood sugar?: This question has only to be answered, if the interviewee stated in the question 3.2 Chronic disease, that she suffers from diabetes. If she/ he regularly measures her/ his blood sugar, the person gets 0 points. If she/ he does not, 10 points are awarded.



2.2.4. Category “Functional factors”

4	Functional factors	Yes	Rather yes	Rather no	No	Don't know/ Not relevant	Comments
4.1	Do you feel well?	0	10	50	75	0	
4.2	Do you sleep well?	0	10	50	75	0	
4.3	Did you go for a walk this week?	0			80	0	
4.4	Did you fall last week?	80			0	0	
4.5	Have you lost weight?	80			0	0	
4.6	Do you have fever?	100			0	0	
4.7	Do you have problems putting on and/ or taking off your clothes?	75	50	10	0	0	
4.8	Do you need help washing yourself?	75	50	20	0	0	
4.9	Do you have respiratory problems?	100	60	40	0	0	
4.10	Has your sense of taste or smell changed?	80	40	20	0	0	
4.11	Do you make use of occupational or physiotherapy?	20			0	0	
	Maximum sum			760			

Figure 4: Functional factors

The functional factors are based on the 12 activities of daily living (ADLs). Activities of daily living (ADLs or ADL) is a term used in healthcare to refer to people's daily self-care activities. The concept of ADLs was originally proposed in the 1950s by Sidney Katz and his team at the Benjamin Rose Hospital in Cleveland, Ohio and has been added to and refined by a variety of researchers since that time. Health professionals often use a person's ability or inability to perform ADLs as a measurement of their functional status, particularly in regard to people post injury, with disabilities and the elderly. Common ADLs include feeding ourselves, bathing, dressing, grooming, work, homemaking, cleaning oneself after defecating and leisure. ADLs consequently refer to the most basic functions of living.⁸ They represent key life tasks that people need to manage, in order to live at home and be fully independent.⁹ The answer options are “Yes”, “Rather yes”, “Rather no”, “No” and “Don’t know, not relevant”. Depending on which answer is given the respondents get more or less points. The exact point distribution of points can be found in figure 4. In addition, there is a field available in which the residential area manager can fill in some comments.

⁸ [https://en.wikipedia.org/wiki/Activities_of_daily_living#:~:text=Activities%20of%20daily%20living%20\(ADLs,people's%20daily%20self%2Dcare%20activities.&text=Common%20ADLs%20include%20feeding%20ourselves,oneself%20after%20defecating%20and%20leisure.](https://en.wikipedia.org/wiki/Activities_of_daily_living#:~:text=Activities%20of%20daily%20living%20(ADLs,people's%20daily%20self%2Dcare%20activities.&text=Common%20ADLs%20include%20feeding%20ourselves,oneself%20after%20defecating%20and%20leisure.)

⁹ <https://betterhealthwhileaging.net/what-are-adls-and-iadls/>



2.2.5. Category “Social factors”

Since social isolation was identified in the needs assessment¹, which was worked out in WP 1, as a major potential threat to health status, special attention should be given to this issue.

5	Social factors (Social Isolation)	Yes	No	Don't know/ Not relevant	Comments
5.1	Do you live alone?	50	0	0	
5.2	Do you get support from family, neighbours or friends?	0	50	0	
5.3	Do you make use of food delivering or purchasing guide?	0	50	0	
5.4	Do you make regular use of home care?	0	50	0	
5.5	Do you go to the day care center regularly?	0	50	0	
5.6	Do you make regular use of home visits from doctors?	0	50	0	
5.7	Do you get help with cleaning work?	0	50	0	
	Maximum sum	350			

Figure 5: Social factors

The answer options are “Yes”, “No” and “Don’t know, not relevant”. Depending on which answer is given the respondents get more or less points. In addition, there is a field available in which the residential area manager can fill in some comments.

The social factors are important to counteract possible social isolation and must be seen in this context. This means: If an item contributes to social isolation, 50 points are given, for example:

- 5.1 Do you live alone? When a person lives alone, there is a risk of becoming socially isolated. If this question is answered with “yes”, the person receives 50 points.
- 5.2 Do you get support from family, neighbours or friends? If a person does not receive support from family, neighbours or friends, there is a risk of becoming socially isolated. If this question is answered with “no”, the person receives 50 points.

Delivering of food or purchasing guide, regular use of home care, regular visit of a day care center, home visits from doctors, or help with cleaning work are also some kind of social contact. If this social contact is given the risk of becoming socially isolated is lower. So if these questions are answered with “no”, the person receives 50 points.



2.2.6. Interview data

After every interview the interviewer gives information about the following:

6	Interview data		
6.1	Interviewer	Name	
6.2	Interview date	Date	
6.3	Duration of the call (in minutes)	Time in minutes	
6.4	Personal Assessment of the call	list of possible choices	Type of communication, Voice range, Participant can follow the conversation, ...

Figure 6: Interview data

The following interview data are asked:

- 6.1 Interviewer: This field shows the name of the interviewer and is automatically pre-filled by the system.
- 6.2 Interview date shows the date, on which the interview was conducted
- 6.3 Duration of the call: This field is automatically calculated by the system.
- 6.4 Personal assessment of the call: To have more information about the interview, the interviewer has the possibility to enter the personal impression of the interview.

