



GOT-IT: A TOOLKIT FOR INCLUSIVE AND UNDERSTANDABLE LIFESTYLE DATA  
VISUALIZATIONS IN EHEALTH SOLUTIONS AAL-2020-7-51-SCP

## D1.1: INFORM

**Dissemination level:** Public  
**Nature:** Report  
**Version:** 0.2.0  
**Date:** 2021-10-21



<b>Date:</b>	2021-10-21
<b>Version:</b>	0.2.0
<b>Due date of deliverable:</b>	2021-10-31
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## DOCUMENT REVISION HISTORY (ONLY DURING DRAFT)

Version	Date	Modifications	Modified by
v0.1.0	<2021-08-19>	TOC	Yvonne Prinzellner (JOAFG)
v0.2.0	<2021-09-07>	Chapter 5	Danielle Drachmann, Lars Münter (DCHE)
V0.3.0	<2021-09-08>	First Draft	Yvonne Prinzellner, Alisa Simon, Veronika Simanko (JOAFG)
V0.4.0.	<2021-09-10>	Review	Carolien Smits (Pharos)
Vo.5.0.	<2021-10-21>	Revision	Yvonne Prinzellner, Alisa Simon (JOAFG)

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## Acknowledgments

The research leading to these results was carried out under the AAL Programme (AAL 2020 – Healthy Ageing with the Support of Digital Solutions) under project n° AAL-2020-7-51-SCP with funding by the European Union and the national funding agencies from the Netherlands, Denmark and Austria: The Netherlands Organisation for Health Research and Development (ZonMW), the Austrian Research Promotion Agency (FFG) and Innovation Fund Denmark.

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## ABSTRACT

The long term goal of the Got-IT project is to enhance the inclusiveness of eHealth solutions by creating accessible and understandable designs. This is bringing about the fight against health disparities and helps to boost citizen empowerment in Europe. In order to reach this goal, a toolkit is created over the course of the project, which is intended to support eHealth developers and other stakeholders on the journey of creating inclusive eHealth solutions. The approach of the toolkit is to first inform developers of eHealth solutions and other stakeholders in this field of the importance of an inclusive approach in the design process of eHealth solutions. Subsequently, information and tips are given on co-designing and testing eHealth solutions in order to make them as accessible and as inclusive as possible. The toolkit is thereby created as a living toolkit, embedded in an accessible online platform, meaning that the different sections can be updated and expanded to cover a variety of eHealth solutions and end user groups. As a starting point, the focus is on older adults (55+) with low eHealth literacy and their usage of eHealth solutions which promote a healthy lifestyle.

This deliverable will be part of the inform-section of the toolkit and therefore aims at sensibilizing eHealth developers and other stakeholders to the struggles of older adults with low eHealth literacy in the usage of eHealth solutions and the resulting need for inclusive designs. Accordingly, the goal is to encourage the usage of the toolkit in the design process. Therefore, an extensive part of this deliverable is a discussion of the term eHealth literacy and its connection to intersectional effects such as age, gender and education. Furthermore, research gaps are identified in this field and the socio-economic impact of low eHealth literacy among older adults in Europe are presented. The experience of professionals in the social and health sector is also brought into the picture. Here results are presented in terms of positive and negative experiences in their work with clients and patients regarding eHealth applications as well as recommendations for developers of eHealth applications that are derived from the results of the focus groups conducted. Ultimately, these different research approaches are brought together in a discussion on the importance of inclusive designs of eHealth solutions.

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## SYMBOLS, ABBREVIATIONS AND ACRONYMS

AAL	Active Assisted Living
D	Deliverable
DCHE	Danish Committee for Health Education
EC	European Commission
HL	Health Literacy
ICT	Information and Communications Technology
JOAFG	Johanniter Österreich Ausbildung und Forschung gemeinnützige GmbH
M	Month
PHAROS	Pharos Expertisecentrum Gezondheidsverschillen
RRD	Roessingh Research and Development
SES	Socioeconomic Status
SDGs	Sustainable Development Goals
SNA	Social Network Analysis
T	Task
TUW	TU Wien: Institute of Visual Computing and Human-Centered Technology – Human Computer Interaction Group
WP	Work Package



## 1. INTRODUCTION

The long term goal of the project *Got-IT: A toolkit for inclusive and understandable lifestyle data visualizations in eHealth solutions*, hereafter referred to as the *Got-IT project*, of which this deliverable is part of, is to make the design of eHealth solutions more inclusive in order to make them accessible and understandable for everyone. This is bringing about the fight against health disparities and helps to boost citizen empowerment in Europe (Cabrita et al., 2020). The project thereby focuses on older adults (55+) with low eHealth literacy, as a representative group of people who have limited access to eHealth solutions as they have difficulties using, understanding and interpreting eHealth solutions and contents (Cabrita et al., 2020; Hage et al., 2013). In this project, the point of attack to achieve this goal are developers of eHealth solutions and other stakeholders, as they have the power to influence the outcome of their products in a more inclusive direction (Cabrita et al., 2020).

A main objective of the Got-IT project is therefore to understand the perspectives and needs of older adults with low eHealth literacy when it comes to the use of eHealth solutions. As a second important step, the challenges designers face in the process of creating simple and inclusive designs for people with low eHealth literacy have to be investigated. Based on these experiences and the input gained within the framework of a co-design process, a toolkit will be developed over the course of the Got-IT project, which is intended to support eHealth developers on the journey of creating inclusive eHealth solutions. Part of this toolkit will be to **inform** developers about the challenges and needs of older adults with low eHealth literacy, as well as the importance of an inclusive approach in the design process of eHealth solutions. Following on from this, the second emphasis of the toolkit will be the **co-design** process. The toolkit will make information and lessons-learned about the co-design process with older adults with low eHealth literacy available to the developers. It will contain a list of ethical considerations and tips for working with such end-users. Of course, the results of the co-design sessions held during the Got-IT project in two different European countries (Austria and the Netherlands) will be provided in the toolkit, showing the needs and preferences of older adults with low eHealth literacy when it comes to visualisations of eHealth solutions. The focus in this project will be on an eHealth solution that promotes healthy lifestyles. The longterm goal is to make a living toolkit, meaning that the different sections can be updated and expanded, for example in regard to other eHealth solutions and also other end user groups. This will be obtained by embedding the toolkit in an accessible online platform. The third section of the toolkit and also of the Got-IT project itself, will be to **test** whether certain visualisations, that were developed in close connection to the co-design process are understandable and implementable for end-users, namely people with low eHealth literacy. The toolkit will provide a checklist, to support eHealth developers in the testing process of their products, in order to make them as accessible and as inclusive as possible (Cabrita et al., 2020).

Ultimately, an important aim of the Got-IT project is to raise awareness for the need for inclusive designs and therefore to disseminate the toolkit and the message as much as possible to reach the long term goal of changing the landscape of eHealth solutions in relation to inclusiveness (Cabrita et al., 2020).

In the overall context of the project, the present document can be placed in the “inform”-section and aims to give an overview and detailed insight of the knowledge-gain achieved in this part of the project.

In order to gain the needed information for this deliverable, different approaches were pursued. Through the implementation of a desk research combined with a social network analysis, a picture was painted enclosing the different aspects that are associated with low eHealth literacy. These topics include sociodemographic and socioeconomic issues such as chronic disease, disability, ethnicity, education and gender. Furthermore, the topic of education was covered, with issues like adult

education, learning behaviour, social support, eLearning and training concepts. Likewise, issues such as consumer health, health services, digital health, digital diversity, patient empowerment and user experience were covered under the umbrella-topic of the technical health sector. In addition, these topics were dealt with in relation to age and different life stages, e.g. students, adolescents, college students, adults and older adults. This social network analysis approach allows to draw conclusions about potential research gaps and starting points for improvement. Following the social network analysis, in **Chapter 2** of this document, the term eHealth literacy is discussed and defined and identified research gaps are presented. The term eHealth literacy is furthermore set in relation with intersectional effects, such as age, gender and education and finally, related research projects are discussed. Based on the desk research, an assessment of the socio-economic impact of low eHealth literacy among older adults in Europe was made and is covered in **Chapter 3**.

In addition, a qualitative approach was pursued. People from different work sectors engaging with older adults with low eHealth literacy were interviewed in the context of focus group discussions. Focus of the discussions was on the challenges people with low eHealth literacy encounter when using eHealth solutions, as well as on the consequences of these limitations. Also, topics such as motivation and usability and the importance of an inclusive design for the people themselves, as well as for professionals working with people with low eHealth literacy were discussed. Insights were gained from professionals from the field of care and support, physiotherapy, social work, psychology, neurology and software development for older adults. The focus group discussions were analysed using qualitative content analysis and results are presented in **Chapter 4**. Ultimately, in **Chapter 5**, all the different research approaches are brought together and the importance of an inclusive design in the development of eHealth solutions is discussed.

#### TOOLKIT BOX INFOS

The long term goal of the Got-IT project is to make the design of eHealth solutions more inclusive in order to make them accessible and understandable for everyone. This is bringing about the fight against health disparities and helps to boost citizen empowerment in Europe. In order to reach this goal, a toolkit is created over the course of the project, which is intended to support eHealth developers and other stakeholders in the journey of creating inclusive eHealth solutions.

