AAL PROGRAMME	**PersonAAL**	

PersonAAL
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Executive Summary

The majority of existing technological solutions designed for enhanced communication of older adults in their home environments focusses on interaction between the user groups and their family members. Yet, there is evidence for increasing demand for more elaborate tools: new innovative technologies need to account for additional requirements of communication, diversified social relations and various aspects for access, control, security and the visualization of data. Research on the two pilot sites of the present project, namely Norway and Switzerland, reveals that preconditions for respective solutions can be diverse, as areas of usage, policies, legal aspects and requirements for system architectures tend to differ, thus having an impact on both the importance of different target groups and the need for specific system features. Possibilities for adapting new solutions to specific environments of usage is therefore as important as the (consumer) requirements of the actual users. The present study sheds light on the specific environments of older adults, their behavior and attitude towards the communication of (medically related) data as well as their familiarity and dealing with communication technologies. It reveals that data collection and the respective communication thereof is a sensitive issue that requires close attention. Older adults assume the role of informed users with affinity to question the purpose of specific features and system actions electronic health systems have. They are therefore far from assuming the mere role of individuals with age related impairments, who seek to find solutions to specific restraints, even at the dispense of their overall comfort and habits. Older adults rather come out with specific interests from their point of view as informed users and customers with individual preferences. The strong desire of data ownership and control requires differentiated views on the addressees of specific information older adults (are willing to) deliver, as well as on the purpose and the shape of the media implied. These findings demand, above all, close consideration of individual social relations underlying all spheres of communication concerned by the envisaged technology: Systems must be personalizable. As regards technological affinity as such, there is reason to assume a desire on the part of older adults for keeping up with the latest developments. New solutions, yet, need to fit into the given routines and environments of the target groups and should not be perceived as additional effort. The cost-benefit ratio for the usage of new technology and / or their implementation into daily lifes must be clearly positive. All architectural aspects therefore need to be assessed concerning their specific strength for problem-solving or potential to create new desires and / or enhanced life quality for their users.

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1 INTRODUCTION

The present PersonAAL-project responds to the challenge of significant social and demographic change European societies increasingly face. The ageing of populations, the change of lifestyles towards growing individualization, a strive for lifelong personal independence and self-determination and the growth of single households go hand in hand with the transformation of social and health systems as well as the increasing digitalization of both private and professional lives.

PersonAAL takes on with these developments. Based on innovative technological solutions, new IT-infrastructures will be developed to assists elderly people satisfy their specific requirements for managing an active, independent life at home. The project features mobile access to personalized support applications with the objective to improve remote formal and informal care as well as the relationships of older adults with their families and friends. PersonAAL will therefore focus on interaction modalities, provision of tailored user interfaces and multi-channel connections through different devices.

In order to ensure the proper adaption of PersonAAL to the realities of older adult's needs and requirements, there are at least two overarching issues to be addressed in the course of the project. First, the specific lifestyles, capabilities, living environments and ambitions of elderly people must be taken into account in order to find adequate concepts and solutions for the purpose of promoting independence. This embraces both their current contexts of care they find themselves in – including their overall social and health situation, access to possible services as well as the underlying policy frameworks – and their preferences and future prospects for an independent life at home. Second, IT-solutions must be designed in a way that they respond to the specific consumer requirements of the target generations. In that respect the target group characteristics of older adults must be considered as distinct from general consumer interests and behavior. This implies, for example, their specific attitudes towards IT, their inclination to adapt daily routines and habits, as well as usability issues stemming from age-related impairments. Accordingly, the present deliverable sheds light on the on the requirements of older adults in their functions as (potential) beneficiaries from care services and consumers with specific, age-related interests, needs and requirements.

These requirements should be read in conjunction with the social, technical and regulatory environments as well as the needs and requirements of informal caregivers (as dealt with in deliverable D2.2.) and health workers (as dealt with in deliverable D2.3) and be taken as a basis for the upcoming development process and system design. In view of that, the present analysis pursues the objective to identify relevant issues allowing choices between potential features, modes of interaction and designs the PersonAAL-system will adopt. The findings from the current study will therefore be complemented by a set of recommendations for the technological developments made throughout the project phase. This study can be used as both an ex ante guideline and an ex post tool for controlling the matching of the developed prototypes with the consumer needs to be satisfied.

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The document will be structured as follows. Section 2 reflects on background information regarding (the need for) homecare services and in the field of e-health solutions for elderly people. Based on the review of primary and secondary literature, the present knowledge about the use of web applications, interaction requirements, prevailing frameworks and practices in the health sectors of the targeted research sites, namely Norway and Switzerland, as well as a collection of the technological state-of-the-art will be elaborated.

These findings will be complemented by an additional study that was conducted for the purpose of this project in Switzerland among the envisaged target group of elderly people. Section 3 introduces the scope and objective of this study. Information about the method and proceedings can be found in section 4. Section 5 discusses the data from the study, which will be summed up, along with recommendations for the upcoming development process of the PersonAAL system in section 6.

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2 STATUS QUO

2.1 Use of digital solutions and Internet services

As the PersonAAL system is going to feature innovative web applications, it is important to gather some background knowledge about the use and acceptance of digital solutions among elderly people. As the field trial of the PersonAAL project will in part take place in Norway and Switzerland, basic data about the use of digital tools and the internet has been collected regarding these two sites.

2.1.1 Norway

This recent and thorough report from Consumption Research Norway (Slettemeås, 2014) is based on a survey of 1000 respondents between 61-100 years of age, indicate a widespread use of Internet among elderlies in Norway.

Access to Internet:

- 74% have access to a computer connected to Internet (for the respondents between 81-100 years the number is a little lower: 55%)
- 93% of the respondents between 61-70 years uses a computer with Internet access daily or weekly
- 79% of the respondents between 81-100 years uses a computer with Internet access daily or weekly
- 37% of the respondents have access to a tablet/pad (26% between 81-100 years)
- 37% of the respondents have access to a smartphone (16% between 81-100 years)

Use of Internet-based services:

- 41% of the respondents searches for information online every day
- 58% reads news online daily
- 56% access their online bank weekly
- 38% uses e-mail or chat functions every day
- 26% uses social media every day
- 59% have used online public services the past 12 months

Need for digital assistance from informal caregivers:

- 48% need assistance to buy digital equipment
- 68% need assistance to in order to install software
- 67% need help for choosing settings on their computer or tablet

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- 56% need assistance in order to connect different type of digital equipment together
- 63% need help to fix technical errors
- 45% need help to download software and apps
- 50% need assistance in order to update security software

Coping:

- 59% feel safe to very safe online
- 55% believe digital tools have become a necessity in their daily life
- 41% think they cope well in their use of Internet

Impaired functioning and use of ICT:

- 22% report to have one or more impairments (32% of respondents between 81-100 years)
- 14% believe their impairment have a negative impact on their use of Internet and digital equipment (25% between 81-100 years
- 38% report that Internet and online services are extra beneficial, due to their impairment

2.1.2 Switzerland

According to the national statistics authorities in Switzerland (Bundesamt für Statistik), the share of elderly people using the internet has been constantly growing in the past 20 years. For the age group of people between 60 and 69 years, almost 70% were counted to the 'close circle of users' in 2015. For the age groups 70+, this share reached only about 40%. The overall share for the age groups 60+, yet, already reaches 53%. Although there are still considerable digital gaps to younger age groups and even though there are currently no clear indication that the gap to the use of the internet by the age group of the 30 years olds (98%) will be closed soon, the high share of the future elderlies predicts that digital solutions will become increasingly important also for the elderlies: Among the 50 to 59 years-olds, almost 75% are already counted to the close circle of users (Bundesamt für Statistik, 2016).

2.2 Review of Interaction Requirements – Communication/Information/Visualization

Modern research in intelligent interactive systems can offer valuable assistant to the older segment of the population by helping older adults engage more fully with the world. However, many existing user interfaces often work for the "average" user but do not cater for the needs of the elderly (Kurniawan2008). This contributes to a low uptake of technologies by the older adults. Therefore, the challenges are in designing interactions and technology that encourages older people to actively engage with each other and the ones around them and remain independent (Sundar2011).

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In the last ten years there have been a huge amount of applications developed in the context of older adults' communication but the majority has focused on the communication with family members (Lindley2009, Raffle2010, Judge2011, Kim2013, Baecker2014, Neves2015). The focus on family has for that reason been appointed as the main requirement for older adults' communication through technology. However, other requirements have also been appointed both in terms of communication and in terms of visualization.

Regarding visualization, the use of the Meeteetse (Brunette2005), an application that focused on place attachment to connect older adults on the same community, was among the first to show that problems related with interaction create the necessity for animated transitions, visual cues and color-coding to give older users a visceral sense of changing pages. The older adults use of PersonCards (Lindley2009), a system which was a step forward to Meeteetse, showed also the necessity for systems to allow for a focused intense communication build-up as older adults are prepared to devote time to activities of keeping in contact. In this sense, other very recent studies revealed the same tendency and even suggested the need for functionalities that emulate past-feelings like writing a paper letter (Hope2014). Additionally, a great deal of works which focused on older adults also suggest visualization issues related with privacy: the need for older adults to feel safe and in control of who sees their data (Garattini2012, Baecker2014), or as Lindley et al. described, the need for a closed network (Lindley2012); the lack of interest communicating with people they do not know, or the need to focus on people they know well (Garattini2012, Kim2013, Neves2015). Moreover, other issues commonly reported take notice in the importance of a close contact like the necessity for digital systems to be allied with face-to-face communication (Garattini2012) and in this context the relevance that should be given to video-chat features (Coelho2015, Michailidou2015), or the necessity for the user interface to act as a catalyst for communication (Norval2014, Hope2014). Quite common is also the need for adapting visualization to each individual or group of individuals (Grosinger2012, Harley2014, Coelho2011, Neves2015, Michailidou2015, Peissner2012) as older adults are quite different between each other both in terms of age-related impairments and preferences or culturally.

A lot of research, the majority around family communication, also provided additional findings concerning communication requirements. Both PersonCards (Lindley2009), a multifamily media space called Family Portals (Judge2011), a video-based communicator entitled TimelyPresent (Kim2013) and more recently two communication prototypes entitled Wayve (Lindley2012) and InTouch (Baecker2014), have evidenced that communication should allow for a personalized level of intimacy like personal touches, voice or handwriting or even nonverbal social cues such as laughter, smiles and funny gestures. In the same sense, PersonCards (Lindley2009) and other studies (Lehtinen2009, Gibson2010, Burke2011) focused on the necessity for social applications (or applications focused on communication with relatives) to offer reciprocity features as older adults want to be able to give something back to their loved ones. Vutborg2010 also described this as supporting older adults caring. This latter researcher implemented and evaluated a communication tool for mediated older adults and grandchildren sharing of virtual objects and audio messages and highlighted other three requirements, the conversational context (to have something to talk about), facilitation (to be given the opportunity to talk), and diversified interaction forms (to maintain attention of different users with different characteristics). This was also described as support for multimodality and employed by a great amount of systems focused on this segment of the population

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(Lindley2012, Baecker2014, Neves2015, Lee2012, Picking2012, ElGlaly2012, Xiong2013). Still concerning alternative modalities of interaction, and past works, which focused on using distinct ways of interaction, speech interaction has been quite commonly used with older adults (Milne2005, Sato2011, Basapur2007, Brewer2005). In this matter, Coelho2015 showed that speech interaction is in fact the main alternative to traditional remote control input on TV-based applications, following Oliveira2010 findings with the MoviPil application, which showed that voice feedback was also the best solution. Still and somehow contradicting this findings, Warnock2013 argued that "there is no best modality but the best modality for that situation" showing relevance for the context of interaction. Simultaneously, research has shown that using touchscreen technology (Oliveira2010, Lee2012, Picking2012, ElGlaly2012) or standard technology present in every home (Garattini2012, Picking2012, Warnock2013, Xiong2013) can be another way of making easier the access to technology by the oldest segment of the population. Lastly, and still concerning requirements for communication, a lot of research shows that one-on-one exchanges are fundamental for older adults, as they are rich in content that strengthens relationships and health, such as self-disclosure, supportiveness and positivity (Lehtinen2009, Valkenburg2007, Burke2011, Hope2014). Therefore, interaction with ICT should be performed through direct communication features between older adults and their contacts (be it family members and relatives, but also doctors and nurses).

2.3 Review of Solutions for Intervention and Rehabilitation - Policy and Services

The following subsections review the policy and current practices in place regarding solutions for intervention and rehabilitation in the two pilot sites of the PersonAAL project, namely Norway and Switzerland. Considering that the envisaged system focusses on the improvement of care services by means of electronic monitoring and exchange of information, it is important to learn more about the existing types of care provided, related procedures, the involvement of different actors, the usage and prospects of different ICT solutions as well as related legal aspects.

2.3.1 Norway

<u>The financial system of health and care services</u>

In Norway all public health services are free of charge, apart for minor services fee typically not larger than 20 EUR. When these service fees in total accumulate to a maximum of 300 EUR a year, the patient is accepted from paying any more of them that year. Private service providers are available, but unless these service providers have negotiated contracts with the regional or local health authority, the service recipient will have to pay for these services. Additional health insurances have become more common, but typically their cover acute illness and is not applicable in the case of long-term health and care services that fall under the responsibility of the local health authorities.

<u>The national health system</u>

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"The Ministry of Health and Care Services formulates and implements the national health policy with the help of several subordinate institutions.

The Norwegian Directorate of Health is a specialized agency under the Norwegian Ministry of Health and Care Services. It is responsible for the compilation of various ordinances, national guidelines and campaigns. It also advises the ministries concerned on health policy and legislation. The Norwegian Board of Health Supervision is an independent authority responsible for the general supervision of the health services of the country. The Norwegian Institute of Public Health (NIPH) is a main source of medical information and advice."

Regional health services

"Public hospitals and specialist services are organized in "health enterprises". The chief state representative of a province is the governor, who is appointed by the central government. He or she is assisted by an executive board of civil servants, including the county medical officer and the dental surgeon of the province."

Local health and care services

"Local authorities, the municipalities, through their council and administration, rep- resent the ground level of the administrative hierarchy. They are entrusted with the provision of a wide variety of primary health services.
The primary health services in the present form were established through the Norwegian Primary Health Services Act of 1982. The responsibility for the primary health services was given to the 430 local authorities. The municipalities are to provide for care and treatment for all persons within their respective borders, including health promotion and prevention, emergency care and immigrant health care." (Norwegian Directorate of Health, 2012).

Relevant Norwegian health legislations

1. *The Patients' Rights Act*
   In Norwegian: Lov om pasient- og brukerrettigheter (pasient- og brukerrettighetsloven)

2. *The Health Care Personnel Act*
   In Norwegian: Lov om helsepersonell m.v. (helsepersonelloven)

3. *The Health and Care Services Act*
   In Norwegian: Helse- og omsorgstjenesteloven

The formal definitions in The Patients' Rights Act of the key roles in these matters are (Notice: our translation):

1. *Patient*: A person who approaches health and care providers with a request of health care related services, or who is provided with such care from a health and care providers.

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2. *Next of kin (informal caregivers)*: Person(s) that the patient pronounces as her or his next of kin. If patients are not able to provide names of their next of kin, the formal next of kin ought to be the person who have had extensive and regular contact with the person, based on the following order: wife or husband or person living with the patient in a marriage-like relationship, children above 18 years of age, parents, siblings above 18 years, grandparents, other family members with close ties to the patients, and formal guardians.

3. *Health care*: Actions that has preventive, diagnostic, curative or sustainable effects for a person's health conditions, including rehabilitation and caring services, and which is performed by health care professionals.
4. *Health care services*: Public primary and specialist health care service providers, dental services and private health care service providers

5. *Health care professionals*: Professions listed in The Patients' Rights Act

6. *User/client*: A person requesting or receiving services included in The Health and Care Services Act, that is not health care according to point 3.

Provision of homecare services

Health and care services delivered in the home of the patient are in large the responsibility of the municipality the recipient belong to, and are provided by public local health and care service providers. In emergency cases and after early discharged from hospitals, the service provider might be part of the specialized health system. However, for the type of services relevant in the PersonAAL project, the service provider would mostly be the local authorities or private companies delivering commercial services mainly on top of the service from the public local health and care service providers.

E-health policy in Norway

A new body, The Norwegian Directorate of e-health (NDE), was established in Norway the 1. Of January 2016. It is a sub-ordinate institution of our Ministry of Health and Care Services. NDE will implement the national policy on e-health, establish the requisite standards, and administrate the use of e-health methodology nation-wide. ICT standards are regulated by the legislation for ICT-standards in health and care services.

Legal situation for telemedicine

Telemedical services have to follow current security standards, and need preapproval from relevant data protection authorities. The main network and service provider for technical telemedicine solution is the Norwegian Health Network which is owned by the Ministry of health and care services.

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2.3.2 Switzerland

Provision of homecare services

Medical care services in Switzerland can be carried out by different actors both from the private and the professional sphere. Apart from home visits by the GP and care services in nursing homes, the professional side is covered by private organizations or qualified freelancers specialized in the provision of consultation and assistance for persons in need living a home. Support can be either remote or on-site, by traditional means or by use of innovative information technology.

The outpatient services covered by health insurances are defined in the regulation 'Verordnung des EDI über Leistungen in der obligatorischen Krankenpflegeversicherung' (KLV; Krankenpflege Leistungsverordnung, 2016) as well as in the regulation 'Verordnung über die Krankenversicherung' (KVV; Verordnung über die Krankenversicherung, 2016).

Professional home visits are organized by qualified personnel. These can be graduate nurses or their assistants. There are three basic categories of services carried out. The first category contains evaluations of need, consultation and coordination regarding the qualification for and launching of care at home. This includes the requirements analysis and examination of the living and social environment, the consulting of the patient and informal caregivers about symptoms, past measures, medicine intake, applications, etc. and the coordination of measures and preventive measures regarding potential emergency situations. Second, therapeutical action for examination and treatment is covered. The third category concerns basic care (Krankenhaus Leistungsverordnung, 2016, Art. 33).

The need for care at home and necessary measures to be taken are usually evaluated in cooperation with the treating practitioner. Informal caregivers (e.g. family, friends, neighbors) can be integrated in the consultation process. The evaluating side takes into account possible complications in complex situations and ensures the deployment of specialized personnel.

For the care activities to be launched, an acknowledged home care service ('Spitex' or other organizations deploying registered nurses according to Art. 49, KVV) starts investigating the requirements upon a doctor's prescription (type, scope, duration etc.) and reports to the doctor with the suggestion of possible measures. The types of organization carrying out these activities are manifold. These can be non-profit-organizations, for-profit-organizations or freelancing specialists. The public sector, notably the municipality, is obliged to take over responsibility in cases where no capacities can be allocated to the patient on his or her own initiative.

After examination of the patient's needs and approval of suitable home care services, the patient can reject individual measures at any time. The official prescription is made by a practitioner on the basis of the overall situation of the patient, including the social environment and individual need for care. Fixed criteria are to be applied by means of a questionnaire. The severity of impairments and the stability of the patient's environment are central factors to be taken into account.

