

2023

# Abstract book

Supporting Health  
by Technology 

Supporting Health by Technology  
International Conference  
1-6-2023

## Abstract book of Supporting Health By Technology XII

June 1<sup>st</sup> & 2<sup>nd</sup> 2023, Enschede, The Netherlands

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## Preface

The [Centre for eHealth & Wellbeing Research](#) of the University of Twente, in collaboration with the [University Medical Center Groningen](#), is very proud to present the abstract book of the **12<sup>th</sup> edition – 2023** of the successful ‘Supporting Health by Technology’ series.

For our 2023 Supporting Health by Technology conference, we are pleased to announce a varied program covering subjects related to implementation, development, evaluation, impact and opportunities of health technologies, on a diverse range of health and wellbeing related topics. We will host a variety of inspirational and interactive formats, such as symposia, workshops, demonstrations, posters or oral presentations.

We were pleased to receive scientific work related to these subjects from a broad variety of contributors, such as scientists, healthcare professionals, eHealth companies, students and many others. By bundling the work of these contributors, we hope to keep the eHealth community alive, and to promote its visibility.

We are delighted to have received 86 contributions to our conference from all over the world. This abstract book contains all accepted contributions to HealthByTech 2023. The included abstracts were reviewed by a board of experts in the field from University of Twente and University Medical Center Groningen by at least two reviewers to ensure a thorough review process. The program committee carefully assessed all reviews and comments made by the reviewers and comprised the final list of abstracts for the conference on this input.

We would like to express our gratitude to all authors that submitted their valuable and inspiring work to our conference in 2023 and to the reviewers for their time and insights, and are looking forward to welcome you for an interactive and exciting conference.

*Enjoy!*

*On behalf of the organizing committee,*

Lisette van Gemert-Pijnen

Saskia Kelders

Nienke Beerlage-de Jong

## Program – oral presentations, workshops & symposia

**Thursday, June 1<sup>st</sup>**

13:30 – 14:15	Title	Presenting author
Manchester	<b>Implementation I</b>	
	A Closer Look at Digitalization in Healthcare	Lisette van Gemert
	Implementation in Minddistrict: Definition of Implementation, Description, and Evaluation of a Tailored Made Implementation Model	Sofia Bastoni
Pique	<b>eHealth Development</b>	
	Bridging the Digital Divide: A Guide for Professionals to Develop eHealth Interventions for Low-SEP Populations	Isra Al-Dhahir
	Requirements and Design Principles for Design Methods to Facilitate Co-Design With People With Visual Disabilities.	Bard Wartena
	Design of the Interaction And Virtual Assistant in a Digital Genetic Counseling Application	Tessa Beinema
Calico	<b>Evaluation and Impact</b>	
	Long Live the Side Effects! Exploring the Non-Health Impact of Health Apps	Anne Bonvanie
	A Mobile Intervention to Promote Low-Risk Drinking Habits in Young Adults: Who Engages and Benefits?	Annet Kleiboer
	Patient Empowerment in the Field of Perioperative Care: Process Evaluation of an mHealth Intervention	Daan Toben
14:45 – 15:30	Title	Presenting author
Manchester	<b>Implementation II</b>	
	Factors Influencing Interorganizational Collaboration in eHealth: A Scoping Review	Aafke Coopmans
	Identifying Barriers for Adopting Serious Games for Health in Practice	Fenne Verhoeven
	Implementing an mHealth Application for a Long-Term Period? Watch Out for High Drop-Out Rates!	Marian Hurmuz

**Pique**

**Developments for Rehabilitation**

Development of an eHealth Intervention in Insurance Medicine Using Principles of Intervention Mapping

Elza Muller

Assessing the Potential of Physitrack and Minddistrict Apps in Geriatric Rehabilitation

Aurelie

Using Action Research to Incorporate Wearables in Rehabilitation Care

Oosterlynck

Kira Oberschmidt

**Calico**

**Opportunities for Technology**

Replication of Machine Learning Research in a Clinical Context is Essential for Healthcare

Paul Hiemstra

Reduction of Alarm Pressure at a Neonatal Intensive Care Unit: A Qualitative Study

Martine ten

Hoeve

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**Friday, June 2<sup>nd</sup>**

09:30 – 10:15	Title	Presenting author
<b>Manchester</b>	<b>Mental Healthcare</b>	
	Digital Interventions for People with Severe Mental Illness: Effects of Self-Control Training and Google Fit	Tessa Dekkers
	Compassion as a Foundational Value for Blended Treatment: Findings From Interviews With Clients and Therapists	Charlotte van Lotringen
	Internet-Based Treatment for Eating Disorders: Bridging the Treatment Gap	Pieter Rohrbach
<b>Pique</b>	<b>Chronic Diseases I</b>	
	Limited Use of Virtual Reality in Primary Care Physiotherapy for Patients With Chronic Musculoskeletal Pain	Syl Slatman
	Personalizing the Care for Patients With COPD and Comorbidities by Using Real-World Data and AI: RE-SAMPLE	Monique Tabak
	eHealth Self-Management Technologies Supporting Patients With COPD and Comorbidities: Development of a Pan-European Service Model	Eline te Braake
<b>Calico</b>	How to Tackle Legal Barriers That Threaten a Successful Implementation of eHealth Technologies? [workshop]	Britt Bente
10:30 – 11:15	Title	Presenting author
<b>Manchester</b>	<b>Mental Health &amp; Well-Being</b>	
	Training in Positivity: the Effects of a Multicomponent Positive Psychology App to Increase Mental Well-Being	Kim Tönis
	The PROfeel 2.0 App: Development in Codesign With Adolescents With Chronic Conditions and Fatigue	Maartje Stutvoet
	Development of Personas for Mood Stability Through BiAffect Data and Self-Report Questionnaires: Preliminary Results.	Emanuele Tauro

<b>Pique</b>	<b>Chronic Diseases II</b>	
	Smart Continence Management for Residents in Nursing Homes: Nurses' Experiences With Two Sensor Systems	Job van 't Veer
	Out of the Box: Co-Creative Multistakeholder Study to Enhance the Effectiveness of Cardiology eHealth Intervention	Sara Hondmann
	Developing an eHealth Intervention for and With Cardiac Patients With a Low Socioeconomic Position	Jasper Faber
<b>Calico</b>	Building a Healthy Relationship: Conversational Agents in the Context of Persistent Somatic Symptoms Through Participatory Design, a Workshop [workshop]	Jan-Wessel Hovingh
<b>11:45 – 12:30</b>	<b>Title</b>	<b>Presenting author</b>
<b>Plenary</b>	<b>Personalized Health Technology for Rehabilitation Care [symposium]</b>	
	Rehabilitation Care in the Netherlands and the Uprise of Personalized Care Technology	Hans Rietman
	The Journey of Roessingh Center for Rehabilitation to Implement Technology in Daily Rehabilitation Care	Ina Flierman
	Show me the Evidence! The Impact of Personalized Care Technology for Rehabilitation Care	Stephanie Jansen-Kosterink
<b>Manchester</b>	<b>eHealth for Kidney Disease</b>	
	Personalized Internet-Based Cognitive-Behavioral Therapy in patients with kidney failure: Potential Effectiveness and Feasibility	Judith Tommel
	Remote Home Monitoring in Chronic Kidney Disease Patients	Anne-Jet Jansen
	Towards Vitality: A Cognitive Bias Modification eHealth Intervention to Minimize Fatigue in Kidney Patients	Jody Geerts
<b>Pique</b>	<b>eHealth for Diabetes</b>	
	Lifestyle Coaching for People With Diabetes Type 2 in Secondary Care: A Feasibility Study of the Diameter + Cool	Anouk Middelweerd
	Mobile Health Apps for the Control and Self-management of Type 2 Diabetes Mellitus: Qualitative Study on Users' Acceptability and Acceptance	Marloes Bults
	Participatory Design of Lifestyle Coaching for People with Low Health Literacy and Type 2 Diabetes	Eclair Hietbrink

<b>Calico</b>	<b>eHealth for Dementia</b>	
	Citizen Science to Enrich Existing VR for Dementia With Fear-Reducing Scenarios	Hilco Prins
	Understanding the Use of Monitoring Technology on Dementia Wards: Opportunities for De-Implementation, Design and Implementation	Sarah Janus
	Information Requirements of Informal Caregivers of Older Adults with Cognitive Impairment Towards a Sensor-Based Communication Platform	Nikita Sharma
<b>13:30 – 14:15</b>	<b>Title</b>	<b>Presenting author</b>
<b>Plenary</b>	<b>Bridging the gap – Developing, Implementing and Evaluating Virtual Reality for People With Severe Mental Illness [symposium]</b>	Hanneke Kip
	Using VR in Treatment of Substance Use Disorder: Participatory Development Approach With Patients and Therapists	Samantha Murray
	Implementing VR in Complex Healthcare Settings: A Scoping Review and Experiences From Practice	Marileen Kouijzer
	Evaluating the Effect of VR Biofeedback Game DEEP in Forensic Inpatient Care: A Single- Case Experimental Design	Lisa Klein Haneveld
<b>Manchester</b>	<b>Wearable Technology</b>	
	Dysfunctional Breathing in Children: Development Wearable Breathing Trainer and Opportunities for Integration in Care Process	Richard Evering
	Towards Continuous Mental State Detection in Everyday Settings: Investigating Between-Subjects Variations in a Longitudinal Study	Lea Berkemeier
	Implementing Digital Care: Lessons Learned and Shared, but not Found and Applied	Jolanda van Til
<b>Pique</b>	<b>Health Literacy</b>	
	Modelling Observations Of Online Sensemaking Involving Digital Health Literacy	Szilvia Zörgő
	Interview Study: Nurses and Nursing Students Perspectives on Digital Health Literacy of Their Patients	Eline Dijkman
	Patients’ Digital Health Literacy – Let’s Focus on Nurse Training & Education	Jobke Wentzel



**Calico**

**The Healthcare Professionals' Perspective**

Using Virtual Reality to Train Healthcare Professionals That Support Patients With Swallowing Problems (Dysphagia) Job van 't Veer

Primary Care Physiotherapists' and Older Clients' Experiences and Needs for Home Rehabilitation Supported by eHealth Laurence Alpay

Facilitators and Barriers for the Implementation of eHealth Technologies From a Healthcare Professional's Perspective Elza Muller

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## Program – posters

Thursday, June 1<sup>st</sup>

12.45- 13.30	Title	Presenting author
Lounge	“Living with Cancer”; Implementation and Sustainability of a Peer Self-Management Support Program	Maud Schreijer
	Self-Help Insights Based on Real-World Data From eMentalHealth Providers Therapieland and Gezondeboel	Maaïke Meurs
	Getting Flow Experience Through Crafting on Physical Activities: A Daily Diary Study	Wei Liu
	Monitoring of Cancer-Related Fatigue After Breast Cancer in Daily-Life: From Development Towards Implementation	Kim Wijlens
	Preferences of Breast Cancer Patients Related to Attributes of Ehealth Interventions for Cancer-Related Fatigue	Lian Beenhakker
	Virtual Reality at Home for Chronic Pain treatment: a Single Case Experimental Design Study	Syl Slatman
	Serious Gaming to Educate Healthcare Professionals: Facilitators & Barriers for Prevention, Positive Health, & Collaboration	Nils Keesmekers
	Engaging with eCHANGE - Users’ Experiences with an App-based Weight Loss Maintenance Intervention: A Pilot-Trial	Rikke Aune Asbjornsen
	Detection of Lifestyle Changes in Physical Activity, Stress, and Sleep With a Wearable Sensor	Carlijn Braem
	Identifying Affective States in Daily Life in Adults With Personality Disorders Using Hidden Markov Modelling	Barbara Montagne
	Design Thinking: Inspiring Professionals to Reflect and Discuss Implementation of Technology in Daily Work Practice	Loes Bulle-Smith
	Adolescents’ Perceptions on Barriers and Facilitators of Physical Activity Maintenance: Diversity and Dynamics	Timothy Houtman
	Medical Device Regulation and Applied Science in Health Technology: Why It Concerns Us All	Sander Holterman

XR-Technology: from Commercial Release to Research Topic in Acquired Brain Injury Rehabilitation	Wouter Keuning
Towards Responsible Use of Decision-Support Systems in Dementia Care: A Qualitative Study on Caregivers' Perspectives	Dirk Lukkien
Cyclic Evaluation and Optimization of Digital Health Interventions	Gido Metz
Self-Rated Health Linked to More Exercise, but not Sitting Time; Objective Monitoring in Public Health	Simone Boerema
Access to Health Care is a Human Right: A Focus Group Study in COPD Patients Regarding Ehealth Accessibility	Esther Metting

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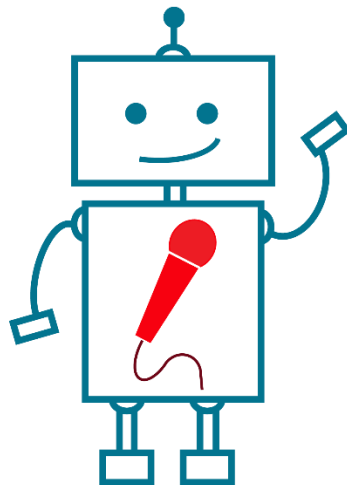
## Program – demos

Thursday, June 1<sup>st</sup>

12.45- 13.30	Title	Presenting author
Lounge	A Personalized and Adaptive Music Player for People with Dementia	Rik Wesselink
	Thubble – Interactive Customer Journey of On Demand Mental Healthcare Service	Nadine Köhle
	Supporting Sensible Self-Testing for STIs and HIV by Self-Assessment Technologies	Koenraad Vermey
	The Design for Autonomy Toolbox	Bard Wartena
	Challenges and Opportunities in Mobile Coaching	Elvis Vrolijk

# 2023

Oral presentations, workshops & symposia



## A Closer Look at Digitalization in Healthcare

Lisette van Gemert-Pijnen & Bart Nieuwenhuis

**Background:** Digital care promises to make a major contribution to bottlenecks in healthcare in the Netherlands. Digitalization in healthcare in the Netherlands is very diverse in terms of objectives, use of technology, and adjustment of healthcare processes. The government is seeking its role to solve these bottlenecks with the help of digital care. Commissioned by the Ministry of Health, Welfare and Sport, the University of Twente (UT) has conducted research addressing the following three research questions:

1. What is needed to introduce, promote and maintain digital healthcare?
2. Which actors are involved in the implementation of digital care, and how can they contribute to a successful implementation of digital applications?
3. What are the effects of the implementation of digital healthcare on healthcare costs, the labor market and the organization of healthcare?