This toolkit consists of three domains: Inform, Co-Design and Test. The **inform**-section intends to inform developers of eHealth solutions and other stakeholders in this field of the importance of an inclusive approach in the design process of eHealth solutions. The **co-design**-section gives information and tips on the co-design process as well as results from previous co-design sessions. Especially in this regard, the toolkit is created as a living toolkit, embedded in an accessible online platform, meaning that the different sections can be updated and expanded to cover a variety of eHealth solutions and end user groups. The **test**-section of the toolkit provides a checklist to support eHealth developers in the testing process of their products, in order to make them as accessible and as inclusive as possible.

## 1.2. Objectives

The aim of this deliverable is to inform (eHealth developers) about the importance of an inclusive approach in the design process of eHealth solutions. This deliverable will therefore form an essential part of the toolkit, which is developed over the course of the project, as it directly addresses the end-users of the toolkit, the developers. The goal is to bring the topic closer to them, as well as to other relevant stakeholders and to motivate them to use the toolkit in their design process. Accordingly, this deliverable plays a big role in achieving the long term goal of this project, which is to make the design

of eHealth solutions more inclusive by communicating the need for an inclusive approach to the people who develop and support these solutions.

### 1.3. Relation to other deliverables

At the beginning of the project, quality, risk and IPR management procedures were described in a first deliverable, in order to set the right path for the successful realisation of the project and the development of the toolkit as well as the engagement with different end users and stakeholders. Furthermore, a deliverable containing an ethics manual and guidelines was created (Cabrita et al., 2020).

The present deliverable aims at communicating the importance of an inclusive approach in the design process of eHealth solutions to developers. The two following deliverables within the first work package of the Got-IT project are focused on the co-design and testing process with older adults with low eHealth literacy. In these deliverables, the gained insight of engaging with older adults with low eHealth literacy in a co-design process of various visualisations will be documented. Furthermore, a short checklist of criteria will be provided, which helps to test visualisations in terms of their comprehensibility and applicability (Cabrita et al., 2020).

These three cornerstones “inform”, “co-design” and “test” will be comprised into the Got-IT toolkit, which is embedded in an open online platform and will be the main outcome of this project. The second deliverable of work package two will give an overview of all engagement and dissemination activities with stakeholders, such as stakeholder mapping (Cabrita et al., 2020).

Finally, at the end of the project, another deliverable will focus on the discussion of legal and ethical requirements, the provision of the Code of conduct and Informed Consents. In addition, the final report will be presented, containing all project results and future plans (Cabrita et al., 2020).

## 2. LOW EHEALTH LITERACY

### 2.1 What is low eHealth literacy?

Before discussing the multi-layered issues of low eHealth literacy, and to gain an understanding of the whole topic holistically, it is helpful to take a step back and deconstruct the wording to its (semantic) essence.

We take literacy as a starting point, which is commonly described as “the ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with various contexts” (UNESCO, 2017) and extend this definition from just having the ability to also having the confidence and willingness to identify, engage etc. with e.g. language. As literacy requires understanding relationships between different (and constantly changing) discourses, it always involves a never ending continuum of learning. Yet, it is not an abstract phenomenon of universal benefit, but gets its value through the uses people make of it (i.e. means of communication and expression, through a variety of media) (UNESCO, 2017). Literacy is a dynamic and adaptive response to new technologies and new social conditions and therefore was already characterized as being a fundamental human right by the Experimental World Literacy Program in 1966 (Keefe &

Copeland, 2011). Since literacy is not only a key skill, but also a key measure of a population's education, it is an integral part of the Sustainable Development Goals (SDGs) as SDG 4 'Ensure inclusive and quality education for all and promote lifelong learning', and is crucial to the achievement of the other goals (UNESCO, 2017).

Globally, more than 796 million people have literacy difficulties, which means they can at best read simple texts or retrieve simple facts (European Literacy Policy Network (ELINET), 2015). Longer or more complex texts, as well as their interpretations state great problems to illiterate individuals. Age is also related to literacy numbers, as literacy difficulties cause problems across generations. In Europe it is estimated that around 13 million children under the age of 15 and around 55 million adults between 15 and 65 years of age have literacy difficulties (European Literacy Policy Network (ELINET), 2015). Europeans between the age of 26 to 35 have the highest literacy score, while those aged 46 years and over have lower average scores (European Literacy Policy Network (ELINET), 2015).

Low literacy also correlates strongly with poor health and is e.g. connected to a higher risk for numerous illnesses and/or being hospitalised (European Literacy Policy Network (ELINET), 2015). Self-assessment numbers support these parallels, as "25% of struggling readers perceived their health as moderate or bad against 9-16% of people without literacy difficulties" (European Literacy Policy Network (ELINET), 2015). Limited literacy is further associated with a nearly 2 times higher death risk than people without literacy difficulties, especially in the elderly population (Sudore et al., 2006).

When talking about these correlations, we have already stepped into the field of health literacy, which "indicates how well a person can obtain the health information and services that they need, how well they understand them and how they use them to make good health decisions" (UNESCO, 2017). In short, health literacy "influences the ability to understand, interpret, and act on health information" (Corrarino, 2013). The impact of health literacy on health disparities can not be denied and limited health literacy has already been stated as a public health problem by many countries (U.S. Department of Health and Human Services, 2010). Broken down to the daily life of individuals with low health literacy, the lack of understanding essential health information can lead to difficulties in making informed decisions about their health. The resulting challenges for health policies and practices must be taken into account when developing public health strategies to improve health equity (Sørensen et al., 2015a). As health equity aims to reduce - and, ultimately, eliminate - disparities in health and in its determinants, "pursuing health equity means striving for the highest possible standard of health for all people and giving special attention to the needs of those at greatest risk of poor health, based on social conditions" (Braveman, 2014). Therefore addressing health literacy requires clear and effective communication, as well as the development of health education materials that are fitting and effective for people with low health literacy (Corrarino, 2013).

When stepping into the realm of eHealth (short for electronic health) the problems and difficulties described above are only getting amplified. With eHealth, which we define as "the use of information and communications technology (ICT) in support of health and health-related fields" (Cheng et al., 2020), increasingly being integrated into the delivery of health resources and services, many (potential) disadvantages for people with low eHealth literacy become visible. In other words, "structural inequities reinforce themselves and continue to contribute to healthcare disparities through the differential distribution of technologies that simultaneously enhance and impede literacy, motivation, and ability of different groups (and individuals) in the population" (Bodie & Dutta, 2008).

When talking about eHealth literacy, we follow Norman and Skinner's definition of the term as "the ability to seek, find, understand, and appraise health information from electronic sources and apply

the knowledge gained to addressing or solving a health problem” (Norman & Skinner, 2006). Low eHealth literacy therefore is the lack of this exact ability. The amount of literature on the subject of (low) eHealth literacy shows that the topic is an acute and urgent one and proves e.g. that issues regarding inequitable access, usage or skills relating to ICT (also known as the digital divide) can be strongly affected by sociodemographic factors associated with health disparities, such as age, income, education, and ethnicity. Especially socially disadvantaged groups, such as people of older age, with less education, and lower income are at risk of becoming digitally marginalized, which then could lead to a potential widening of health disparities (Cheng et al., 2020).

With eHealth having the capacity to improve health outcomes, its systems need to match the (potentially low) eHealth literacy needs of users. Arcury et al. (2020) call for further research and intervention to delineate leverage points for improving technology use and eHealth literacy especially among socially disadvantaged groups. Based on this, “interventions that use these leverage points should be developed and tested” (Arcury et al., 2020).

### 2.1.1 Social network analysis

After an extensive literature research regarding the topic of low eHealth literacy, we were interested to find out how individual topics and keywords are connected with each other, if patterns emerge, and where there are still blind spots in terms of research.

To achieve this, we performed a social network analysis (SNA), which is an interdisciplinary approach and is generally defined as “mapping and measuring the relationships and flows” (Can & Alatas, 2019) between actors in a network. These relationships are the main structures of a social network and for example “can be shown as a network made up of a cluster of nodes (or social system members) and a set of links showing the links between them” (Can & Alatas, 2019). A SNA is commonly carried out with the aim of revealing some information related to these nodes and relations. While the origins of SNA lie in examining individual and social group structures, today it is being used in many areas such as the economy, commerce, and health.