2.2.7. Combinations

These possible combinations were worked out together with our residential area managers and should be observed separately. If one or more of these combinations occur, the system should inform the residential area manager, who then decide whether steps need to be taken.

Possible combinations			
Consecutive number	Name	Draft number	Possible answers
1	Fall	4.4	80
	Chronic diseases	3.2	100
	Hospital	3.10	100
2	Chronic pain	3.5	100
	Feeling bad	4.1	75
	No support	5.2	75
3	Depression	3.3	100
	Living alone	5.1	50
	No support	5.2	75
4	Medication	3.9	100
	Depression	3.3	100
	Chronic diseases	3.2	100
5	Chronic diseases	3.2	100
	No support	5.2	75
6	Diabetes	3.2	100
	Wounds	3.7	75
7	Visiting family doctor last week	3.11	100
	Fever	4.6	100
	Diabetes	3.2	100
	Chronic wounds	3.7	75
8	Chronic diseases	3.2	100
	No visit to the hospital	3.10	0
9	Chronic diseases	3.2	100
	Wounds	3.7	75
	Fever	4.6	100

Figure 7: Possible combinations



2.2.8. Presentation of results

In order to be able to observe the state of health over time, it was decided to display it in a line diagram and a radar graph. Examples of what this might look are shown in Figure 8, 9 and 10.

Each category shall be mapped separately in a line diagram (Figure 8 - Example for clinical factors), but also a line diagram should be worked out, where all results can be seen summarized (Figure 9 - Example for a line diagram, where all categories are summarized). The same is true for the radar graphs (Figure 10 - Example for a radar graph, which shows the clinical factors).

Contrary to the first version, the background should show a coloured gradient from red to green in order to present the danger zone at a glance.

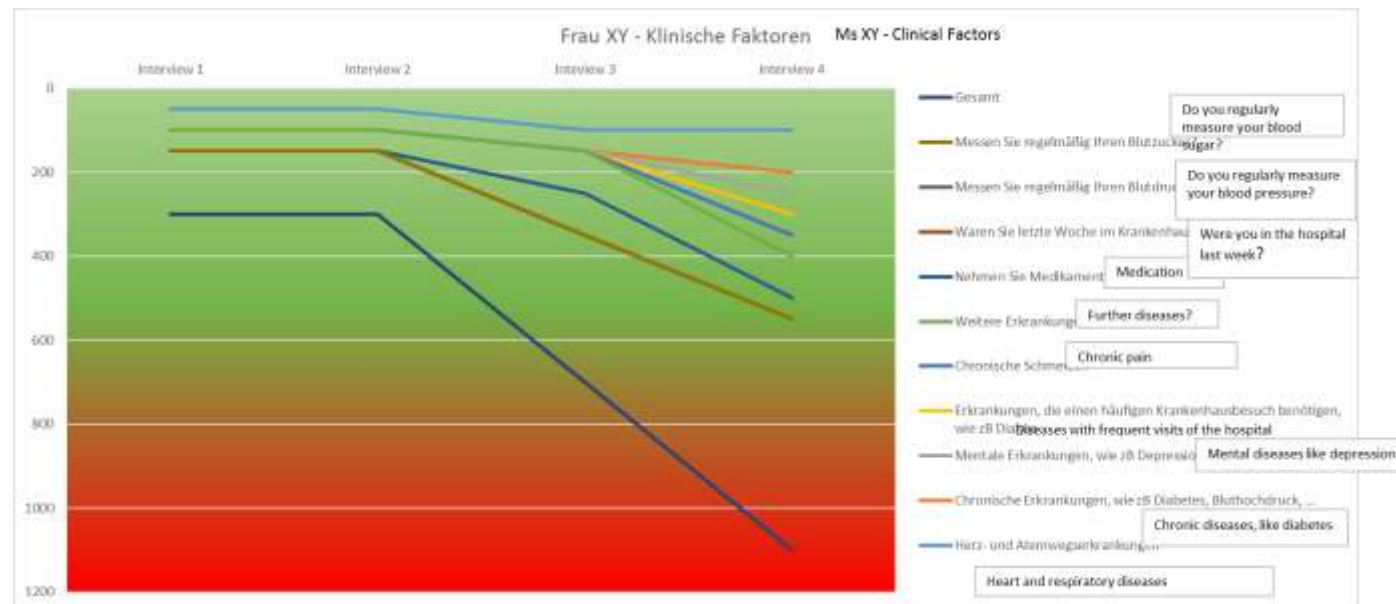


Figure 8: Presentation of the results in a line diagram with gradient background (Clinical factors)