**Methods:** A literature study, case study and quantitative cost-benefit analysis have been carried out. The literature study provided insight into how and to what extent digital applications in healthcare are successfully applied, what knowledge gaps there are, what role the government could play in promoting digitalization, and what can be learned from abroad.

The case study comprised four cases: video care in elderly care, telemonitoring, blended care in mental health care and artificial intelligence in the ICU. Actors have been approached from their various roles as supplier, IT specialist, implementation coordinator, practitioner to offer multiple perspectives on digitization and its approach within their organization.

The quantitative analysis was used to assess the effects of the implementation of digital care on healthcare costs, the labor market and the organization of healthcare using the maturity assessment scan for implementation, and methods for Cost-Benefit Analysis and Activity Based Costing.

**Findings:** The research shows that there are several factors that hinder digitalization in healthcare. There is a lack of a clear vision of the goals of digitization in healthcare. There is a need for a different approach to funding. The interoperability of systems is insufficient. Guidelines are needed when purchasing technologies. Pilot projects should pay more attention earlier and better to generating evidence for the added value of digitization compared to traditional care. There is a need for targeted support for staff and patients. And finally proper evaluation methods should be applied to deliver evidence for implementation of digital care.

Recommendations include a call on the national government to take a proactive and coordinating role. This would help ensure privacy, inclusiveness and security, and that there are standards in place when it comes to AI and algorithms that make decisions about people. With the government firmly at the helm, citizens could also be better prepared for the impact AI will have. In consultation with the healthcare sector and other partners, the government must develop digital policies and ensure a climate in which new and promising technologies can be used more effectively.

**Discussion:** The combination of the literature study and a field study collecting qualitative and quantitative data provides added value, because the literature allows for a mirroring of practical results. The quantitative data on costs and benefits are important to gain first insights into the effectiveness of digital care and to further interpret the qualitative data.

## Implementation in Minddistrict: Definition of Implementation, Description, and Evaluation of a Tailored Made Implementation Model

Sofia Bastoni, Hanneke Kip, Lisette van Gemert-Pijnen, Robbert Sanderman & Anne van Dongen

**Background:** Numerous eHealth interventions and technologies exist both in academia and in market settings. However, most of them face challenges of implementation and end up abandoned or misused. Previous research investigated main differences in implementation strategies between academic and market settings, uncovering differences in knowledge and use of implementation frameworks and models. The present study focuses on the self-developed implementation approach of the Dutch eHealth company Minddistrict's and aims at 1) inquiring the employees' mental model of implementation, 2) describing and 3) evaluating their implementation approach involving main stakeholders. The present study offers insight on best practices and pitfalls of developing a self-developed implementation approach for eHealth.

**Methods:** The qualitative study is organized in 3 phases, according to the 3 main research questions. Three rounds of semi-structured interviews will be conducted with Minddistrict's implementation managers to investigate 1) their mental model of implementation (e.g. what is their implicit definition of implementation, what are the steps and stakeholders who are ideally involved etc.); 2) extract a detailed description of Minddistrict's implementation model and 3) identify and involve stakeholders in a preliminary evaluation of Minddistrict's implementation model.

**Findings:** Data collection is ongoing; interviews are scheduled from the end of February 2023 to May 2023. We expect to have (at least) preliminary findings at the time of the conference. We advance several hypotheses. First, we expect the mental model of implementation to be a rather implicit concept among implementation managers. Also, we expect some extent of variability between individual mental models of implementation. Secondly, we expect different stakeholders to have different needs regarding the implementation process. Lastly, we expect stakeholders (including internal stakeholders in Minddistrict) to be able to identify strengths and weak spots of the implementation method.

**Discussion:** We anticipate the results of this study to hold several implications and provide lessons learned both for Minddistrict and for similar groups of professionals interested in implementing eHealth technologies. On Minddistrict's side, the implementation team will be able to reflect on their mental model of implementation and the practical implications that it holds in the implementation process. If crucial individual differences are in place, we expect it to impact the functioning and expectations toward the company's implementation model. Furthermore, we expect stakeholders' feedback on strengths and weaknesses of the implementation model to inform and guide future adaptations to the model. On a general side, we expect to be able to identify lessons learned and best practices which are applicable and reusable in different contexts.

## Bridging the Digital Divide: A Guide for Professionals to Develop eHealth Interventions for Low-SEP Populations

Isra Al-Dhahir, Jasper Faber, Linda Breeman, Thomas Reijnders, Jos Kraal, Rita van den Berg-Emons, Rosalie van der Vaart, Sandra van Dijk, Veronica Janssen, Roderik Kraaijenhagen, Valentijn Visch, Niels Chavannes & Andrea Evers

**Background:** eHealth interventions have the potential to enhance health outcomes for people with a low socioeconomic position (SEP), but lack of knowledge on how to effectively meet the specific needs of this population can limit their effectiveness and widen the digital divide. The aim of this study was to develop an inclusive eHealth guide that can assist professionals, such as eHealth developers and researchers, in developing and modifying eHealth interventions for people with a low SEP. To achieve this, we aimed to gain a thorough understanding of the needs and preferences of professionals for such a guide.

**Methods:** During the initial phase, we conducted two studies: (1) a Delphi study with professionals (e.g., researchers and health professionals), in which we identified barriers when developing, evaluating, and implementing, eHealth interventions (top-down), and (2) a community-based study with people from low SEP backgrounds, in which we explored their perspectives on health, healthcare, and eHealth (bottom-up). In the second phase, we employed an iterative participatory process to develop the website of the 'inclusive eHealth guide'. Eleven professionals participated in think aloud evaluations of test versions and semi-structured interviews to assess acceptance of the content and design. The presentation focuses on outcomes of this second phase.

**Findings:** Professionals found the eHealth guide to be user-friendly and useful, and expressed a desire for more applicable information. The guide's recommendations on barriers, facilitators, and user scenarios were valuable, but professionals requested more practical examples and engaging content. Additionally, the guide was suggested as a potential hub for connecting multiple instances (e.g., individuals and research groups) to enhance knowledge sharing.

**Discussion:** This guide is an important contribution to addressing the knowledge gap in eHealth interventions for people with a low SEP. The guide provides information which can support professionals who are new to this field as well as those who are already working in it. The guide was developed through an iterative process that combined insights from both grassroots and expert perspectives, resulting in a well-received and widely accepted product. Further research should focus on enhancing the guide's usability and flexibility to meet the diverse needs of its intended audience, which includes healthcare practitioners, researchers and other professionals working on eHealth interventions for this population.



## Requirements and Design Principles for Design Methods to Facilitate Co-Design With People With Visual Disabilities

Bard Wartena, Chiem Tuil, Job van 't Veer, Paul van het Veld, Christiaan Pinkster & Ingen Kok

**Background:** Co-design workshops can be used to involve people with visual disabilities in the design process of health innovations. These workshops bring together designers, researchers, and people with visual disabilities to develop and refine design concepts collaboratively. However, when designing with people with visual disabilities, it is important to use methods that take into account their specific needs and capabilities. Most design methods rely heavily on creative cooperation through visual affordances; this makes using them in co-design with people with visual disabilities a challenge. The project “Inclusive Innovation” focuses on finding requirements and design principles necessary to facilitate inclusive co-design through design methods.

**Methods:** A total of four design days were organized to try out different design methods toward a design goal, and gain insight into the requirements and design principles for co-design with people with visual disabilities. Eight different design methods were used during the design days which design goals encompassed; prototyping a coffee machine day-session (n=18), Service design improving a barista experience (n=18), Autonomy support through robots day-session(n=12), and a hackathon focussing on food practices(cooking and/or shopping) day-session(n=45). During the design days, design practices were audio and videotaped and facilitators had short co-reflection sessions in between methods.

**Findings:** Through a thematic analysis of the sessions, eleven requirements for the use of design methods for people with visual disabilities and five design principles to tailor design methods to the needs of inclusive co-design were found. Afterward, the findings were reviewed through a focus-group session with other facilitators (n=5) with experience with people with visual disabilities.

**Discussion:** Design methods should be accessible to people with a range of disabilities, including visual disabilities. Their accessibility and ability to facilitate collaboration between different participants depend on their flexibility and the preparations by the facilitator. This presentation aims through sharing the lessons learned, this presentation aims to give tools to future design practices and projects for inclusive co-design with people with visual disabilities.

## Design of the Interaction and Virtual Assistant in a Digital Genetic Counseling Application

Tessa Beinema, Randy Klaassen, Jan Kolkmeier, Marlies van Lingen, Lieke van den Heuvel, Marten Siemelink, Dianne van Essen, Peter van Tintelen & Dirk Heylen

**Background:** Family members of patients with an inheritable cardiac condition (ICC) have to decide if they want to undergo a DNA test to find out whether they are also at risk to develop this ICC. As this is often an emotional and difficult decision, they can make an appointment with a genetic counselor to discuss their situation. However, in practice, only 40% of family members visit the outpatient clinic. Reasons for this range from practical to very personal and emotional reasons to simply not being informed by patients or using wrong information.

The Online Family Clinic project aims to develop a digital clinic to support family members in making informed decisions. This concept includes a virtual assistant (VA), which could provide both practical and emotional support. The presentation will elaborate on the design of the interaction with the application and the VA.

**Methods:** We have iteratively designed the interaction with the application and role and tasks of the VA with stakeholders. This process involved conversations with genetic counseling experts, and discussing mockups and prototypes to focus groups and individuals from the general public.

**Findings:** We have defined a digital counseling interaction flow, which is the basis for users' interactions with the application (see Figure 1). First, users will log in and go through onboarding. Then, they go through a series of counseling cycles in which several topics are addressed. Finally, users will indicate their preference regarding DNA testing.

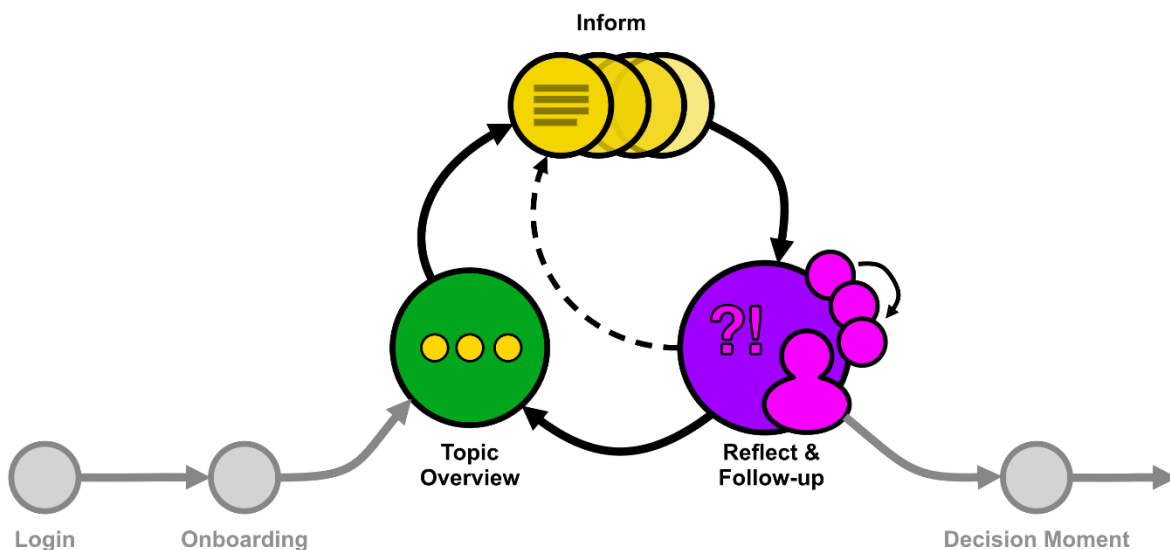


Figure 1: The designed interaction flow for the Online Family Clinic application.

The core of the interaction flow, the cycle, is repeated for a set of topics that were defined with genetic counselors. Each cycle contains the following steps: 1) an overview of the next topic to be discussed; 2) information on the topic is given, which may also include ad-hoc questions to be answered (e.g., 'do you

also experience these symptoms?’ ‘yes/no’); and, 3) the user and the VA can reflect on the topic and the VA can follow-up on certain responses to ad-hoc questions.

The VA has three roles. First, asking the user additional (obligatory) questions for risk assessment during the reflection and follow-up step. E.g., if a user previously indicated experiencing symptoms, additional questions by the VA may lead to the advice to contact a general practitioner. Second, providing additional in-depth information about a topic. Third, providing emotional support, as having an ICC can potentially be difficult for people.

**Discussion:** The Online Family Clinic aims to provide family members of an ICC patient with a digital clinic to support them in informed decision-making about potential DNA testing. We believe the designed interaction flow and VA will provide users of the application with the support they need - both on a practical and emotional level – ultimately leading to more relatives making informed choices on DNA testing. Future work will involve further studies with the VA and a clinical trial in which the use of the application is compared with usual care.