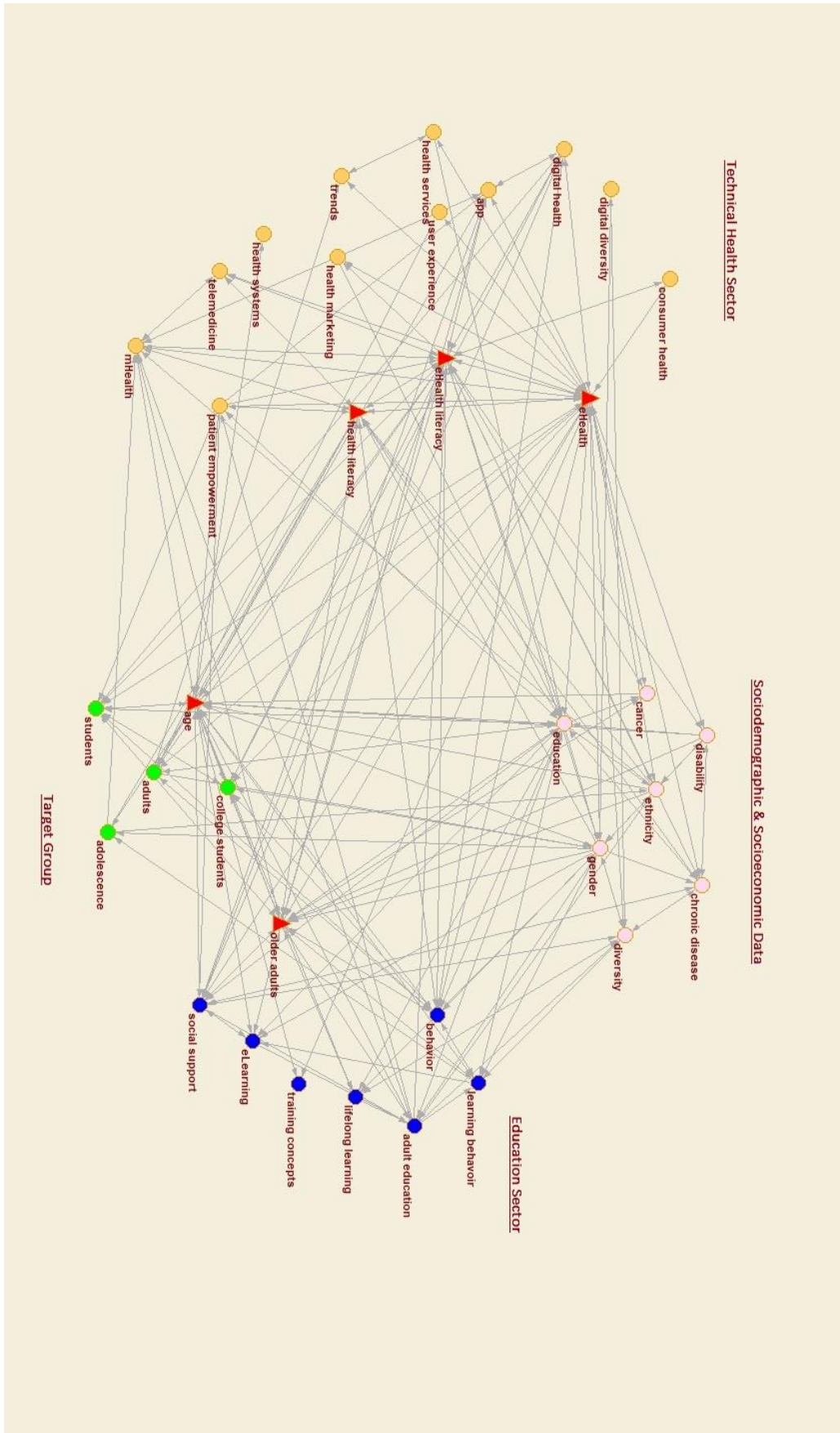
For our SNA we used the open source software programme ‘Pajek’ (slovenian for ‘spider’), which makes it possible to visualize and analyze large networks (see Fig. 1). In detail we examined the emergence of specific keywords that came out of our literature review and if/how they refer to each other. It quickly became apparent that the pivotal points of the analysis (so called ‘nodes’) were the keywords eHealth, eHealth literacy, health literacy, age and older adults (marked with red triangles in Fig. 1). This also made four thematic clusters visible, which we color-coded accordingly.

The first cluster revolves around the technical health sector with keywords like consumer health, digital diversity, digital health, app, user experience and health services. Cluster two we called sociodemographic and socioeconomic data, because it revolves around topics such as disability, ethnicity, diversity and gender.

Many articles center around low eHealth literacy with specific illnesses and/or diseases, so we added cancer and chronic disease as often emerging keywords. Another cluster is the education sector, as a lot of publications thematize (learning) behavior, (adult) education, lifelong learning, training concepts, eLearning and social support. When talking about the specific target groups, frequent keywords were age, adults, (college) students, adolescence and older adults. Missing connections between keywords (of different clusters) allow conclusions about (potential) research gaps. A lot of potential therefore

lies especially in the technical health sector with keywords such as health services, health systems, consumer health or digital diversity having few connections to other thematic clusters and standing relatively alone.

What could be done with this information is to recognize needs and gaps and look into a potential expansion of e.g. specially targeted health marketing and health communication towards people with low eHealth literacy. Efforts should also be made to address structural characteristics that create and sustain conditions of low eHealth literacy and could integrate perspectives such as community mobilizing and organizing, as well as stakeholder network building.



**Figure 1: Low eHealth Literacy - Social Network Analysis**

TOOLKIT BOX INFOS

Low eHealth literacy is defined as lacking the ability to seek, find and understand health information from electronic sources and apply the gained knowledge to address or solve a health problem. This lack of understanding essential health care information can lead to difficulties in making informed decisions about health. Therefore addressing low eHealth literacy requires clear and effective communication, as well as the development of health education materials that are fitting and effective for people with low health literacy. The amount of literature on the subject of (low) eHealth literacy shows that the topic is an acute and urgent one and shows e.g. that issues regarding inequitable access, usage or skills relating to ICT (also known as the digital divide) can be strongly affected by sociodemographic factors associated with health disparities, such as age, income, education, and ethnicity. Especially socially disadvantaged groups, such as people of older age, with less education, and lower income are at a higher risk of becoming digitally marginalized, which then could lead to a potential widening of health disparities. The impact of low eHealth literacy on health disparities can not be denied and limited health literacy has already been stated as a public health problem by many countries. With eHealth having the capacity to improve health outcomes, its systems need to match the (potentially low) eHealth literacy needs of users.

To find out how individual topics and keywords regarding low eHealth literacy are connected with each other, if patterns emerge, and where there are still blind spots in terms of research, we performed a social network analysis (SNA). This interdisciplinary approach is generally defined as mapping and measuring the relationships and flows between actors in a network. Pivotal points of the analysis (so called 'nodes') were the keywords eHealth, eHealth literacy, health literacy, age and older adults. This also made four thematic clusters visible. The first cluster revolves around the technical health sector with keywords like consumer health, digital diversity, digital health, app, user experience and health services. Cluster two we called sociodemographic and socioeconomic data, because it revolves around topics such as disability, ethnicity, diversity and gender. Another cluster is the education sector, as a lot of publications thematize (learning) behavior, (adult) education, lifelong learning, training concepts, eLearning and social support. When talking about the specific target groups, frequent keywords were age, adults, (college) students, adolescence and older adults. Missing connections between keywords (of different clusters) allow conclusions to be drawn about (potential) research gaps. A lot of potential therefore lies especially in the technical health sector with keywords such as health services, health systems, consumer health or digital diversity having few connections to others and standing relatively alone.

What could be done with this information is to recognize needs and gaps, bridge various clusters and look into a potential expansion of e.g. specially targeted health marketing and health communication towards people with low eHealth literacy. Efforts should also be addressing structural characteristics that create and sustain conditions of low eHealth literacy and could integrate perspectives such as community mobilizing and organizing, as well as stakeholder network building.



## 2.2 Intersectional effects and low eHealth literacy

“Poor health behaviour is more prevalent among the disadvantaged” (OECD, 2019)

As described above in chapter 4.1.1 ‘Social network analysis’, the performed SNA regarding low eHealth literacy showed that sociodemographic factors like gender, age and ethnicity and socioeconomic status (e.g. education) can influence eHealth literacy, as well as the degree to which individuals utilize personal health technology (Arcury et al., 2020). This can lead to serious health inequalities and can possibly limit people’s chances to live longer, healthier lives.

Therefore, an intersectional approach is recommended, as it takes into account the interweaving of different structural categories generating inequality. Intersectionality aims to analyze the interaction of different positions of social inequality and to illustrate that forms of oppression and disadvantage cannot be strung together additively, but must be considered in their interconnections and interactions. When looking into intersectional effects in the sector of low eHealth literacy, categories that show very strong influence are age and education.

Within the worldwide expansion of both the proportion of older adults in society and innovations in digital technology, the presence of a deep digital health divide cannot be denied (Cosco et al., 2019). Older adults (age 65+) in particular have significantly lower eHealth literacy, and are less likely to feel confident evaluating health resources on the Internet or knowing how to use the health information found online. Therefore, it is not surprising that computer stress, i.e. anxiety and/ or nervousness when computers work in a different way than expected, maintained a significant inverse association with eHealth literacy. “Although advancements in smart devices and wearables present novel methods for monitoring and improving the health of aging populations, older adults are currently the least likely age group to engage with such technologies” (Cosco et al., 2019). Therefore, there is a great need for educational interventions to help older adults successfully use technology and improve eHealth literacy. Engaging with older adults in a meaningful manner, improving computer skills and limiting computer stress, as well as co-design easy to use options, may be the keys to improving older adults’ eHealth use and understanding (Arcury et al., 2020).