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The costs for care services are distributed or shared between the insurance, the municipality and the patient, depending on the measure (e.g. basic care, consultation, home help). Normally, health insurances pay 60 hours of home care per quarter, the rest must be separately applied for. Domestic economy services are not covered by the obligatory health insurance. In specific situations, individual measures can be covered by social insurances / pension fund through so-called 'Ergänzungsleistungen' (AHV-IV, 2015).

The provision of examination and treatment at home covers common areas of nursing and therapeutical care such as

- Blood sugar evaluations
- Measuring vitality (e.g. urine, blood pressure, temperatures)
- Respiration
- Line placement (catheters)
- Dialysis
- Preparation and intake of medicine
- Taking of fertilizers
- Applications for monitoring and steering of body functions
- Surgical dressing (wound and visceral cavity treatment)
- Control of functioning of bladder and intestines
- Taking of bathes
- Execution of medical rehabilitation measures
- Psychological impairments

Basic care concerns activities such as assistance for eating, drinking, personal hygiene, basic rehabilitation exercises, prophylaxis and measures mobilizing the patients. In cases where patients suffer from psychological issues, respective measures can also include assistance in coping with daily activities, the planning of schedules and activities, training on self-organization, the promotion of social relations, measures envisaging the security and orientation of the patients, etc.

The progress of the patients is mainly followed through observation and assessment by the care personnel having the lead of the case. These also take on the coordination in case the impairment or the environment of the patient change. Graduate care personnel can decide about delegation of specific tasks to qualified assistants or informal caregivers upon personal assessment. Depending on the impairment, the care personnel can be committed with the elaboration of long-term solutions and adaptations of given living conditions and habits. Whereas short-term concern basic care and stabilization of domestic (housekeeping) activities, such long-term measures rather focus on solutions for coping with daily routines and independent domestic housekeeping.

<u>E-health policy in Switzerland</u>

There is no explicit health strategy in Switzerland yet. Swiss politics, though, a working on a common e-health strategy that may shape the future health system in the country. The

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national ministry for health (Bundesamt für Gesundheit) has issued in 2007 a basic paper defining three major building blocks in that regard: the implementation of electronic patient dossiers, the development of online-services and the implementation of adequate solutions. The Swiss e-health strategy is not meant to establish an entirely new architecture for the health market. Rather, emphasis is put on the design of a legal, organisatory and technical pillars. Issues such as data protection, privacy and obligations resulting from the use of e-health solutions are significant examples of the prerequisites allowing a secure and efficient replacement or complementation of traditional services (Bundesamt für Gesundheit, 2007). Central components are:

- The establishment of a central coordination body on national level
- Legal frameworks
- The definition of an architecture for e-health
- Standardization of patient data and interoperationability
- Infrastructure for the secure authentication and identification of patients
- Quality standards for health information and health services

The political and administrative structure of the country increases much of the complexity the stakeholders of the current e-health initiatives face. Despite elaborate technical and organisatory frameworks, many of the existing ICT-solutions are insular systems without integration into larger networks. Public competences and solutions are spread all over the federal system comprising 26 cantons and almost 3000 municipalities, whereas private actors such as insurances and services providers benefit from a comparably large degree of freedom. Accordingly, information about patients and their requirements are often highly dispersed. There are few instances to date in which patient data is forwarded or shared among multiple stakeholders of the medical treatment and care processes (Bundesamt für Gesundheit, 2007).

The provision of healthcare in Switzerland is based on the remuneration of allowances defined through fixed DRG. Incentives for practitioners to coordinate treatment in such a way that repeated or avoidable examinations are avoided are exceptions under the current health policy as defined in the Krankenversicherungsgesetz. Moreover, in cases where cost savings can be reached by use of electronic solutions, these savings often are often reached by actors other than those who invested (ibid.).

Political decision makers have realized the need for public coordination, above all with regard to information sharing. Therefore, two measures have been decided: The introduction of national health insurance cards and the introduction of electronic patient dossiers. The national administration is qualified to regulate the collection and treatment of patient data according to Article 117 of the Swiss constitution (Bundesverfassung). The competence for implementation of technical and legal solutions, yet, stays with the cantons.

The health insurance cards have been operative since 2010. Information sharing, however, is by default limited to administrative data. Information about characteristics of patients such as chronic diseases, medication, implants etc. can be centrally accessible only the individual patient's request (Bundesamt für Gesundheit, 2016). The introduction of electronic patient dossiers will place in 2017. It envisages data sharing among communities of complementary

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service providers (e.g. hospitals, drug stores, home care services, laboratories). The basic architecture stipulated in the 'Bundesgesetz über das elektronische Patientendossier' from June 19, 2015, provides for certified access points where members of the respective communities can retrieve information. Patients can decide on their own whether or not they wish to open an electronic health dossier. Furthermore, they can voluntarily upload information they desire to share, for example, information about allergies or even contact data of informal caregivers. Access to the network requires distinct identification. Data is stored through decentralized patient-indices. The architecture is built on the principle of interoperationability, i.e. systems capable of communicating with each other (Kohler et al., 2011).

Whereas both the introduction of electronic health cards and patient dossiers facilitate information sharing that may be essential prerequisites for telemedical services, few is done about telemedicine itself. Even though there is a common understanding that it will play a major role in the Swiss health market in the future, there is not yet an agreement about the implementation and shape of respective services. To date there are neither binding directives nor any reliable studies on the use and benefits of modern communication devices in the health sector (Swiss Association of Telecare & Health, 2016). As regards the Swiss e-health strategy, telemedicine is considered as part of the action concerning online services. Central measures and questions concern the following issues (Bundesamt für Gesundheit, 2007):

- Increase of the competence and information of the patient through access to health data
- Prevention
- Cost reduction
- Data sharing through and with public authorities
- Transaction and communication
- Interaction
- Telemedical services (consultations)

The Swiss association for telecare and e-health (Schweizerische Gesellschaft für Telemedizin und eHealth, 2009) has launched in 2009 an initiative to define common standards for e-health. Teleconsultations, in these terms, were understood as all kinds of interaction between health practitioners and their patients in cases where in which treatment is directly concerned or in which decision-making based on the health situation takes place, provided, there is no physical contact between the two groups. Technically, such consultations can take place through phone calls, video-conferences, online-consultations are tele-biometrical services (ibid.). So-called tele-councils, where healthcare professionals consult each other without participation of the patient, are not counted among telemedical services.

Legal situation for telemedicine

For teleconsultations today, the same legal standards apply as for consultations with physical presence. These standards concern, above all, the duty of care. Once a medical issue is reported to a practitioner and there is the objective assumption that further analysis is required, the practitioner is obliged to take the required measures for a sound examination, including – in case of the patient's incapacity to move – the assurance suitable home visits (see judgement of the Federal Court dating October 23, 1990, BGE 116 II 519). Mandates for

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teleconsultations are subject to the 'Swiss Code of Obligations', including the free choice of practitioners and the right of these latter to accept or decline a mandate, provided there is no case of emergency. They are also subject to the common stipulations regarding medical confidentiality (penal code, Strafgesetzbuch, Art. 321) and data protection (Bundesgesetz über den Datenschutz, 1992). Prescription of narcotics is possible subject to the respective legislation on pharmaceutical products (Bundesgesetz über Arzneimittel und Medizinprodukte, 2014) and drugs (Bundesgesetz über die Betäubungsmittel und die psychotropen Stoffe, 2013).

Teleconsultations rank among standard benefits of the social security scheme. The relevant stipulations in the accident insurance, the health insurance, the military insurance and the disability insurance providing for consultations with practitioners do not make a difference regarding the type of contact between the practitioners and their patients. In other words, it is irrelevant whether or not a meeting takes place on-site or remotely (Schweizerische Gesellschaft für Telemedizin und eHealth, 2009).

2.4 Overwiew of Technological Solutions for e-Health Monitoring and Intervention

Activity monitoring has been increasingly used in healthcare studies with older adults. In fact, the development and implementation of ECG knew its biggest boom in the beginning of 2000s [Addison2005, Davenport2006], and until date has focused in three main areas, wireless body sensors, mobile telemedicine and the context of monitoring and detecting falls by using smart-home technology.

Concerning the first type, wearable health monitoring technology has been widely adopted to diagnose and assess major health risks and chronic cardiac diseases: LOBIN [Lopez2010] integrated ECG monitoring into a smart-shirt; [Yoo2009] developed a similar technology using a fashionable circuit board which could be used for a period of 24 hours; [Jourand2009] and [Heilman2008] took the same approach to measure respiratory rate and heart-rate; while [Buttussi 2008] and [Yoon2011] developed a mobile personal trainer and a textile electrode to supervise physical fitness activity and the degree of skin hydration throughout the day. However, all these systems experienced problems related with electrodes drying out and signal dropping as a result. These problems evolved into the implementation of technology based on more resistant electrodes like Blue Box [Pollonini2012], a wearable belt for wireless health monitoring of older adults staying at home [Sardini2010], and a combination between a smart-vest and personal digital assistant called MEMSWear [Feh2009].

Concerning the second type, mobile telemedicine has not only focused on ECG but also on other distinct health issues: MEDIC [Wu2008] was a medical-embedded device for individualized care which was integrated into a PDA or a cell-phone; Webber2009 were among the first to made use of a GPS watch and accelerometers to monitor and increase older adults mobility; in the same way Hart2011 revealed that three days of accelerometer data and four days of pedometer data or logs can accurately predict physical activity, while one more day of data is needed to identify sedentary behavior; MedAssist [Bsoul2011] was a real-time monitoring system for registering sleep apnea; Oresko2010, Wey2012 and Barnwell2012 developed portable ECG monitoring systems integrated in smartphones for cardiovascular diagnosis; more

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recently HeartSaver [Sankari2011] was a mobile-based android application for automatic detection of cardiac pathologies; and.

Other main focus related with monitoring technology was the case of technology aimed at falls prevention, detection and alarms. Over the last years, several ICTs emerged focusing on monitoring falls and alerting carers being both reactive and pro-active, and wearable and non-wearable: Brownsell2004 made use of waist mounted fall detectors for a period of 17 weeks; Mihailidis2008 were one of the firsts to study older adults acceptance of home monitoring technology like personal emergency response systems, fall detection systems and switches, motion-based and video-based sensors; Courtney2008 and Demiris2008 focused their intervention in the use of smart-home technology such as bed sensors, kitchen sensors, motion sensors and fall-detection sensors and included video-monitoring as part of the system; Horton2008 focused on fall observation using a pendant alarm, a bed occupancy sensor and a key safe; Dorsten2009 also made use of video-monitoring technology complementing it with several other assistive and surveillance technologies; Heinbuchner2010 measured the level of satisfaction of older adults wearing portable help buttons; Hozinger2010 made use of a wrist device prototype entitled EMERGE to measure pulse rate and impact and lack of movement (i.e. falls) where the data would be continuously sent to a wireless base station; Bailey2011 performed a four-week intervention based on daily exercises and activity logs using both emergency alarms, a pedometer, and home-automation features; VanHoof2011 deployed technology focused on emergency alarms and home automation with the use of sensors and set top boxes for video telephony and cameras activated with alarms; Hsin-Kai2012 deployed a telecare medical support system which was connected to a response center and made use of wireless pendants, fall detectors and several other sensors to detect anomalies in daily living.

Furthermore, and reflecting on all these studies several conclusions and recommendations have been suggested by researchers. Baig2013 showed wearable and mobile ECG monitoring systems tend to be very well accepted in aged care facilities as they ensure better quality and health care delivery. In the same way, Boise2013 showed that about three quarters of older adults are willing to be monitored and have their data shared with doctor and family members.

Still main reasons against its adoption are usually reported as being the short battery life of systems, the lack of professional feedback, the lack of security and privacy of the data collected (the use of video-cameras is especially problematic in this sense), the unclarification of the systems goals, and the perceived risk of injury (Baig2013, Hawley-Hague2014, Mihailidis2008, Boise2013).

The same researchers also reveal the need for the system to be usable and accepted by not only the clinicians but above all the target population in order to be adopted: By the words of Baig2013 "the acceptance of any system in the healthcare industry depends on the user awareness and acceptability. Adaptation of a device within the clinical field is stuck when they are negatively perceived". Additionally, other factors like older adults' attitudes around control and independence (Hawley-Hague2014, Mihailidis2008), the possibility of aging-in-place, and notions such as low-cost, attractiveness, discreteness, comfort, maintenance, involvement of family members and the level of human contact (favoring video-conference tools) (Mihailidis2008) are also important in motivating them to adopt and use technology.

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Finally, as a lot of new monitoring methods are currently under development, it is important to take into consideration the results of the review performed by Taraldsen et al. (Taraldsen2012) who alerted for the need of a consensus regarding ways of collecting and reporting data as these are typically too varied contributing to confusion in research.

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3 SCOPE AND OBJECTIVES

3.1 Problem Statement

Whereas much is already known about the practices and technological possibilities of e-health-system in place, the successful development of new solutions needs to account for the specific environments and realities of the sites and user-groups targeted. The PersonAAL project seeks to adapt solutions to the specific requirements of older adults, providing them with useful and usable means for better managing older adults' lifestyles. This implies that the present attempts to develop and personalize the new system not only needs to adapt to the policies and (health-)care related practices in the countries under consideration, but also for the specific requirements of elderly people in their role as informed users and – thus – customers. In other words, whereas knowledge about the care systems in the respective countries is helpful to consider the basic frameworks in which the PersonAAL system can be integrated, further information will be required to adapt the system to the specific needs, preferences and habits of older adults apart from their role as patients or persons in need.

3.2 Goals of the Deliverable

Whereas a number of technical features and solutions are ready to be integrated into the technical architecture, we do not know which of these features will be suitable to solve the specific requirements of the targeted end-users and in how far these will be accepted for the implementation in their daily lives. Learning more about the dealing of older adults with health related information, ways of communication and the general usage and acceptance of ICT will therefore be vital to develop applications suitable to their specific ends, i.e. to finding the most suitable technical and conceptual design of the PersonAAL system. In addition to the mere nature of preferences and needs, the distribution and amplitude between different respondents is of major concern for the present study, as this will shed light on the actual importance of the different possibility to personalize individual features.

3.3 Research Questions

In addition to general characteristics of the sample, including possible impairments creating demand for specific care solutions, four major parameters were identified for the present investigations.

<u>Modes of communication / Methods of providing health related information</u>

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This parameter looks into the general behavior of the target group regarding the sharing of personal (health related) data. The acceptance of external monitoring (e.g. with regard to continuity and empowerment), expectations on information sharing and feedback, the acceptance and use of different media and the replaceability of personal relations shall be further analyzed.

Use of technical devices

This parameter sheds light on the current familiarity of the target group with different ICT solutions. Issues such as habits, preferences and experiences are subject to scrutiny along with their fit into peoples' daily routines. This includes amongst others, possible concerns and openness to behavioral adaptations which might be crucial to consider when introducing new solutions.

Usability of technical devices

Usability issues are important factors for the acceptance of ICT, as handling, understandabiliy and overall user-friendliness are likely to have a major impact on the acceptability and frequency of usage and thus the overall success of the envisaged product.

Criteria / prospects for market success

General criteria for the success of new ICT solutions such as PersonAAL shall be analyzed, among which belong the overall comfort with respective solutions, effects on the peace of mind and cost-considerations.

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4 METHOD

4.1 Target Group Specification

The target group for the older adults' requirements analysis was defined as elderly people with or without impairments, having at least minor technological affinity. Information about the sample was collected as part of the survey in order to validate the quality of the target groups addressed and their matching with the target group for the envisaged PersonAAL system. However, it should be noted that the target group for the analysis should not be confused with the target group of the envisaged solution developed in the course of this project. Since PersonAAL may also focus on preventive measures and as the present survey also considers general consumer interests of elderly people (rather than only consumer interests of impaired people), the target group for this survey was defined in rather wide terms.

4.2 Method

4.2.1 Research Design

The research design was developed using input of all consortium partners. Based on the above-mentioned research parameters, partners were invited to state their opinion from the perspective of their background and expertise so that the results will directly contribute to their respective project contributions.

4.2.2 Media

As the target group was defined as elderly people with or without impairments and with at least minor technological affinity, an online survey was considered the most suitable tool. Sending out a questionnaire through the internet was considered helpful for reaching a large share of respondents as well as for reaching people who have at least basic experience with using the internet.

4.2.3 Language

As the survey was carried out in the German speaking part of Switzerland, it was entirely designed in German. Since the original research design was developed in cooperation of all consortium partners in English, translations into German had to be made. Questions were not literally translated but in line with their sense. After

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completion of the surveys, results were transformed back into English. Qualitative comments from text fields were translated according to their sense.

4.2.4 Limitations

As the current study is based on online survey data, the data gathered here shall be taken with care. Although responses can give indications about preferences and requirements by the respondents, some of the questions may be subject to interpretation and different experiences by these latter. For example, the participants may have individual ideas or associations regarding specific notions such as "e-health-system", "homecare" or "voice recognition", which could provoke different reactions on their part depending on their point of view. Moreover, respondents might be insufficiently informed about the consequences specific choices could have on related aspects to be considered. The current survey therefore reflects current behavior and attitudes from the point of view of the status quo, based on existing knowledge and experiences. This first analysis not yet give information about the behavior and attitudes once people are more sensitized for new solutions and their respective benefits.

As most of the respondents were addressed by email and as the basic survey is typed into an online tool, there is an express bias for the reach of the target group. In other words, the survey is likely to reach predominantly people using devices with online access, which makes it likely to have most respondents be rather inclined to use modern ICT solutions. This however, fits into the intention of the survey, which seeks information from target groups with at least basic technological affinity.

Generally speaking, the survey is not meant to be representative. It is intended to indicate trends and directions for further scrutiny among the target groups for the PersonAAL system in the course of the present project.

4.3 Procedure

The online survey started December 17, 2015 and was closed January 15, 2016. It was sent out by an online mailing on December 17, 2015, to the target group from the database of terzStiftung. A reminder was sent out to the same target groups on January 5, 2016. The mailing offered a short project description as well as a link to the online tool LimeSurvey hosting the questionnaire. The sample of addresses was not filtered before sending out the emails and everyone with access to the weblink was able to answer the survey. The filling out was completely anonymous. All questions, including those about personal characteristics, could be answered on a voluntary basis.