## Long Live the Side Effects! Exploring the Non-Health Impact of Health Apps

Anne Bonvanie & Gitte Kloek

**Background:** An increasing number of smartphone owners uses apps for health tracking or monitoring. The use varies from diseases-specific monitoring (Kerst et al., 2020) to general health behaviour (Helbostad et al., 2017) and mental health (Van Ameringen et al., 2017). Many apps are useful for improving or maintaining the users' health – but others do not significantly affect user health, or are aimed at patients with conditions that cannot be influenced over a short time-span. The question then arises: what impact do these apps have, if not on day-to-day health?

**Methods:** We executed a small explorative field study, as a part of the TOPFIT Citizenlab. The disease-specific application that was used is COSMA, an app aimed at early detection and delay of memory loss and dementia. Participants were recruited through the TOPFIT network, and were eligible to apply if they had family members with memory loss or dementia. Of the 12 respondents, 11 started the experiment, and 8 completed the whole study. The participants were asked to use the COSMA-app for three months, participate in an interview before, and after the period of use, and optionally to give additional design feedback in a focus group setting. Data collection took place between September 2022 and January 2023.

**Findings:** The motivation of participants differs greatly. Some participants use the app to compare themselves to a benchmark: are my bouts of memory loss normal for someone like me? Others focus on the possible future impact of apps such as these, and participate because they feel the need to help future patients with dementia.

Results from the pre-study interview show that many participants do not share their fears, hopes, and thoughts about 'what-if' with their loved ones. Communication about dementia and memory loss is often limited to practical issues regarding care for their (grand)parent(s) with dementia, or joking comments when they forget something. Post-study interviews show that the use of the COSMA-app did not influence participants' day-to-day health-related behaviour. It did, however, trigger conversations between participants, their spouses, and their kids, about the impact memory loss or dementia would have on their lives. Of the 8 participants that completed the study, 1 changed their job content and workload due to a conversation with their children. Two other participants used the app to actively start the conversation about memory loss and dementia with their own parents and/or spouses, and to talk about the scenario that one of them would suffer from memory loss. These conversations were, according to the pre-study interview, very uncommon.

**Discussion:** The first results from this study show that despite not reaching the primary goal of the app (regular app usage in order to early detect memory loss), the app still has a significant impact on users' lives. Users experience increased control over their future health and life, or their current lifestyle. These insights enable future app developers and app initiators to look at the whole ecosystem of their health app, and take this system into account when developing and marketing the app.

## A Mobile Intervention to Promote Low-Risk Drinking Habits in Young Adults: Who Engages and Benefits?

Annet Kleiboer, Mieke Schulte, Niko Boumparis, Anja Huizink & Heleen Riper

**Background:** Drinking habits in young adults often exceed low risk drinking guidelines. Mobile applications can support young adults who wish to reduce their alcohol consumption and usually include behaviour change techniques such as personalised normative feedback, motivational interviewing, and protective behavioral strategies. User-engagement with these types of applications varies widely between- and within target populations, however, which may hamper optimal benefit from these interventions. The current study examined in young adults who received a mobile intervention to reduce alcohol consumption: (1) predictors of user-engagement (e.g. sociodemographics, problem severity, wellbeing, readiness to change, work performance) which we defined as the user's uptake and sustained interaction with the application and (2) the relation between user-engagement and reduced alcohol consumption.

**Methods:** We used data from a two-arm randomized controlled trial that compared the effectiveness of a 6-week self-guided mobile application incorporating various behaviour change techniques (n=252) to a minimal psycho-educational intervention (n=251) in young adults who wished to reduce their alcohol consumption. Inclusion criteria were being aged 18-30 and willingness to develop low risk drinking habits. Our analyses were based on the 252 participants who received the mobile intervention. Log data from the mobile application and the Twente Engagement with eHealth Technology Scale (TWEETS) were used as measures of engagement; Alcohol related problem severity was assessed with the Rutgers Alcohol Problem Index (RAPI); Readiness to change with the Readiness to Change Questionnaire (RCQ); wellbeing with the Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS); work performance with the Task performance Questionnaire (IWQP); and alcohol consumption was assessed with the timeline follow-back (TLFB).

**Findings:** Results from the randomized controlled trial showed that both participants assigned to the mobile application and those assigned to the minimal intervention had reduced their alcohol consumption at post-intervention. User-engagement with the application varied widely. Of all 252 participants assigned to the mobile application, 231 (92%) logged into the application, 161 (64%) opened the app at least once, and 128 (51%) completed the initial personalized normative feedback and motivational interviewing module. Further results on the predictors of user-engagement and the relation between user-engagement and alcohol consumption will be presented at the conference.

**Discussion:** User-engagement with mobile applications have shown to vary widely. The current study provides insight into characteristics related to user-engagement of young adults who wish to improve their drinking habits, which increases our understanding of who we reach and who may benefit from health promotion interventions in the general population.

## Patient Empowerment in the Field of Perioperative Care: Process Evaluation of an mHealth Intervention

Daan Toben, Astrid de Wind, Eva van der Meij, Judith Huirne & Johannes Anema

**Background:** Modern improvements in perioperative care have reduced the length of hospital admission for patients undergoing elective surgery. With the care setting shifting from intramural to trans- and extramural, patients can- and should be empowered with the tools they need for effective recovery. The ikHerstel app is one such tool, constituting expert-based multidisciplinary recommendations on convalescence following abdominal surgery. The app has been shown to increase patients' speed of recovery, reduce their pain and improve their quality of life. Currently, implementation of ikHerstel hinges on care providers, who have an intermediary role to provide it to their patients. Depending on the context, this strategy may limit the reach of the intervention compared to its potential; care providers may forget to provide the app to their patients or they are unable to do so because the hospital they work at does not subscribe to ikHerstel. When such failure occurs, patients that could be reaping the benefits of ikHerstel are unable to do so. An alternative implementation strategy, whereby ikHerstel is provided to the patients without intermediary care providers, may work to circumvent this issue. Our aim was to evaluate the viability of an alternative implementation strategy which supersedes the intermediary role of care providers and distributes ikHerstel directly to patients, by piloting the strategy and conducting a process evaluation.

**Methods:** Implementation outcomes were selected on the basis of the guidelines provided by Steckler & Linnan. These were: context, reach, dose delivered, dose received, fidelity, implementation and recruitment. In addition to these, outcomes specific to the technological character of ikHerstel were selected based on the Unified Theory of Acceptance and Use of Technology developed by Venkatesh, Thong & Xu. These were: performance expectancy, effort expectancy, facilitating conditions, habit, and price value. We sampled 50 patients through hospitals, social media, the Internet and magazines using posters, flyers, business cards, care providers and articles, among others. Data on the aforementioned outcomes were collected at baseline as well as 3, 6 and 12 weeks following surgery through digital surveys. Data were subsequently analysed using descriptive statistics, using frequency tables as well as the median and mode values for scale variables. Comparison of subgroups was performed using independent samples t-test and ANOVA.

**Findings:** The enrollment of patients started in September 2022. The follow-up period will be concluded in March 2023. Data preparation and analysis will be finished before the Supporting Health by Technology conference.

**Discussion:** This study represents a pilot study, where we assess the viability of an alternative implementation strategy for ikHerstel, an evidence-based intervention in the field of perioperative care. We hope that the findings of the study will help us to map out patients' needs and preferences regarding ikHerstel, so that the benefits it provides may be delivered to a broader scope of patients. We hope, furthermore, that our findings may be of sufficient generalizability so as to be of use to other researchers and care providers looking to develop or implement a mHealth intervention.

## Factors Influencing Interorganizational Collaboration in eHealth: A Scoping Review

Aafke Coopmans, Remco Mannak, Anna Braspenning, Eveline Wouters & Inge Bongers

**Background:** The development, evaluation, and implementation of eHealth interventions requires a multi-disciplinary approach in which different disciplines from different organizations are working together. This interorganizational collaboration is beneficial for a successful eHealth intervention since collaboration with all involved stakeholders ensures that it fulfills the needs and wishes of all stakeholders involved and a better fit with the context in which the intervention will be implemented. To guide interorganizational collaborations the existing literature provides different kinds of reviews, frameworks, overviews, and models within factors that facilitate or hinder interorganizational collaboration in different domains. However, an overview of influential factors that can guide organizations with their interorganizational collaboration in the context of eHealth is lacking. Therefore, a scoping review was conducted aiming to provide an overview of factors influencing interorganizational collaboration during the development, evaluation, and implementation of eHealth interventions.

**Methods:** PubMed, PsycINFO, and Web of Science were searched in April 2022 for English or Dutch peer-reviewed empirical studies on interorganizational collaboration in the context of eHealth. The study characteristics and findings on influencing interorganizational collaboration were extracted into a data extraction form, summarized, and coded per article to come up with an overview of factors. A search update will be conducted in April 2023 in which new articles will be screened and eligible articles will be analysed.

**Findings:** The search in April 2022 resulted in 3212 references after removing duplicates from which 40 articles were eligible for inclusion. The preliminary results of this review show that interorganizational collaboration is influenced by factors as (1) alignment in goals, timelines, priorities, and expectations, (2) communication, (3) collaboration strength, (4) collaboration culture, (5) collaboration context, (6) history of the collaboration, (7) leadership and management, (8) trust and (9) commitment.

**Discussion:** This scoping review provides an overview of factors influencing collaboration between organizations in the context of eHealth. During the presentation we will discuss the implications of this overview of factors for interorganizational collaboration during the development, implementation, and evaluation of eHealth interventions. Future research could explore in depth how the factors found influence interorganizational collaboration in the context of eHealth.

## Identifying Barriers for Adopting Serious Games for Health in Practice

Fenne Verhoeven, Gido Hakvoort & Marike Hettinga

**Background:** The application of serious games is rapidly increasing within various industries and although there are numerous studies on serious games (SG) for health, adoption in practice seems to be lagging behind. The Dutch SG market seems to be dominated by a handful of large game developers. As the majority of Dutch game developers are small and medium-sized enterprises (SMEs), we investigated barriers they encounter when bringing SG for health to market.

**Methods:** The study was conducted between February and June 2022. After an initial plenary meeting with SMEs (n=8) in February to detect major barriers, we conducted online, semi-structured interviews with SMEs (n=13) in April and May using the online tool Mural to visualize a timeline of their game development process, depicting barriers and facilitators. In June, we interviewed experts regarding SG for health to identify solution directions, which we validated in a plenary meeting with all experts and SMEs (n=18).

**Findings:** The SMEs interviews highlighted two focus areas of SG for health: 1) as patient intervention (e.g., to support physical and cognitive rehabilitation treatment), and 2) as training tool for professionals. In addition, the interviews also exposed two main barrier themes 1) evaluation, and 2) regulation. First, potential buyers are often healthcare or educational organizations asking SMEs about clinical or educational effectiveness. However, the majority of these SMEs do not have the resources nor the expertise to carry out long-term evaluation studies. SMEs wonder if a stepwise approach exists for collecting 'evidence' during their game development process and which research methods are most adequate? Still, even if they could utilize such a stepwise approach, then how to deal with the contrasting research paradigms of longitudinal, quantitative research in healthcare on one hand, and short iterative qualitative research loops in design research on the other? Second, similar to the evaluation barrier, the regulation barrier exists within both focus areas. For patient interventions, SMEs wonder how to deal with the Medical Device Regulation (MDR) and whether this applies to SG for health? Although this question is less prevalent among SG as training tool for professionals, many of these games must still meet quality assurance in some form of accreditation. Expert interviews demonstrated that some frameworks and tools are available for both regulation and evaluation. However, these are rather theoretical driven and not directly applicable to SMEs' daily practice.

**Discussion:** The two main barriers we found weaken the competitive position of SMEs developing SG and thereby the adoption of SG for health in daily practice. Although SMEs do conduct research throughout the entire game development process, they seem unaware of this and therefore do not explicate their research process to potential buyers. We therefore initiated new research projects, starting from March 2023, regarding: 1) discussion framework for evaluating SG for health that supports a shared understanding and constructive dialogue between potential buyers and SMEs, 2) evaluation tools that are both practical and feasible, and that lead to an acceptable level of evidence, and 3) applicable MDR-information tools.



## Implementing an mHealth Application for a Long-Term Period? Watch Out for High Drop-Out Rates!

Marian Hurmuz & Stephanie Jansen-Kosterink

**Background:** The recent years mHealth has been presented as the solution to overcome the healthcare issues. A lot of short-term studies are performed to assess the acceptance of mHealth, however long-term studies focusing on acceptance are scarce. Long-term observational mHealth studies are needed to acquire this missing knowledge needed for sustainable implementation. So, we conducted a study in which an mHealth application could be used for one year among the general population of adults.

**Methods:** We conducted an observational cohort study, in which the Healthentia application was implemented among adults aging 18 years or older. Within the Healthentia application, participants could complete quality of life questionnaires (EQ-5D and positive health) and could track their physical activity in number of steps, their fluid intake and their heart rate. During this one-year study, participants completed a baseline questionnaire consisting of demographics and several questionnaires (after 2, 6 and 12 months of use) consisting of technology acceptance measured by the Technology Acceptance Model (TAM).

**Findings:** During this study, we quickly ran into the problem of drop-out. We started with 61 adults who completed the baseline questionnaire. From these, 49 actually started using the Healthentia application, 41 completed their 2 months of use, 39 completed their 6 months of use, and at the time of writing, 34 completed their 12 months of use. Besides using the Healthentia app, participants were also asked to complete some TAM questionnaires. Here we also stumbled upon drop-out problems: 30 completed the 2-months questionnaire, 22 completed the 6-months questionnaire, and at the time of writing, 21 completed the 12-months questionnaire. A part of the drop-outs did inform the main researcher why they wanted to quit the study. The most mentioned reasons were lack of time or experiencing no added value from using the Healthentia app. However, most of the people who dropped out were lost to follow-up. The intention to use of the Healthentia app scored on average a 4.0 (SD=1.7) after 2 months of use, and a 4.3 (SD=1.6) after 6 months of use. The study is currently still ongoing: there are 5 participants left who have not finished their 12 months of use and there are 13 participants who received the 12-months questionnaire, but did not complete it yet. All results will be available half of March 2023. The presentation will focus on the acceptance and drop-outs over the whole 1-year study period.