Especially in this age group gender is a key predictor of use of the internet and online health information behavior. While more males use the Internet than females, they are less likely to use the internet for health information-seeking and to trust online sources. Women on the other hand have expressed greater levels of anxiety toward computers, less self-perceived competence, and lower perceived ease of use with respect to the Internet than men. All in all, women were more likely than men to be affected by health barriers. These gender differences in reasons behind Internet withdrawal can provide new perspectives that help health educators understand strategies that encourage older adults to keep learning, an important component of active aging (Chiu & Liu, 2017).

Education plays a significant role in the understanding of health literacy. “No matter how it is measured, the least educated are more likely to be in bad health” (OECD, 2019) and younger age, as well as higher levels of education are associated with higher health literacy. People with higher education were more likely to use the Internet than those with high school education or less. More education also predicted greater internet use for health information (Arcury et al., 2020).

**TOOLKIT BOX INFOS**

Sociodemographic factors (e.g. Gender, age and ethnicity) and socioeconomic status, such as education, can influence eHealth literacy, as well as the degree to which individuals utilize personal health technology. This can lead to serious health inequalities and can possibly limit people’s chances to live longer, healthier lives.

When looking into intersectional effects in the sector of low eHealth literacy, categories that show very strong influence are age, gender and education.

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Education plays a significant role in the understanding of health literacy. No matter how it is measured, the least educated are more likely to be in bad health and younger age, as well as higher levels of education are associated with higher health literacy. People with higher education were more likely to use the Internet than those with high school education or less. More education also predicted greater internet use for health information.

### 2.3 Low eHealth literacy and related research projects

Many findings highlight that low eHealth literacy is often overlooked in developing eHealth interventions targeted at socially disadvantaged groups, such as elderly people (Cheng et al., 2020). To ensure equal access and inclusiveness, eHealth literacy of disadvantaged groups needs to be addressed to help avoid a digital divide. There are many still active and already completed projects regarding digital health (literacy) and ageing (well), often with a focus on elderly people, with the goal of improving health equity. From better healthcare accessibility (e.g. ‘BETTEReHEALTH’) to elderly care (e.g. ‘CAREMOVES’), citizens’ secure access (e.g. ‘DigitalHealthEurope’) or patient/person-centred health services (e.g. ‘eHealth Innovation’), all the projects described have great potential and cover a wide range of digital health concerns. A selection of project examples can be found in the Appendix.

What makes the Got-IT project special and differentiates it in this regard from the other projects listed above, is its co-design and co-creation approach with AAL developers and primary end-users on the

one hand, and the development of an online toolkit that supports the design of accessible and understandable AAL solutions on the other hand. By providing the Got-IT toolkit as an openly available, dynamic and living online platform, it will lay the foundation for professional community building and engagement. Over time, the toolkit could easily be expanded into other (design) contexts, such as children with low literacy or migrants with low language proficiency in the new country of residence (Cabrita et al., 2020). The concrete direction of the expansion will be community- and market-driven, to ensure a high applicability and buy-in from (commercial) AAL developers. Another feature that distinguishes Got-IT from other currently available toolkits for inclusive design, is the importance of understanding user diversity and recognizing factors for the potential exclusion of people with limited abilities. With a focus on removing barriers of eHealth technology for people with low eHealth literacy, Got-IT strives to make health-related data understandable and actionable (Cabrita et al., 2020).

**TOOLKIT BOX INFOS**

Many findings highlight that (low) eHealth literacy is often overlooked in developing eHealth interventions targeted at socially disadvantaged groups, such as elderly people. To ensure equal access and inclusiveness, eHealth literacy of disadvantaged groups needs to be addressed to help avoid a digital divide. There are many running and already completed projects regarding digital health (literacy) and ageing (well), often with a focus on elderly people, with the goal of improving health equity.

From better healthcare accessibility (e.g. 'BETTEReHEALTH') to elderly care (e.g. 'CAREMOVES'), citizens' secure access (e.g. 'DigitalHealthEurope') or patient/person-centred health services (e.g. 'eHealth Innovation'), many projects have great potential and cover a wide range of digital health concerns.

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### 3. SOCIO-ECONOMIC IMPACT OF LOW EHEALTH LITERACY AMONG OLDER ADULTS IN EUROPE

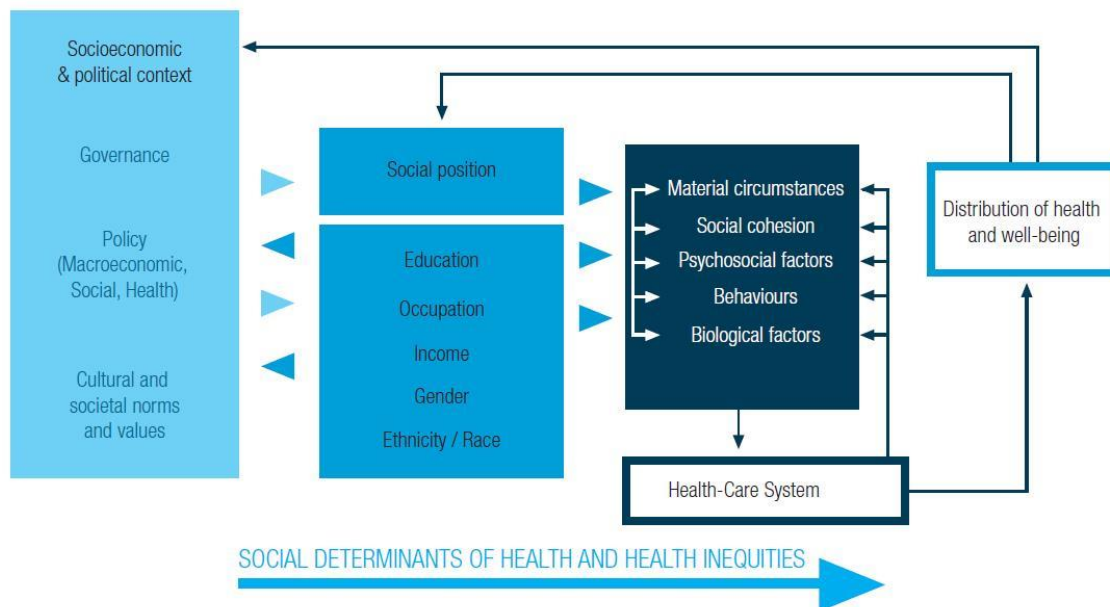
According to the WHO report *CSDH (2008)* one in five adults in the United Kingdom has problems with the basic skills needed to understand simple information that could lead to better health. Poorer

groups are less likely to seek information or help for health problems, which highlight the issue of low health literacy in the rich countries (Kickbusch, Wait & Maag, 2006).

Eichler et al., aimed in the article “the costs of limited health literacy: a systematic review” to summarize the evidence about (1) the costs of limited health literacy (HL) and (2) the cost-effectiveness of interventions to improve limited HL. They found on the health system level the additional costs of limited HL range from 3 to 5% of the total health care cost per year. On the patient level, the additional expenditures per year per person with limited HL compared to persons with adequate HL range from US \$143 to 7,798, concluding that the costs of limited HL may be substantial (Eichler et al., 2009).

The concept of “fundamental causality” theorizes the correlation between socioeconomic status (SES) and health outcomes (Lutfeff & Freese, 2005). SES includes social resources outside of the medical domain that can contribute to health maintenance and improvement. Studies have shown that people with a high SES tend to have better health conditions as compared to those with a low SES (see Fig. 2) (Mackenbach et al., 2008).

**Figure 4.1** Commission on Social Determinants of Health conceptual framework.



Source: Amended from Solar & Irwin, 2007

**Figure 2: Figure 4.1 from the WHO report “A conceptual framework for action on the social determinants of health. Discussion paper for the commission on social determinants of health” by Solar & Irwin 2007.**

Numerous theories have been forwarded in an attempt to elucidate the nature of this correlation. According to social causation theory, the experience of socioeconomic hardship increases the risk of subsequent illness, whereas health selective theory attributes better health to more possibilities for greater social mobility (Dahl, 1996).

Regardless of the extent of the association between SES and health outcomes, it would seem that SES represents a proxy of intermediate causal factors that have an impact on health, such as education, income, age, employment status, and migration background (Lastrucci et al., 2019).

One of the key SES intermediate factors on health status is health literacy (HL), which is defined as “knowledge, motivation and competencies of accessing, understanding, appraising and applying

health-related information within the healthcare, disease prevention and health promotion setting”. (Lastrucci et al., 2019; Svendsen et al., 2020)

Throughout the years, many definitions of HL have been stated, whereof the most used has been united in the paper by Sørensen et al. (2015). Here, in a literature review in a Danish context, HL has been defined as a combination of personal competencies and resources in the environment that determine people's ability to find, understand, evaluate, and use information as well as offers to make health decisions.

The term also includes the ability to communicate, maintain and act on these decisions.