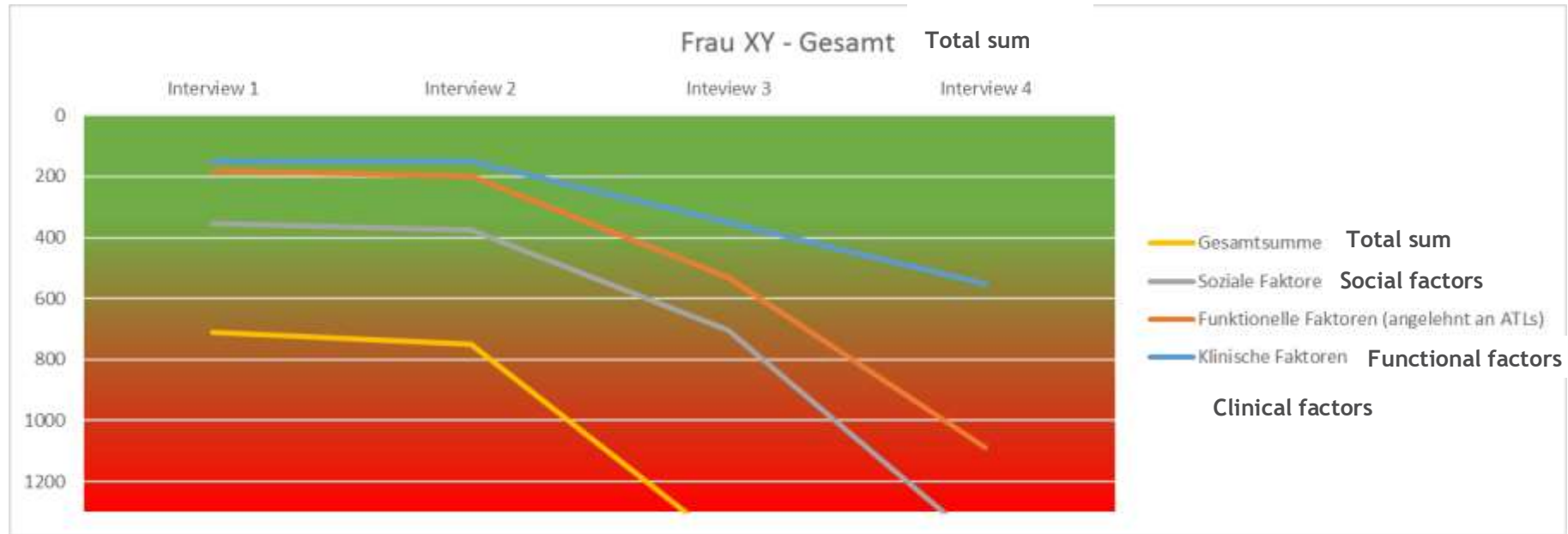


Figure 9: Presentation of the result in a line diagram with gradient background (Total sum)

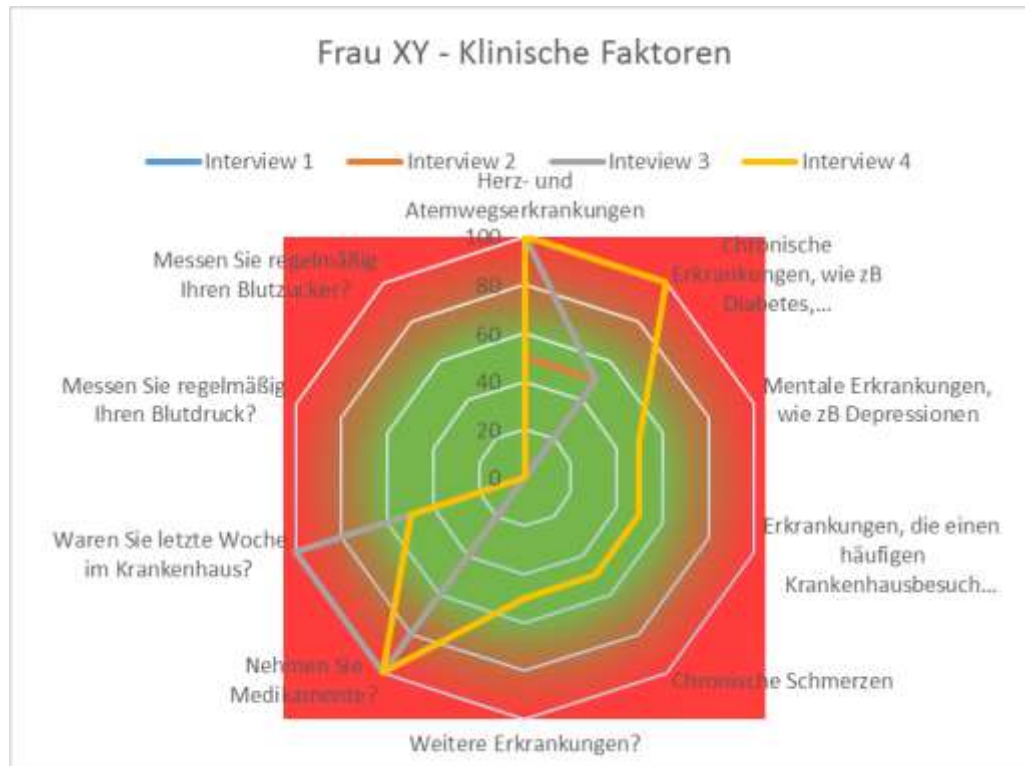


Figure 10: Presentation of the result in a radar diagram with gradient background (clinical factors)

2.3. Home emergency call ¹⁰

The monitoring grid has been extended by the home emergency call.

