SMARTER LIVES meets uDay 2019

Digitalization and Quality of Life in an aging society

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In the past, research and development (R&D) in the field of Ambient Assisted Living / Active & Assisted Living (AAL) has strongly focused on specific needs of primary and secondary users. Both, care professionals and the scientific community agree that modern technology can help older adults to live longer, autonomously and with a higher degree of freedom as well as self-determination in a familiar environment and to relieve not only the care system but also secondary user groups. This has been shown in several studies, research papers and at conferences (e.g. SMARTER LIVES, uDay). As pointed out by *Piazolo et al.* [1] and shown by *Ates et al.* [2] a holistic as well as design orientated and participatory research approach, which ensures the orchestration and involvement of all relevant stakeholders in the design and development process of AAL solutions, leads to more effective and profound results. The application environment and the existing knowledge base [3] have to be taken under strong consideration by researchers, developers, solution and service providers as well as the formal secondary users; especially since the digitalization has reached out to all areas of society and therefore will have an ever stronger influence on the quality of life.

In the course of the conference SMARTER LIVES stakeholders in the field of AAL meet once a year to exchange knowledge and views regarding “innovative solutions for an ageing society” to design future concepts, solutions, services and processes that bear in themselves a more holistic and design science research aligned approach.

In 2019, the conference SMARTER LIVES meets uDay 2019 took place on the 28th of May at Eurac Research in Bolzano, Italy. Again, room was provided to innovative solution and service providers to present their AAL and smart care products to an audience of diverse stakeholders. Additional to the fair, tracks, sessions and panel discussions cover research, business, social and political topics.

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Prior to the SMARTER LIVES meets uDay 2019 a 'Call for Papers' was announced with the goal to contribute to a scientific debate concerning the field of AAL. The 'Call for Papers' aimed at both theoretical as well as practice-oriented contributions. Contributions were accepted only in English language. After the submission deadline, the contributions were reviewed by an external program committee with explicit competencies in the field of research. After the review process, the authors had the chance to integrate the feedback given by the program committee into their contributions as long as the contribution was not rejected in general. The accepted contributions are published in the proceedings at hand. The proceedings can be categorized into three thematic areas.

AAL projects across Europe

The first part contains insights from AAL projects across Europe with respect to the different stages of the project lifecycle. At first, it is discussed what characteristics older adults have as a target group in a demographically changing world [4]. Interim results of an Austrian pilot region show – based on end-user characteristics – the practical realization of long term user integration activities in research projects [5]. After the presentation of expected benefits of a technology-based "Service-Living" initiative from the point of view of primary users [6] a user-centred approach of an AAL platform supporting individualized services is presented [7]. Finally, a cross-generational analysis takes a deeper look at the general acceptance of smart technology [8].

Degree of Quality of Life affected by technology

A more and more visible field of research – also supported through national and international pilot regions – is the evaluation of products, services and processes regarding their effects on the quality of life. The first contribution in this context addresses the evaluation of a whole bundle of AAL and Smart Home solutions using a qualitative method [9]. A second contribution addresses the development of user-centered prototypes to maintain physical health [10]. Improving the degree of mobility and activity of older adults requires e.g. also accessible tourism and is covered by the third accepted paper of the thematic area [11]. An overview of acceptance, quality of life and willingness-to-pay measures to assess prerequisites and impacts of the use of assistive technologies based on a literature review is given by *Simbrig et al.* [12].

Technologies for older adults with cognitive impairments

The final thematic area covers the increasingly relevant topic of technology and its potential effects on older adults with cognitive impairments. The AAL project *Petal* is aiming to support persons affected by mild dementia and first results are presented in the reviewed contribution [13]. *Fuchs et al.* present a paper covering the usage of music technology for neurological diseases among older adults [14]. Additionally a self-learning

mood transfer system [15] and the potentials of using light, scent and sound to activate and to relax are presented [16] and conclude this section.

Acknowledgements

We would like to thank all the authors for their valuable contribution and the program committee for their profound reviews. We hope that the selection of contributions can provide additional insights regarding AAL-relevant research activities and lead to a sensitization for a stronger holistic and user-centered approach in the design and development of solutions for older adults and their environment.

Special thanks go to the local organizing team of Eurac Research and this year´s guest event uDay 2019, organized by the FH Vorarlberg – University of Applied Sciences, User Centred Technologies, which was fully integrated and enriched the SMARTER LIVES conference.