Health competence deals with (among other things):

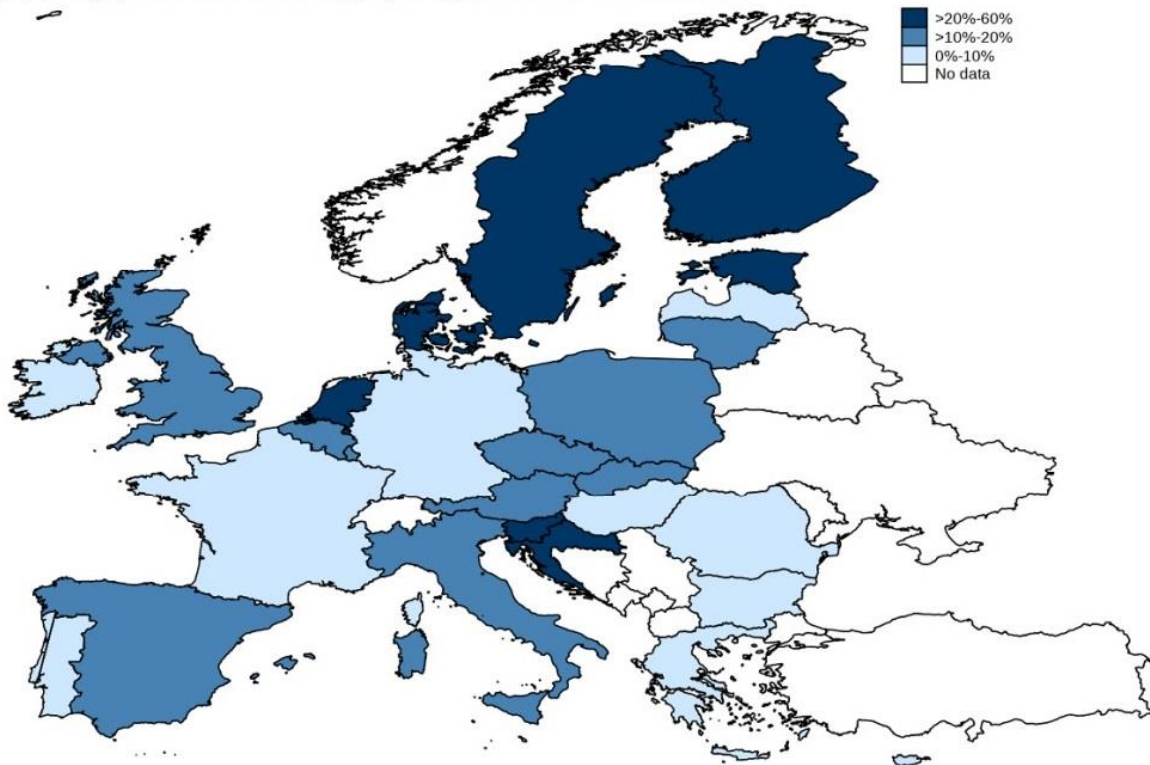
- Ability to find, understand and critically relate to health information
- Ability to navigate healthcare
- Ability to interact with healthcare professionals
- Ability to take active care of one's own health
- Social support and support from health professionals to take care of their own health

High health literacy is associated with appropriate health behaviors, low morbidity and low mortality. High health literacy is also associated with high socio-economic status measured on e.g. educational level, social status, economic situation, ethnicity and cohabitation status (Maindal et al., 2019, Aaby et. al., 2019, Maindal et. al., 2016). Therefore, HL affects health outcomes through its impact on access and utilization of health care, the patient-provider relationship, and self-care (Paasche-Orlow & Wolf, 2007).

Throughout the past decade, a greater SES divide, an increased financial demand on health systems, and higher expectations of proactive patient behavior have created multiple challenges for HL, especially in Europe. For example, an HL survey conducted in 2011 by the European Health Literacy Project (HLS-EU) in eight member states of the EU indicated that nearly half of the respondents had insufficient competencies in health literacy (Sørensen et al., 2015b).

The survey also illustrated the impact of socioeconomic factors on HL (i.e., financial deprivation, low social status, low education and/or old age). The survey clearly demonstrated that the limitations of HL increased with age: 58.2% of respondents between the ages of 66 to 75 had insufficient health literacy, as compared to 60.8% of those who were 76 or older (Sørensen et al., 2015b). According to Merkel & Hess (2020), the divide in geographical distribution on the elderly population using telemedicine solutions looks like the depiction below (see Figure 3).

**Figure 1.** Geographical distribution of elderly people using internet-based health care services.



**Figure 3: The Use of Internet-Based Health and Care Services by Elderly People in Europe and the Importance of the Country Context: Multilevel Study by Merkel et al., 2020**

The HL divide for the elderly has been further amplified as a result of the rapid digitalization of health care. This group is of particular concern in Europe: it was estimated in 2017 that those aged 65 years or more constituted approximately a fifth (20.3 %) of the total EU population (European Commission, 2020b).

More elderly people put increased financial pressure on the health care system due to higher demands on medical services and pension pay outs. It is projected that public spending related to pensions, health, and medical services for elderly people in the EU will rise by 3 to 4 GDP points by 2050 (Rechel et al., 2009). Nonetheless, successful health education interventions for elderly people can help to reduce age-related health care expenditures.

The following factors should be considered when assessing the elderly’s digital HL:

1. internet accessibility and skills,
2. internet usage for health-related purposes and
3. the ability to search for, select, and apply accurate online health information (Merkel & Hess, 2020).

Although the elderly need adequate health information and care, as of 2017, only 62.8% of those aged 55 to 74 were connected to the internet, in contrast to 96.5% of 16 to 24-year-olds (OECD, 2017). According to DIGITOL’s 2020 context analysis report, young people (aged between 16 and 24) are the most active internet users in Europe, 97% of whom possess a high level of formal education. The study also indicates that 24% of non-internet users have little to no education, 23% of non-users are in the 55 to 74 year age group, and 26% of non-users are retired (Rechel et al., 2009).

Furthermore, a “grey divide” has been identified in Western countries among those aged 65 or more because internet access declines with age (Friemel, 2016). Eurostat data from 2017 indicate that 87% of people aged 75 or more have never been online (European Commission, 2018). This divide is also linked to other factors such as education, income and previous computer knowledge (König et al., 2018).

The elderly’s internet use is also determined by infrastructure, particularly for those who live in rural areas (Merkel & Hess, 2020). Additionally, social support and networks can improve the elderly’s ability to access the internet and engage with new technologies (König et al., 2018).

But the digital divide is not only about internet accessibility; it also includes navigation skills and the ability to discern safe and appropriate information. In 2020, 58% of the EU population have at least basic digital skills (European Commission, 2020a). Furthermore, these skills are significantly impacted by SES: people living in better conditions are more likely to use the internet to improve their lives.

However, age-related health conditions can impede the elderly’s digital HL. According to Eurostat (2017), 9 % of the elderly at the age of 75 have visual impairment, and 18 percent have hearing limitation. Additionally, low SES can significantly increase the risk of the onset of visual impairment (Whillans & Nazroo, 2016).

The cognitive decline caused by aging reduces the elderly’s digital capacity. Moreover, the extent of this decline is strongly associated with different socioeconomic factors such as economic status, education, social support, among others (Zhang et al., 2015).

Ageing is also a predisposing factor for many mental disorders such as depression and anxiety. One out of five elderly people suffer from one or more mental disorders (Riadi et al., 2020). Studies have shown that 25% of elderly people suffer from both depression and cognitive dysfunction (Morimoto et al., 2014). Depression can negatively impact the elderly’s ability to retain information and their digital HL capacity. Finally, it has been reported that there is negative association between SES and depression among European patients (Freeman et al., 2016).

What is also helpful is shared decision making, which involves, at minimum, a clinician and the patient. “In shared decision making, both parties share information: the clinician offers options and describes their risks and benefits, and the patient expresses his or her preferences and values. Each participant is thus armed with a better understanding of the relevant factors and shares responsibility in the decision about how to proceed (Barry & Edgman-Levitan, 2012).

Self-efficacy, or the personal belief in one’s capacity to perform specific actions, is also a critical factor in determining the elderly’s digital HL (Pourrazavi et al., 2020). Self-efficacy is directly linked to age and education.(Clark et al., 1995) Furthermore, the elderly’s level of trust in the source of health information plays a significant role in their access and usage of online resources. Studies show that a high SES increases trust while a low SES can have psychological consequences (Brandt et al., 2015).

The ultimate goal of digital health literacy is to enhance people’s lives and lessen marginalization. Acquiring digital health literacy involves work on digital inclusion, participation and capacity. Active aging strategies must shift to address the elderly’s needs and perspectives for better digital aging in Europe. Finally, digital health literacy for the elderly is not simply an issue of health; but rather, it is a matter of cultural transformation and the democratization of medical care through better access to information and shared decision making so that nobody is left behind.

## 4. SECONDARY END USERS’ OPINION ON EHEALTH-APPLICATIONS

### 4.1. RQ & Empirical Design

To collect insights on the secondary end users’ perspective regarding eHealth-literacy, we decided to conduct focus group interviews. A total of three focus groups were conducted in June and August of 2021. Each focus group included participants of a specific secondary end user target group. The first focus group consisted of three professionals within the field of nursing and care, in the second focus group three health care related professionals were part of the group (i.e. Social worker, physiotherapist, occupational therapist) while the third focus group consisted of three participants covering the fields of neurology, psychology and eHealth development for elderly people.