**Discussion:** The functionalities of the mHealth application we studied focus mainly on measuring health data. An explanation for the high number of drop-outs we experienced could be that for mHealth users, it is not about collecting health data. There needs to be an added value to be willing to use the mHealth application for long-term period. So, even though people can use the overview of their health data to monitor their own health as a first step in living a healthy life, this is not enough to keep engaging them in the long-term.

## Development of an eHealth Intervention in Insurance Medicine Using Principles of Intervention Mapping

Elza Muller, M.A. Huysmans, H.J. van Rijssen & J.R. Anema

**Background:** Although eHealth interventions are used to deliver, and improve healthcare, they are still scarcely used in the field of insurance medicine. We therefore developed an eHealth intervention tool that could help insurance physicians (IP) enhance efficiency and effectiveness of the process of doing disability assessments. Additionally, the needs and input of people with a social disability benefit were taken in account. We defined eHealth according to the WHO definition.

**Objectives:** We aim to discuss the development of an eHealth intervention for structuring information of disability assessments and preparing both IP and people with a social disability benefit for it, using the intervention mapping protocol.

We will present the process of development and discuss eHealth intervention in accordance with our most recent progress.

**Methods:** We used intervention mapping (a six step iterative protocol) to develop and evaluate this intervention. We first conducted a needs assessment by means of a survey amongst IP and semi structured interviews with experts to learn from the implementation of eHealth tools in adjacent medical fields. We used the Donabedian model to structure the process of disability assessments. By means of brainstorm sessions, we identified eHealth intervention directions within the process of disability assessments for further development. Subsequently, we formulated performance and change objectives and developed pilot studies for daily practice. Finally we aimed to implement and evaluate the usability and feasibility in the daily practice of insurance medicine.

**Results:** We identified 3 preliminary intervention directions that can be implemented alone or in combination in the field of insurance medicine.

1. Digital questionnaire collecting relevant information digitally prior to the disability assessment by the IP, e.g. information on medical and psychosocial situation, self-reported symptoms and work limitations, or daily activities.
2. Online information support for people with a disability benefit about aspects of the disability assessment to enhance their empowerment and to manage expectations.
3. Dashboard for the IP to more directly see all retrieved client information. This enables the IP to better prepare for the disability assessment.

**Conclusion:** Results of further development of a prototype are expected by the end of June 2023.

## Assessing the Potential of Physitrack and Minddistrict Apps in Geriatric Rehabilitation

Aurelie Oosterlynck, Laurence Alpay, Jorit Meesters, Marije Holstege

**Background:** Geriatric rehabilitation requires more efficient, effective and when possible rehabilitation at home. eHealth used in a blended way has the potential to offer solutions to this challenge. This study is a follow-up of an orientation which was conducted at Omring on the wishes and needs of eHealth applications in geriatric rehabilitation from the perspective of patients, healthcare professionals and the healthcare organization. The present study investigated the requirements for the implementation process of Physitrack (PT) and Minddistrict (MD) applications in (outpatient) geriatric rehabilitation of CVA patients, and its added value to the long-term vision for digitization of Omring. This research is part of the Medical Delta Living Lab Geriatric Rehabilitation @Home.

**Method:** Qualitative method of two focus groups was used. Persona's, a patient journey and scenarios were composed in co-creation with physiotherapists (n=3) and a psychologist. Data from the sessions were used to formulate, in collaboration with information managers and a data-architect, the functional requirements for MD and PT and to sketch the layout of a blended care pathway.

**Findings:** The PT app has the potential to increase the exercise frequency and monitor adherence to treatment, in particular in the outpatient phase. Especially when there is the need to support, motivate and monitor patients who perform exercises independently at home. Starting clinically with the use of PT in a blended way could contribute to a better implementation in the outpatient phase. Setting up fixed exercise programs is important to increase the practitioner's ease of use.

The MD app seems to be promising in the clinical phase when patients have processing problems. It could also be used preventively. Non-functional processing problems often only appear to be identified at a late phase of geriatric rehabilitation. It is desirable to carry out a broader inventory to identify the wishes/needs for supporting behavioral and/or cognitive problems in rehabilitation.

The development of the patient journey provided input about which factors are important for setting up the apps within the blended care pathway. In order to use the apps, they must be tailored to the ICT infrastructure. For example, these must be included in the organization's app management, linked to the electronic patient file and to the Single Sign-On login facility. Further exploration on how the apps and associated functionalities fit into the long-term vision for digitization of Omring must be conducted.

**Discussion:** PT offers the potential in (outpatient) geriatric rehabilitation to increase the frequency of independently performed exercise. This confirms the findings of the FAST@Home study, which includes PT in rehabilitation in a general population. It is recommended to start a pilot using PT in practice, where patient cases are followed and a business case is drawn up. In addition, wishes and needs can be identified on how PT can be integrated into a CVA blended care pathway. The possible applicability of MD requires further exploration into the current content and how it matches the target group.

## Using Action Research to Incorporate Wearables in Rehabilitation Care

Kira Oberschmidt, Rachele Rinzema, Valentina Bartali, Ina Flierman, Allard Dijkstra, Reinout van Vliet & Monique Tabak

**Background:** Action Research (AR) is a methodological framework for iterative participatory research. In AR, relevant stakeholders are involved as project partners and co-researchers, who actively shape and contribute to the research project. AR is situated in practice within the context or community it aims to serve, to ensure a connection between the research project and the practical context, so that findings can have a real world impact. Our aim was to apply and reflect upon AR applied in a rehabilitation centre in the Netherlands, to test existing wearable sensors as part of rehabilitation care. In this setting, wearables can be useful to monitor patients outside of the visits to the clinic. This allows healthcare professionals and patients to gather objective measurements of patients in their everyday life, and thus keep track of their progress. Also, wearables can for example be used to measure baseline data, and evaluate the effect of a treatment.

**Methods:** AR projects take place in cycles of planning, action and reflection. In line with the principles of action research, the project team, consisting of several healthcare professionals (e.g. rehabilitation physician, physical therapist), the innovation coordinator of the rehabilitation centre, and researchers, collaboratively decided on the course of the project. Furthermore, the research was conducted in iterations, and regular reflections took place in the project team meetings to shape the next steps.

**Findings:** Our AR project started with a requirements identification based on interviews in two departments: paediatric rehabilitation and neurology, and with seven healthcare professionals. Next, we made an inventory of existing solutions on the market that met these requirements, as well as a list of devices already available in the rehabilitation centre, which was presented to the project team. Then, we evaluated two of these wearables in practice to decide which would fit the best. To do so, two duos of current patients and healthcare professionals tested the wearables together, with the patient wearing both devices for two days, and the healthcare professional receiving and evaluating the data. Patients and healthcare professionals answered a survey about the perceived usefulness of both devices and gave a rating on which wearable they preferred. These tests were set up together with the healthcare professionals on the team, giving room to questions they were interested in. The findings included that aspects of both wearables were valued, but either real time monitoring or data processing were lacking. Therefore, for the next phase of the project, which is currently ongoing, a different wearable will be tested.

**Discussion:** On the one hand, our findings include lessons learned about doing AR in a healthcare context. The structure and approach we took can be translated to other contexts and projects. We also learned where and how best to involve the healthcare professionals in the role of co-researchers. On the other hand, there are practical findings from the sub studies we conducted (e.g., requirements for wearables in rehabilitation, protocols for testing and comparing wearables in practice, ethical considerations) that can be useful for similar projects.

## Replication of Machine Learning Research in a Clinical Context is Essential for Healthcare

Paul Hiemstra, Gido Hakvoort, Brian Vendel, Joris van Dijk & Marike Hettinga

**Background:** Repeating an experiment following the exact same procedures and using the exact same data and tooling should always give the same results. This is referred to as replicability, a key principle within the scientific research community. To support replicability in a clinical context, recording and reporting detailed information about data collection procedures and machine settings are standard procedures. However, since data is increasingly used for machine learning purposes it also becomes essential to extend this recording and reporting to the machine learning models that are created. Within this study we attempted to replicate a machine learning model that identifies patients with a high chance of a heart attack from a published article to identify what information is key for replicating machine learning models.

**Methods:** Our primary input was the original data file and the published article. We followed the procedures described in the article to replicate the model. Next, we gained access to the original code used to replicate the published model. Furthermore we investigated how data, tooling, and model configuration influenced the replicability.

**Findings:** The provided data was clean and well organized without any missing or incomplete data. Moreover, patient selection and collection of the data was well documented in the article. The authors clearly described that gradient boosting was used to create the model and although the specific version of XGBoost was listed, versions of Python or a specific Python distribution were missing. Finally, the authors provided insufficient information regarding configuration of the XGBoost model. For example, the authors described a grid search for optimizing hyperparameters but did not specify which XGBoost settings were optimized, which options for each of these settings were tested, and what the best performing settings were. As a result, solely based on the primary input, we could not replicate the machine learning model described in the article. Moreover, even with the original code, we were unable to replicate the model.

**Discussion:** The inability to replicate the machine learning model is mainly due to the lack of information regarding the configuration of the XGBoost model. This lack of information was in contrast to the data collection procedure that was extensively described in the article. We believe that within a clinical context not only data collection procedures but also development environment and exact model configurations to train machine learning models should be recorded and reported. For both tooling and model configuration, containerization could be utilized to efficiently replicate the results of machine learning research. Finally, we recommend the use of a digital lab notebook during development of machine learning models extending replicability beyond just the final model and include the entire process up to that point.

## Reduction of Alarm Pressure at a Neonatal Intensive Care Unit: A Qualitative Study

Martine ten Hoeve

**Background:** Medical equipment for measuring vital parameters of hospital patients is becoming more advanced, implying an increasing number of alarms, particularly in critical care such as the neonatal intensive care-unit (NICU). Each alarm requires classification by nurses to determine clinical relevance and prioritize follow-up. Since only 20% appears to be clinically relevant, efficiency of the care process can be improved. Moreover, nurses experience alarm fatigue, posing a major threat to patient safety. Furthermore alarm fatigue contributes to lower job satisfaction and even burnout risk for nurses. The large availability of (patient) data at a NICU might provide opportunities for artificial intelligence to safely reduce the number of alarms. To explore this, a two-phased, qualitative study was conducted.

**Methods:** This study was conducted at a Neonatal Intensive Care Unit (NICU) at a non-academic, top clinical hospital in the Netherlands. This NICU has three units, with a total of 18 beds where 70 nurses provide 24/7 care, to both neonates and their parents. The study consisted of two phases:

1. Data exploration: Between 2019 and 2021, three IT-student groups explored NICU-patient data;
2. Field research: the health care workers' perspective was investigated from April to June 2022, consisting of more in-depth alarm data analysis, a literature quick scan on alarm(s) reduction, observations and semi-structured interviews with NICU-nurses (n=6) and multiple conversations with clinical physcists (n=2).

### **Findings:**

1. Students (sequentially) built a usable dashboard within the hospital's PowerBI-environment, sorting alarms by color (yellow, red, blue), parameter, beds and units, and identified patterns in frequency. It gives insight into an average of 2.3 million alarms monthly, classified by cause or seriousness of exceeding threshold values. The vast majority of the alarms are blue- and yellow-classified. Blue alarms signal a deviation in the measurement signal. Yellow and red alarms indicate a deviation from the alarm thresholds. In addition, patterns (sets of alarms occurring frequently) were identified within the data set, providing possibilities for software solutions to reduce perceived alarm pressure;
2. Many blue and yellow alarms were indicated by nurses as irrelevant. Nurses could define when not to respond to a particular alarm: patients characteristics, patterns in alarms, or clinical interventions simultaneously with the alarm. This indicates and confirms the potential of using patient or pattern data to silence alarms marked as irrelevant. Reducing these alarms will have a huge impact in experienced alarm pressure, according to the involved nurses.

**Discussion:** Our research so far demonstrates that artificial intelligence can be a promising solution for the alarm pressure-problem in two ways:

1. We determined specific cues to experiment with alarm settings to reduce alarms or use pattern data to silence minor irrelevant alarms and draw attention to relevant alarm patterns.
2. A logical next step would be to experiment with changing alarm settings and a smart combination of alarms in a safe experimental setting. A digital twin is a replica of the physical, dynamic NICU-setting in which data from patients, devices and their mutual interactions can be simulated and artificial intelligence can make predictions about the impact of changes.

## Digital Interventions for People with Severe Mental Illness: Effects of Self-Control Training and Google Fit

Tessa Dekkers, Tahnee Heirbaut, Stephanie Schouten, Saskia Kelders, Nienke Beerlage-de Jong, Geke Ludden, Jeroen Deenik, Yvonne Bouman & Hanneke Kip

**Background:** Lifestyle-related factors such as sedentary behaviour and lack of physical activity put people with severe mental illness (SMI) at risk of cardiovascular disease and early mortality. Increased self-control, i.e. the ability to prevent or override unwanted thoughts or behaviors in favor of higher order goals, could improve physical of people with SMI. Self-control plays supports both reflective processes (e.g. establishing a healthy eating goal) and ensures individuals' ability and capacity to control impulsive tendencies (e.g. declining snacks). However, digital lifestyle interventions primarily focus on reflective processes. These require substantial cognitive skills and may be less suitable for people with SMI who often experience deficits in memory and attention. Yet teaching self-control abilities involves a relatively straightforward, effective intervention that is independent of language and cognitive skills. Therefore, the aim of the current study was to examine the effectiveness of digital self-control training (SCIPP: the Self-Control Intervention aPP) when used in conjunction with a reflective digital lifestyle intervention (Google Fit) on physical activity and self-control of people with SMI.