In the course of working out the needs of the elderly, it turned out that the elderly not only want to be called, but also want to be able to call the monitoring team themselves.¹¹ To make this possible, the home emergency call already in use will be extended by this function. The yellow button, shown in Figure 11, shall then connect the user of the home emergency call to the responsible person of the Samaritan Burgenland Department of Home Care. This button is therefore marked as a “service button” for the participants.



Figure 11: Home emergency call of the Samaritan Burgenland Department of Home Care

Anyone who wants to have a home emergency call can order it from the Samaritan Burgenland Department of Home Care. There is a one-time connection fee of € 49.90 and a monthly fee of € 22.90 (for fixed network) or € 34.90 (for Samaritan Federation GSM SIM Card). In Burgenland, there are currently 198 people living at home and 4 people living in assisted living homes, who take advantage of the home emergency call (as at June 10th 2020).

The home emergency call helps people in crisis situations in the following steps:

1. A **transmitter**, worn on the wrist or around the neck, is connected to the control centre of the Samaritan Burgenland Department of Home Care
2. In an emergency, the person who needs help presses the transmitter and thus **triggers an alarm** in the rescue centre of the Samaritan Burgenland Department of Home Care. This is manned 7 days a week, 24 hours a day and is therefore always available.
3. The integrated hands-free facility of the base station can be used to **communicate** with the headquarters. The data of the calling person is immediately transmitted to the rescue centre and the situation will be evaluated. The rescue workers notify the contact persons specified and, if necessary, immediately take the appropriate measures.
4. Depending on the respective accident or emergency situation, all **appropriate measures will be taken**. Ambulances are ready 24 hours a day.

The device is checked daily and is regularly maintained and monitored. The battery lasts for 120 hours in the event of a power failure.

¹⁰https://www.samariterbund.net/pflege-und-betreuung/notrufsysteme?pk_campaign=HNR&pk_kwd=duscha&gclid=EAlaIqobChMlZLbI9D86wIV1fhRCh2g4QozEAAYASAAEglpE_D_BwE. [Accessed 22 09 2020]

¹¹ Samaritan Burgenland Department of Home Care, “Project: niCE-life: D.T1.1.4 Summarisation of interviews,” page 5, Austria, 2020.

3. Technical development

Technical realization of the proposed solution is based on JAVA platform where so-called thin client is being used. Spring Framework is a Java platform that provides comprehensive infrastructure support for developing Java applications. The ORM module provides integration layers for object-relational mapping APIs, including Hibernate, which was used in our case. The Web layer consists of the Spring-MVC framework and is based on Model-View-Controller framework. The application is secured over set of protocols, so the data are protected.

The resulting application consists of several main components. One of them is a login form. This page serves for secure authentication and authorization of the user. For this purpose, a username and password must be provided.