Secondary-End User	Format	Duration
nursing and care	Face-to-face as well as Zoom	1h 30Min
social worker, physiotherapist, occupational therapist	Zoom	45 Min
Neurologist, Psychologist, Developer	Zoom	45 Min

**Table 1: Overview of the participants, the format and duration of the focus groups**

The research questions we developed were aimed at exploring the experiences people working with patients and/or clients with a low eHealth literacy made in regards to the challenges and recommendations for the projects’ relevant target group.

RQ1: What are the positive experiences gained in regards to eHealth solutions?

RQ2: What are the negative experiences gained in regards to eHealth solutions?

RQ3: What are the recommendations from the secondary end-users’ point of view for eHealth developers?

The transcripts of the focus groups were analyzed with a qualitative content analysis.

In the following chapters the results of the content analysis will be displayed according to the research interest identified in the research questions.

### 4.2. Positive experiences

- Time and location-independent use of eHealth solutions
- Bottom-up approaches work best, when introducing new eHealth solutions
- A low-threshold approach is ideal, when introducing new eHealth solutions

**Table 2: Positive experiences with eHealth applications**

Regarding the positive experiences made with eHealth solutions, the participants mentioned that the digital health applications they experienced in their practice had the advantage of being low-cost and can be used by the participants regardless of time and place, which is a very attractive characteristic according to the health professionals.

The nurses and care professionals also use health-related digital applications in their spare time to exercise (e.g. fitness and yoga videos on YouTube) and to learn something new. They emphasize the importance of a “less is more”-approach when it comes to introducing eHealth applications into their



daily routines. In their opinion, there currently is a societal trend and a change in the mindset, when it comes to the use of digital and technical devices in general (“back to basics”).

The participants of the second focus group also stated that they mainly use fitness apps in their leisure time, to keep themselves fit, which they find especially advantageous since the outbreak of the pandemic.

### 4.3. Positive experiences the clients/patients had with eHealth-solutions

The experts of the first focus group stated that, in their experience, not all clients have a low digital-, health- and in combination eHealth literacy. The patients are a very diverse crowd, not only but also depending on their (former) occupation. Older adults, who worked around computers for years before their retirement, were described as clearly more adept at dealing with new technologies as those who are not familiar with digital applications.

When introducing new eHealth appliances to patients, it is best to foster a bottom-up-approach, i.e. familiarize the users with the tools and raise the awareness and acceptance among the patients themselves. In the experts’ opinion, new eHealth solutions are accepted most, if there is a positive word-of-mouth amongst the users. It is furthermore best to take it slow with the introduction of new digital tools to ease the patients into it.

### 4.4. Negative experiences

- Not all eHealth applications are created for the same purpose (medical vs. health-related)
- An abundance of eHealth solutions leads to a feeling of being overwhelmed, technical fatigue and technology stress
- If there is a lack of support for the users in using the application, frustration leads to abandonment of the solution

**Table 3: Negative experiences with eHealth applications**

The negative experiences working with eHealth tools and applications among the participants of the focus groups is very diverse and encompasses personal negative experiences as well as negative experiences, their clients/patients had with new tools. One important factor for the health care professionals was the differentiation between applications and tools used for health-related leisure activities and medical applications which are being used as a support for medical treatments. The health professionals pointed out, that this differentiation is highly relevant due to safety-related reasons where medical applications are concerned. Also, another factor that contributes to negative experiences for their clients/patients is the abundance of eHealth applications with a wide spectrum of functionalities. This often leaves the patients/clients overwhelmed, especially when they are inexperienced with new technologies.

The experts pointed out, that negative experiences with eHealth applications are determined by certain factors like basic technical problems with the appliances, problems with the infrastructure, the general affinity for technology of a person as well as feelings of anxiety when there is little experience with technical appliances. Especially in terms of differences in infrastructure, it is important to keep the difference between rural and urban regions of a country in mind. Whereas, mostly in urban areas, access to the internet might not pose a big problem, people living on the countryside do not always have the same ease of access to the internet.

One of the main factors for negative experiences for their patients is the long term motivation to use eHealth applications. It is not just a matter of prescribing a certain tool to improve their health.

*“We always need to motivate people to use the software. Some can be already motivated by a prescription. Some need personal interventions. We experienced that not just the severity of the illness is motivating but the personal coping capabilities.” (Psychologist, 57 – 59)*

Nurses and care professionals mentioned that they themselves experience a fatigue when it comes to learning and working with new eHealth applications, mostly because there is too little training for the personnel working with the applications. One participant summed it up by stating:

*“Yet another application.” (Nurse, 228)*

Also the abundance of applications currently on the market and in use at their workplace creates technology stress for the professional care providers. They feel patronized by the many apps in use, constantly prompting them to do something. This creates a feeling of dependency on the technical devices.

#### 4.5. Negative experiences the clients/patients had with eHealth solutions

The negative experiences the experts talked about, were mostly about technical difficulties from two different perspectives. Patients themselves had problems using devices to work with the eHealth applications, like operating the devices is difficult due to bodily changes in the specific age-group (e.g. the skin becomes drier with age and makes it more difficult to use touchscreens).

Another factor that is highly frustrating for the patients/clients is the loss of data or problems with the transfer of data onto smart devices (e.g. display of the step-count is not displayed properly on the Fitbit or functions get deleted unintentionally). The secondary end users stressed that a lack of support when using eHealth applications creates a lot of friction for the clients/patients. Hereby, they mean the technical and software support by the provider as well as the support the patients expect from the staff as well.

*“Also, it is very much depending on how much support can be given. The more support, the more confident the user is. There is a certain technology fear or barrier to engage new technologies.” (Developer, 51 – 52)*

Support by the staff almost always encompasses motivating the clients and patients.

#### 4.6. Recommendations for developers

Recommendations expressed by the experts can be clustered in six main areas.

- Motivation is key
- Providing interfaces with other medical applications and health care providers is beneficial
- Support at every stage is necessary
- Health- and medical information provided should be evidence-based
- The financial resources of the end user should always be kept in mind

- eHealth applications should be designed in an inclusive, accessible and non-discriminatory manner

**Table 4: Recommendations for eHealth-Developers**

According to the participants of the focus groups, the most important factor in order to reach the target group of people with a low eHealth literacy is motivation and to include motivating elements in the health applications. Motivation includes a spectrum of practical implementation options and actions mentioned by the experts. A feeling of success is especially important as a motivational factor.

*“A sense of accomplishment is necessary for the patients, like using a smiley in the app, when a job is well done. This always goes down well” (Nurse, 27 – 28).*

Usability is another highly important factor and can greatly hinder or foster the acceptance and the usage of an eHealth application for the clients/patients the experts are working with. Especially considering people with a low eHealth literacy, it should be taken into account that if an app is not designed in a way to navigate intuitively with, the inexperience and (what often times goes hand in hand with it) anxiety of using new digital applications, can lead to these vulnerable target groups not taking advantage of the potential benefits the application could offer to them. The experts propose using appealing visuals and easily identifiable navigation.

*“Just keep it simple.” (Neurologist, 82)*

In this respect it was also emphasized that consistency of developed eHealth solutions is important in order to ensure its longtime use. Sudden changes in the interface of an application can be overwhelming and can cause people to stop using it any further.

*“Yes, exactly, it has to be constant. It may be a little different somewhere, but you can't log in after a long time and then everything is in a different place and you can't find anything anymore.” (Nurse, 188 – 190)*

According to the health professionals, another motivational factor is the adaptability of the service. There should be options to personalize an app which is dedicated to fostering one’s own health to one’s own needs (e.g. in terms of personal data, color- and music preferences or additional health-information). This also fits with the recommendation of keeping it simple, as not all users might want to use all functions that are available in the application and might easily get overwhelmed by the overabundance of possibilities. Being able to alter the application to the users own preferences (e.g. only basic functions visible) can alleviate overwhelm and anxiety in connection with the new technology.

*“Enter selections myself, so I can control as a user what I want to have. And not to risk being overwhelmed by the 15 parameters that I now have, 15 different things. Being able to say: Okay, I’m just interested in this and that and I’d like to have that. And these are my goals I want to set.” (Care staff, 486 – 490).*

Also, gamification can lead to a higher motivation to engage with health applications, especially if serious-games elements enable more inexperienced clients/patients with a low eHealth literacy to familiarize themselves with the new digital content. This can be achieved by using avatars, mascots who are supporting the navigation, as well as enabling peer-activities in the digital environment (e.g. group challenges).

Providing interfaces to other programs is another important factor mentioned by the participants of the focus groups. Health-related applications can be deemed as more useful by the user, if the data collected using the app (e.g. blood-pressure, blood-sugar-levels), can be shared with professional and

other health-related personnel, always taking into account data-privacy issues. This can be especially beneficial for medical eHealth applications designed for chronically ill people or older adults, to have one central platform where the relevant data for the care- and medical team is saved and distributed.