**Methods:** A concurrent multiple-baseline Single-Case Experimental Design (SCED) involving three people with SMI (all male, 1 outpatient and 2 inpatients, mean BMI = 24.7) was used. After baseline (8-11 days, randomized) participants used Google Fit for 6-8 days. Google Fit consisted of goal setting, a step counter, self-monitoring, and feedback on physical activity. Next, participants used SCIPP (14 days), concluded by follow-up (7-8 days). SCIPP consisted of 14 daily challenges in which users use their non-dominant hand for everyday tasks. This practice is expected to build self-control capacity. During all 38 days, participants wore an accelerometer (ActiGraph GT3X+) for at least six hours a day and answered short surveys on self-control twice a day. Daily average of total activity counts per hour (TAC/h) and state level of self-control served as primary and secondary outcome measures. Data were analysed using visual analysis and piecewise linear regression analyses.

**Findings:** Results showed that participants' average TAC/h ( $M= 83298.68$ ,  $SD= 20898.44$ ) and self-control ( $M= 3.02$ ,  $SD= 0.19$ ) were highest when using Google Fit. Unexpectedly, physical activity was significantly better in the Google Fit phase compared to the Google Fit + SCIPP phase ( $TAU-U= -0.279$ ,  $p=.01$ ), which was mainly evident in individual analysis of participant A ( $TAU-U= -0.500$ ,  $p=.005$ ). No overall or individual effects on self-control were found, likely due to problematic adherence to the protocol and missing or inaccurate data collected.

**Discussion:** While self-control training has the potential to complement existing lifestyle interventions for people with SMI, no significant effect was found in the current study. This highlights the difficulty of studying digital interventions over time in people with SMI. However, the data does show that Google Fit may be a feasible, effective intervention for people with SMI and that accelerometry produces high-quality data enabling the study of physical activity over time. Therefore, the study is set to be replicated in the general population next.

## Compassion as a Foundational Value for Blended Treatment: Findings From Interviews With Clients and Therapists

Charlotte van Lotringen, Benedetta Lusi, Gerben Westerhof, Saskia Kelders & Matthijs Noordzij

**Background:** The acceptance of digital mental health interventions (DMHI's) in mental health care remains low, despite their potential benefits. Both clients and therapists value personal contact during treatment highly. Therefore, combining human support with the use of DMHI's in blended treatment increases the acceptance of DMHI's. However, a clear conceptual basis for how to integrate blended treatment in daily practice is lacking according to therapists. Compassion, referring to recognizing and wanting to alleviate suffering, is often called a central value in the field of (mental) health care, and could be a guiding force to shape blended treatment. The present study used interviews with clients and therapists to explore whether compassion could be a fitting and helpful motivation and framework for blended treatment.

**Methods:** Semi-structured interviews were conducted with several clients and therapists from the mental health care field. The interviews focused respectively on the experiences, needs, and expectations of clients, and the motivations and ways of working of therapists. The interviews were analyzed using thematic analysis, with the five components of a proposed definition of compassion as a deductive, interpretative frame. At the same time, inductive coding was used for themes that did not fit in the framework of compassion.

**Findings:** At the moment of writing, data collection and analysis is ongoing, with interviews already having been conducted with 12 therapists and three clients from different organizations and domains of mental health care. We expect to have finished the full analysis by the time of presenting. So far, therapists seem to be strongly motivated by several components of compassion, while the construct of compassion is never explicitly used by them. There seems to be a lack of clarity around why and how to adopt technology in their organizations, though this differs per mental health care organization and domain. On the client side of the interviews, we hypothesize that components of compassion meet at least some of their expressed needs in a treatment. This would emphasize the importance of explicitly focusing new ways of working with technology in mental health care on a value such as compassion.

**Discussion:** The findings from these interviews will offer a starting point for the co-creation of new guidelines for compassionate blended treatment, based on the needs and expectations of clients and the motivations and ways of working of therapists. Therefore, the interviews will be followed up with focus groups and co-creation sessions with clients and therapists. The eventual aim of this study is to contribute to compassionate and sustainable blended mental health care, where the therapist and technology complement each other.



## Internet-Based Treatment for Eating Disorders: Bridging the Treatment Gap

Pieter Rohrbach, Alexandra Dingemans, Eric van Furth & Philip Spinhoven

**Background:** It often takes multiple years before people with an eating disorder receive specific help. An important step in reducing both the individual and global burden of eating disorders is by making interventions more accessible. Internet interventions and support from an expert patient (i.e., someone who has recovered from an eating disorder) are two potential ways of bridging the treatment gap. The current study aims to investigate the effectiveness of the internet intervention Featback, a self-guided internet-based monitoring and feedback system, and the added value of online expert-patient support.

**Methods:** Participants (N=355) were recruited mainly through Proud2Bme, a Dutch online pro-recovery community for eating disorders. Inclusion criteria were: being 16 years or older and having at least mild eating disorder symptoms. Participants were randomized to four conditions: (1) Featback, (2) Featback with weekly chat or e-mail support from an expert patient, (3) weekly chat or e-mail support from an expert patient, and (4) a waiting list control condition. Assessment took place at baseline, post intervention (8 weeks), and at 3, 6, 9 and 12 months follow-up. The primary outcome measure was self-reported eating disorder psychopathology as measured with the EDE-Q.

**Findings:** Retention and intervention usage in the study were high. An intention-to-treat approach was maintained throughout the analyses. The main analysis shows that the three active interventions (pooled) were superior to a waiting list control condition in reducing eating disorder symptoms from baseline to post intervention ( $d=-0.35$ , pooled  $t(405.6)=-3.57$ ,  $p<.001$ ), with no difference in effectiveness between the three active conditions. Satisfaction with the intervention was significantly higher in conditions with the possibility to receive expert-patient support. Featback and expert-patient support stimulated some participants to seek professional help.

**Discussion:** Results suggest that both Featback and expert-patient support, separately and combined, might be effective strategies to reduce eating disorder symptomatology and stimulate help seeking behaviors. Such low-threshold interventions can be widely implemented at low costs and might reach an underserved population and guide individuals to specific help for their eating disorder more quickly.

## Limited Use of Virtual Reality in Primary Care Physiotherapy for Patients With Chronic Musculoskeletal Pain

Syl Slatman, Bart Staal, Harry van Goor, Raymond Ostelo, Remko Soer & Jesper Knoop

**Background:** Chronic musculoskeletal pain (CMP) is a disabling condition which is prevalent in about 20% of the adult population. Physiotherapy is the most common non-pharmacological treatment option for CMP, but often demonstrates unsatisfactory outcomes. Virtual Reality (VR) may offer the opportunity to complement physiotherapy treatment, for varying treatment aims. As VR has only recently been introduced in physiotherapy care, it is unknown whether it is used and how that is experienced. The aim of this study was to explore the current usage and experiences with therapeutic VR for patients with CMP in Dutch primary care physiotherapy.

**Methods:** This online survey among Dutch primary care physiotherapists used two waves of recruitment (i.e. cluster random sampling and purposive sampling). In total, 873 physiotherapists were invited in the first wave, of which 245 (28%) physiotherapists responded. In the second wave, 20 physiotherapists that use therapeutic VR were included.

**Findings:** In total, 265 physiotherapists participated in this survey study. Approximately 7% of physiotherapists reported using therapeutic VR for patients with CMP. On average, physiotherapists rated their overall experience with therapeutic VR at 7.0 and whether they would recommend it at 7.2, both on a 0-10 scale. Most physiotherapists (71%) that use therapeutic VR, started using it less than two years ago and use it for a small proportion of their patients with CMP. Physiotherapists use therapeutic VR for a variety of conditions, including generalized (55%), neck (45%) and lumbar (37%) CMP. Physiotherapists use therapeutic VR mostly to reduce pain (68%), improve coordination (50%) and increase physical mobility (45%). Use of therapeutic VR was associated with a larger size of physiotherapy practice. Lack of knowledge about VR seemed to be the primary reason for not using VR.

**Discussion:** Therapeutic VR for patients with CMP is still in its infancy in current Dutch primary care physiotherapy practice as only a small minority uses VR. Physiotherapists that use therapeutic VR are modestly positive about the technology, with large heterogeneity between treatment goals, methods of administering VR, proposed working mechanisms and CMP conditions to treat.

## Personalizing the Care for Patients With COPD and Comorbidities by Using Real-World Data and AI: RE-SAMPLE

Monique Tabak, Serge Autexier, Christiane Grünloh, Costas Lambrinoudakis, Tessa Beinema, Alice Lurashi, Marjolein Brusse, Rain Jögi, Alberto Acebes, Marie Nabbe & Anke Lenferink

**Background:** Chronic conditions such as cardiovascular diseases, anxiety, depression, and diabetes are highly prevalent in patients with Chronic Obstructive Pulmonary Disease (COPD) as comorbidity. Targeting treatment and tailoring coaching is challenging, not only considering the different disease characteristics and overlapping symptoms, but also a person's characteristics, preferences or goals. Timely and proactive care is essential, as COPD exacerbations and comorbidity flare-ups are detrimental to health outcomes. The European H2020 "RE-SAMPLE" project aims to provide an integrated care approach that prevents disease progression and empowers patients with both COPD and comorbidities to self-manage their care and lifestyle, by using real-world data (RWD) and artificial intelligence (AI), embedded in a multi-disciplinary eHealth application: the Virtual Companionship Program (VCP).

**Methods:** First, we created a knowledge base of multimodal data coming from literature and guidelines, electronic health records, clinical studies, and expert and patient knowledge. Moreover, a human-centered design approach provided end-user requirements for credible and accepted RWD monitoring tools and the VCP, strictly following privacy and security-by-design principles. Currently, our knowledge base is extended with prospective RWD on predictors of exacerbations and disease progression, collected through a RWD application (including symptom diaries, sensing) in a multi-center observational cohort study of >700 patients. Furthermore, we are developing predictive modelling of exacerbations and disease progression through privacy-preserving AI to increase the understanding of COPD including the interdependence of multi-morbidities. Also, we are developing the VCP and its service model based on a shared-decision making approach between technology, healthcare professionals and patients.

**Findings:** We established a collective knowledge base and active end-user involvement. Three systematic literature reviews were performed on 1) clinical predictors of COPD exacerbations, 2) markers differentiating acute heart failure from COPD exacerbations, and 3) shared-decision making and clinical decision support systems in chronic care. Various methods were applied to involve patients, healthcare professionals and other stakeholders from Estonia, Italy and the Netherlands to discuss RWD tools and important parameters, as well as to define user needs, privacy aspects, system requirements, iterative evaluation of early prototypes and development of the service model for integration in daily care and daily life. The aforementioned information and experience has led to functional specifications, the design of a platform for secure and privacy-preserving RWD monitoring and AI, and the development of a first functional prototype. Furthermore, three iterations of the data collection in the cohort study were executed to optimise the data collection of predictors during the cohort follow-up.

**Discussion:** RE-SAMPLE provides a unique multidisciplinary approach to tackle the challenge of providing tailored and proactive care for people with COPD and co-morbidities. We expect that RE-SAMPLE will gain unique insights into the relationships between patients' clinical and non-clinical characteristics and how these impact disease progression, using RWD monitoring and AI. The data will serve predictive models that could help patients and their doctors make treatment changes in time and enabling tailored coaching for self-management and a healthy lifestyle.

In this way, to alleviate the overall burden and manage care of the increasing number of patients.

## eHealth Self-Management Technologies Supporting Patients With COPD and Comorbidities: Development of a Pan-European Service Model

Eline te Braake, Christiane Grünloh & Monique Tabak

**Background:** The use of eHealth technologies for chronic diseases is increasing and many benefits are expected e.g., reducing healthcare costs, improving accessibility of healthcare, and empowering patients in their self-management. However, adoption in daily practice appears to be complex and limited which may result in partial implementation or complete implementation failure. One way to decrease these problems is by service modelling from an early stage: a schematic representation of how an eHealth service should be implemented in practice, thereby describing the activities and responsibilities of its relevant stakeholders. In literature, little is known about this process for eHealth technologies for complex chronic conditions. Moreover, differences between healthcare organizations or even (European) health systems makes implementation even more complex as the service in its whole may need to be shaped differently. Therefore, our aim was to develop a service model for an eHealth technology to support self-management in COPD and comorbidities involving three different countries.

**Methods:** The service model design process consisted of five rounds with salient stakeholders and consortium members of the RE-SAMPLE project (Horizon 2020 grant no. 965315) to develop the service model involving three iterations. These study rounds were: stakeholder identification, stakeholder saliency analysis, identification of current practice, and two feedback sessions, by means of workshops and questionnaires. Studies with salient stakeholders were carried out in the three different countries (Italy, Estonia, the Netherlands). In the studies with consortium members, where possible, different pilot sites were combined, and the different perspectives were discussed together. All studies were carried out between January and August 2022. A combination between face-to-face and online methods facilitated the participatory design process fitting (travel and health) restrictions.

**Findings:** The identified key stakeholders in the final service model were: healthcare professionals (HCPs), the patient, and others (e.g., patient organisations), all with different responsibilities within the service model. Together they have important roles to enable successful implementation of the eHealth technology, like ensuring the onboarding. In addition, stakeholders assigned certain responsibilities to roles who are not established yet in practice, but which may result in optimal implementation. This reflects the constant consideration within the service modelling process between ensuring feasible implementation and aiming at improving quality of care. Knowledge identified to be critical for successful implementation included e.g., self-management training for both patients and HCPs before starting the technology. Several differences were found in stakeholders' responsibilities because of variations in care organization between countries. Therefore, the final service model highlights these differences.