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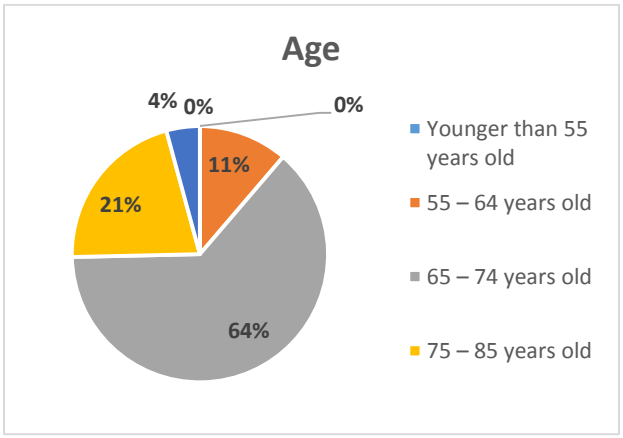
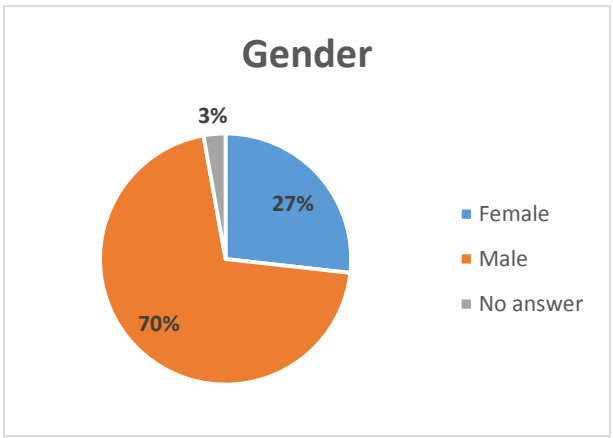
4.4 Sample

4.4.1 Response Rate

By January 13, 2016, LimeSurvey registered 196 file counts in the questionnaire, 71 of which were completed. The remaining file counts relate to the mere external opening of the hosting webpage or the dropping out before the end of the survey. For the underlying evaluation, the sample of 71 completed questionnaires has been further considered as the data base for the results published in this paper.

4.4.2 Composition and main characteristics





In order to learn more about the sample, all respondents were asked for basic characteristics such as age, gender, living environment and personal (health conditions).

The large majority of respondents can be found in the age group 65-74 years (64%), followed by 21% in the group between 75-85 years and 11% between 55 and 64 years. A minority is older than 85 years old, none of the respondents is younger than 55 years old. As regards gender, a huge majority of 70% was male, only 27 % reported to be female.

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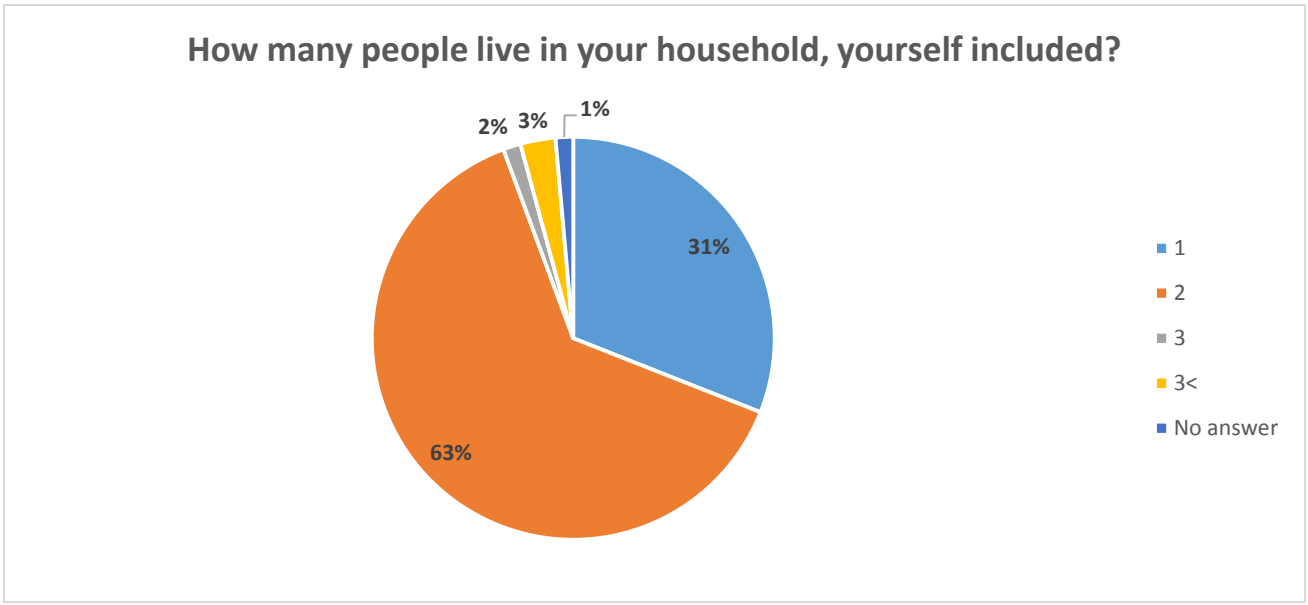
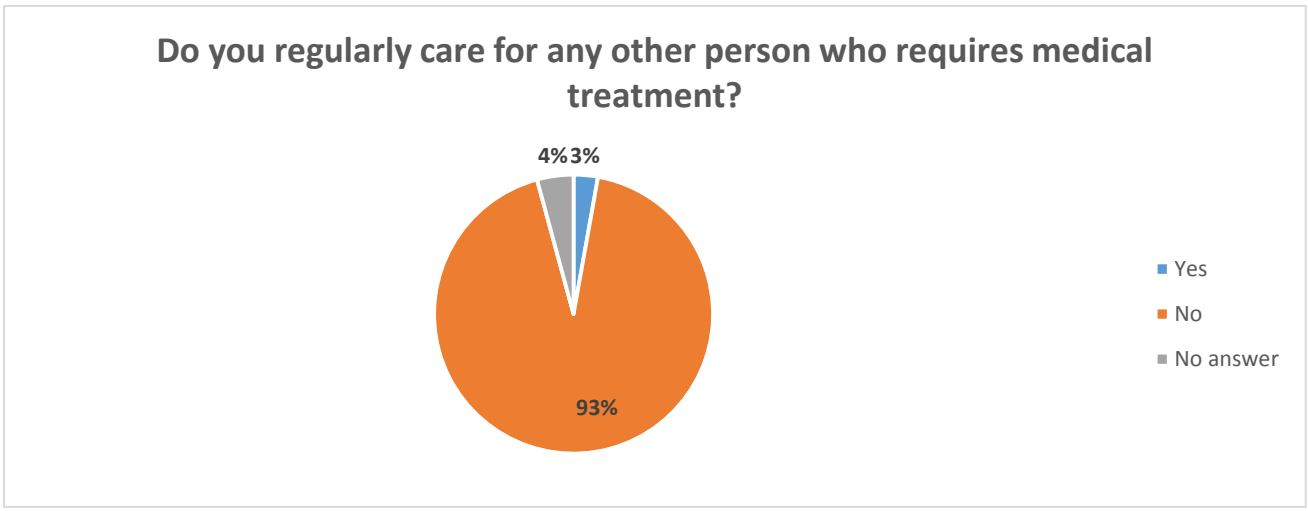


The living environment is an important factor for the underlying analysis considering that the PersonAAL-project envisages prolonged independence of elderly people at home and potential requirements of care given by different target groups. Only minorities (5%) of the respondents from the end-user survey reported to live together with more than one other person, which might suggest a lower need for assistance by external caregivers for monitoring activities. 63 % live with one other person (supposedly partners from similar age groups), whereas about one third (31%) live alone. Only 4% indicate to care for other people themselves.



When asked about their level of independence, a large majority of 85% report that they do not require any care, whereas 14% consider themselves at least in some areas dependent on care.

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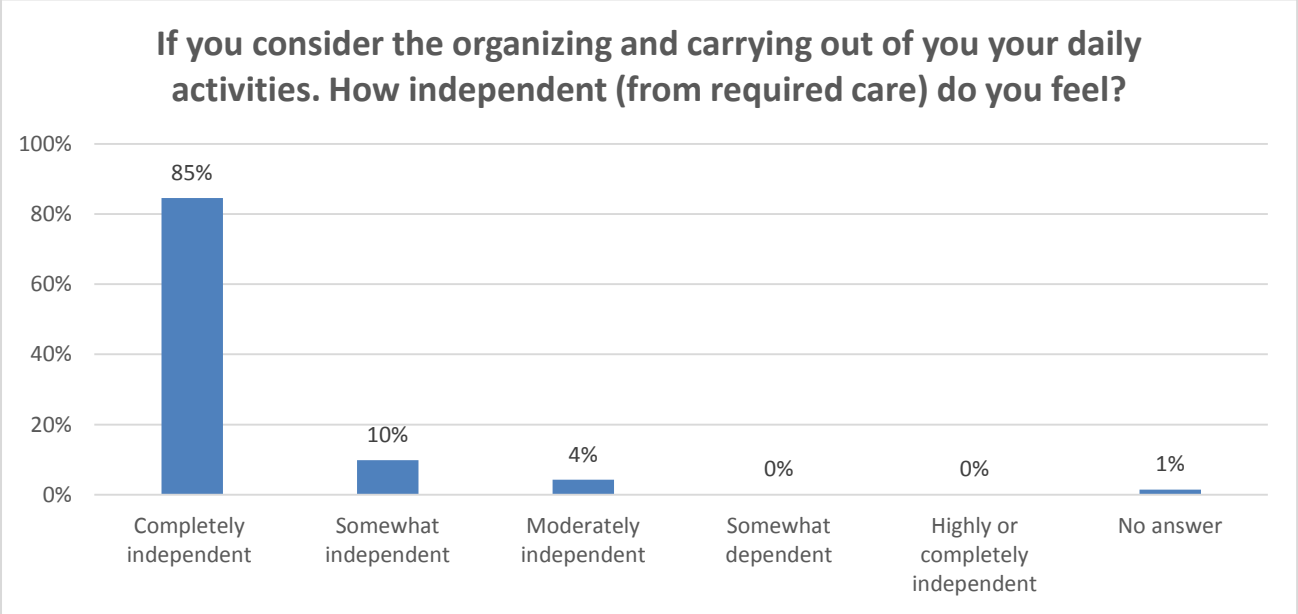
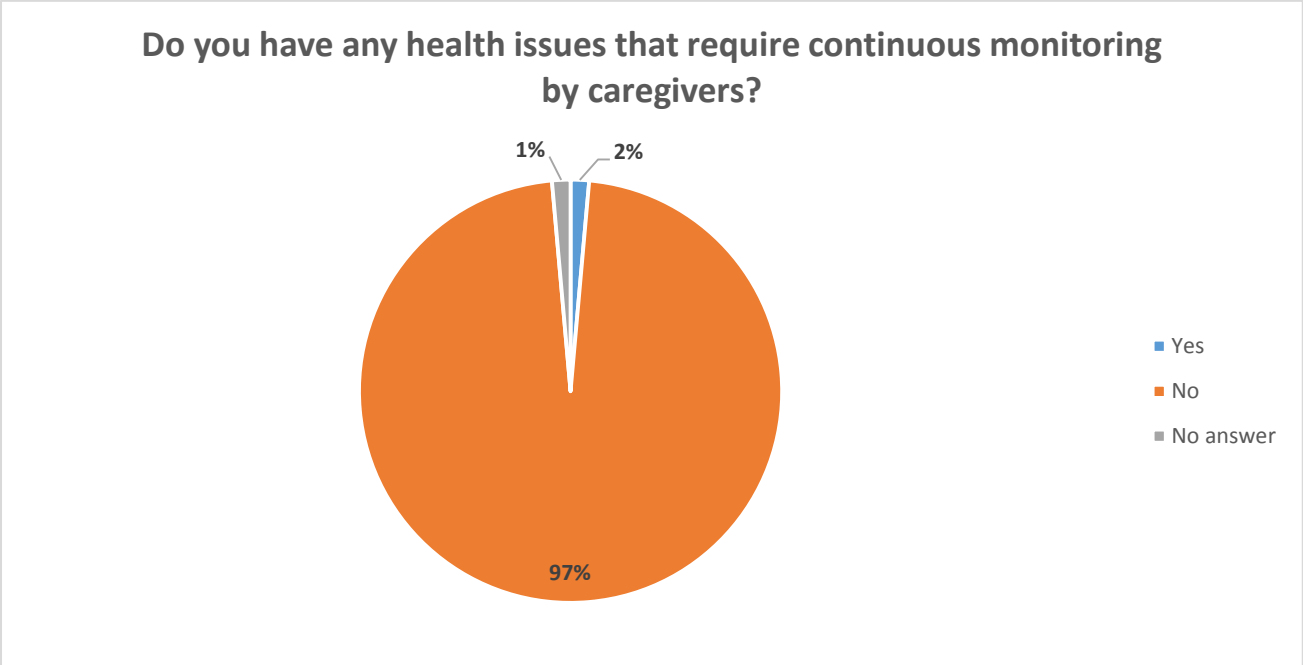


Continuous monitoring as a result of health issues is even less required by the considered sample, with only 2% reporting respective needs.



Nevertheless, health related impairments are an issue to be considered. In order to learn more about the areas people might be sensitized for, health related problems experienced in the past

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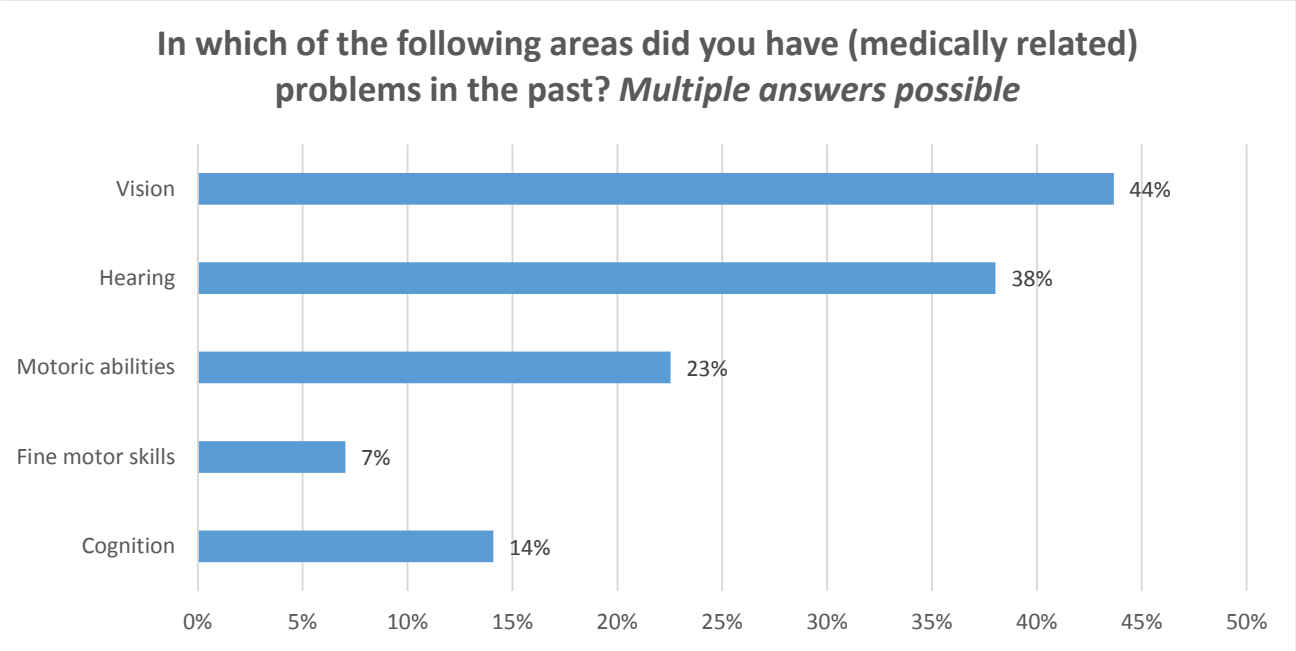
were surveyed. Vision turned out as the most important category with 44% reporting problems in the past, followed by hearing (38%) and motoric abilities (23%). Cognitive issues (14%) and fine motor skills (7%) were checked in the survey by minorities. None of the impairments reported are necessarily linked to medical problems currently faced (for reasons of expected feedback on this response), even if they could. The numbers should therefore not be considered as an indication for impairments elderly generally tend to suffer from but as areas in which they might at least be sensitized for respective problems. At the same time, looking at the categories mentioned the least gives an idea about impairments barely experienced as problems both now and in the past and thus suggests in which areas effort should – subject to further verification - be put less into the PersonAAL development process.



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5 FINDINGS

5.1 Modes of communication / Methods of providing health related information

Discovering modes of communication and methods of providing health related problems is important to understand how elderly people interact with potential caregivers and what differences they make between different categories of these latter. The major target of this exercise is to find out more about the acceptance of functions the PersonAAL system could feature and the way they need to look like for successful application and usage. Respective issues concern types of data, modes and channels for communicating data, storage, privacy rules and security.

One major question for the conceptual development of PersonAAL concerns the differentiation of users and potential frameworks for their interaction. Understanding the willingness of elderly to share their health related information is crucial to understand what different types of functionalities and data should be accessible by different stakeholders in the caring process, which also may lead to the design of distinct applications for each of them.

The following chart shows the acceptance of sharing different healthcare related data to different types of institutions, namely treating practitioners (including therapists), professional caregivers, persons of trust (including family) and public institutions. The results clearly indicate sharp differences in attitude when considering the different groups as addresses of health care related information. Referring to the number of respondents accepting the sharing of data, practitioners clearly rank the highest (between 45% and 75% approval depending on the type of data), followed by persons of trust (41% to 61%) and professional caregivers (21% to 58%). There is clearly low enthusiasm among the participants to share their data with public institutions, with ranges from 10% to 27%.

Strong differences can be observed above all, regarding the health record, where practitioners and persons of trust are majoritarian considered eligible addressees, whilst professional caregivers and public institutions are only accepted by minorities. Major gaps between these two pairs of target groups can also be observed regarding mental conditions, private data, physical activities and personal activities (with professional caregivers each time still ranking considerably higher than public institutions). Regarding the status of care and rehab measures as well as current physical and body conditions, only public institutions are clearly lacking behind as non-appreciated receivers of the respective information.