SMARTER LIVES is organized by the AAL Competence Network of the Department of Strategic Management, Marketing and Tourism at the University of Innsbruck and the Institute for Public Management of Eurac Research. It is realized in cooperation with the Standortagentur Tirol. With this initiative, the organizers aim to support the whole network of relevant stakeholders, such as technology providers, social and care institutions, primary as well as secondary users and research representatives.

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Part I:

AAL-projects across Europe

Who are the elderly? Characteristics of a target group in a demographically changing world

Nadine Sturm[1], Georg Aumayr[1], Sofia Kirilova[1], Alessandro Vercelli[1], Mathew Summers[1]

The type and nature of participants selected for a study influences the main outcomes of any service, product or bundle tested in a project. However, at the commencement of a study or trial, knowledge or assumptions about the target groups' physical, cognitive and psychological constitution are often vague. Within a large randomized controlled trial conducted in the H2020 project My-AHA (My Active and Healthy Ageing) 169 people were screened in Austria (n=133) and Germany (n=36) using validated questionnaires according to predefined criteria for frailty. Prescreening data collected spanned multiple domains including: physical and cognitive status, activity levels, anxiety and depression scale as well as usage of basic technology. Analysis of the screening data provides insights into different factors of human beings aged over 60 years. The data describe the overall condition of the potential target group for products and services in the field of health, active and assisted living (AAL).

Description of MY-AHA-Project

The Horizon 2020 project My-AHA (My Active and Healthy Ageing) aims to promote and support active and healthy aging through early detection and mitigation of different frailty risks. The project has a runtime from 2016 – 2019, involving 16 partner organizations across 10 European countries and associated countries (Australia and Japan) under the lead of the University of Turin. An 18 month long randomized controlled trial (RCT[2]) to measure the efficacy of the My-AHA platform is currently in progress, aiming to recruit and assess up to 600 participants distributed evenly across treatment and control arms. In Austria and Germany 169 people have been screened (AT n=133, DE n=36) for entry into the main RCT. All project activities are approved by ethical boards. Further project information is available at the project website http://www.activeageing.unito.it/.

The project will illustrate the participant's (over 60 years of age) frailty risk profile by different dimensions by implementing and delivering tailored ICT-based interventions. A communication and information platform is used to connect with several devices and

[1] My-AHA consortium

[2] ClinicalTrials.gov; identifier: NCT03342976

services (e.g. fitness and nutrition tracker, cognitive games app) to foster prevention of risk for frailty [1]. Other goals of the project are the development of intervention tools, suggestions for public health interventions, approval of effects of activities and support by technological innovations.

Besides, the technical part, individually tailored physical, psychological, cognitive, social, and nutrition measures are implemented to prevent or delay the development of clinical frailty in prefrail older adults. Physical interventions include, for example, the prevention of falls through balance program training (Otago) and gymnastics lessons. Cognitive interventions comprise different working memory trainings. Psychosocial measures are being implemented, such as group activity e.g. addressing mental health. A nutrition application for mobile devices is used and additionally participants receive nutritional advice by a dietitian. These interventions are provided exclusively to participants in the intervention group. In order to minimize the dropout rate of people in the control study arm, information events, for both – intervention and control group participants – are being offered [1].

Description of prefrailty concept

Frailty can be a pre-stage to age-related diseases, which affect 7%-12% of the adults aged over 64 years. The occurrence of frailty increases with age and potentially reaches a prevalence of 45% in the age group over 85 years [2]. Frailty denotes the vulnerability of older adults to adverse events. It includes the results of indirect and progressive metabolic and physical changes. The risk for poor health outcomes, incident disability, hospitalization, and mortality significantly increases [3, 4]. Frail people are not medically ill, but rather in a state of reduced capacity and function. At the highest stage of frailty a person is highly dependent on caregivers or rather they continuously lose their autonomy. Hence, it is essential to early identify frailty and obviate this deterioration [1]. In the My-AHA project operational prefrail criteria are derived from Fried [5] clinical frailty criteria. Prefrailty is defined as the presence of 1 or 2 symptoms of physical frailty, whereby there are 5 clinical features with 3 or more indicating the presence of clinical frailty. Screening of participants involved a formal objective assessment of the physical frailty criteria to establish that all participants recruited into the My-AHA RCT met operational criteria for prefrailty. The operational criteria for prefrailty encompass subtle deficits in **physical functions**. A person is considered prefrail, if one or two of 5 features of frailty are below age- and gender adjusted cut-off values [6]:

- Weight loss
- Weakness
- Poor endurance and energy
- Slowness
- Low physical activity level

If no physical criteria are met, the person has no signs of prefrailty. On the contrary, if more than two criteria are met, the participant is considered as frail. In both cases the person was excluded from the study.