**Discussion:** Service modelling for chronic care is complex, as it emphasizes the challenge between the prescriptive and descriptive model. Involving stakeholders in the service modelling process is crucial as it reveals strengths and difficulties in current care and aligns the needs and wishes of stakeholders which may make implementation successful. Furthermore, our work shows the importance of identifying country-specific differences to increase chances of successful implementation. Revealing that service modelling is not a one-size-fits-all approach.

## How to Tackle Legal Barriers That Threaten A Successful Implementation of eHealth Technologies?

**Britt Bente, Anne van Dongen, Ruud Verdaasdonk & Lisette van Gemert-Pijnen**

**Background:** Over the years, many eHealth technologies have been developed and implemented that support patients and healthcare professionals in addition to traditional treatment. Due to increased knowledge and technical options, the possibilities of (automation of) data exchange also increased, and more and more patient-doctor relationships are taking place via technology. We therefore see a transition from the development of eHealth tools for specific purposes, to the development of “Digital Health Environments”, which automatically connect the stakeholders and data involved. Within the eHealth Junior Consortium, we aim to develop such a digital health environment for chronic ill children. This environment will integrate several scientifically validated eHealth tools that provide personalized and transdiagnostic prevention. There are many possibilities and advantages offered by (automatic) sharing of data between eHealth tools, connected ICT systems (e.g., EPD), and the children, parents and other stakeholders involved. However, legal challenges also arise in the implementation of such environments with regard to guaranteeing privacy as well as medical ethical discussions.

**Goals:** The aim of this workshop is to identify and validate barriers and success factors related to legal aspects of implementation of eHealth technologies, and to identify how we could overcome these legal barriers. We will discuss results from a previous literature review with the participants, exchange experiences in legal issues that occurred in participants’ own (clinical and scientific) field, and brainstorm about how we could tackle or prevent these issues.

**Content and (interactive) activities:** In a previous literature review (included both peer reviewed as grey literature), we identified several barriers and success factors related to the legal aspects of implementation of eHealth. During the workshop, we will present the results of this review as input for a discussion on the findings that are uncertain or raise questions (e.g., issues in data privacy/transparency/responsibility). We will ask participants to share their opinions and experiences with these issues (or related ones) within their daily practice/research. We cooperate with the Stimulate Healthcare Technology Program and TechMed Centre, and we will invite legal experts from our consortium (eHealth Junior) to join the workshop and support us with their knowledge. The workshop will consist of a short presentation followed by an interactive group discussion and brainstorm session. We will create a mindmap during the workshop to provide an overview of all discussed legal topics, and how these relate to each other. Our target audience are researchers, healthcare professionals and policy makers, working with health technologies.

**Expertise of workshop leader(s):** Our research team has a lot of expertise in organizing and conducting stakeholder workshops. The workshop will be moderated by two persons from our team and one person will keep track of the mentioned points in a mindmap, during the discussion/brainstorm session, to provide an overview. We will also strength forces by collaborating with the Stimulate Healthcare Technology Program, TechMed Centre, and experts from the legal field (partners from eHealth Junior Consortium), to support us during the brainstorm and discussion sessions. These experts also participated in earlier workshops of our consortium and bring valuable knowledge on the legal aspects of implementation of eHealth from own experiences\*.

## Training in Positivity: The Effects of a Multicomponent Positive Psychology App to Increase Mental Well-Being

Kim Tönis, Jannis Kraiss, Stans Drossaert, Joyce Karreman, Judith Austin & Ernst Bohlmeijer

**Background:** Positive psychology interventions (PPIs) consist of exercises that are targeted at promoting mental well-being. Multicomponent PPIs are interventions consisting of multiple exercises targeting several components of well-being. Previous research showed that (multicomponent) PPIs can have significant effects on mental well-being as well as on depression, anxiety and stress. However, knowledge is still rare regarding the potential effectiveness of multicomponent PPIs delivered as mobile health (mHealth) intervention. Therefore, this current study aimed to evaluate the effectiveness of a 3-week multicomponent PPI delivered as mHealth intervention called Training in Positivity (TiP) on mental well-being and distress.

**Methods:** A randomized controlled trial was performed comparing TiP with a waitlist control group in participants from the general population with mild to moderate levels of anxiety and depression. Outcomes were assessed online at baseline (T0), at posttest, three weeks after baseline (T1) and 12 weeks after baseline (T2) The intervention group (n = 118) received the TiP intervention immediately, whereas the waitlist control condition (n = 116) received the app after the posttest was completed. The TiP app consisted of six modules with positive psychology exercises (three good things, strengths, setting goals, acts of kindness, lessons from setbacks) combined with a self-compassion exercise. Each exercise was aimed to be repeated for three times and lasted 15 minutes per exercise. Linear mixed models with group and time interactions were used to analyze effects between groups at posttest after controlling for potential baseline differences. Within-group analyses between T1 and T2 were performed to determine if potential effects within the intervention group maintained, and whether the control group showed improvements in the outcomes after they also received the TiP app.

**Findings:** Significant interaction effects were found for mental well-being, anxiety, depression, spiritual well-being, ability to adapt and self-compassion. Moderate to large between-group effect sizes were found for these outcomes ( $d=0.71-0.94$ ). No between-group effects were found for savoring and positive reframing. Within-group analyses revealed that the effects within the intervention group could be maintained until 12-week follow-up. Significant within-group effects on most outcomes were also found for the control group between posttest and follow-up after they also received the intervention.

**Discussion:** The findings suggest that a relatively short and low-threshold multicomponent PPI delivered as mHealth intervention is effective in improving mental well-being and distress when compared to a waitlist control group. The fact that this intervention was delivered as mHealth intervention has several advantages, such as integration in daily life, accessibility, scalability and cost-effectiveness. The results of this RCT suggest that TiP might therefore be a valuable tool for public mental health purposes. Yet, further research is warranted to study the effectiveness of this intervention, for example in comparison with an active control group, using longer follow-ups, or in different populations.

## The PROfeel 2.0 App: Development in Codesign With Adolescents With Chronic Conditions and Fatigue Maartje Stutvoet, Elise van de Putte, Remco Veltkamp & Sanne Nijhof

**Background:** Severe fatigue is a common and potentially disabling symptom for adolescents with chronic conditions (e.g., auto-immune diseases, post-cancer treatment). A transdiagnostic method targeting universal mechanisms across disease groups is promising, whilst a personalised approach tailored to individual's needs is key. PROfeel combines both by providing individualised insight into fatigue-associated factors in a trajectory blending on- and offline care. Insight is obtained with repeated questionnaires (Experience Sampling Methodology (ESM)) via the smartphone-based PROfeel app. This leads to face-to-face shared decision making on personalised lifestyle recommendations. As a result, PROfeel can support adolescents with symptoms of persevering fatigue to regain control of their lives. Efficacy of PROfeel is being studied. Although adolescents with chronic conditions and fatigue evaluated the PROfeel trajectory as a whole as feasible and useful, in the design of the PROfeel app user preferences have not yet been taken into account. Leaning on the Double Diamond Model, this study describes the iterative discovery and defining steps taken, involving patients and clinicians as co-designers in the development of the PROfeel 2.0 app.

**Methods:** In semi-structured qualitative interviews with 1) adolescent users of PROfeel, 2) their important others and 3) health care professionals we evaluate the PROfeel trajectory and explore human facilitators and barriers for future implementation. Interviews are conducted from October '22 to February '23. In January '23, the potential of a persuasive gamified PROfeel was discussed amongst PROfeels target population in focus groups.

**Findings:** Health care professionals stressed the urgency of an approach to fatigue. Ease of use and time constraints were designated as potential barriers in the use of PROfeel. Recurrent themes in interviews with adolescent users of PROfeel were the difficulty with responding to ESM questionnaires on time and with implementing lifestyle recommendations. Most focus group participants saw gamification of the PROfeel app as a solution for both increasing adherence to ESM questionnaires and maintaining motivation for lifestyle change. The importance of personalisation was pointed out often. Younger participants (12-15 years) were interested in minigames, scores and themes, while older participants (16-18 years) were less interested in games and stressed the relevance of linking the app design to the primary motivation of usage of the app: regaining control of their life by gaining insight into fatigue.

**Discussion:** Showing feasibility was the first step in the development of PROfeel. Irrespective of efficacy, to adopt PROfeel in clinical practice, PROfeel should answer the needs of its users (i.e., adolescents and health care professionals). Qualitative studies are key to explore those needs. Translating the diverse needs (e.g., minigames vs. no minigames) into one app design remains a challenge. This challenge shows the necessity of continued patient participation as co-designers in subsequent development stages in order to develop and deliver a more engaging and motivating PROfeel 2.0 app.

## Development of Personas for Mood Stability Through BiAffect Data and Self-report Questionnaires: Preliminary Results

Emanuele Tauro, Elena Idda, Alex Leow, Tory Eisenlohr-Moul & Enrico Gianluca Caiani

**Background:** The DSM-IV defines mood instability as a common condition, with a higher prevalence in women, in which an individual's mood changes dramatically, that could lead to development of mental health issues, such as bipolar disorder and others. Currently, self-report questionnaires are the standard way to monitor mood instability. Also, useful information can be derived through the use of digital tools: the BiAffect is a system for understanding mood and neurocognitive functioning in bipolar disorder using smartphone keystroke dynamics. We hypothesized that both self-report questionnaires and BiAffect data could be merged in the creation of different Personas to better characterize the studied population. Accordingly, our aim was to initially test this integrative approach to better understand and stratify mood instability.

**Methods:** Participants were enrolled voluntarily in the U.S. to be monitored for a period of at least two months. Self-report surveys, composed of validated and ad-hoc questionnaires, were daily collected. Through the BiAffect application, substituting the smartphone keyboard, metadata such as time and type of keypress (i.e., but not the text content) were collected. From these data different features were extracted, such as daily Interquartile range, interkey delay, mean absolute deviation for each day, and daily entropy. Personas were developed through a method we recently published, having as input both BiAffect features, and self-report replies: 1) several dimensionality reduction methods (Principal Component Analysis, Principal Component Analysis of MIXed data, Factor Analysis of Mixed Data and Gower's distance) were compared; 2) K-Medoids Clustering with Partitioning Around Medoids (PAM) algorithm was performed for all preprocessing methods; 3) the optimal number of clusters and dimensionality reduction method were evaluated through average silhouette graph and the percentage of statistically different attributes between Personas; 4) Persona cards were built, to summarize the main associated features.

**Findings:** Six females (age from 18 to 45 yo) with diagnoses of mood instability participated in the study, resulting in 539 distinct daily records. The optimal preprocessing method was identified as Gower's distance with K=2 clusters (average silhouette = 0.55, 82% of statistically different attributes). The first Persona was characterized by absence in physical pain or tension, no forgetfulness and low suicidality, irritability, and emotional symptoms of premenstrual dysphoric disorder. This was associated to keyboard dynamics behavior with slightly faster and stable typing, less pauses, and more daily keypresses. The second Persona presented higher levels of pain when compared to the first, as well as feeling as a burden to others, forgetful and distractable, together with medium-high levels of dysphoric disorder emotional symptoms and suicidal ideation. This was associated to slower and more variable typing, with more pauses and less daily keypresses.

**Discussion:** Self-questionnaire and BiAffect data integration through Personas is feasible and allows stratification of mood instability between different levels of symptoms' severity, in coherence with current literature findings that associate typing behavior with mental health issues.



## Smart Continence Management for Residents in Nursing Homes: Nurses' Experiences With Two Sensor Systems

Job van 't Veer & Chiem Tuil

**Background:** Continence care management is one of the main care demands in nursing homes. Increasingly, technological innovations support continence care, using sensors that monitor diaper saturation. Using a notification-system, more efficient and less intrusive care is possible. While more systems emerge on the market, it is unclear how specific differences in these systems fit the needs of professionals and residents. Since experimenting with just one system already is costly, studies that compare two systems in the same healthcare context are rare.

**Objective:** This study examines nurses' experiences using two different smart continence management systems on the quality of care for residents (reduced intrusion, sleep-quality, self-management) and on usability, efficiency (e.g. reduced workload, saving materials).

**Methods:** We conducted pilot studies in the same nursing home (late 2021, late 2022), using 2 different smart continence management systems consecutively. In both pilots (8 weeks runtime) 10 nurses participated. Residents were excluded as respondents, since most residents that participated suffered severe psychogeriatric illnesses. With structured interviews (pre- and post-pilot) we measured shifts in usability (preparation of diaper-materials, use of the notification app), efficiency in material use, efficiency in time on nursing procedures, and assessed quality of care for residents. Additional quantitative data on efficiency parameters was provided by companies involved.

**Findings:** Pre- and post-measurements show that expectations about the benefits (efficiency, quality of care) of both systems are high. While expectations are not fully met, nurses still report that both smart diaper systems facilitate distinguishable improvements in quality of care, especially during nightshifts: both systems reduced unnecessary disturbances in residents' sleep. There were no meaningful benefits regarding residents' self-management, when psychogeriatric problems of residents included were too severe. Nurses also report clear differences in reduced workload and materials used; again, in about the same amount in both systems. This was confirmed by the qualitative data, although nurses generally under-estimated the extent of their efficiency in time and materials as indicated by the system. These two systems do however differ concerning usability and stability. Both diaper systems use different methods of applying the sensors to the diaper-material. In case of one system this procedure was rather time-consuming and vulnerable to making mistakes. This proved important in the (lack of) reliability nursing experienced in using the system and how they relied on the notifications provided by the system.

**Discussion:** Generally, both systems seemed equally able to offer the same benefits (efficiency, quality of care). Nurses report positive user-experiences, especially regarding quality of care during nightshifts. Some differences in specific design choices makes one product more usable and reliable than the other. These practical interferences must be avoided, would it lead nurses to use a system to its full potential. Since not all residents benefit to the same amount using these systems, future research should focus on what personal characteristics help identify suitable residents to introduce to these products.