In addition to differences between target groups, the numbers suggest a generally prudent attitude of the respondents to share health care related data. Except for the sharing of the health record with practitioners, which most people might expect to be shared with practitioners anyway, no more than roughly every second person is willing to share their information with at least one of the listed target groups. Considering some qualitative data collected with these charts on a voluntary basis, privacy protection is considered a major issue

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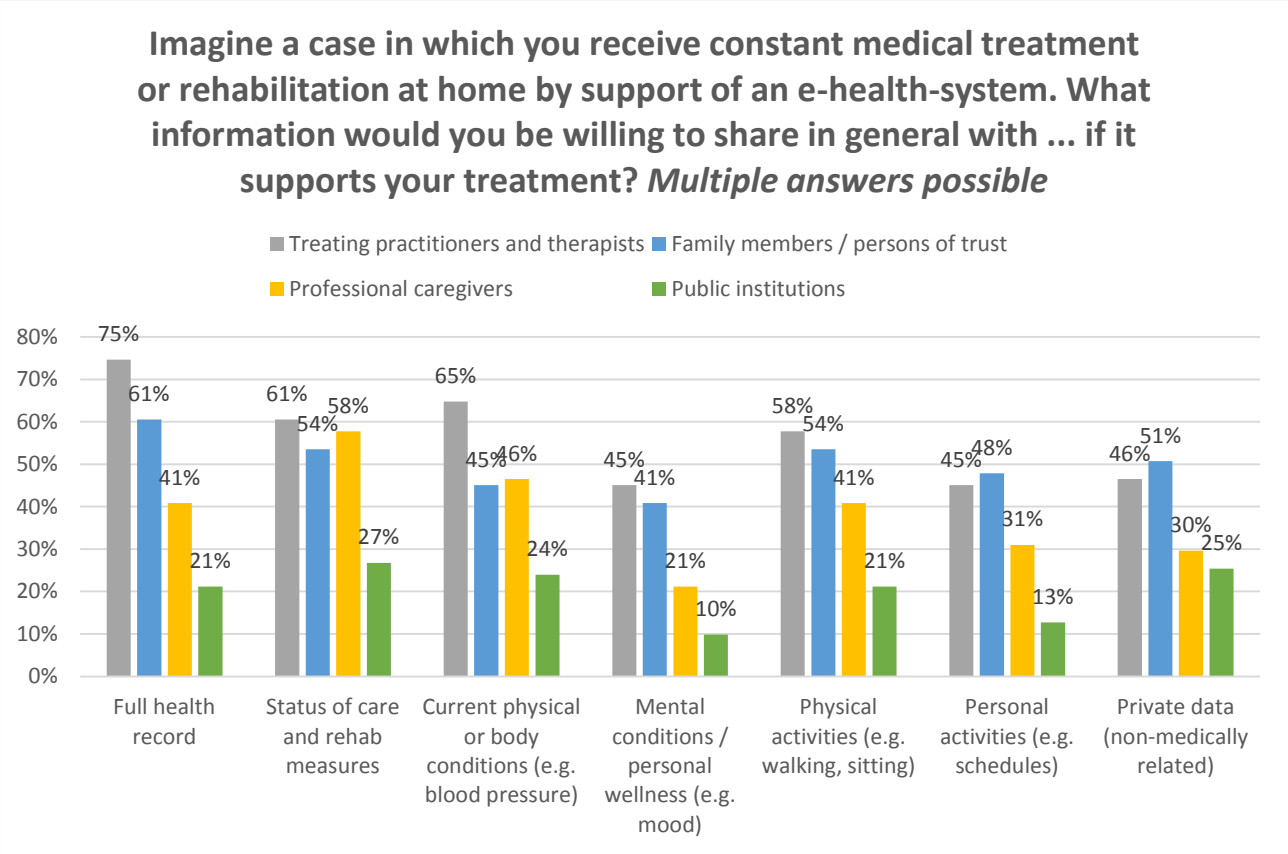
to the respondents. Only information that is convincing as improving the health care process, should be shared at all, as can be inferred from the textual information delivered.



Whereas these numbers relate to the attitude of sharing of health related information with the intent to see differences for specific target groups, the following information looks into the privacy factors in more detail by asking for the willingness of having different types of information stored in an e-health system. As indicated in the following chart, a majority would be willing to store the health record (58%) and current physical conditions (56%), whilst 44% and 35% are still willing to store their status of rehabilitation measures and private data. Only minorities, in contrast, allow for physical and private activities as well as mental conditions to be stored, suggesting that only data directly associable with distinct treatments and health improvement (data medically required from a layman's perspective) would be considered beneficial for long-term saving. These conclusions are confirmed by the qualitative input which underline privacy protection and the claims that information should only be saved for transparent purposes and when medically required.

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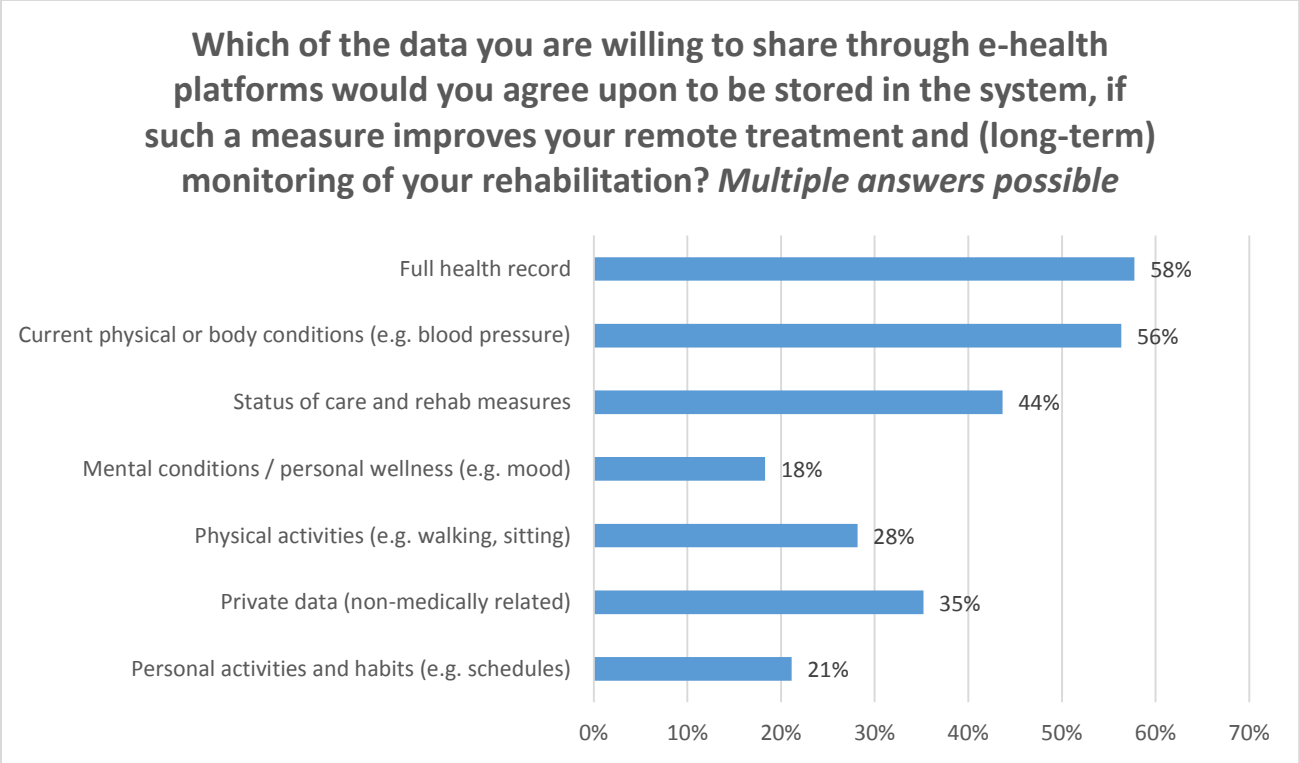

As regards the sharing of information, different types of formats were put up for choice, namely measures, pictures, videos, sounds and symbols. This information should be used to find the most suitable functions in PersonAAL allowing communication with the different target groups, taking into considerations potential obstacles such as intimacy, privacy, data protection, reach and preferences for interaction. As can be derived from the following numbers, there is a strong indication that impersonal information, namely measures, are largely preferred over multimedia features (videos, pictures, sounds) and consolidated measures (symbols such as smileys). The highest values were reported for practitioners (92% approval), the lowest for public institutions (55%).

Considering the different target groups, there is a clear indication that the variety of formats possible for application differs among them. For example, the accumulated number of percentage points across all types of formats is by far higher for practitioners than the accumulated number among public institutions. In other words, whilst for both categories there are the highest values for submitting information as measures, there are clear differences regarding the acceptance of alternative formats, as ranging between 10% and 44% for practitioners and only between 6% and 10% for public institutions. For both persons of trust and caring professionals, there are still interesting response rates for alternatives to mere measures, ranging between 14% and 37% and 10% and 28%, respectively.

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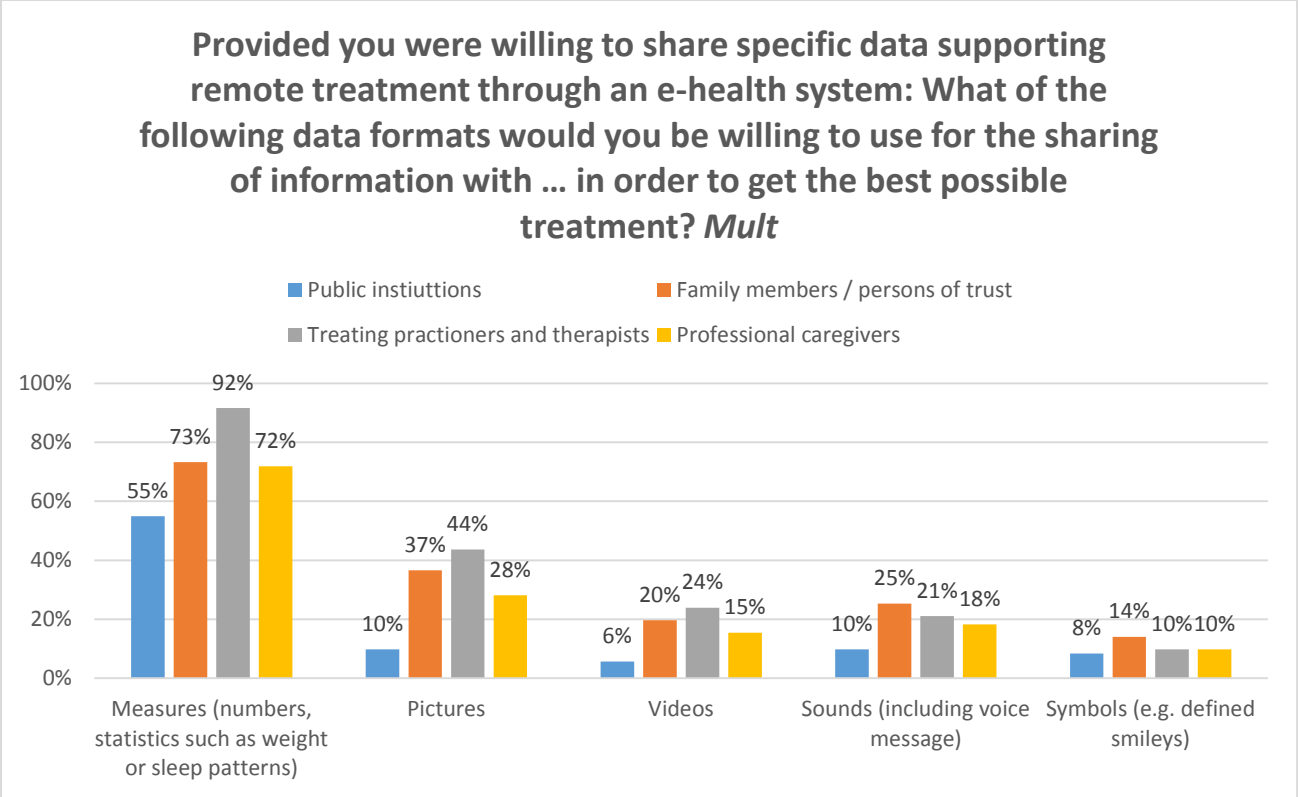

In order to gain a deeper understanding about the sharing of health-related information to different target groups, the survey asked in more detail how different types of information needed to be treated in case an electronic system as provided through PersonAAL was available to the end users. For each category of information, the willingness to share these latter could be specified in more detail, i.e. by indicating whether or not control over the data would be required before external communication of these latter.

Between 35% (for mood-related information) and 49% (regarding status of body functions) of the responding end users claim their own selection of information prior to the submission to treating practitioners or therapists. No reservations were reported by 27% (regarding personal activities and habits) and 51% (Current physical and body conditions) of the respondents. The complete unwillingness to submit data, in contrast, is rather low, with a peaks at 18% (personal activities) and lowest shares at 3% (physical and body conditions). Again, the findings confirm that information to practitioners should be limited to those commonly considered as necessary for proper treatment under the standard of academic medicine.

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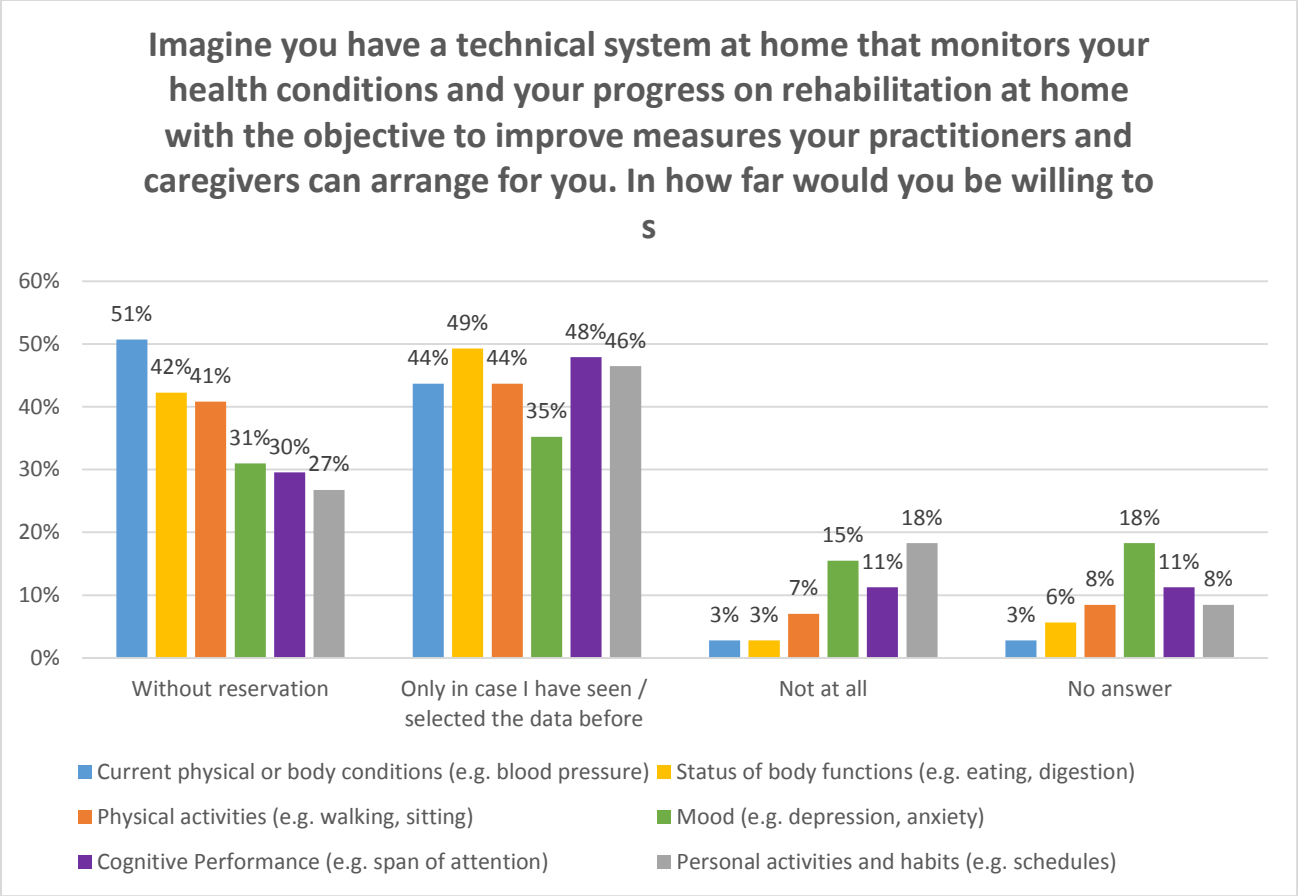

For professional caregivers, the picture looks clearly different. Whereas the shares for selecting data before submission are roughly comparable to the shares collected for practitioners - with roughly every second respondent requiring such control -, more reservations can be detected regarding uncontrolled submission. The highest approval was reported for current physical and body conditions (38%), which are likely to be relevant for the treatment by professional caregivers. Only one third to one fifth would agree upon unreserved submission of the remaining categories. Strikingly, the shares for respondents generally rejecting the communication of data are much higher, reaching up to 25% for mood or 21% for cognitive performance. These might be considered as irrelevant for the treatments at hand and therefore likely to be unappreciated for the purpose of sharing.

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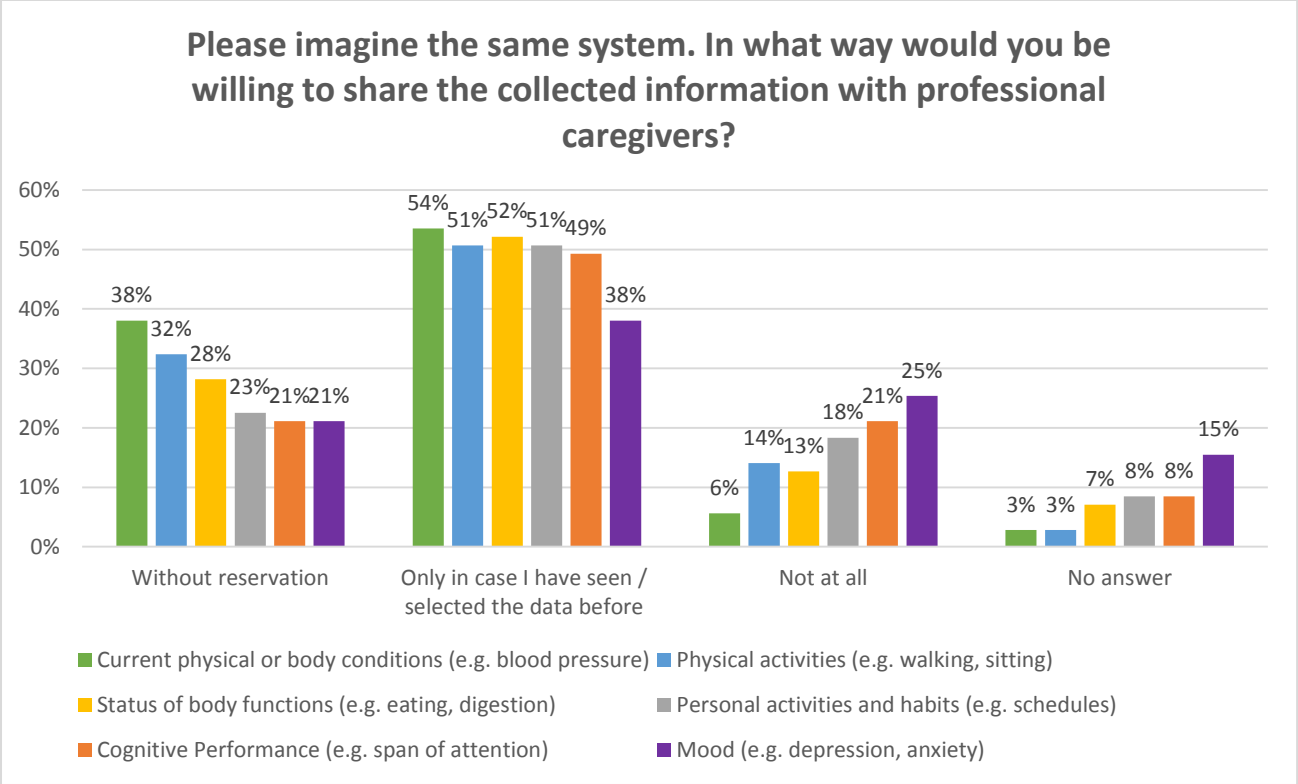

The highest values for implicit sharing of health related data through an e-health system as provided by PersonAAL were collected with regard to the target group family / friends with ranges between 45% (cognitive performance) and 56% (physical activities). This information suggest that persons of trust from private realms are considered not only in their function as medical caregivers carrying out specific medically related tasks, but that they should be aware of additional information required for other purposes, e.g. more intimate or personal information. Accordingly, the values for conditional sharing are also lower than for healthcare professionals, ranging between 31% (mood) and 37% (cognitive performance, current physical or body conditions). Reservations are comparably high for mood (29%) and cognitive performance (21%) though, reaching about the amount of respondents without reservations.