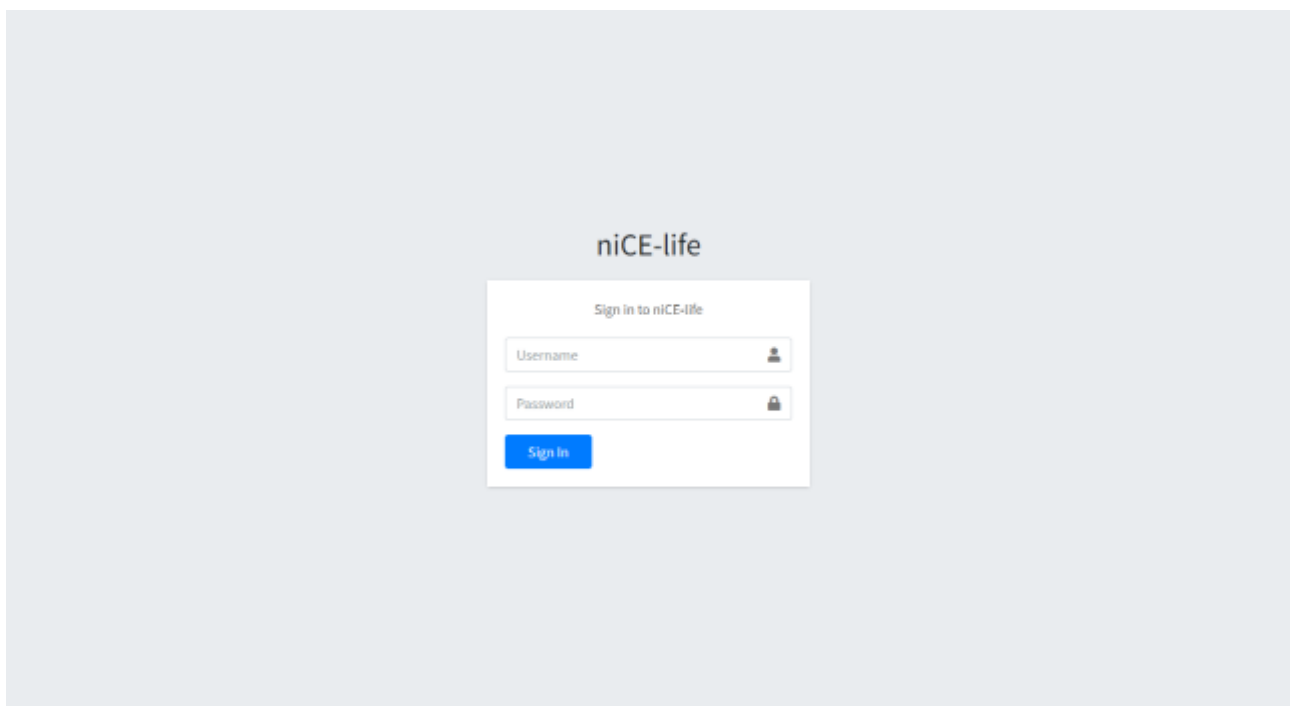


Figure 12: Login Form

In case of successful login, user can see list of persons who are monitored by the system. In case the number of monitored people will grow in future, there is a search option which can immediately locate a person.



ID	Interference Name	Start using MB	Date of birth	Actions
1	Sylvia L. L. L.	12/11/2000	04/04/1998	Actions

Figure 13: Person list

In the left dark grey column in figure 13 two applications for **managing the interviewees** are shown:

1. Person list, which shows all participants (explained above)
2. New Person, which is used to create a new participant (explained below):

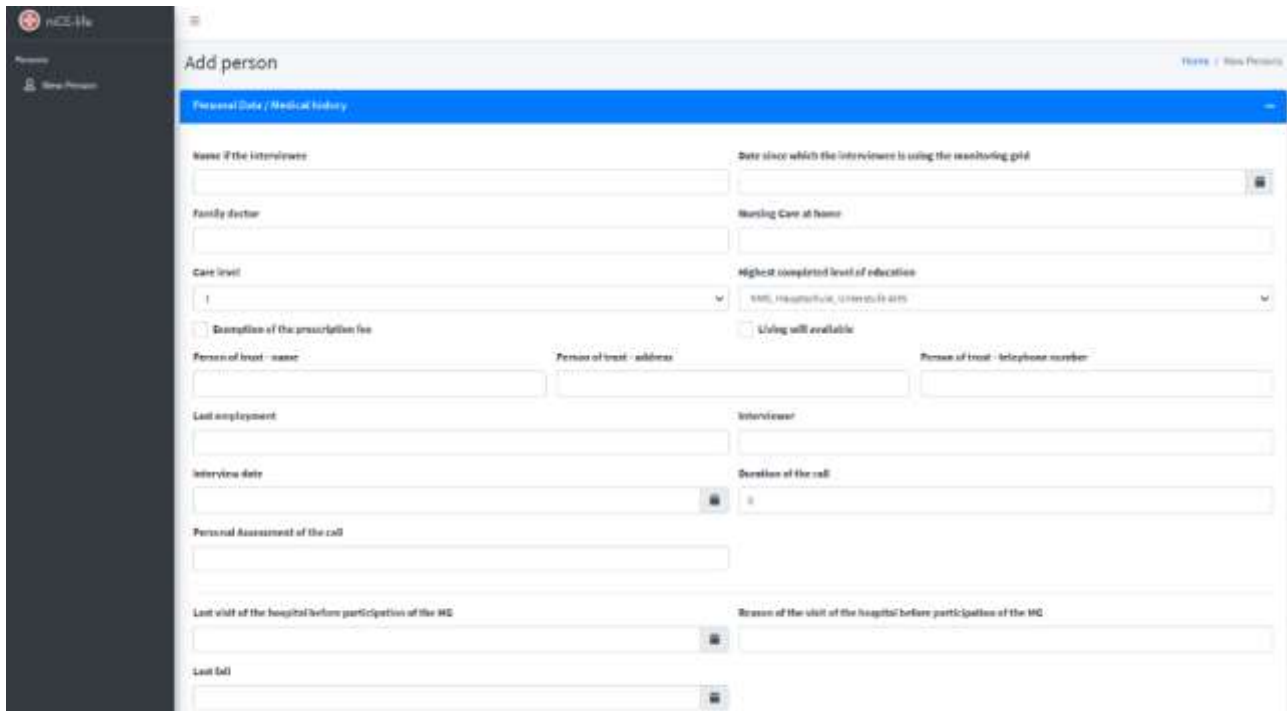


Figure 14: Add new person - personal data form

When a new record is available it depicts in another web page:



Figure 15: Add new person - new person and first interview

The button “Actions” in the **Person list** (figure 13) gives the user the opportunity to choose from the following applications:

- Add interview
- Analysis
- Edit personal data
- Create user account
- Delete person

These functions are briefly described below:

1. Add interview

To each monitored person can be regularly added result of questionnaires, which are then securely stored to database and evaluated to assess current state. There are available several types of interview forms, which are depicted below:

Question	Yes, serious	Yes, mild	No	Don't know / Not relevant	Last interview	Comments
Heart and respiratory disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes, mild	Details
Chronic disease, e.g. Diabetes, Hypertension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes, mild	Details
Mental diseases, e.g. depression	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes, mild	Details
Diseases with frequent visits of the hospital	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes, mild	Details
Further diseases <small>If this disease results in serious suffering for the patient please → Yes, serious; if not → Yes, mild</small>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes, mild	Details
Medication <small>If the person doesn't change → Yes, serious; with data or equal 8 drugs → Yes, mild</small>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes, mild	Details
Chronic pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes, mild	Details
Wounds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes, mild	Details
Side changes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes, serious	Details