## Out of the Box: Co-Creative Multistakeholder Study to Enhance the Effectiveness of Cardiology eHealth Intervention

Sara Hondmann, Andrea Evers, Valentijn Visch, Douwe Atsma & Veronica Jansen

**Background:** Cardiovascular disease is one of the leading causes of disability worldwide. eHealth has the possibility to improve health outcomes and quality of life adjunct to regular care. “The Myocardial Infarction Box” (MI Box) is an at home monitoring system using smartphone-enabled health monitoring devices. However, like many eHealth interventions, the MI Box had variable adherence. This variable adherence could be due to a misalignment with the needs of the users and the intervention. Through co-creation, this study aims to develop design strategies to enhance the effectiveness of the MI Box in the long term: to increase adherence in the first year and support MI patients in adopting a healthy lifestyle.

**Methods:** Six iterative co-creation sessions were conducted with various stakeholders. One with designers and with healthcare professionals. Four sessions with users. In these sessions, the patient journeys and personas were discussed to identify needs and opportunities for enhancements to the intervention. Furthermore, design strategies aiming both to optimize adherence and stimulate a healthy lifestyle were discussed.

**Findings:** This resulted in themes such as personalized feedback, understanding the data, and regaining confidence in one’s own body to be key aspects to creating a more meaningful and personally relevant intervention.

**Discussion:** Involving the stakeholders in co-creation sessions provides invaluable insights into the user-experiences and opportunities for personalization. Adapting the intervention to these needs is the next step to increase engagement with the intervention and thereby increase adherence.

## Developing an eHealth Intervention for and With Cardiac Patients With a Low Socioeconomic Position

Jasper Faber, Isra Al-Dhahir, JosKraal, Linda Breeman, Thomas Reijnders, Andrea Evers, Niels Chavannes, Rita van den Berg-Emons & Valentijn Visch

**Background:** Health disparities between socio-economic classes are of great concern. While eHealth and lifestyle interventions have been proposed as potential solutions, they often disproportionately benefit people with a higher socio-economic position (SEP) thereby exacerbating the problem. Designing interventions for people with low SEP is challenging due to the variety of health needs, capabilities and contexts-of-use. Despite the growing body of research on designing for low SEP groups, there is limited knowledge on effectively translating this knowledge into implementable and accepted eHealth interventions. The goal of this study was to use a recently developed inclusive eHealth design guide to develop an eHealth intervention within the specific context of cardiac rehabilitation (CR). This allows insight into the implications of the translating existing knowledge into the design of accepted and implementable eHealth interventions for low SEP groups.

**Methods:** This study followed a participatory design process following the phases of the CeHRes Roadmap. The inclusive eHealth design guide, as well as a variety of participatory and inclusive design tools and techniques, such as context mapping, focus groups, concept evaluations, and guidelines, were used to identify needs of the target group and develop the intervention. Participants included eight cardiac patients with a low SEP, eight healthcare providers, and three stakeholders at a rehabilitation facility. To ensure feasibility, a focus group discussion with healthcare providers was held to align the intervention design with the needs and limitations of the CR center and its personnel. The acceptability of the final design, in terms of usability, experience and perceived effect, was formatively assessed using a prototype evaluation with an additional seven cardiac patients with a low SEP.

**Findings:** The participatory design process, aided by the guide for inclusive eHealth, revealed that patients with a low SEP require certainty and guidance during their waiting period between hospital referral and start of the CR. To address this, a digital intervention was designed to guide patients through this transitional phase by providing daily updates on waiting time and preparatory messages in various forms, including informative videos, spoken success stories and practical advice. The formative evaluation indicated a positive reception of the intervention among patients with a low SEP, with high scores on usability (4.4 out of 5), experience (4.1 out of 5) and perceived effect (4.0 out of 5).

**Discussion:** The inclusive eHealth guide and the participatory approaches helped overcome difficulties in reaching and engaging the target group and making informed design decisions. The inclusive eHealth guide helped care providers having informed discussions about the target group's unique needs and challenges and it helped to focus design decisions on the specific needs of the target group. Participatory approaches with the target group helped provide immediate support and clarification. Further research is needed to assess the effectiveness of the intervention and extend its applicability to other contexts and target groups. The study highlights the importance of considering participatory and inclusive methods in feasible and acceptable eHealth intervention design for people with a low SEP, to decrease health disparities.

## Building a Healthy Relationship: Conversational Agents in the Context of Persistent Somatic Symptoms Through Participatory Design, a Workshop

Jan-Wessel Hovingh

**Background:** eHealth interventions are mostly conceptualised using medical evidence-based principles [1] and are often mainly instrumental in nature: the technology used is seen primarily as a medium to bring the evidence-based care concept to the patient [2]. Many adherence and implementation problems are thus seen as utilisation problems [3] and addressed where they occur: an implementation problem tends to occur in the context of the healthcare provider [4]; an adherence challenge lies more with the patient [3].

This approach is successful in many cases, but when specific care contexts impose limitations and challenges on communication and the patient-provider relationship, it may be useful to reconsider the role that eHealth can play. Research has shown that relationships between patients with persistent somatic symptoms (PSS) and healthcare providers are strongly influenced by the persistent and sometimes medically unexplained nature of the symptoms, combined with the patient's recurrent need for care [5]. In such cases, the use of e-health interventions may even exacerbate this relationship, given the known difficulties with adherence, implementation and adoption of e-health.

However, in addition to the therapeutic goals that eHealth should address, we can also look at the social role that the eHealth intervention could play in the patient-provider relationship: using the relationship, not the symptoms, as a starting point. It is known that the use of embodied conversational agents in another care context has shown promising results for both patients and healthcare providers [6]. In considering the role that such an intervention could play in this specific context, boundary theory may also prove to be useful [7]. It could provide useful strategies for both bridging and crossing the boundaries of the different socio-cultural activity systems of PSS patients and healthcare providers [8].

**Goals:** The aim of this workshop is twofold. Firstly, the workshop aims to explore the concept of embodied agents as boundary actors with participants interested in the design and development of eHealth interventions in order to develop a shared understanding of the challenges and opportunities around this topic.

Secondly, the workshop aims to gather insights from other eHealth experts on ways to conceptualise, design and deploy embodied agents as boundary actors in the relationship between healthcare providers and patients with persistent somatic symptoms.

**Content and (interactive) activities:** Following IxD best practices such as participatory design [9], this workshop will consist of a session in which participants will be invited to co-create concepts and strategies that explore the possibilities of deploying embodied eHealth agents as boundary actors in a given patient-caregiver scenario.

A previous example of such a workshop on privacy by design can be found here:

<https://vimeo.com/manage/videos/206368102>

**Expertise of workshop leader(s):** Jan-Wessel Hovingh (1977) is an interaction designer, lecturer and researcher at NHL Stenden University of Applied Sciences and PhD candidate at UMC Groningen and UTwente, where he focuses on eHealth for persistent somatic symptoms. He specialises in design research, especially the use of participatory design to inform complex, networked challenges.

## Personalized Health Technology for Rehabilitation Care [symposium]

**Stephanie Jansen-Kosterink, Ina Flierman, Reinout van Vliet, Hans Rietman & Marian Hurmuz**

In rehabilitation care it is very common to use technology. Especially when patients are disabled and technology is the solution to regain independence. A wide variety of technologies are available for rehabilitation care. For example very common and simple technologies such as walking sticks and wheelchairs. But also more complex ones, such as wearables and exoskeletons. Despite the natural tendency to use technology in rehabilitation care, it is still difficult to implement personalized health technology in this setting. Research of the last 10 years showed us that even when the outcomes on clinical effectiveness, and/or cost-effectiveness are available and extremely positive, the implementation of an innovative personalized health technology into rehabilitation care can be difficult or even a failure. The aim of this symposium is first to address the uprise of personalized health technology in rehabilitation care. Furthermore, we will address the steps taken by a local rehabilitation center to boost the implementation of these technologies in daily rehabilitation care and to make them available for patients and healthcare professionals. Finally, the importance to gain knowledge on the societal impact of personalized health technology for rehabilitation care will be addressed to convince all stakeholders of the value of these technologies.

## Rehabilitation Care in the Netherlands and the Oprise of Personalized Care Technology

**Hans Rietman**

In the coming decades, there will be a growing need for care for the aging society and people with chronic diseases. At the same time, people coping with disabilities strive for autonomy and social participation. These challenges will have impact on the costs of our healthcare system. New technologies are becoming more prevalent in health care, enabled by a wide range of sensors and increased connectivity available through the Internet of Things. Technical innovations such as active training devices (robotics, gaming, virtual reality), active assistive devices (prostheses, exoskeletons, orthoses), monitoring and telerehabilitation will actually improve the person's abilities to remain independent. Technical improvements in sensors, actuators and artificial intelligence in these devices make them more and more functional when augmenting the human body. The interaction between the adaptive capabilities of a person and the adaptive capacities of the device will define the level of functional capability. The number of medical technologies used in home settings has increased substantially over the last decades. Many of these technologies can be very empowering, allowing older adults to remain in their homes longer, or enabling patients with chronic disease or mild cognitive impairment to both understand their illness better and adopt strategies to improve their quality of life. The following topics will be addressed in the lecture:

- Mission driven policy in Healthcare in the Netherlands.
- Assessment of human movements in their home environment.
- Novel and revolutionary solutions developed in Rehabilitation and Smart aging.
- Integration of technology in Home training and care (de-hospitalization), and Long-term care.

## The Journey of Roessingh center for Rehabilitation to Implement Technology in Daily Rehabilitation Care

### Ina Flierman & Reinout van Vliet

For several years, Roessingh Center for Rehabilitation (RCR) has a clear focus on the implementation of health technology in daily rehabilitation care. This focus is operationalized by means of two pillars: an online patient portal called Telerevalidatie and an innovation lab with a variety of rehabilitation technologies (soft- and hardware), ready to be used by patients and healthcare professionals. Both pillars are accompanied with dedicated working groups. The first pillar (Telerevalidatie) is an online portal which provides patients the opportunity to perform parts of their rehabilitation treatment (e.g. exercises, questionnaires, tutorials) independently at home under the supervision of their own healthcare professionals. In the workgroup aligned to Telerevalidatie, healthcare professionals are by means of train-the-trainer principles facilitated to help their own team to implement the online portal into daily rehabilitation care and to make it part of their own care path. A program with the duration of three years is developed to guide and monitor this implementation strategy. First results will be shared during this presentation. The second pillar to stimulate the use of health technology in daily rehabilitation care is the InnovationLab. Roessingh's InnovationLab is located in two separate treatment rooms in RCR. These rooms are free accessible for patients and healthcare professionals to use a wide range of rehabilitation technology with or without supervision, such as virtual reality, robotics and eHealth. Virtual reality and robotics are very suitable to motivate patients during functional training that can be experienced as boring by a patient. By the workgroup aligned to this pillar an implementation protocol is developed. This protocol describes all the steps necessary to take to scout, demonstrate and implement rehabilitation technologies. Also the first results of this process will be shared during this presentation.

When it comes to the implementation of health technology in daily rehabilitation care a lot changed during the last 10 years. During this presentation we will share our lessons learned, tips and tricks that are gathered during these years. Our approach to implement health technology in daily rehabilitation care together with healthcare professionals is paying off. Little by little, more patients and healthcare professionals are using Telerevalidatie or visit Roessingh's InnovationLab.

## Show me the Evidence! The impact of Personalized Care Technology for Rehabilitation Care

**Stephanie Jansen-Kosterink & Marian Hurmuz**

**Background:** For the sustainable implementation of personalized care technology in rehabilitation care it is important to convince all stakeholders of the value of these technologies. Not only patients and/or healthcare professionals should be enthusiastic, but also the (locale) policy and decision makers. During a first pilot phase when the personalized care technology is tested by patients and healthcare professionals in daily rehabilitation care, it is also important to assess the value of the technology for all stakeholders and to draft a clear implementation plan. Addressing both will boost the sustainable implementation of the technology in daily rehabilitation care. Various methodologists are available to address the impact of personalized care technology, such as traditional randomized controlled trials (RCTs). These methodologies are very valuable to address the clinical perspective and the value for the clinical stakeholders, but provide no information on the user and societal perspective. A promising methodology to address the societal impact of personalized care technology for rehabilitation care is the social return on investment (SROI) methodology developed by Nicholls and colleagues (2009).

**Methods:** The aim of the SROI methodology is to demonstrate the sustainability and the social value added by an intervention or organizations through the understanding, managing, and communication of their impact in economic, social and environmental terms (Maier et al., 2015). In total, seven SROI principles are defined: 1) involve stakeholders; 2) understand what changes; 3) value the things that matter; 4) only include what is relevant; 5) not over-claim; 6) be transparent; and 7) verify the results. Next to these seven SROI principles there are six SROI process steps: 1) Establish scope and key stakeholders; 2) Map outcomes; 3) Gather evidence and value outcomes; 4) Establish impact; 5) Calculate the SROI and 6) Report, use and embed. In general, there are two type of SROIs: the evaluative and the forecast SROI analyses. The evaluative SROI analysis is retrospective and is based on the actual outcomes achieved by an intervention. The forecast SROI is based on desk-research.

**Findings:** At Roessingh Center for Rehabilitation (RCR), multiple SROIs are drafted and presented in- and outside the organization. There is a promising SROI (forecast) about the online portal (Telerevalidatie) and currently we are working together on multiple SROIs of this portal for various target populations (e.g. patients suffering from ALS or CVA and children). Last year, also an SROI about the use of social robotics was composed after various small pilot test with a Pepper robot. The societal impact of this social robot was very limited, which led to the discontinuation of implementing this technology in daily rehabilitation care.

**Discussion:** We are still at the beginning, but it is our opinion that the SROI methodology provides insight into the added value for every stakeholder on every level (micro, meso and macro). This insight will convince all stakeholder of the value of a personalized care technology and improve the changes of sustainable implementation in daily rehabilitation care.