Easing patients and clients with a low eHealth literacy into a new digital application is especially important. Therefore, the experts propose face-to-face workshops, where users can try and test out different functions of an application. This gives them the opportunity to understand and internalize the benefits for their health and their daily-routines, digital applications can have.

*“I try not to motivate but to educate. In my experience, this helped not more but with a longer effect.” (Psychologist, 121 – 122)*

Also, it should always be clear on where to turn to in order to receive support (i.e. technical or software support) when it is needed.

*“Yes, I think that support is a major issue. It happened to us, too. There is an app that you download, you really like the app at first, until you encounter a problem and you do not know whom to turn to in order to get help.” (Physiotherapist, 281 – 283)*

Especially when it comes to medical information provided for the user within an app, it is of the utmost importance to clearly state where the information is coming from. The patient/client should always be made aware of the source of the information and the users should feel assured that they can trust the health and or medical information they are provided with.

*“The information should be evidence-based and state-of-the-art.” (Nurse, 1165)*

The professionals recommend collaborating with the state in order to work on certificates clearly indicating the quality of an eHealth application.

Considering that some of the patients/clients the experts talked about are living in a retirement homes and/or have high nursing costs, it was also emphasized that the financial resources in regards of digital health solutions should always be made a priority. A software could potentially be highly beneficial (if used correctly) for the health of the user, but if the costs of acquiring and implementing the application are too high, it will not be bought and/or used.

In order to include as many vulnerable target groups with low eHealth-literacy as possible, the experts point out, that it is absolutely necessary to design the application with a strong focus on inclusivity, accessibility and non-discrimination. A good starting point hereby, besides previously mentioned ones, should be the language used.

*“The language used is an important factor. The content has to be easily understandable.” (Social Worker, 183 – 184)*

This is also important in terms of people whose mother tongue is not (like it was in this case) German, in order to enable the participation of everyone. Gender is another important aspect. The experts state, that especially in the field of health, gender-medicine is an important topic. Therefore it is only suitable that gender should be considered when creating content (e.g. different physiology).

## 5. DISCUSSION ON IMPORTANCE OF INCLUSIVE DESIGN OF EHEALTH SOLUTIONS

This deliverable aims to inform stakeholders in the field of eHealth (e.g. developers) on the importance of an inclusive design process of eHealth solutions.

In order to do so we had a closer look at eHealth-literacy and European projects concerned with similar research topics like Got-IT. We conducted a Social Network Analysis to the current state-of-the-art in research on eHealth literacy and identified research gaps. Also we researched the socioeconomic impact of low eHealth literacy on older adults in Europe. In order to gain more insight on recommendations for developers, three focus-group-discussions were conducted with professionals in the field of health-care.

A lot of research is done on people with a low eHealth literacy, focusing especially on age, gender and socioeconomic status. What is lacking is a holistic and intersectional approach to address the target group in all its complexity. Only looking at singled-out socio-economic variables in terms of individual cases will not be enough to engage with this target audience and enable them to increase their Health literacy, especially eHealth literacy.

Even more so, the SNA showed that few synergies are being used directing health-communication (e.g. health marketing) towards the target group of people with a low-eHealth literacy, taking into account the diversity of this target audience. Also targeted consumer health for this target group and health-systems still hold a lot of potential for people with a low eHealth literacy. There is a lack in initiatives to build communities of empowerment and stakeholder building.

In order to empower the target group of people with a low eHealth literacy to engage with eHealth-solutions and thereby increasing the benefit for their health, research needs to not only be done with the target group in mind, but even more so involving the target group in the process of creating guidelines for eHealth-developers.

The focus-group discussions with the secondary end users in the field of health care showed the importance of involving as many stakeholders as possible to broaden the perspective on the topic. Especially when working with older clients and patients, their care-providers need to be involved in the process of introducing a digital health-solution as much as the patients and clients themselves, for they are the ones who can foster and support peoples' self-confidence and empower them to familiarize themselves with technology and health information which might be alien to them at first. The results of the qualitative research point to six main recommendations concerning (not only) eHealth-developers.

The (1) motivation to use eHealth solutions should be high with all parties involved. This can be achieved via the stakeholders as well as the usability of the application itself. Stand-alone solutions are not ideal, especially treatment-related medical eHealth-solutions gain attractiveness for the user and the secondary end-user, if more (2) interfaces are provided to make the planning and overview of treatments manageable in an easier way for the patient as well as the health-care provider. Inexperience with new technologies as well as socioeconomic factors (e.g. age) create a barrier for people with a low eHealth literacy to efficiently engage with eHealth-solutions. Therefor the provision of (3) a sustainable support-system at every stage of the introduction of an eHealth-application is necessary. Health is a complex topic and should therefore be delivered in an understandable but still (4) evidence-based and current manner. Also, especially considering the target group within this project (55+ years) and their financial means (e.g. when living in a retirement home), it is important to

keep the (5) costs of a digital solution within an affordable price-range. When describing people with a low eHealth literacy one should always be aware that they are a diverse crowd of people. Thus, designing (6) eHealth-solutions in an inclusive, accessible and non-discriminatory manner is important. Including and involving all stakeholders in the research process and also in the development of the toolkit should be made a priority. Collaboration with the different target groups as well as applying a co-design approach seems to be a very beneficial strategy.

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## APPENDIX

**Table 5: App. 1: Example projects related to low eHealth Literacy**

<b>Project Name</b>	<b>Short Description</b>
AgeingWell: Network for the Market uptake of ICT for Ageing Well	(Coordinated by INOVA+ - INNOVATION SERVICES, SA). Running from 01/2012-12/2014, the aim of the AgeingWell Network was to build and animate a European network focused on improving the quality of life of elderly people by promoting the market uptake of ICT solutions for Ageing Well. The five main objectives of the AgeingWell project are: “1. Develop Guidelines for deployment and sharing of best practice between key competence centres; 2. Build an ICT for Ageing Knowledge Centre with the aim to share relevant information and results with the AgeingWell Community; 3. Develop an ICT for Ageing Society Strategic Agenda, with the aim of providing a study on options for future structure and implementation of EU innovation funding; 4. Promote the European innovation reinforcement between innovative ICT & Ageing enterprises (in particular SMEs) and the Investment Community; 5. Raise awareness within the European community of ICT & Ageing stakeholders.” (More information: <a href="https://cordis.europa.eu/project/id/297298">https://cordis.europa.eu/project/id/297298</a> ).
BETTEReHEALTH: Human, technical and political factors for better coordination and support of e-health in Africa	(Coordinated by: SINTEF AS). Running from 01/2021-12/2022, BETTEReHEALTH aims to increase the level of international cooperation in eHealth, inform and strengthen end-user communities and policy makers in making the right decisions for the successful implementation of e-Health. The project has the overall objective of better health outcomes through better healthcare accessibility and higher quality through a bottom-up evidence-based holistic approach. (More information: <a href="https://betterhealth.eu/">https://betterhealth.eu/</a> ).
CAREMOVES: Conceptual approach for new routes in eHealth: Movement practices of elderly care	(Coordinated by: IT-UNIVERSITETET I KOBENHAVN). This projects duration was from 09/2009-08/2012 with the goal to explore how formal and informal elderly care is reconstituted with an analytical focus on movement practices. The aim of CareMoves was to understand what this focus might imply for new conceptualizations of healthcare and healthcare technologies. The three main research objectives were to “1. Generate empirical knowledge of movement practices of elderly care in different healthcare settings, based on exploratory ethnographic research in the United States and Scandinavia; 2. Devise an alternative conceptual approach of elderly care formulated on this new empirical knowledge; 3. Enable knowledge transfer, exchange, and public dissemination with internal and external stakeholders.” (More information: <a href="https://cordis.europa.eu/project/id/249322">https://cordis.europa.eu/project/id/249322</a> ).
DigitalHealthEurope: Support to a Digital Health and Care Innovation initiative in the context of Digital Single Market strategy	(Coordinated by: EMPIRICA GESELLSCHAFT FUR KOMMUNIKATIONS UND TECHNOLOGIEFORSCHUNG MBH). Running from 01/2019-06/2021, DigitalHealthEurope aimed to provide comprehensive support to the Digital Health and Care Innovation initiative in the context of the Digital Single Market Strategy. The project’s approach involved a number of actions to boost innovation and advance the Digital Single Market priorities for the digital transformation of health and care (DTHC). Priorities concerned: 1. Citizens’ secure access to and sharing of health data across borders; 2. Better data to advance research, disease prevention and