Figure 16: Clinical factors - interview form



Functional factors							
Question	Yes	Rather yes	Rather no	No	Don't know / Not relevant	Last Interview	Comments
Do you feel well?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Rather yes	<input type="text" value="Details"/>
Do you sleep well?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Rather yes	<input type="text" value="Details"/>
Did you go for a walk this week?	<input type="radio"/>			<input type="radio"/>	<input type="radio"/>	Yes	<input type="text" value="Details"/>
Did you fall last week?	<input type="radio"/>			<input type="radio"/>	<input type="radio"/>	Yes	<input type="text" value="Details"/>
Have you lost weight?	<input type="radio"/>			<input type="radio"/>	<input type="radio"/>	Yes	<input type="text" value="Details"/>
Do you have fever?	<input type="radio"/>			<input type="radio"/>	<input type="radio"/>	Yes	<input type="text" value="Details"/>
Do you have problems putting on and / or taking off your clothes?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	<input type="text" value="Details"/>
Do you need help washing yourself?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Rather yes	<input type="text" value="Details"/>
Do you have respiratory problems?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	<input type="text" value="Details"/>
Has your sense of taste or smell changed?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	<input type="text" value="Details"/>

Figure 17: Functional factors - interview form

Social factors					
Question	Yes	No	Don't know / Not relevant	Last Interview	Comments
Do you live alone?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	<input type="text" value="Details"/>
Do you get support from family, neighbours or friends?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	<input type="text" value="Details"/>
Do you make use of food delivering or purchasing guide?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	<input type="text" value="Details"/>
Do you make regular use of home care?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	<input type="text" value="Details"/>
Do you go to the day care center regularly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Yes	<input type="text" value="Details"/>
Do you make regular use of home visits from doctors?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Don't know / Not relevant	<input type="text" value="Details"/>
Do you get help with cleaning work?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Don't know / Not relevant	<input type="text" value="Details"/>

Figure 18: Social factors - interview form

As you can see in Figures 16-18, in addition to the answer options “Yes”, “No”, “Don’t know/ Not relevant”, the answer of the last interview is also shown.

2. Analysis

This point gives an overview of charts, comments, interviews and combinations.



ID	Interviewer Name	Interview Date	Number of combinations	Actions
4	Admin	01/15/2020	0	Show Interview Show Combinations
5	Admin	01/12/2020	2	Show Interview Show Combinations
6	Admin	01/04/2021	2	Show Interview Show Combinations

Showing 1 to 3 of 3 entries

Previous 1 Next

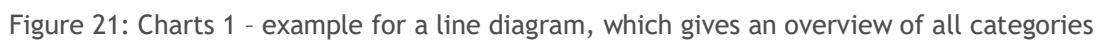
Figure 19: Overview of analysis

Results of the interview is evaluated and visualized using three types of **charts**, namely a line diagram, which should give an overview of the state of health (figure 21), a line diagram for the clinical, functional and social factors (figure 22) and a spider diagram for the clinical, functional and social factors (figure 23). As mentioned in “2.1 Modifications of the Monitoring Grid” the background of all diagrams has been marked in colour. The progression from green to red shall make the critical areas visible at a glance.



Chart Type	Action
Person XY: Overall	+
Person - XY: Clinical factors	+
Person - XY: Clinical factors - radar graph	+
Person - XY: Functional factors	+
Person - XY: Functional factors - radar graph	+
Person - XY: Social factors	+
Person - XY: Social factors - radar graph	+