In addition to the presence of physical prefrailty criteria, participants were required to display no evidence of clinically significant cognitive impairment as assessed by above clinical cutoff performances on two measures of the cognitive function:

- The Mini-Mental Examination Test (MMSE) [7] – a global cognitive screen that can indicate the presence of significant cognitive impairment, such as possible dementia.
- The Hopkins Verbal Learning Test (HVLT) [8] is a brief test of verbal list learning and memory. The test gives evidence, if the participant has lower learning abilities and weaker memory than the age-appropriate learning and recall abilities.

Where a participant displayed clinically significant impairments on both measures, they were considered to be cognitively frail and excluded from the study.

The third and last requirement concerns the **psychological domain.** Here clinically significant symptoms of anxiety or depression were considered to preclude participation in the study. Objective assessment of depression and anxiety symptoms was conducted using the Hospital and Depression Scale (HADS) [9]. Participants reporting clinically significant symptoms were considered to be psychologically frail and precluded from participation in the RCT.

Topics and questionnaires

By using validated tools, dimensions such as physical and cognitive functions and psychological state were objectively assessed. The focus is therefore not only on a higher quality of life or independent living but also on a combination of factors that contribute to a status of prefrailty. The data collected in the first measurement – screening phase – provides insight into the different dimensions of interest of people aged $\geq$ 60 years. Demographic data have been surveyed and extended by selected impairments and medical parameters such as blood pressure and grip strength.

Included are the following validated questionnaires that have been screened with each participant in an individual two hour long face-to-face screening assessment: International Physical Activity Questionnaire (IPAQ) [10], Mini-Mental State Examination (MMSE) [7], Hopkins Verbal Learning Test (HVLT) [8], Hospital Anxiety and Depression Scale (HADS) [9]. Participants must meet certain requirements (personal and formal) in order to participate and complete the 18 months testing phase.

Awareness needs to be raised on the preconditions of these outcomes and recruitment processes. People who were willing to be screened were in principle interested in participating in the study. One main motivation for recruited persons was the prevention of

frailty which leads to the assumption that participants lead a rather active than inactive life. Further, people who pass this examination are requested to participate in a 18 months randomized controlled trial, which needs personal motivation and a basic interest in and openness to new methods and technologies. Furthermore an informed consent had to be understood and signed by each participant including rights and obligations for participating on the study. Thus one needs to be aware that the results of the screening data are not valid for the overall population of people over 60 years. They are even more interesting for research projects in the field of AAL and health as they portray the potential target group according to criteria of frailty and examine their physical, cognitive and psychological constitution.

Results of the screening

The sample and description of screening interviews

This paper describes the data obtained from Austrian and German screenings. Participants were recruited through advertisements and articles in local newspaper, journals, homepages and organisation related magazines or publications. Special events were organised to present the project aim and the RCT to potential participants. Predefined inclusion criteria were used for the screening of 169 people in Austria and Germany from March to October 2018. All persons expressing interest in participation underwent a preliminary telephone prescreening interview to ensure potential participants met health and medical inclusion criteria. Of the persons prescreened, a total of 169 participants in Germany and Austria were deemed potentially eligible following prescreening and were referred for formal screening assessment where objective assessment for prefrailty criteria was undertaken. This process was necessary, in order to minimize the extensive work in relation to conducting the full screenings. Of the 133 participants who were screened for participation in Austria only 43 (32.3%) met all eligibility criteria for inclusion in the study.

Socio-demographic data

As part of the screening assessment, demographic data including age, gender and education was collected (see Table 1). Our sample shows the majority of participants are female, aged 59-70[3] years and have completed > 13 years of education. At this point, it has to be emphasized that the target group, given their age, is very educated. In comparison to population data from “Statistik Austria” the sample recruited is proportionately more highly educated than is represented in the wider community, with only 16%

[3] The age of participants is actually 60 years and older. Due to the circumstances that is was very difficult to find enough people fulfilling the strict criteria, is was decided to include one 59 year old participant in the sample.

of the population aged over 60 years attaining this high level of education compared to 49% of our sample[4].