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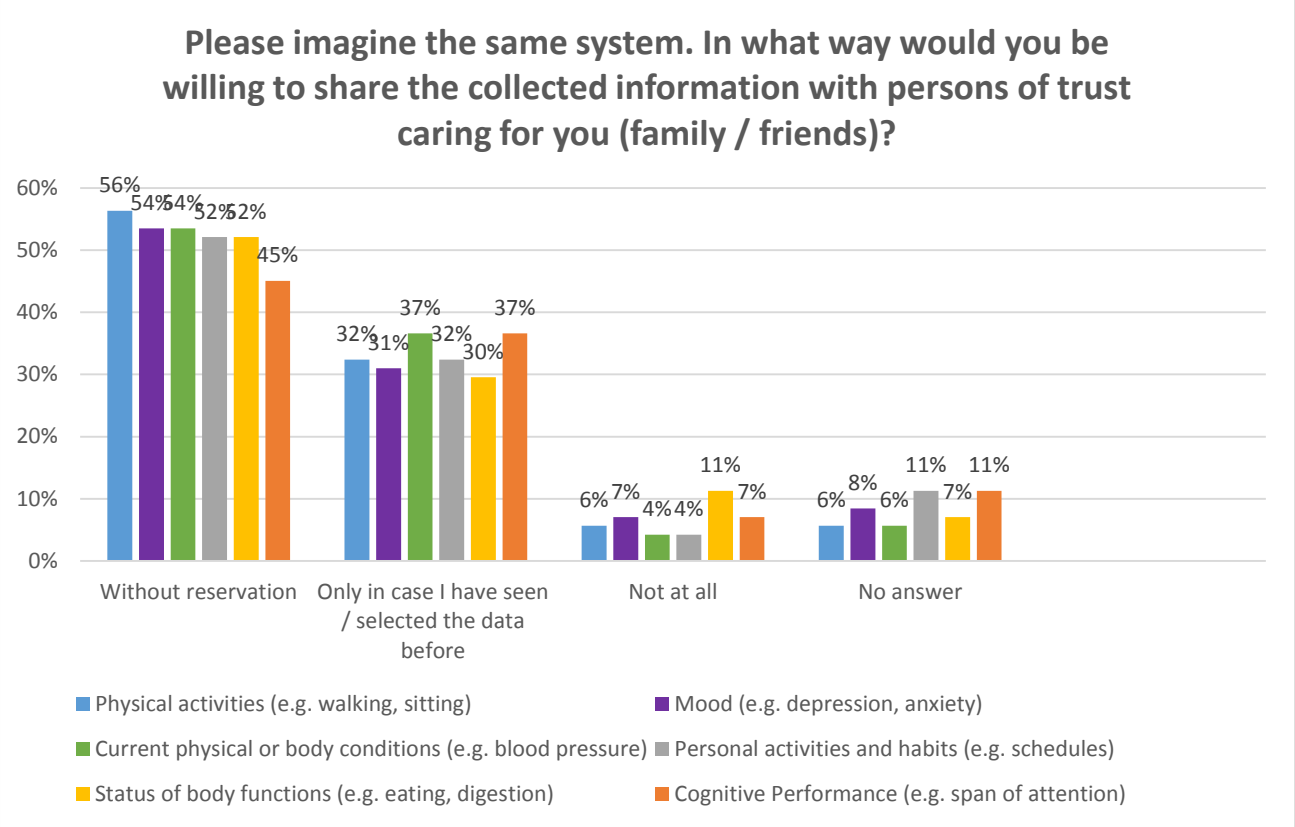

Looking at the inflow of information, the usage of a respective e-health system is likely to be much less restrictive. When asked about specific information end users want to receive from professional caregivers and practitioners, all offered categories of information were approved by more than 80%, except reminders. Instructions, analyses and responses and responses to specific request are thus likely to be highly appreciated by use of an e-health system. As reminders were welcomed only reported by 42% of the respondents, these might be valuable as an additional feature, yet no majoritarian requirement. Other suggestions concern information such as psychological aid, information on nutrition and detailed reports on treatment.

When asked about additional types of information the interviewees cannot provide to their practitioners at the moment but would like to share with them, most answers brought up cover aspects relevant for improved treatment. Data about nutrition, their physical and mental status and diagnoses made by other practitioners are examples thereof. Moreover, some respondents would desire to share information facilitation holistic medical treatment that looks at factors beyond the mere academic medicine, such as living environments, personal relations or their financial situation. Last not least, there is an indication that they would appreciate shorter intervals for the exchange of information to practitioners and caregivers than is given under the status quo.

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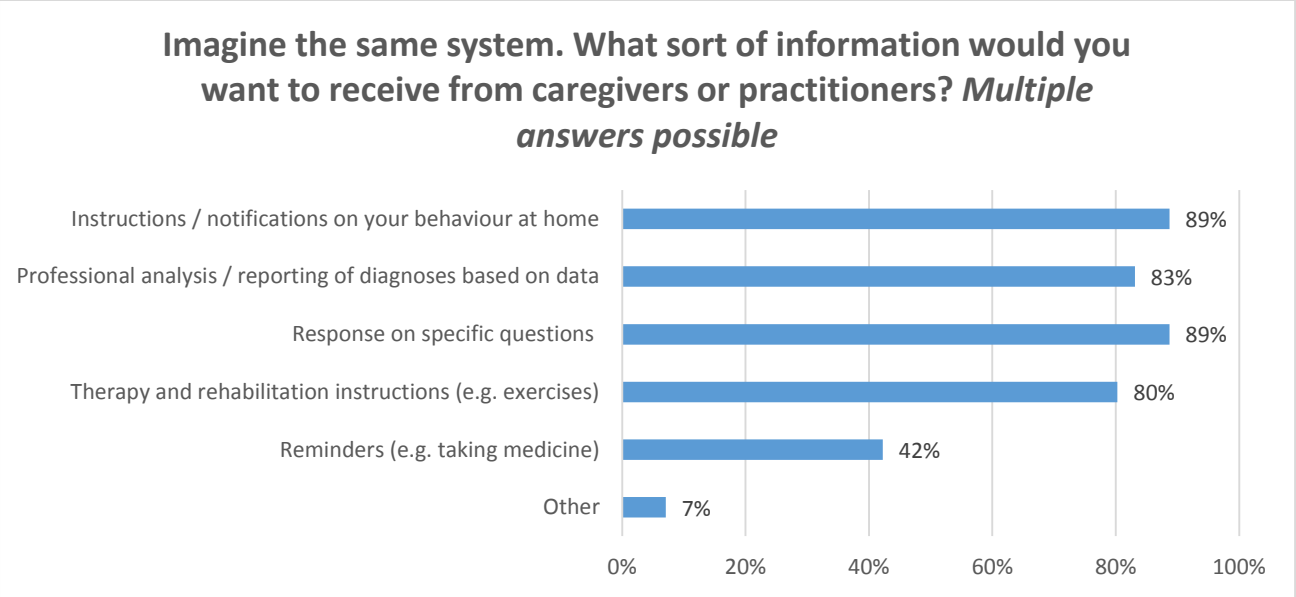

Having considered the general willingness to share information with practitioners and caregivers through an e-health-system such as envisaged in PersonAAL, including types of data, storage and potential data formats, this impersonal / delayed sharing of information was directly compared with modes of direct interaction to the target groups. For this purpose, the respondents were asked about the convenience of different modes of informational exchange including both direct interaction and delayed modes. In contrast to the question asked earlier about accepted data formats, this question was not based on optional choice but on scale so that each way of communication can be analyzed in more detail.

The findings show that direct calls are considered by far the most convenient mode, with 55% considering this type of informational exchange highly convenient. Video message, contrast was only considered highly convenient by about 20%, whereas almost the same amount of respondents considers this mode inconvenient. Comparably high acceptance was also reported for recorded voice messages and touch messages, with 39% and 41% considering these types at least somewhat convenient. Less enthusiasm was shown for recorded video and gesture messages that were considered inconvenient by 21% and 23% and highly convenient by only 8% and 14%, respectively.

The findings suggest that the respondents do not generally prefer direct talks over communication through messages. Rather, there are indications that voice is preferred over video. One may also conclude that the low shares for sounds in the earlier question on accepted data formats are rather associated with sounds other than voice messages.

Text chat and email communication are further appreciable options brought up by individual respondents. At the same time, however, usability and simplicity in handling were claimed for the overall usage so that the additional effort through text chats would need to be subject to further scrutiny.

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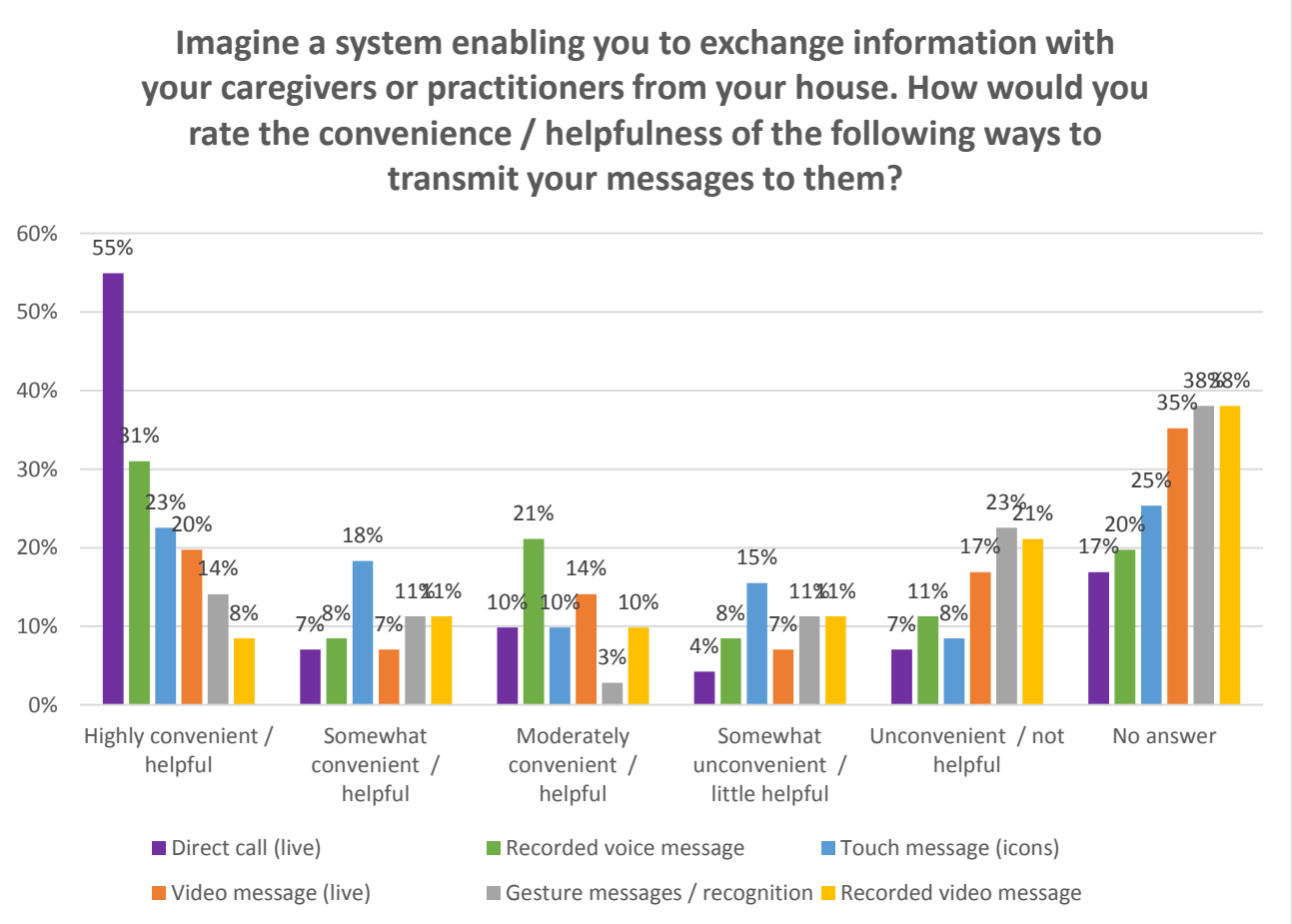

Looking on the inbound flow of communication, the picture looks rather different. As with the outbounds, phone calls are the medium with the highest share of respondents feeling high convenience (65%). Strikingly, all other mediums that were considered for the outwards communication, received rather low shares for high convenience. Moreover, rather high shares of respondents did not answer to this question, which may indicate indecisiveness or lack of experience with modes other than directly talking to their caregivers. Rather low shares may also be affiliated with the fear of annoyance by the expected inbound frequencies. On may suppose that direct calls, in contrast, could be associated with experience and the respective awareness, that calls can be refused.

The current question also includes text messages since the effort for receiving instructions or information (other than sending) in written form may be bearable even in case of specific impairments. This type of communication is indeed considered highly appreciated by 46% of the participants and still appreciated by 27%.

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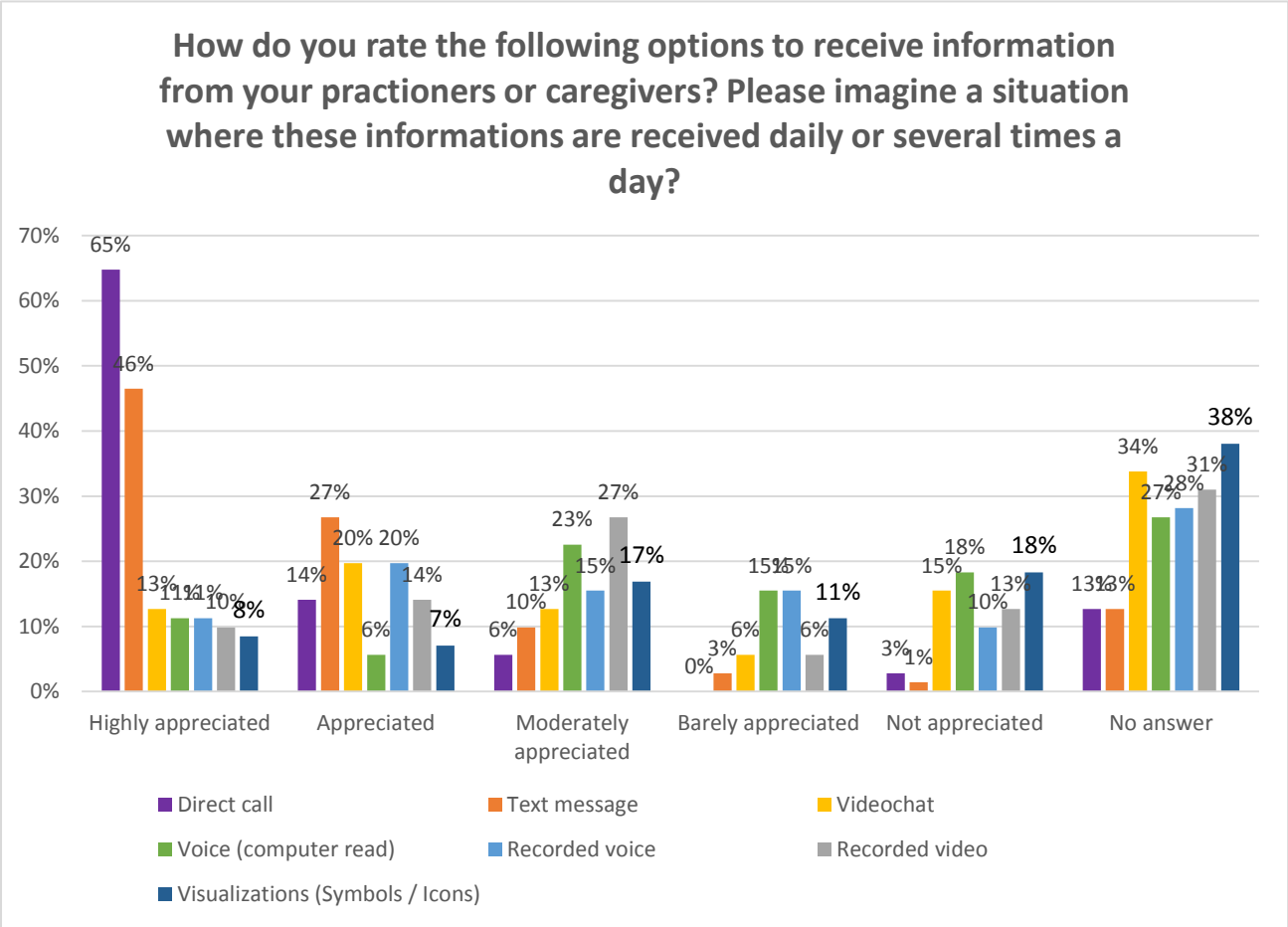

Privacy was mentioned earlier as an important issue in the context of the overall exchange of health related data through an e-health platform. As the PersonAAL system intends to collect health-related data by use of different sensors, the respective acceptance of such data collection was investigated. As can be derived from the following chart, two thirds of the end users asked would agree on the installations of sensors, yet only if personal control over these latter is given. 46% further specify that no alienation from the intent to install sensor should be possible, which emphasizes the claim that functions should be limited to data necessary for the intended treatments. The shares are also rather noticeable for the claims regarding confidentiality (38%) and possibilities of data selection (35%). 23% generally decline the collection of data related to health at home.