Figure 20: Charts - overview



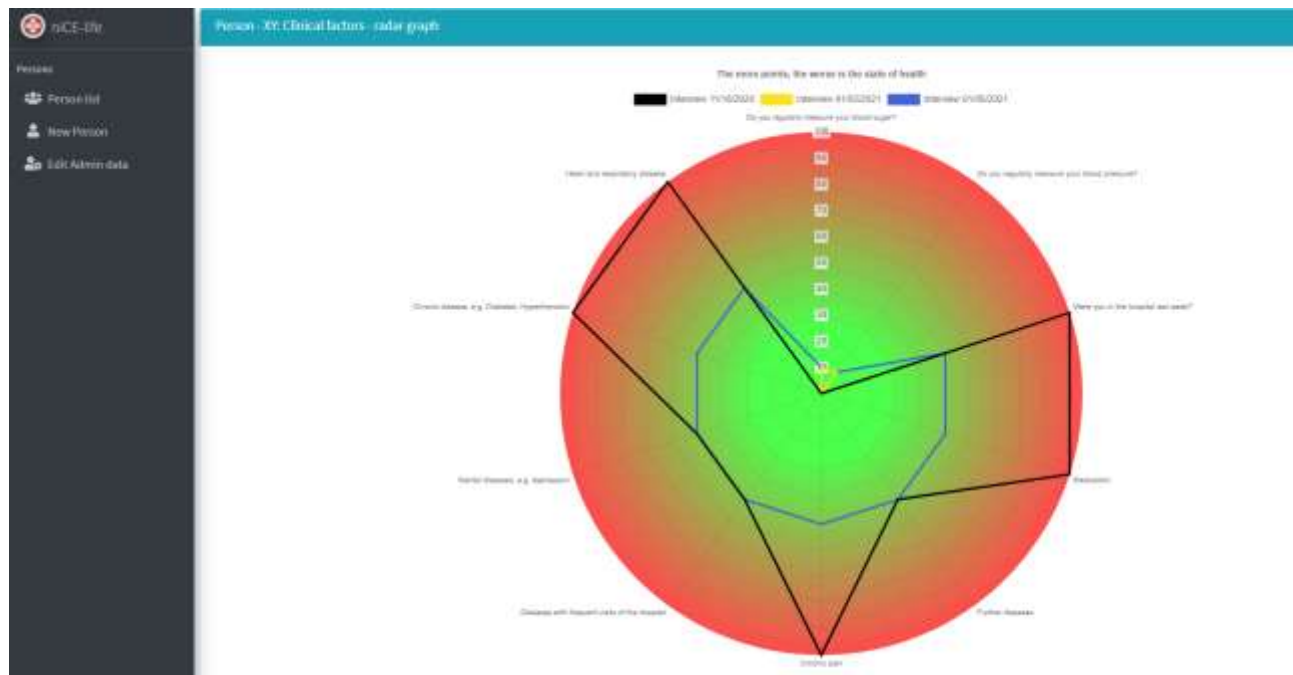


Figure 23: Charts 3 - Example for a radar graph, which shows the clinical factors

The "Actions" button also enables to display all comments made by the interviewed people:

Comments Overview - All

Interview	Heart and respiratory disease	Chronic disease, e.g. Diabetes, Hypertension	Mental diseases, e.g. depression	Diseases with frequent visits of the hospital	Further diseases	
Interview - 11/16/2020	-	-	-	-	-	-
Interview - 01/02/2021	-	-	-	-	-	-
Interview - 01/05/2021	-	-	-	-	-	-

Close

Figure 24: Example for the representation of comments (clinical factors)

Comments can be shown for each factor (clinical, functional, social) or all in one table.

The button "show interview" shows the complete interview of the respective day.

Last analysis possibility is to show possible **combinations**, which need further observation:

Interview '11/16/2020' - combination list

×

Combination #1

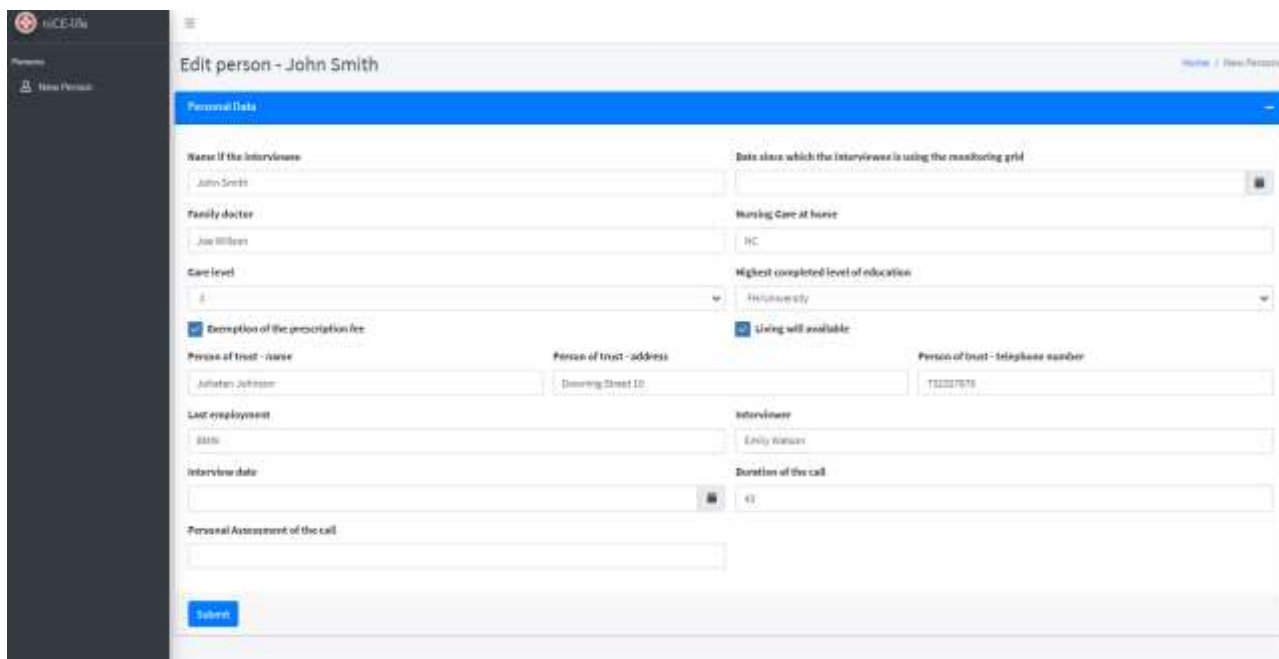
Problem	Answer	Value
Fall	Yes	80
Chronic disease	Yes, serious	100
Hospital	Yes, serious	100

Close

Figure 25: Example for a possible combination

3. Edit personal data

Any person, which is in database, can be easily updated using the button “Edit personal data”.