Table 1: Socio-demographic variables of Screeniong Sample (Austria), n= 133-169

Age band	**% of sample**	**Gender**	% of sample
59-65 years	25	male	30
66-70 years	27	female	70
71-75	22	**Education**	
76-80	15	0-8 years	8
81-85	8	9-12 years	43
86 years and older	1	13 and more years	49

As stated before, prefrailty is defined by the prevalence of certain outcomes regarding different physical, cognitive and psychological indicators. In the following section these indicators, their inclusion and exclusion criteria and our results will be explained in more detail.

Physical domain

One criterion of the physical domain is the physical activity level (figure 1). The physical activity level of participants was measured via the International Physical Activity Questionnaire (IPAQ) [10]. It focuses the energy expenditure per week by metabolic equivalents of tasks. After collecting the data, the IPAQ scores were adjusted for the participants weight (in kg) and classified in low, moderate and high activity level. Figure 1 presents the grouped activity level. Thereby, almost two thirds of the participants have a moderate, 32% have even a high activity level and 7% a low level.

[4] www.statistik.at (last retrieved: 15 February 2019)

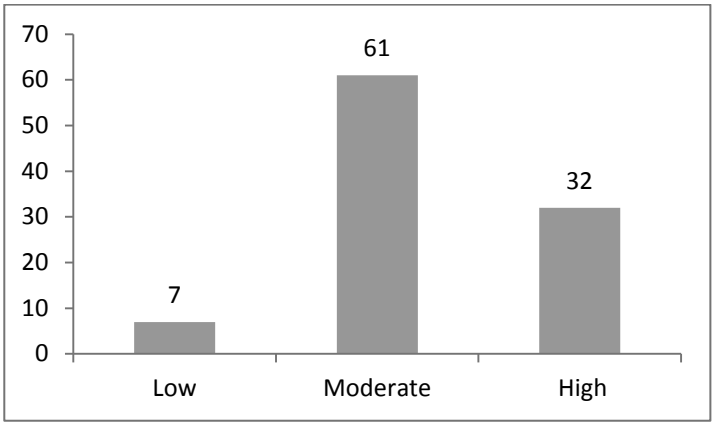

Figure 1: Physical activity level in %, n=169 (Source: Calculations based on own survey 2018)

Figure 2 gives an overview about all physical indicators and if the participants meet the inclusion and exclusion criteria.

One criterion for prefrailty is that people have low energy expenditure per week. As stated before, 7% of the sample fulfills this prefrailty indicator.

For measuring the “slowness” of the participants, they had to walk 4.57 meters. Depending on height and gender different cut-off values were defined for classifying the measured time scores. We see that 96% of the tested people managed to walk on time, 4% walked slower than the adjusted cut-off value.

Using the Center for Epidemiologic Studies Depression Scale (CES-D) [11] the self-reported exhaustion was recorded. Therefore respondents were asked if in the past week they felt that everything they did is an effort and/or, if they could not get going. When people answered “often” or “most of the time”, it was considered that they met the prefrailty criteria. In our sample 4% and 9% of the participants have signs of prefrailty concerning the items poor endurance and energy.

The dominant hand grip strength (kg) was measured using the Jamar Hand Grip Dynamometer. The grip strength is a very reliable indicator for the physical condition [1, 2]. The grip strength cut-off value was adjusted for gender and for the Body Mass Index (BMI). The data indicate that 10% of the test persons had grip strength beneath the adjusted cut-off value while 90% passed the criterion.

The last criterion of the physical domain is “shrinking”, evidenced by (unintentional) weight loss [1, 2]. If the self-reported weight loss in the past 12 months is greater than or equal 4.5 kg then the person meets the weight loss prefrailty criteria. From figure 2 we can see that this affects 2% of the sample.