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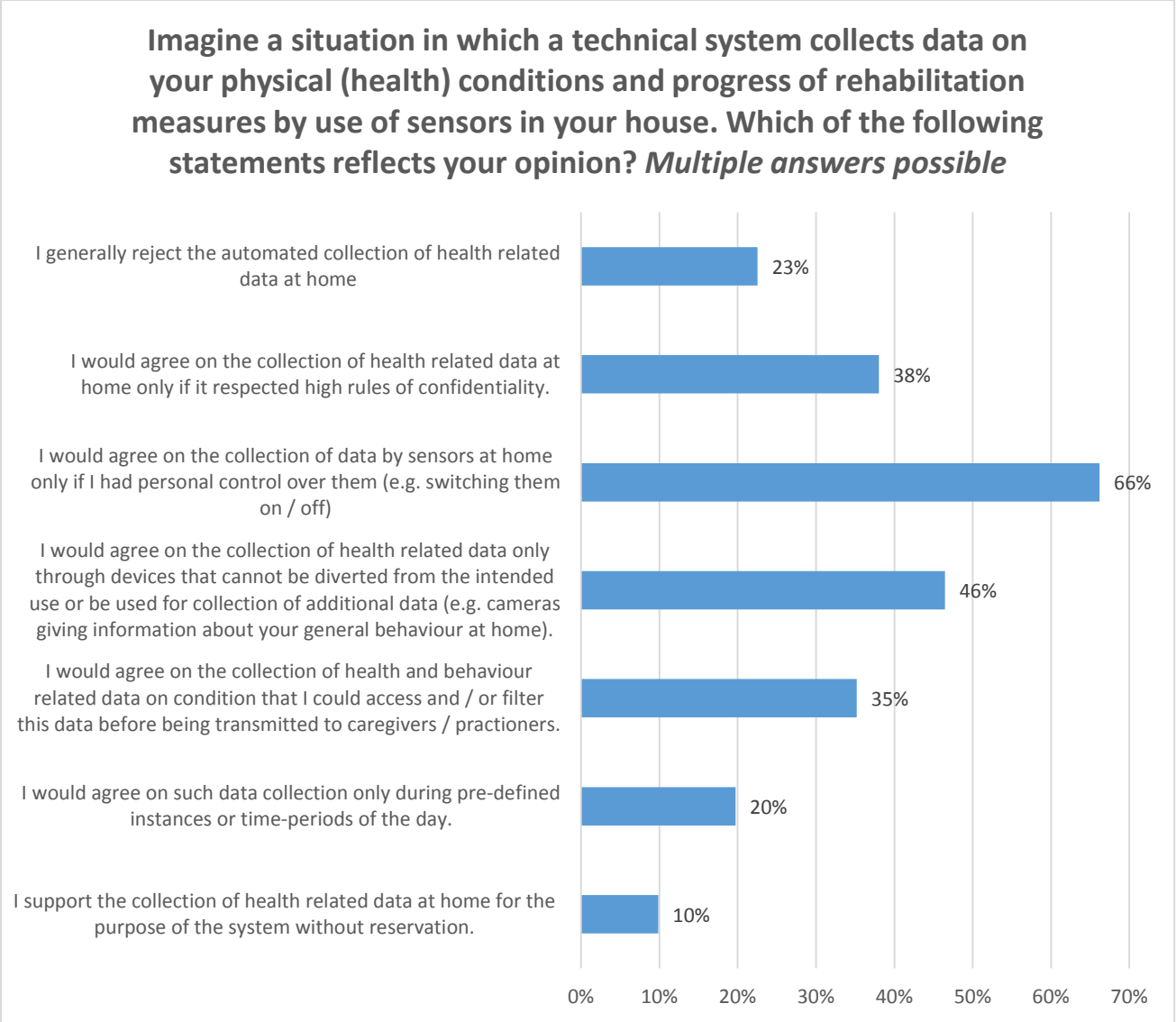

In addition to privacy protection, the questionnaire was interested in general prerequisites people have for accepting and working with an e-health system. As came out earlier, the ability to have personal access and control over the data is mentioned as a fundamental requirement by 77% of the respondents. 59% need clarity that the system works reliably. Unobtrusiveness, self-control over the settings and low outlay are important by still one third of the respondents, whereas medical innocuousness is only mentioned by 10%.

Strikingly, only 17% mention that they would be willing to accept the system only on condition that this latter is tailor-made for specific treatment they receive. Earlier, it was concluded that large numbers would be willing to share data to practitioners and professional caregivers only if

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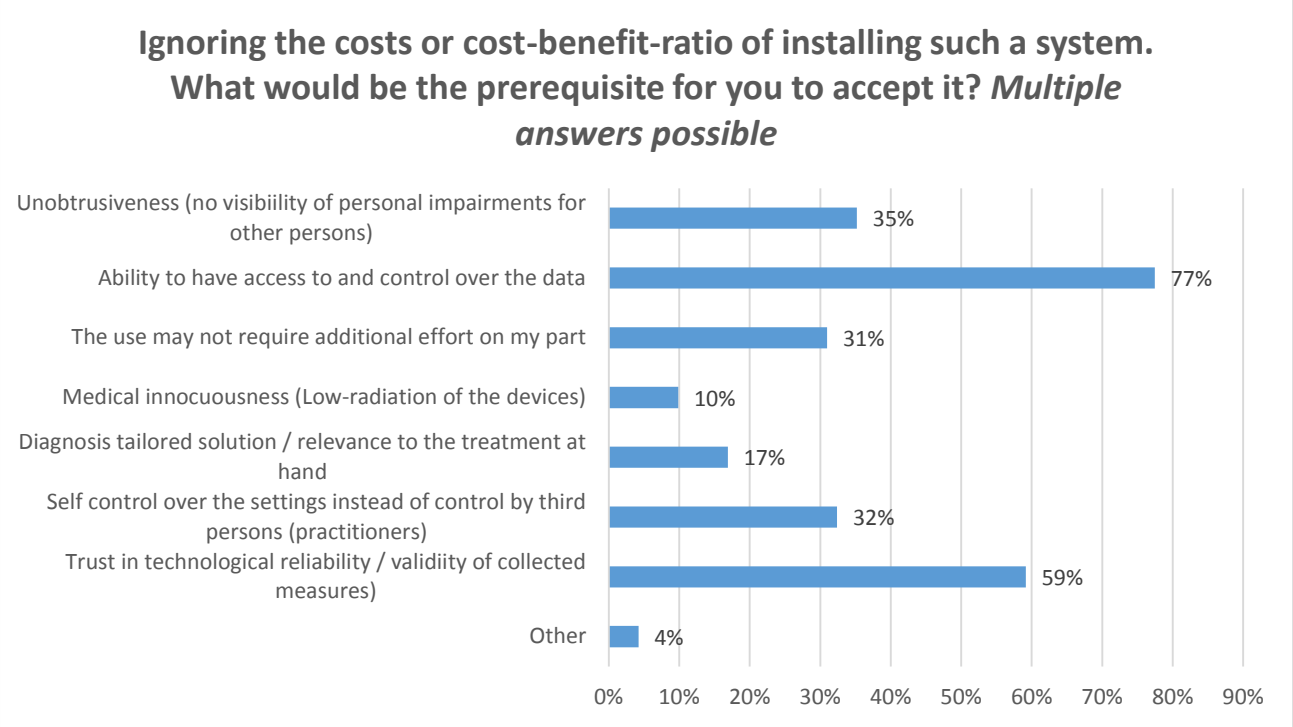
they consider these data to be medically relevant. In light of this, the current findings suggest that that the system design as such should not be limited to specific treatments, but that it should rather offer all-round functionalities that can be adjusted or calibrated to specific monitoring requirements in terms of data collection.



In order to find out the support of respective hardware for the data collection, the comfort with different categories of sensors was surveyed among the probands. Only minorities between 10% and 15% indicate clear discomfort with smart home sensors, integrated wearables (e.g. in jewelry), separate wearables and non-wearable health sensors. More people, in contrast, feel uncomfortable with those sensors that are presumably more common: Prevention sensors (e.g. fall detection; 31%) and security sensors (e.g. alarms; 30%). Between 31% (non-wearable health sensors) and 48% (separate wearables) approve their discomfort on condition, which could mean that the context for usage is decisive.

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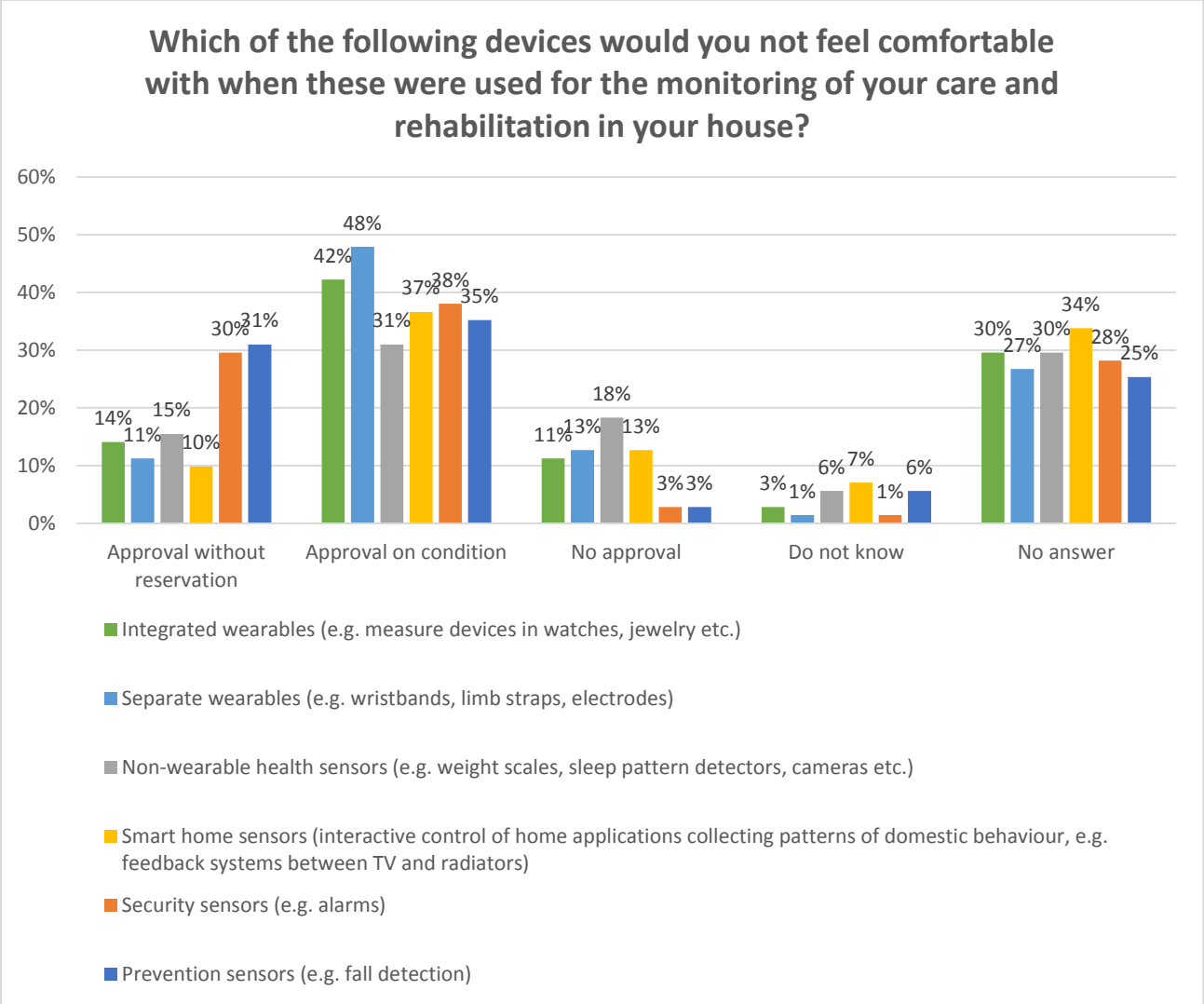

About 56% do not expect that sensor based monitoring of healthcare related activities would improve their actual treatment, whereas 34% do. These numbers, however, should be interpreted in light of the current health status of the respondents. As most of the interviewees currently do not require major care or care at all, most of them might not be aware of potential improvements an e-health system could actually enable in case of impairments. The 34% expecting an improvement can therefore already be considered an important substantiating the purpose.

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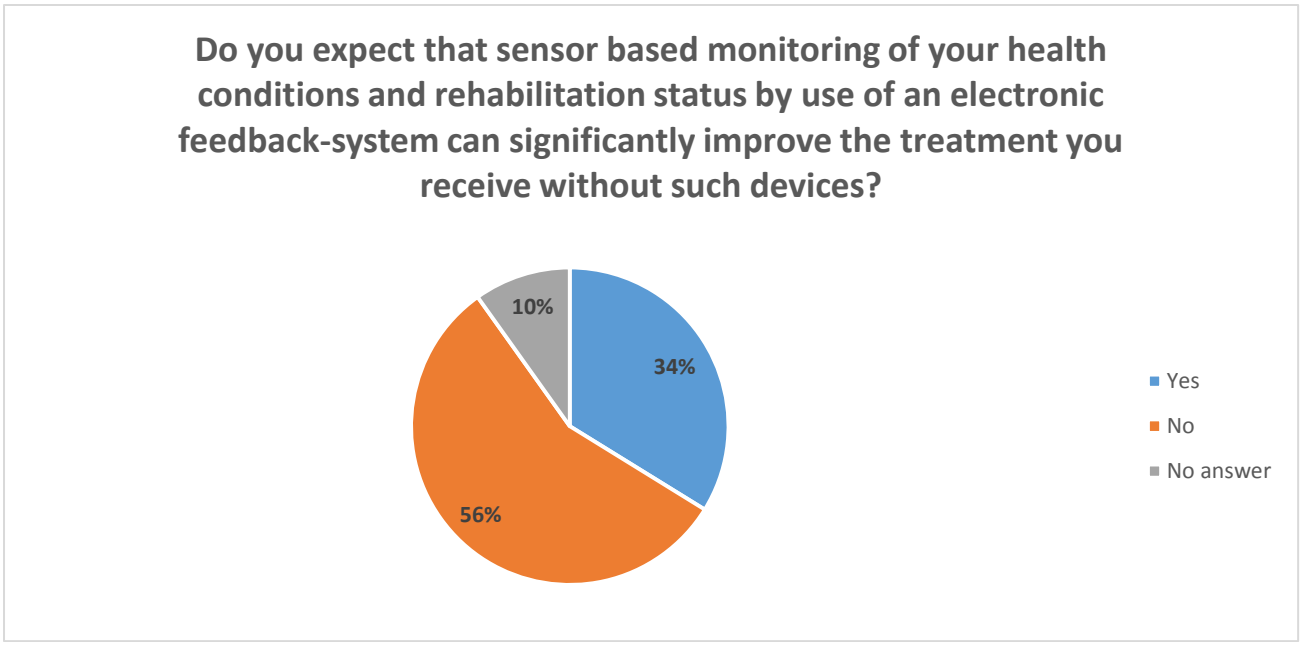

Only 35% of the respondents think that they would see their practitioner or therapist less frequently if they used a reliable monitoring system. This may be explained in the benefits of face to face interaction, among which social aspects were mentioned in the first place. Direct dialogues, psychological aspects, emphathy, loneliness, personal appreciation and the buidling of relationships of trust are examples thereof. Moreover, there is a widespread concern that only few aspects of the required healthcare can be covered by an e-health system. Activities such as medication intake, body-check-ups, physiological activities and the taking of blood samples were mentionioned, amonst others, as requireing personal visits. This does not mean, however, that an electronic system cannot take over parts of the treatment. Benefits such as reduced waiting times and dispensible visits were identified concurrently.

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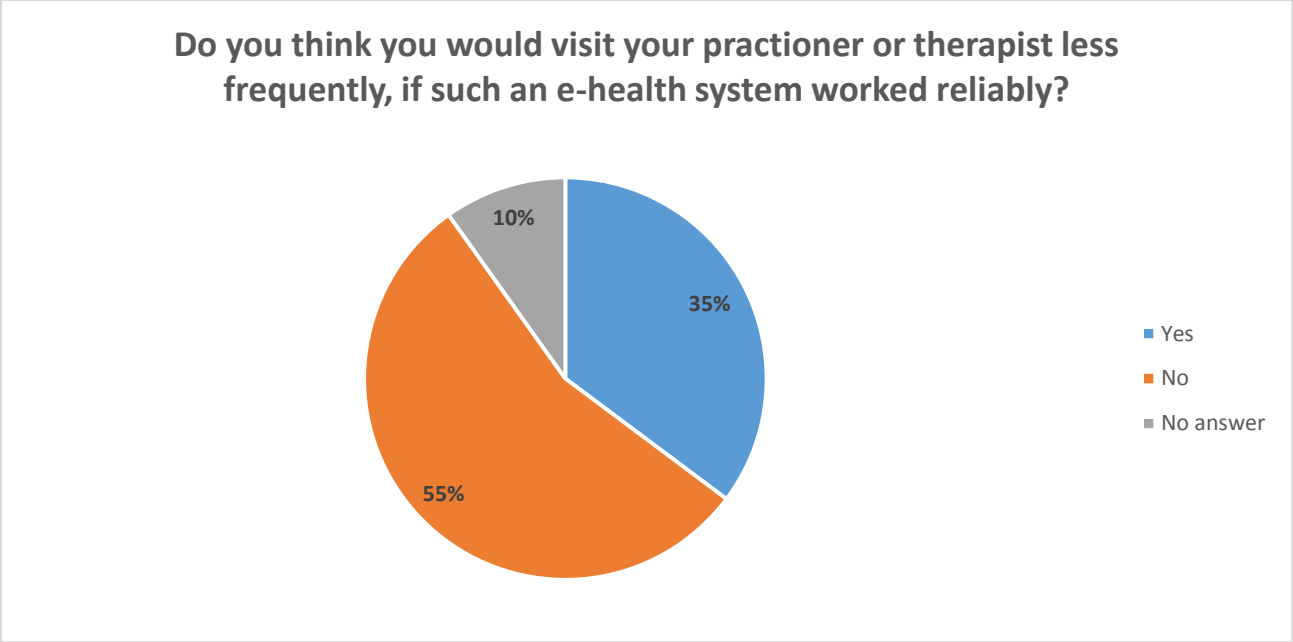

5.2 Use of technical devices

The current use of technical devices was investigated through the survey in order to learn more about elderly people's habits and familiarity with modern technological devices. Knowledge about these aspects is important for the PersonAAL system as the target groups will need to be able to understand the handling of the innovation and as integration into their daily routines will be crucial to guaranteeing constant usage.

As can be derived from the following chart, the current sample is rather familiar with the use of modern technological devices and can handle them well. The bias in this survey, which was predominantly addressed to the target group by email, explains the high usage among the respondents and confirms the intended target group, namely elderly people with at least minor technological affinity.

Among modern communication devices, familiarity was reported for common cell phones (80%), Smartphone (56%) and tablets (42%). Whereas 82% can handle well TV, only 14% are familiar with smart TV.

Actual usage is equally important to the choice of a suitable medium considering that innovation is more likely to be successful if it fits into existing routines. In that regard, PC (92%) and TV (76%) are the most promising platforms in the context of daily usage. Smartphone (49%) and tablets (31%), which both appear adequate to the PersonAAL platform given their multimedia functions, still appear rather promising as devices with potential of frequent use.