	personalized health and care; 3. digital tools for citizen empowerment and person-centered care. (More information: <a href="https://digitalhealtheurope.eu/">https://digitalhealtheurope.eu/</a> ).
eCARE: Digital solutions supporting continuum of care for frailty prevention in old adults	(Coordinated by: BRAVOSOLUTION ESPANA SAU). Running from 11/2019-03/2024, the eCARE project is developing a digital solution – tools and services – to improve outcomes for frailty in older adults by accounting for physical and psychosocial factors. It will target the pre-frail and frail older adults to facilitate the implementation of integrated care models across health and social services. (More information: <a href="https://cordis.europa.eu/project/id/856960">https://cordis.europa.eu/project/id/856960</a> ).
eHealth Innovation: Scaling up eHealth facilitated personalised health services: Developing a European roadmap for sustained eHealth Innovation	(Coordinated by: UCL Consultants Ltd.). Running from 05/2011-10/2013, eHealth Innovation developed consensus among stakeholders and recommendations to-wards making innovative, integrated, and therefore interoperable eHealth services operational and deployed at large scale in Europe. The focus was to analyse, achieve consensus on and deliver a detailed summary report on how to achieve in the medium-term more patient/person-centred health services for an ageing population, supported and facilitated by enabling innovative eHealth solutions and services - for instance, electronic patient records, personal health records and personal health systems aimed at supporting patients in managing their health. (More information: <a href="https://cordis.europa.eu/project/id/270986">https://cordis.europa.eu/project/id/270986</a> ).
ELily: eHealth Literacy Learning skills among carers of older people and people with Dementia	(Coordinated by: Szczecinska Szkola Wyzsza Collegium Balticum). This project ran from 2018-2020 and aimed to provide a blended training programme (class sessions and eLearning course) for carers of frail older people and people with dementia. The e-learning programme facilitated the class goals and included selected modules that assisted carers training. All involved countries Poland, Italy, Bulgaria, Greece and Cyprus are countries with low rate of health-related internet use among older people. (More information: <a href="https://elily.eu/">https://elily.eu/</a> ).
EUUSEHEALTHWORK: Mapping Skills and Competencies; Providing Access to Knowledge, Tools and Platforms; and Strengthening, Disseminating and Exploiting Success Outcomes for a Skilled Transatlantic eHealth Workforce	(Coordinated by: OMNI MICRO SYSTEMS / OMNI MED SOLUTIONS GMBH). From 09/2016 to 05/2018 the EU-US eHealth Work Project has had an overall goal of mapping, quantifying, and projecting the need, supply and demand for digital workforce skills and competences. The project carried out objectives in four major areas of focus: 1. Measure (Mapping) – executing the tasks of measurement by performing surveys, analyzing the results through gap analyses, and compiling the findings from case studies; 2. Inform (Access) – informing new and incumbent eHealth workforce members, pertinent actors, stakeholders and others in the health information and technology field; 3. Educate (Assessment) –educating by building a set of foundational curricula for digital skills in eHealth; 4. Advance (Strengthening) –advancing the field of eHealth/health IT and further enhancing workforce building initiatives by disseminating and exploiting the work generated under this project. (More information: <a href="http://www.ehealthwork.eu/">http://www.ehealthwork.eu/</a> ).
fMOOC: Fitness MOOC Interaktion von Senioren mit tragbaren Fitnesstrackern in	(Coordinated by: Beuth Hochschule für Technik Berlin) From 2014-2015 this project investigated senior citizen interaction with wearable fitness trackers (interlocking wristbands) with social sharing and interaction opportunities in a MOOC platform. An overall focus was on the integration of portable mobile and desktop based technologies in a MOOC, as well as

integrierter MOOC Plattform	the development of open interfaces. (More information: <a href="https://de.slideshare.net/ibuchem/fitness-mooc-research-day-2016-beuth-hochschule">https://de.slideshare.net/ibuchem/fitness-mooc-research-day-2016-beuth-hochschule</a> ).
Förderung der Gesundheitskompetenz mittels digitaler Applikation: Adaptation und Überprüfung des sporttherapeutischen Tübinger Hüftkonzepts THüKo für Patienten mit Arthrose	(Coordinated by: Uni Tübingen). Running from 2017-2020, in this project an evidence-based training concept for the treatment of hip osteoarthritis, which is available in book form, was being digitized and made available to patients by means of a software application. A particular challenge was the individualization of the teaching content to promote health literacy. The teaching content could be differentiated into the teaching of motor skills for optimal movement execution, the ability to adequately control training and load, and the initiation and maintenance of training in the sense of self-regulation. (More information: <a href="https://www.wissenschaftscampus-tuebingen.de/www/de/forschung/forschungsbereiche/projekt09/index.html">https://www.wissenschaftscampus-tuebingen.de/www/de/forschung/forschungsbereiche/projekt09/index.html</a> ).
förges 4: Strengthening eHealth Literacy among older people	(Coordinated by: Uni Bielefeld) From 04/2018 until 03/2021 the forges 4 project aimed 1. to investigate how interventions to promote eHealth Literacy among older people with health impairments have to be designed and to determine the specific characteristics that have to be considered; 2. to develop and test an intervention to promote eHealth literacy among older people at risk of chronic diseases and care dependency.
IC-Health: Improving digital health literacy in Europe“	(Coordinated by: GOBIERNO DE CANARIAS) From 11/2016-10/2018 IC-Health provided support for the improvement of digital health literacy in Europe. In particular, the project designed 35 open access online courses (MOOCs), in seven different national languages, for different population cohorts including children, adolescents, pregnant and lactating women, elderly and people affected or susceptible to be affected by type 1 and type 2 diabetes. The identified population cohorts, along with health professionals, academics and other practitioners, were organised in Communities of Practice and involved directly in the co-creation of the MOOCs content and structure. Once the courses were designed, they were tested by the members of the CoPs and by other users. MOOCs use and impact was monitored and assessed in order to ensure their uptake and sustainability beyond the duration of the project. (More information: <a href="https://cordis.europa.eu/project/id/727474">https://cordis.europa.eu/project/id/727474</a> ).
iGame: Multi-dimensional Intervention Support Architecture for Gamified eHealth and mHealth Products	(Coordinated by: BOURNEMOUTH UNIVERSITY). From 01/2019-12/2022 the iGame project will develop a multidimensional intervention support architecture/platform in order to improve the efficacy of gamified e-health products. Specifically, advanced game production techniques will be developed with ready-to-use toolkits to accelerate the innovation process for e-health and m-health products. The outcomes of the project will include gamification toolkits, an integrated ICT platform and clinical assessment methodologies as a whole framework. The project will assist the digital industry (games, Internet of Things and ICT) to innovate new products and services for e-health industries. (More information: <a href="https://cordis.europa.eu/project/id/823871">https://cordis.europa.eu/project/id/823871</a> ).
IROHLA: Intervention Research On Health Literacy among Ageing population	(Coordinated by: ACADEMISCH ZIEKENHUIS GRONINGEN ). Running from 12/2012 until 11/2015, the IROHLA project aimed at innovating the conceptual understanding of health literacy interventions in Europe. The IROHLA project investigated health literacy interventions among the

	ageing population and will draw lessons from other sectors, e.g. the social sector and the commercial sector. By involving scientist from the medical and paramedical field, social and behavioural sciences, communication sciences and other related fields, the project was multidisciplinary. The project also involved stakeholders from the ageing population and from different levels of government. (More information: <a href="https://cordis.europa.eu/project/id/305831">https://cordis.europa.eu/project/id/305831</a> ).
my-AHA: My Active and Healthy Aging	(Coordinated by: UNIVERSITA DEGLI STUDI DI TORINO). Running from 01/2016 until 03/2020, my-AHA aimed to reduce frailty risk by improving physical activity and cognitive function, psychological state, social resources, nutrition, sleep and overall well-being. It empowered older citizens to better manage their own health, resulting in healthcare cost savings. my-AHA used state-of-the-art analytical concepts to provide new ways of health monitoring and disease prevention through individualized profiling and personalized recommendations, feedback and support (More information: <a href="https://cordis.europa.eu/project/id/305831">https://cordis.europa.eu/project/id/305831</a> ).
PHArA-ON: Pilots for Healthy and Active Ageing	(Coordinated by UNIVERSITA DEGLI STUDI DI FIRENZE). From 10/2019-11/2023 the PHArA-ON project will maximise the use of advanced services, devices, and tools – from IoT, artificial intelligence and robotics to cloud computing, smart wearables, Big Data and intelligent analytics. Its aim is to create a set of integrated and highly customisable interoperable open platforms. Platform interoperability will be implemented within Pharaon ecosystems and platforms, which will be validated in two stages: pre-validation and large-scale pilots (LSPs) conducted at pilot sites in Italy, Netherlands, Portugal, Slovenia and Spain (Murcia and Andalusia). (More information: <a href="https://cordis.europa.eu/project/id/857188">https://cordis.europa.eu/project/id/857188</a> ).
WideHealth: Widening Research on Pervasive and eHealth	(Coordinated by: Ss. CYRIL AND METHODIUS UNIVERSITY IN SKOPJE) Running from 01/2021 until 06/2023, the EU-funded WideHealth project aims to conduct research on pervasive eHealth and establish a sustainable network of research and dissemination across Europe. WideHealth will focus on data-driven health care, human factors in pervasive health and federated machine learning. It is expected that the outcomes of the project will be shared among early-stage researchers and researchers in target institutions. Additionally, WideHealth will feature training of administrative staff to improve their skills in project management and administration of research. The consortium will include partners from North Macedonia, Slovenia, Portugal, Italy and Germany. Ultimately, WideHealth will enable a new generation of researchers in these countries to develop and adapt novel eHealth technologies, exploitable in the longer run in their different healthcare contexts. (More information: <a href="https://cordis.europa.eu/project/id/952279">https://cordis.europa.eu/project/id/952279</a> ).