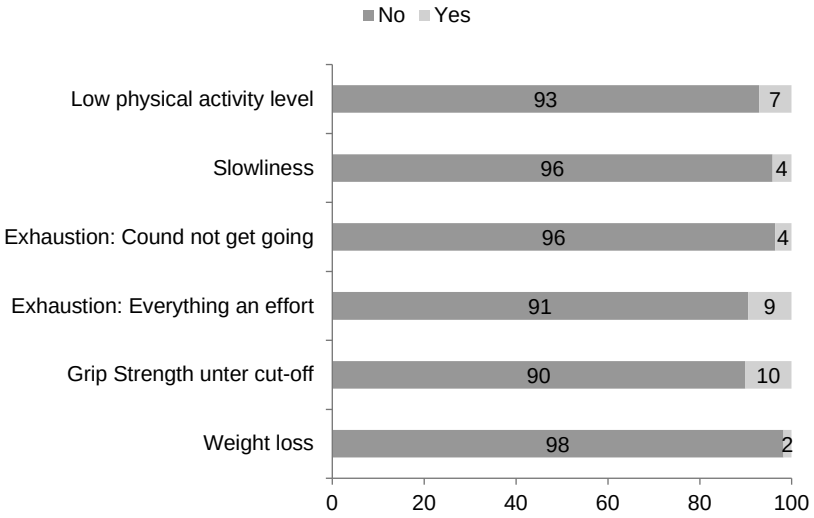

Figure 2: Physical indicators in %, n=167-169 (Source: Calculations based on own survey 2018)

In conclusion to the topic "physical domain", it can be said that actually only few participants have prefrail indicators. The challenging part of our study was however that at least one and maximum two criteria are met. People could not participate in the study if they were particularly fit or already frail. The following table shows that 21 % (or a number of 35) of 169 people screened met one or two prefrailty criteria in the physical domain:

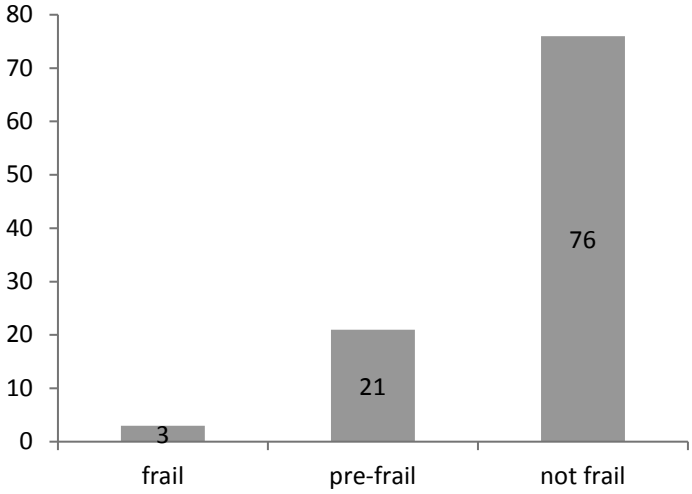

Figure 3: Results of physical domain criteria cumulated, in %, n=167-169 (Source: Calculations based on own survey 2018)

Cognitive domain

To capture the cognitive condition of the sample, two tests were used. The first one is the Mini Mental State Examination Test (MMSE) [7]. It is an 11 item brief screening assessment of basic screens functions. The cut-offs for abnormal cognition are adjusted for age and level of education. Due to availability of data, results were only calculated for Austria. As shown in table 5, only 1% of the study group scores below the adjusted MMSE cut-off.
The second test is the Hopkins Verbal Learning Test (HVLT) [8]. As already mentioned it is a brief test of verbal list learning and memory. It comprises 12 words, organized into three semantic categories, and presented over three constructive learning trails. If a test person scores below or equal to the cut-off value of 24, it is considered that he/she has an insufficient learning or memory ability. In the screening this affects almost one third of the Austrian sample (figure 4). In order to exclude the participant from the study, he/she has to score below the cut-off values in both tests. The column “meets inclusion criteria” shows that this did not apply in any case. This means that no participants were excluded due to their cognitive condition. Corresponding data for the MMSE for Germany is still in evaluation process. Therefore only the HVLT calculations for Germany can be presented.