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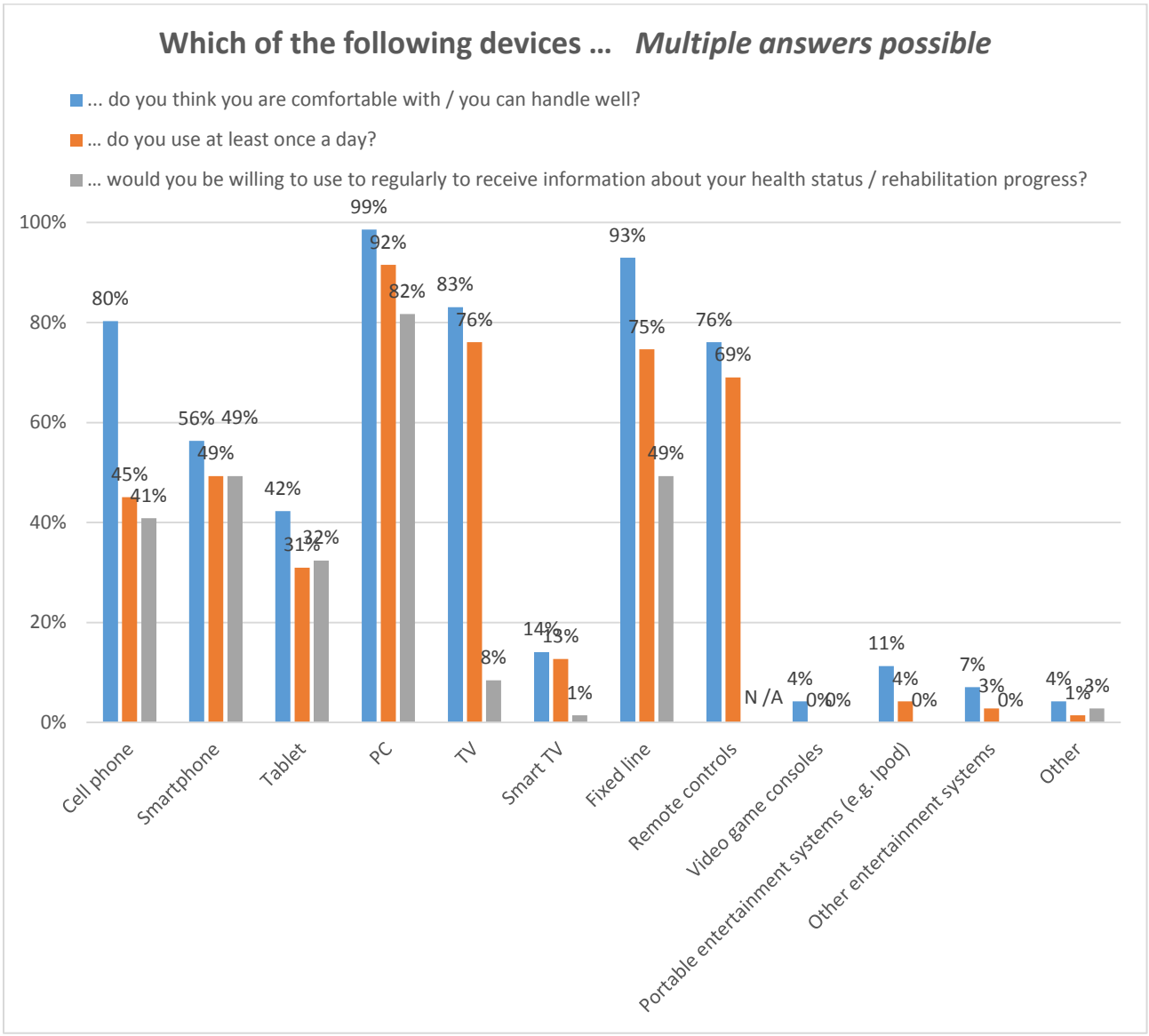
As regards preferences by the elderlies regarding the access to an e-health application, PC (82%) and smartphone (49%) rank in the fore, followed by cell phone (41%) and tablet (32%). Only 1% conceives of using an e-health system through a smart TV, which, however, may be a result of low familiarity of smart TV to the target group.



Taking a closer view at the use of modern communication devices confirms the picture depicted above that elderly people largely stay up-to-date with the latest technology. 61% indicate a daily usage of devices such as smartphones and tablets, 17% still use these latter at least once

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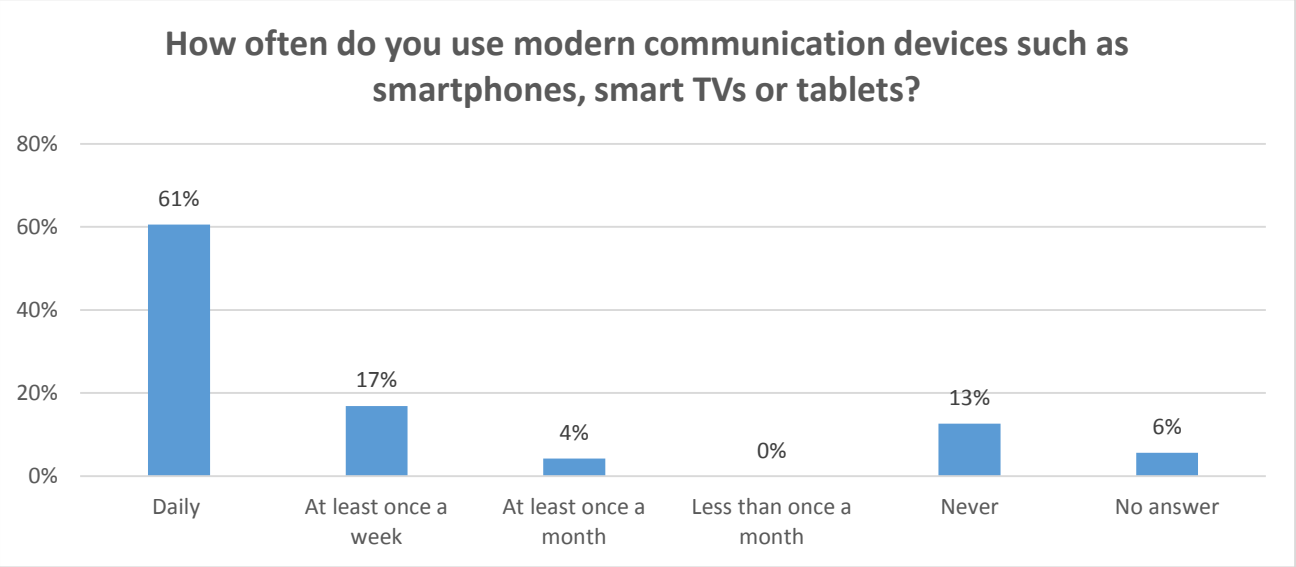
a week. Only 13% of the respondents refrain from any usage of modern communication devices.



In order to tailor the PersonAAL system to the actual needs the target group has, it is important to take a closer look at potential shortcomings existing technologies have and at the question what the target group prevents from using them. The survey was therefore further interested in reasons why modern communication devices are not being used. As illustrated in the chart below, a major reason is a simple lack of need (44% approval), followed by usability issues (27%). These are indications that a major focus should not only be put on potential impairments regarding proper handling and comprehension, but that any new development should put major investments into the clear provision of extra-benefits, problem-solving and respective sensitization.

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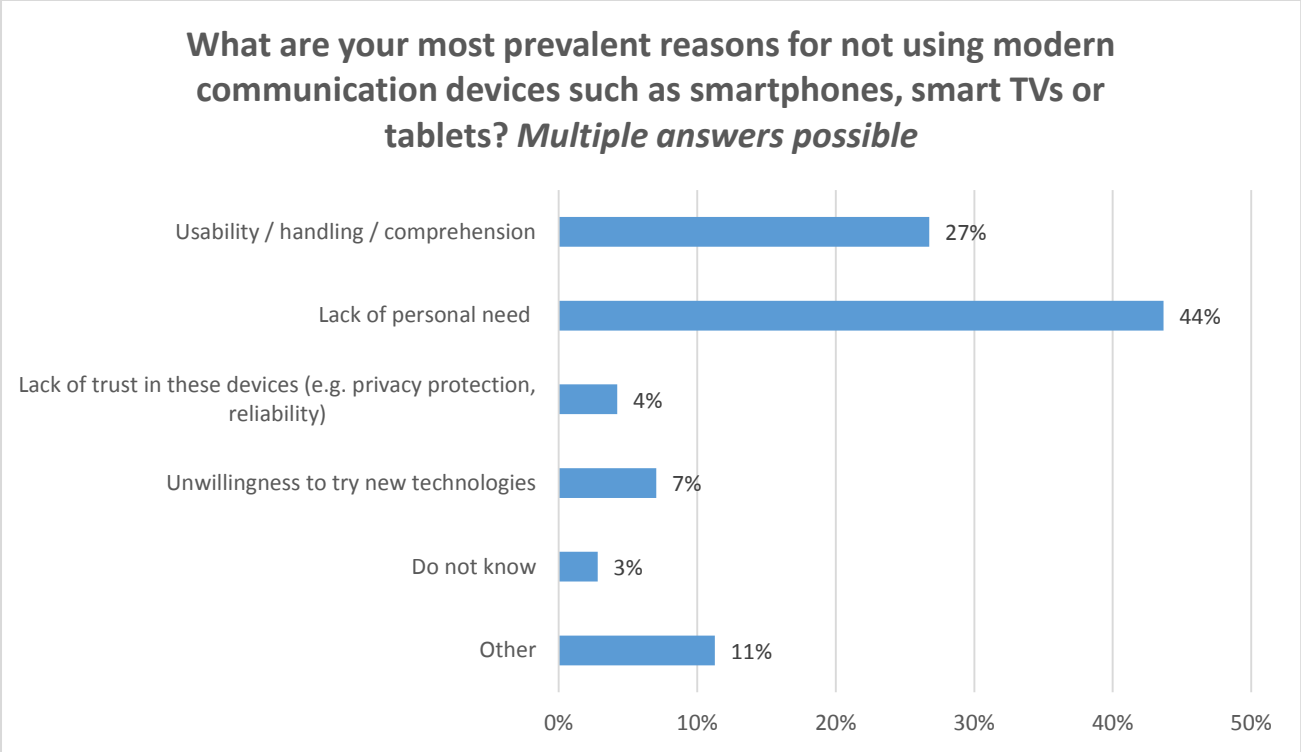
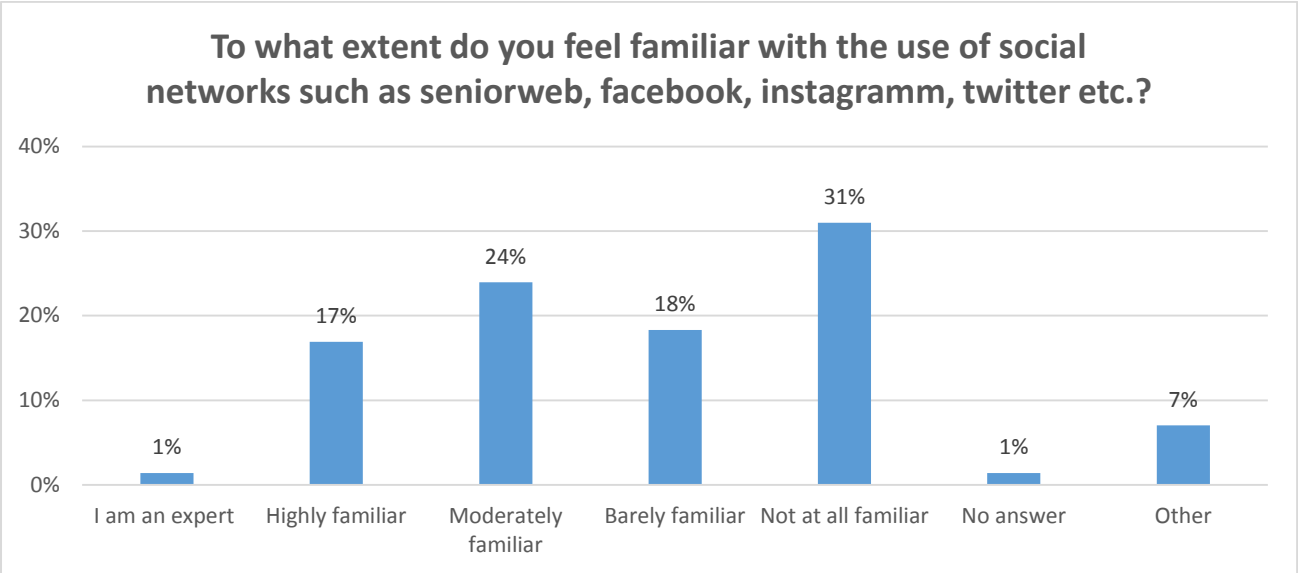


The use of social networks so far is rather sporadic among the given sample. One third of the respondents is not familiar with them, only 17% indicate high familiarity.



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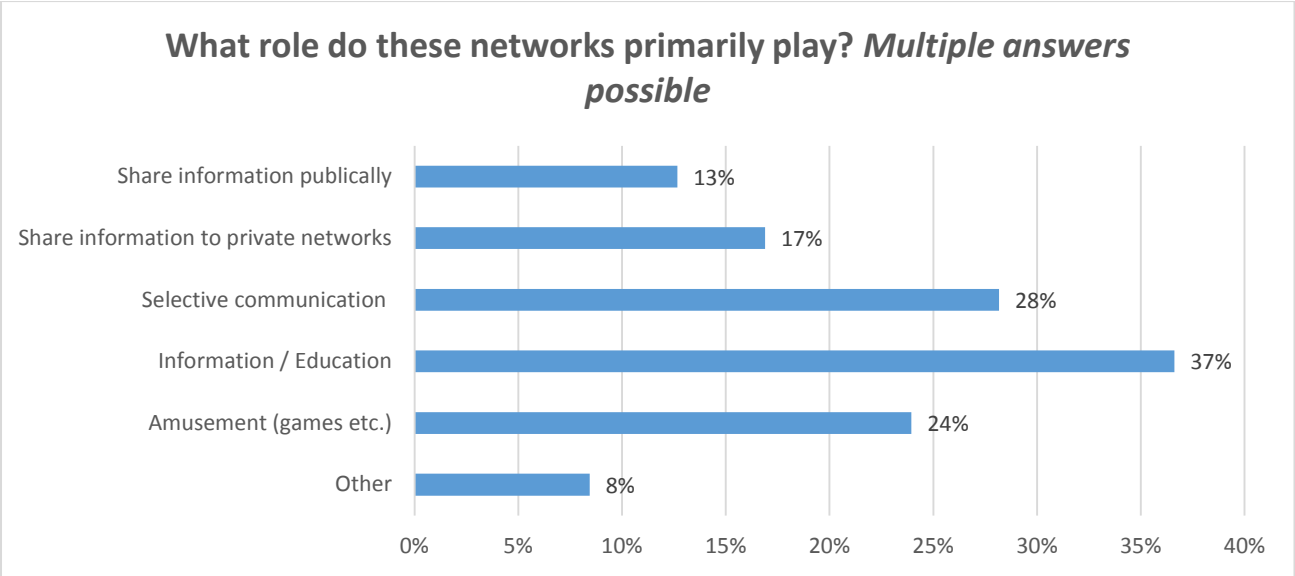
Despite only moderate familiarity, the chart below shows that social networks are still being used by large shares of the sample. 37% use social networks for informational reasons. 28% communicate to defined addressees and 24% use social networks for entertainment. At least roughly a fifth even shares their own information to private networks.



Tracking systems are already used by a fifth of the sample. 'Tracking' system has not been further defined for the purpose of this questions. Nevertheless, the findings suggest that a noticeable share of the respondents already cares about assistance technology, even though their own independence, as found earlier, is perceived as rather high and as external care is hardly required by now. This indicates that prevention and peace of mind merit further attention.

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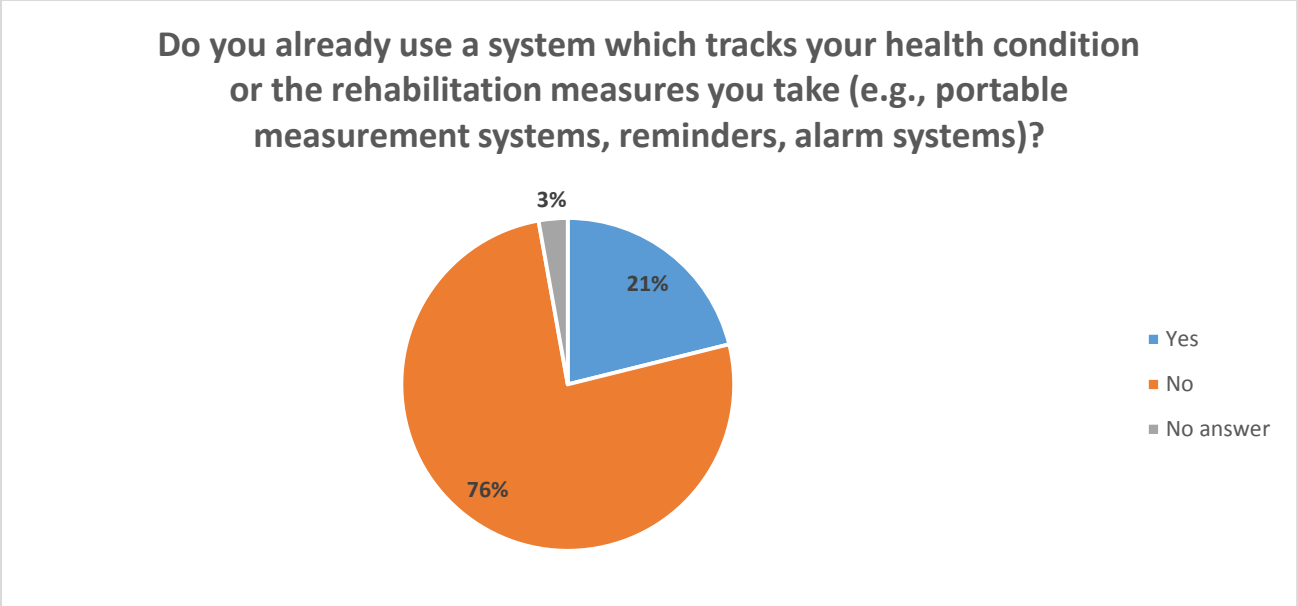

It was mentioned above that any new technology is expected to have higher chances for success if it is provided that they do not inflict additional effort on the user and change his or her common routines. The constant usage of new portable devices such as tracking or even informational systems would be expected to be little accepted. Yet, the following charts illustrate that this expectation hardly holds true in situations in which the end-user perceive direct benefits: 70% answer that they would be willing to use a new portable device on a daily basis if such a measure helped to improve their medical care significantly and / or it contributed to the peace of mind of their beloved ones. Still, these numbers must be taken with care and require further analysis. Shape, unobtrusiveness and contexts of use are some of the qualifications mentioned by the respondents.