Edit person - John Smith

Personal Data

Name of the interviewee: John Smith

Family doctor: Joe Williams

Care level: 8

Exception of the prescription fee: ☒

Person of trust - name: Jonathan Johnson

Person of trust - address: Downing Street 10

Person of trust - telephone number: 712327878

Duration of the call: 45

Interviewer: Emily Watson

Personal Assessment of the call:

Submit

Figure 26: Edit existing person

4. Create user account

The interviewee has the possibility to get an own account, where she/ he can see all his data.



Figure 27: Create a user for the interviewee

The account can be created immediately or at any time later. The user “interviewee” is allowed to see only his own information. Activities like create new person/ see information about another person are blocked.

In addition to the options for managing the participants, figure 13 also shows the three **setting options** that the admin has:

1. Interviewer list shows all the persons, who are able to conduct interviews
2. “New interviewer” is used to create a new interviewer

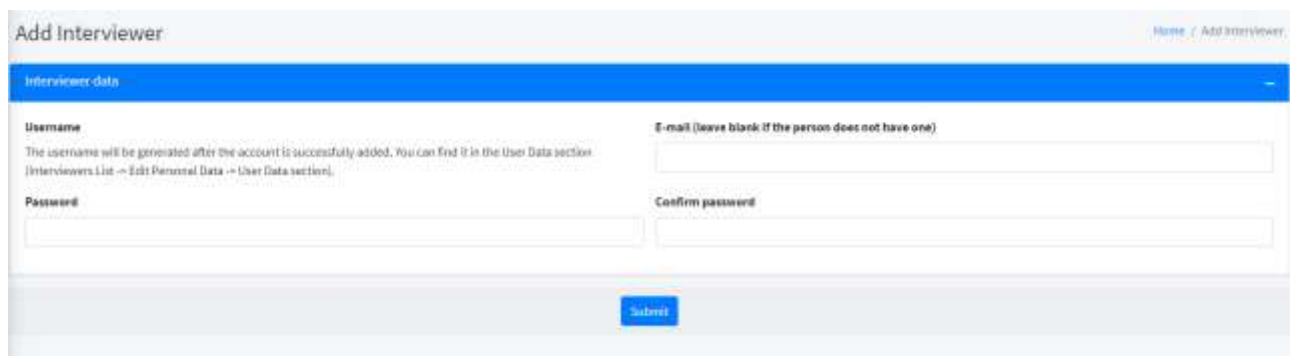


Figure 28: Add interviewer



3. Edit admin data

In addition to the user for the interviewed person, you can also edit the admin user:

The screenshot shows the 'Admin account settings' page. On the left is a dark sidebar with a 'niCE-life' logo and a menu with 'Persons Edit', 'New Person', and 'Edit Admin data'. The main content area has a title 'Admin account settings' and a breadcrumb 'Home / Edit Person data'. Below the title is a blue bar labeled 'User data'. The form contains the following fields: 'Username' with the value 'admin', 'Email (leave blank if the person does not have one)' with the value 'wyszkola@wp.pl', 'Name of the person' with the value 'Admin', and 'Address' which is empty. There is a 'Change Password' checkbox and two password input fields labeled 'Password' and 'Confirm password'. A blue 'Submit' button is at the bottom right.

Figure 29: Edit Admin data

The password and the username of the admin account can be changed at any time.

4. Conclusion

This document summarizes the concept and the technical development of the Monitoring Grid. It consists besides the introduction of two main chapters, namely overview of the Monitoring Grid and technical development.

Introduction discusses the demographic change and the associated problems. Because of these problems (mainly the effects of demographic development) it is necessary to develop new technologies that enable older people to live an independent life at home for as long as possible and therefore to reduce the costs. One of these new technologies is the Monitoring Grid, which allows the monitoring of frailty factors, both from a functional, social and clinical perspective and shall enable the monitoring team to detect early signs of deterioration of health and social conditions. It is based on long-term experience of e-Care network of Bologna, extended based on other EU good practices and adapted to the local conditions and needs of elderly in Austria. Different measures to be performed based on different types of frailty were not defined, since if the health condition deteriorates, measures individually tailored to the person must be initiated. The implementation of these measures takes place after personal contact and individual agreement with the persons concerned. Instead, special combination options were worked out, which require urgent observation of the participant if they occur.

Overview was divided into three main parts, namely “2.1 Modifications of the Monitoring Grid”, “2.2 Presentation of the concept of the Monitoring Grid” and “2.3 Home emergency call”. The first part describes the changes, that were implemented upon review by other partners and discussion with local stakeholders. The concept, which represents the basis for the technical implementation of the monitoring grid includes the individual categories and possible combinations. If these combinations occur, the monitoring team should be informed by the system and this shall enable to detect early sign of deterioration of health and social conditions. Last but not least the home emergency call and the connection to the Monitoring Grid was described.

The last chapter describes the **technical development**. The Monitoring Grid was implemented using platform independent technology based on JAVA platform and frameworks like Spring, Spring MVC. The resulting application runs as a web service and provides an interface for secure tracking health status of monitored subjects.

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