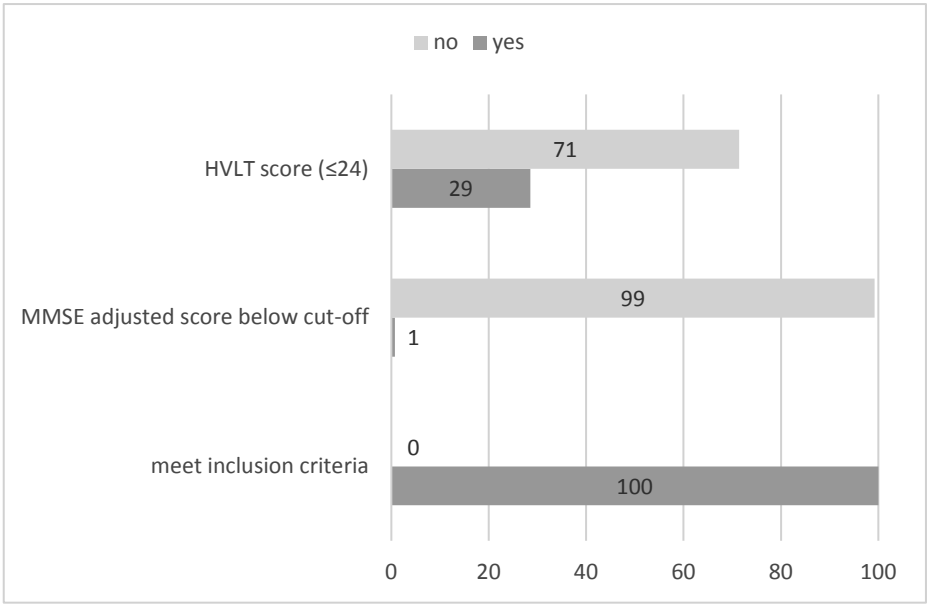

Figure 4: Austria: Cognitive domain in %, n=133 (Source: Calculations based on own survey 2018)

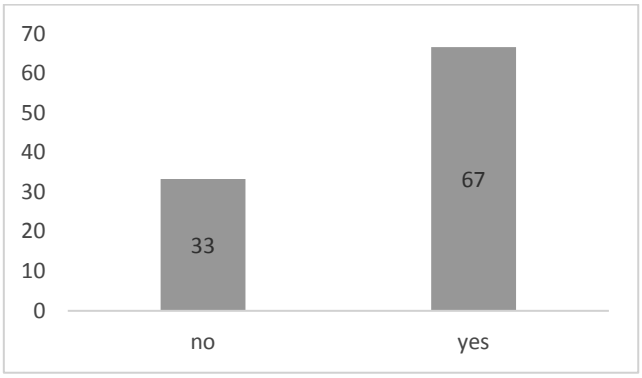

Figure 5: Germany: HVLT in %, n=36 (Source: Calculations based on own survey 2018)

Psychological domain

The Hospital and Depression Scale (HADS) [9] was used to measure the psychological domain. It is a 14 item scale to which a participant indicates the degree of agreement/frequency of anxiety and/or depression in the previous week. Scores greater or equal to 15 (on the depression or anxiety scale) indicate presence of clinically significant depression or anxiety. Figure 6 presents the distribution of the frequencies of the scores, already with the appropriate labeling. It can be shown that the majority of the people in our study have scored values related to “normal mood”. 8% of the participants have scores greater or equal to 15, which stands for a significant presence of depression or anxiety. These people were excluded from the study.

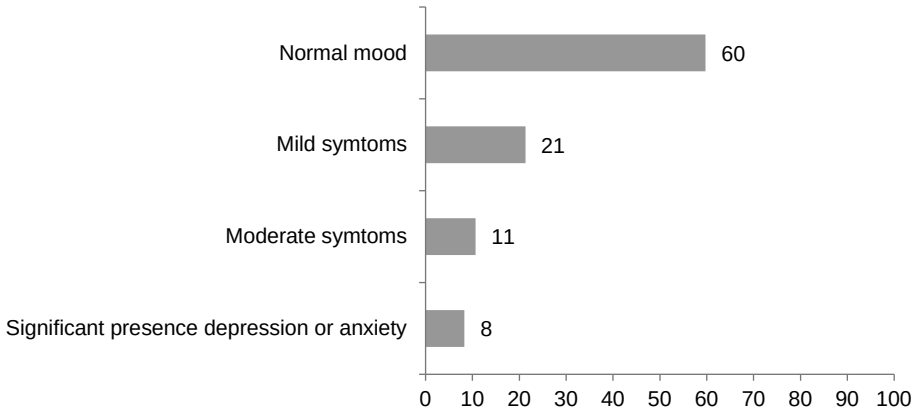

Figure 6: Hospital and Depression Scale in %, n=169 (Source: Calculations based on own survey 2018)