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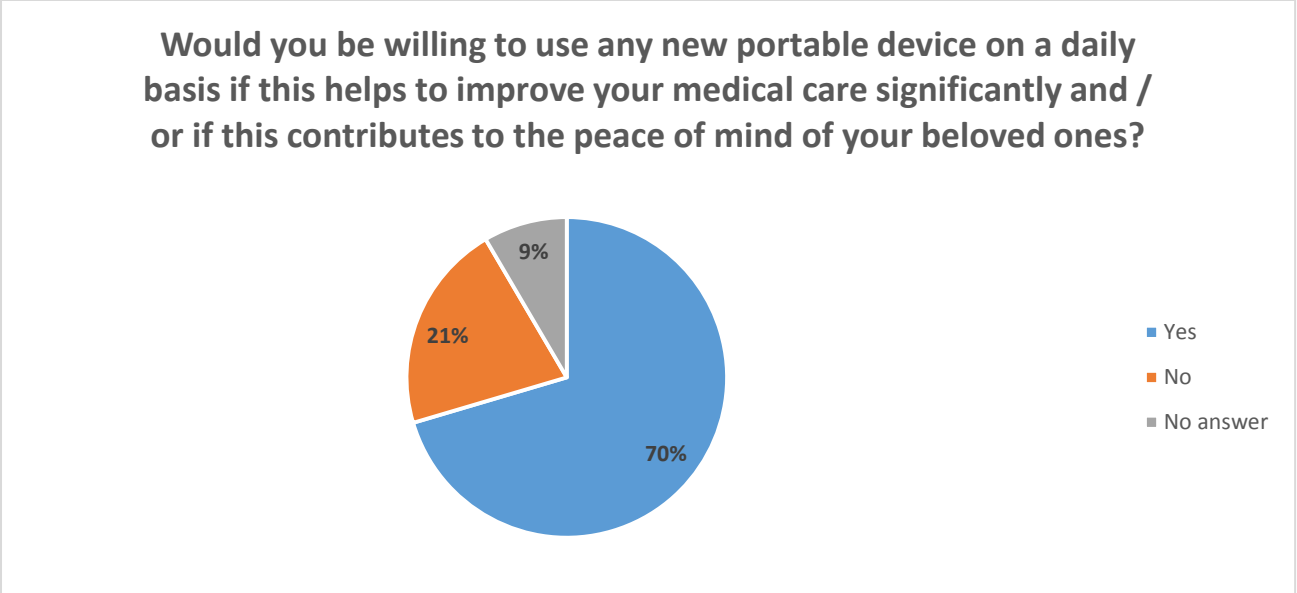

5.3 Usability of technical devices

The familiarity with modern technological devices gives only some information about the potential success the different hardware could have for usage with the PersonAAL application. Equally important is the usability, i.e. comprehensibility, handling and ease of learning associated with them. The survey therefore investigated in more detail what types of usability issues elderly people from the underlying sample are concerned with.

The most important associations with usability problems and the most prevalent reasons preventing elderly people from using modern communication devices were identified in the following areas:

- Privacy and data protection
- Handling
- Protection of personal communication
- Age
- Costs
- Security concerns
- Discretion
- Personal need
- Sales of data
- Complicated navigation
- Overcomplexity (too many functions)
- Insufficient Know-how
- General user-unfriendliness

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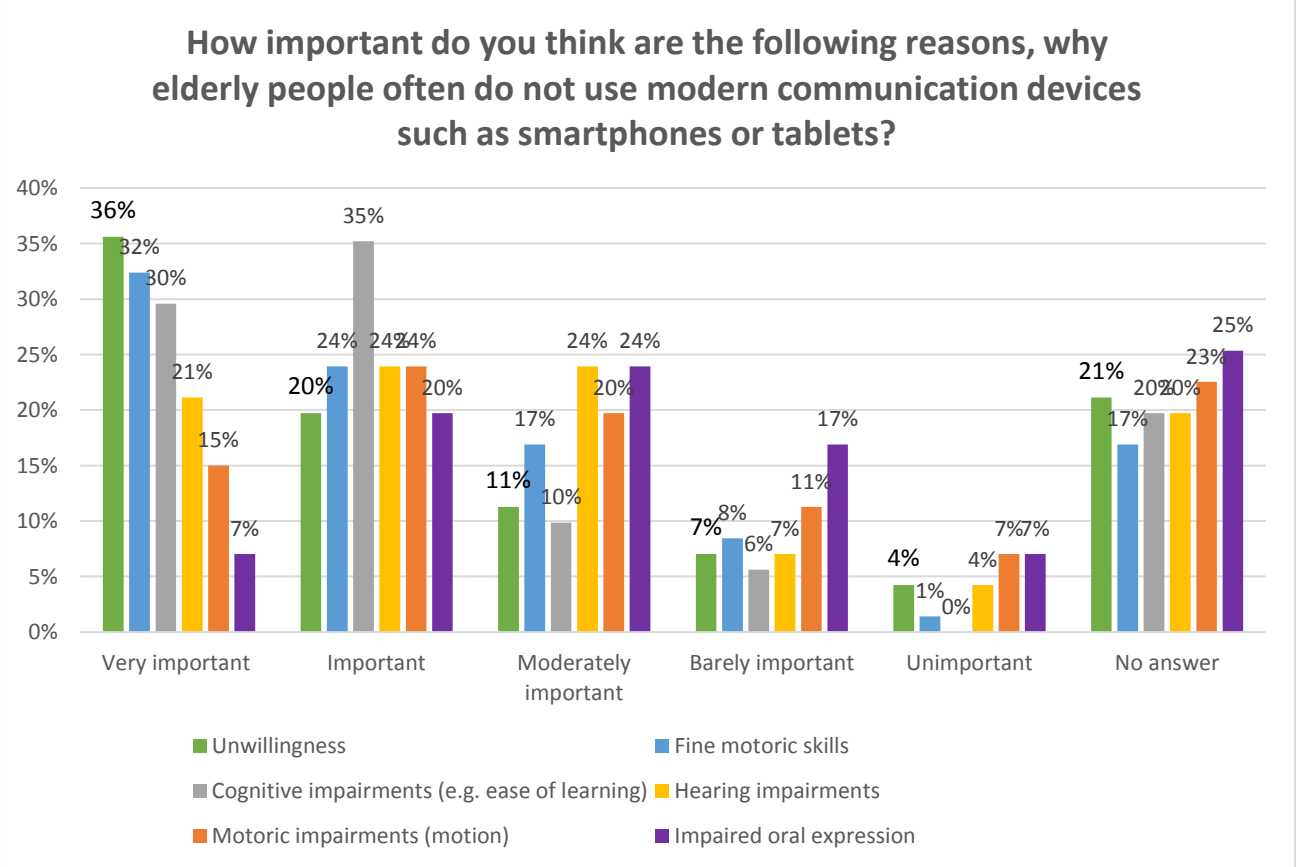
In order to prevent the respondents to confess their own (potential) reluctance for using modern communication devices, the sample was asked to give their own estimation why elderly people refrain from using them. As shown in the following illustration, unwillingness to try new things is the category considered as very important the most (36%) and hence more often than actual physical problems they might suffer from. Taking the cumulated checks for 'important' and 'very important', cognitive issues rank the highest (cumulated 65%), followed by fine motoric skills and unwillingness (56%). Oral expression is considered comparably unimportant.



Typical experiences with usability issues were reported qualitatively. A noticeable share of the respondents indicate that they have had problems with devices they were willing to use but could not handle. In these cases, consultation, assistance and personal effort were decisive remedies. Exemplary solutions were found in the following:

- Use of instruction manuals and consultation of vendors
- Help by younger people
- Trying again
- Taking of time

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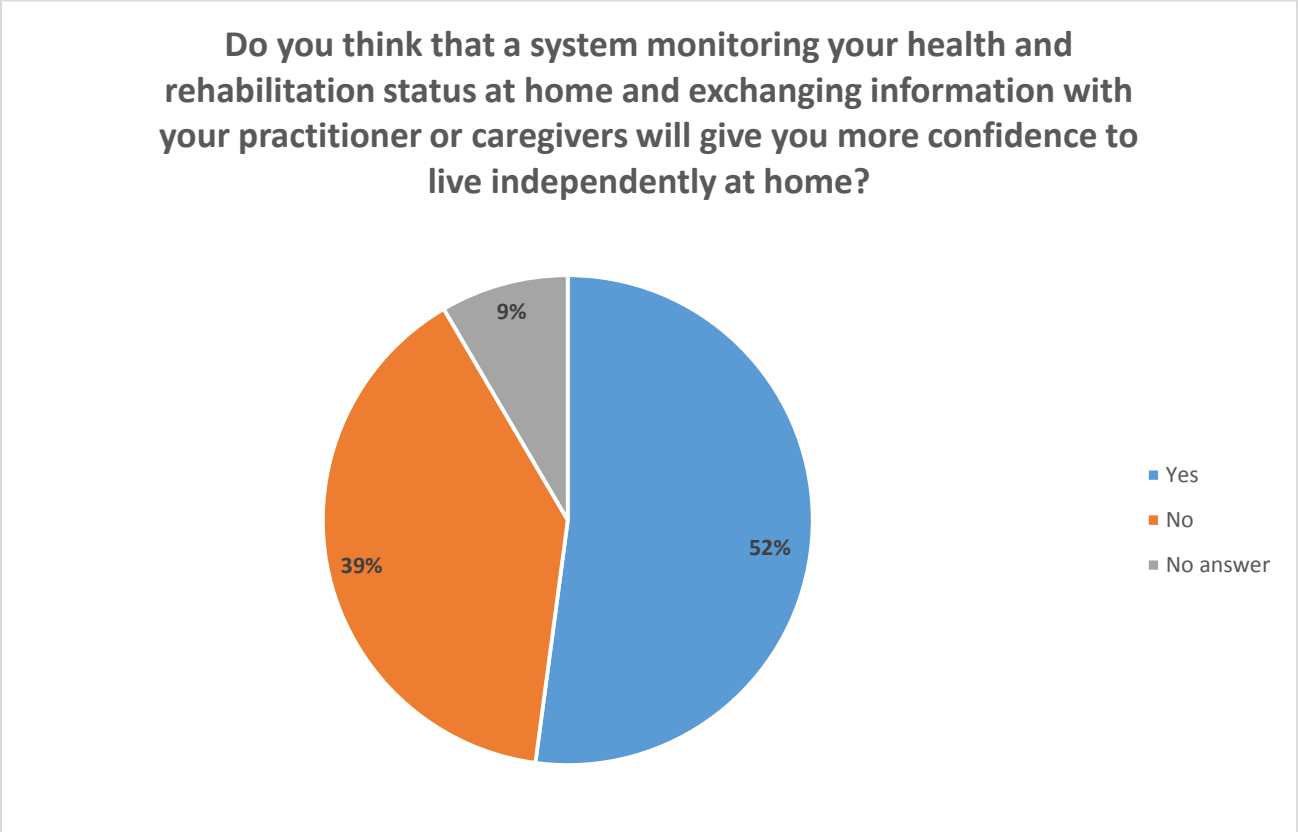
- Consultation of professionals
- Search for solutions online
- Repeated trail after accepting 'the challenge'

However, whereas some of the are rather solutions oriented, others indicated increasing frustration, dissatisfaction and growing impatience with their exposure to technological innovation.

5.4 Criteria / Prospects for market success

About half of all respondents expect an e-health system such as envisaged in PersonAAL to contribute to their ability to live at home independently for a longer period of time.



Nevertheless, it was found earlier that the actual usage will be subject to qualifications and meeting of fundamental requirements such as in terms of usability, purpose and technical as well as operational design. In order to find out more about general success factors, all participants were confronted with particular statements, the approval of which can give valuable information about fundamental requirements of usage.

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As can be derive from the chart below, there is a high willingness not only to use the system, but also to accept direct consequences in terms of costs and effort if benefits are clearly visible. These can be peace of mind (35%), improvements of daily care (51%), improved communication to practitioners and caregivers (49%). 23% would even use the system irrespective of the costs it might require, whereas 55% rather expect a clear ration of costs and benefits.

Only minorities see mainly negative consequences such as coming out with personal impairments (4%), problems with comprehensibility (7%) or violation of privacy rights (20%).

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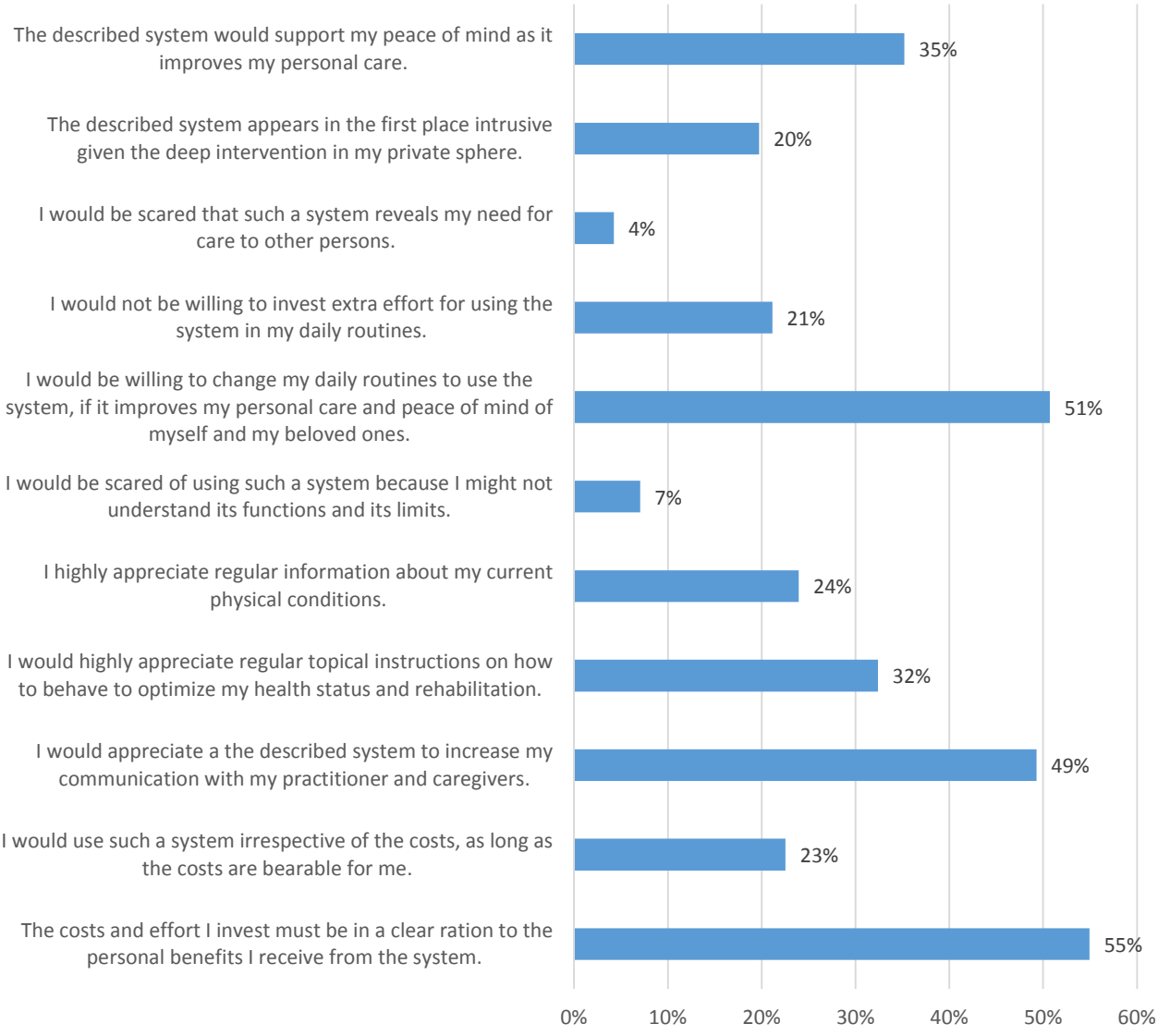
Which of the following statements reflect your opinion? Please imagine a scenario in which you use a system that monitors your health and rehabilitation status at home and which allows direct feedback with and by your practitioners and caregivers. *Multipl*



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6 ANALYSIS

6.1 Evaluation

In a nutshell, the present survey among older adults gives valuable indications for a number of aspects relevant to the further development of the personal system. In the first place, the great variety and distribution of responses among the participants clearly indicates the requirement for adaptation capabilities. It confirms the diversity of lifestyles, requirements and preferences for both usage of ICT and the communication of (health-)care related aspects.

The willingness of sharing information through e-health systems is likely to reflect current practices, which aim strongly for the integration of any new system into the common habits and routines of the target group. Globally, the target group can be expected to be less inclined to share information they do not already share through e-health platforms. The respondents are more inclined to share personally intimate information, such as psychological factors (e.g. mood) with emotionally more proximate people, whereas professionals shall be granted access to information only where clear benefits for the treatment at hand can be expected. This may also explain why public institutions, which are usually associated with rather administrative or legal aspects of the health care policy, are hardly appreciated partners of information sharing.

Similar results can be derived regarding the types of data. Roughly speaking, multimedia data, which may be associated with more intimate information sharing, is rather accepted among networks of trust. The social aspect of such relations is likely to play an important role regarding the sharing of information.

A very strong point can be made regarding privacy and data security. There is a tendency that even where the target group considers information sharing as beneficial, this sharing should not result into a loss of control over the information they share. In other words, even though e-health systems may be intended to promote independence, people may not be given the feeling to loose personal autonomy. Personal intervention should always be possible, which also implies the selection of information they communicate.

As regards media, there are, roughly speaking, preferences for devices already in use. This may be interpreted in different ways. Either respondents are not sufficiently sensitized for the benefits of innovative ICT, or these latter are not expected to account for their actual usability issues elderly people have.

The PersonAAL system should be intuitive and should be transparent in a way that the user receives a minimum of information about what he or she is sharing, with whom and why, because as we saw from the inquiry the there is some unwillingness to share information with the healthcare professionals and above all public institutions. However and since this information sharing is important and could be beneficial for the user, there is reason to sugges that this attitude can be a result of the lack of knowledge about the benefits of the PersonAAL

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system. The PersonAAL system should be clear in this aspect and actively promote higher adhesion to and information sharing with the healthcare professionals.

6.2 Recommendations

According to the findings stated above, there are four major recommendations to be made for the further development of the PersonAAL-system. These recommendations are intended as guidelines for the upcoming development process and be subject to validation. They must be read in conjunction with the findings that are directly inferable from the charts listed above.

Personalization

The spread of the data confirms the necessity for distinctly individualizable system features. This involves not only the presence of individual features tailored to specific impairments at hand, but also the possibility to adapt the usage of features to specific lifestyles and living environments.

Transparency and data control

The system must make sure to allow transparency over the data, which should be easily accessible by the end-user, as well as possibilities for personal control by the end-user. This also includes the possibility to switch on and off functions intended for the collection and sharing of information. Different forms of access and feedback to the end-user (e.g. rough vs. consolidate data) should be considered in the design process.

Social aspects

As different types of information shall be shared with different actors through different media, the system must make sure to allow for different channels targeting different stakeholders in the PersonAAL network. The application must allow for more personally intimate modalities in areas in which social aspects play a major role and revert to more impersonal modes where relations are more factual. The relation to the respective addressees should be a defining criterion regarding the type and content of data to be shared.

Openness to local/regional/national architectures

Considering the strong policy differences between different countries and networks targeted with the PersonAAL system, this latter must be technically open to account for different IT-infrastructures, legal requirements, healthcare systems and routines of the stakeholders involved. The system should thus be suitable to be integrated in different scenarios and environment (e.g. in professional healthcare or home environments) and to different purposes of usage (e.g. relief of carepersons vs. extension of capacities of carepersons).

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