## Personalized Internet-Based Cognitive-Behavioral Therapy in Patients With Kidney Failure: Potential Effectiveness And Feasibility

Judith Tommel, Andera Evers, Henk van Hamersvelt, Milon van Vliet, Lieke Wirken, Marc Hermans, Daan Hollander, Yvonne de Waal, André Gaasbeek, Ralf Westerhuis, Sandra van Dijk, Luuk Hilbrands & Henriët van Middendorp

**Background:** Patients with kidney failure struggle with various symptoms that negatively impact their daily life and their quality of life (QoL). Because of this high variety of symptoms and the heterogeneity of the population, personalized strategies are needed to treat the symptoms that are most bothersome to individual patients. Internet-based cognitive-behavioral therapy (ICBT) can be a good strategy in this regard, as it is found to be effective in supporting patients in adjusting to illness and improve QoL in diverse chronic somatic populations. Currently, almost no studies are performed to evaluate the effectiveness of ICBT tailored to the individual needs of patients with kidney failure. Therefore, it is unknown whether the promising findings found in other populations translate to patients with kidney failure, especially considering their high disease burden, high comorbidity, and advanced age in most patients that might hinder participation. The aim of the current study is to evaluate the feasibility and effectiveness of a personalized ICBT intervention in patients with kidney failure.

**Methods:** Patients with kidney failure treated with hemodialysis or peritoneal dialysis were recruited from several Dutch hospitals and dialysis centers. Using a multicenter randomized controlled trial, patients were randomized to care as usual (control group) or the ICBT intervention (intervention group). The ICBT intervention was guided by a therapist and consisted of modules on coping with physical disabilities, fatigue, pain, itch, negative mood, social relations, and lifestyle. The specific content (i.e., selected modules) of the intervention differed per patient and was personalized to the individual patient's priorities. Patients completed self-reported questionnaires at baseline and post-intervention (6 months after baseline). The primary outcome was distress. The secondary outcomes included several domains of functioning and a newly-developed personalized outcome measure that evaluated patients' priorities and progress on their prioritized domains. Additionally, semi-structured interviews were conducted among patients, therapists who guided the intervention, and nephrologists to gain in-depth insight in their experiences with the intervention to provide input for potential optimization of the intervention for this population.

**Findings:** Recruitment during the COVID-19 pandemic was difficult and resulted in a lower-than-expected sample size. The drop-out rate was 34%. No significant differences in distress or functioning were found between the intervention ( $n = 9$ ) and control group ( $n = 14$ ) at post-intervention, with  $0.01 \leq d \leq 0.97$ . The personalized outcome measurement yielded a large significant effect ( $d = 1.34$ ), with the intervention group showing more progress on the domains they prioritized for improvement compared to the control group. The interviews showed that patients generally liked the intervention, especially the support from the therapists, and said to have learned better coping skills. However, almost all patients encountered difficulties with the online format and the exercises which was also observed by the therapists and nephrologists.

**Discussion:** Despite promising effects on the personalized outcome, the current findings suggest that the intervention in its original form did not sufficiently match patients' abilities or preferences. Several



recommendations are proposed to improve the feasibility and effectiveness of future ICBT interventions focused on patients with kidney failure.

## Remote Home Monitoring in Chronic Kidney Disease Patients

Anne-Jet Jansen, Laura Kooij, Anneke Bech, Eugenie Schipper, Wim van Harten & Carine Doggen

**Background:** Healthcare organizations are experiencing an increased demand of care due to the ageing population, which is associated with an increasing number of chronically ill patients, and rising costs. Transfer of hospital care to the home setting of the patient could reduce the amount of regular outpatient visits. Providing remote home monitoring by the virtual care center will play a major role to deliver hospital care at home. However, the feasibility of remote home monitoring in chronic kidney disease (CKD) patients and for their healthcare providers is not yet known, and is therefore studied in terms of usability, acceptance and satisfaction.

**Methods:** This study includes a total of 80 CKD patients from Rijnstate Hospital. Patient enrollment started on February 16, 2023, with an expected inclusion period of 9 months. All patients receive remote home monitoring as standard care, including weekly blood pressure and body weight measurements and weekly short questions about physical complaints using a smartphone application. Baseline sociodemographic and clinical characteristics, eHealth literacy (eHEALS) and satisfaction (RTSQs) are assessed. After a three month monitoring period, questionnaires concerning usability (SUS), acceptance (based on UTAUT), and satisfaction (RTSQs and RTSQc) are measured from patient's and healthcare provider's perspective. Health- and technology related burden are collected using the electronic medical record and application log data respectively.

**Findings:** Prior to the study, a pilot (n=10) showed that the frequency of measurements may be too high according to both patients and healthcare providers. Moreover, healthcare providers need to gain confidence in collaborating with the virtual care center to reduce their workload. The pilot was not included in the study, but the pilot was followed by it. In the study, two or three patients are expected to be included weekly. In June interim results will be presented including usability, acceptance and satisfaction of the healthcare providers involved. The first results of baseline measurements will be presented, and an insight into the patient's perspective of remote home monitoring. Insight in health- and technology related burden will be given based on log data of the application and provided care.

**Discussion:** There is a gap in the literature on the impact of home care in CKD patients on healthcare resources, and most studies focus on end-stage CKD patients. We aim to reduce regular outpatient visits in early-stage CKD patients using remote home monitoring, which are expected to be four times less. The results of this study contribute to optimizing the use of remote home monitoring in CKD, including measurement frequency and patient selection. By using remote home monitoring, the role of the healthcare providers will change due to collaboration with the virtual care center. The burden for both the patient and healthcare provider is expected to decrease. Current literature shows improvement of self-management in heart failure patients, which is also expected in CKD patients. If the results of this study remain positive, remote home monitoring could be expanded to other departments and hospitals. A future study will focus on clinical outcome of home monitored CKD patients.

## Towards vitality: A Cognitive Bias Modification eHealth Intervention to Minimize Fatigue in Kidney Patients

Jody Geerts, Christina Bode, Peter ten Klooster, Elske Salemink, Goos Laveman, Femke Waandres, Nicole Oosterom & Marcel Pieterse

**Background:** Fatigue is a frequent and important symptom among patients with chronic kidney disease (CKD) with high negative impact on psychological and societal functioning of patients. Maladaptive cognitions and behaviours can exacerbate and perpetuate fatigue symptoms. Cognitive biases can contribute to this process, such as hypervigilance for fatigue-related signals (attentional bias) or by having developed a mental image of the self as a tired person (self-identity bias). Cognitive bias modification (CBM) uses simple computerized training procedures to re-train such cognitive biases. This study is the first to explore CBM to counter fatigue and foster vitality in people with CKD. The aim of this proof-of-concept single-case series clinical study is therefore to investigate the effect of the CBM-training on self-identity and attentional bias, as well as self-reported fatigue, vitality and related (avoidance and all-or-nothing) behaviour.

**Methods:** Twenty-four patients (12 pre-dialysis, 8 haemodialysis and 4 peritoneal dialysis) completed the study. Of the 22 participants that filled in their demographics, 50% was female and age ranged from 26 to 84 (mean = 63) years. The study lasted 8 to 9 weeks; a baseline of 1 or 2 weeks, 2-weeks training (1 week attentional CBM or self-identity CBM, 1 week combination), and 4 weeks post-measurements. Participants received measurement tasks with the implicit association task and the visual probe task to measure attentional and self-identity biases. In addition, participants received either a long or a brief questionnaire. The brief questionnaire contained 2 virtual analogue scales measuring vitality and fatigue. The long questionnaire contained the Checklist Individual Strengths (CIS) to measure fatigue, the Dutch vitality measure (Vita-16) to measure vitality, and the Cognitive and Behavioural Responses to Symptoms Questionnaire (CBRSQ) to measure all-or-nothing behaviour and avoidance. The data was analysed with Linear Mixed Models. Because of missing data, multiple measurements were collapsed, and baseline, post and follow-up were compared.

**Findings:** A training effect was found in both biases (self-identity bias;  $p < .001$ , attentional bias;  $p = .005$ ). Both biases went from a neutral or slight fatigue bias at baseline ( $M_{\text{self-identity}} = -.04$ ,  $M_{\text{attentional}} = 23.39$ ) to vitality bias at post ( $M_{\text{self-identity}} = -0.26$ ,  $M_{\text{attentional}} = -20.19$ ) and follow-up ( $M_{\text{self-identity}} = -0.28$ ,  $M_{\text{attentional}} = -15.34$ ). Comparisons for symptom severity and behavioural components showed no meaningful training effects, except when vitality was investigated with training type (self-identity / attentional CBM) and illness severity (pre-dialysis / dialysis) added, then a significant time effect was found ( $p = .015$ ) as well as the interaction between time and training type ( $p = .032$ ). When participants mainly trained with the SI-CBM, they showed stable vitality scores ( $M_{\text{baseline}} = 3.5$ ,  $M_{\text{post}} = 3.3$ ,  $M_{\text{follow-up}} = 3.4$ ). When participants mainly trained with the A-CBM, they showed a slight increase in vitality scores ( $M_{\text{baseline}} = 3.6$ ,  $M_{\text{post}} = 3.8$ ,  $M_{\text{follow-up}} = 4.1$ ).

**Discussion:** This study shows promising results with clear training effects on both biases and a small effect on vitality by the attentional CBM. This study supports the potential of incorporating implicit cognitive patterns in the treatment of fatigue symptoms.

## Lifestyle Coaching for People With Diabetes Type 2 in Secondary Care: A Feasibility Study of the Diameter + Cool

Anouk Middelweerd, Eclair Hietbrink, Carine Gotink, Annemieke Konijnendijk & Goos Laverman

**Background:** The Cool-intervention, a two-year lifestyle intervention, is considered to be an effective lifestyle intervention for overweight people with type 2 diabetes mellitus (T2DM). Combining face-to-face coaching (Cool) with an app (the Diameter) that supports patients between Cool-sessions can provide additional support in making healthy choices between the in-person meetings. The Diameter enables continuous monitoring of nutrition (diary), physical activity (PA; Fitbit) and glucose values (Freestyle libre) and provides tailored feedback, i.e. guided goal setting, daily informative and motivating coaching messages and weekly exercises aimed at learning to cope with barriers that arise in daily life to maintain a healthy lifestyle. The aim was to evaluate the feasibility of using the Diameter in combination Cool (Cool+Diameter) to change lifestyle behaviors in people with T2DM in secondary care from the perspectives of patients and healthcare professionals.

**Methods:** A mixed-method approach was used to explore the feasibility, e.g., acceptability, intervention usage, limited-efficacy testing, with regard to the Cool+Diameter intervention. Five patients with T2DM used the Diameter for three months and attended monthly group sessions with a lifestyle coach. Measurements on glycemic regulation, body composition, PA and nutritional intake were performed at baseline and at the three-month follow-up. Post-intervention semi-structured interviews were conducted with five patients and eight healthcare professionals.

**Findings:** Patients and healthcare professionals saw the Diameter as a valuable addition to the Cool-program, mainly because of the glucose and lifestyle monitoring and discussing these behaviors during the meetings. However, the coaching content of the Diameter is not adapted to the Cool-program and should be more tailored to the user. Limited efficacy testing showed significant differences between baseline and follow-up for glucose levels ( $\Delta$  HbA1c = 11 mmol/mol, 95%CI=0.35 – 21.65) and BMI( $\Delta$ BMI= 0.78 kg/m<sup>2</sup>, 95%CI=0.28 – 1.28). In addition, promising results for hip ( $\Delta$ hip= 1 cm, 95%CI= -0.24 - 2.24) and waist ( $\Delta$ waist= 2.6 cm, 95%CI= -1.38 – 6.58) circumference were seen.

**Discussion:** Cool+Diameter was predominantly perceived as a feasible intervention for T2DM patients in secondary care by both patients and healthcare professionals, but coaching content of the Diameter should be more tailored to the user and adapted to the Cool-program.

## Mobile Health Apps for the Control and Self-Management of Type 2 Diabetes Mellitus: Qualitative Study on Users' Acceptability and Acceptance

Marloes Bults, Catharina Margaretha van Leersum, Theodorus Johannes Josef Olthuis, Robin Enya Marije Bekhuis, Marjolein Elisabeth Maria den Ouden

**Background:** Mobile health apps are promising tools to help patients with type 2 diabetes mellitus (T2DM) improve their health status and thereby achieve diabetes control and self-management. Although there is a wide array of mobile health apps for T2DM available at present, apps are not yet integrated into routine diabetes care. Acceptability and acceptance among patients with T2DM is a major challenge and prerequisite for the successful implementation of apps in diabetes care.

**Methods:** A descriptive qualitative research design was used in this study. Participants could choose 1 of the 4 selected apps for diabetes control and self-management (ie, Clear.bio in combination with FreeStyle Libre, mySugr, MiGuide, and Selfcare). The selection was based on a systematic analysis of the criteria for (functional) requirements regarding monitoring, data collection, provision of information, coaching, privacy, and security. To explore acceptability, 25 semistructured in-depth interviews were conducted with patients with T2DM before use. This was followed by 4 focus groups to discuss the acceptance after use. The study had a citizen science approach, that is, patients with T2DM collaborated with researchers as coresearchers. All coresearchers actively participated in the preparation of the study, data collection, and data analysis. Data were collected between April and September 2021. Thematic analysis was conducted using a deductive approach using AtlasTi9.

**Findings:** In total, 25 coresearchers with T2DM participated in this study. Of them, 12 coresearchers tested Clear, 5 MiGuide, 4 mySugr, and 4 Selfcare. All coresearchers participated in semistructured interviews, and 18 of them attended focus groups. Personal health was the main driver of app use. Most coresearchers were convinced that a healthy lifestyle would improve blood glucose levels. Although most coresearchers did not expect that they need to put much effort into using the apps, the additional effort to familiarize themselves with the app use was experienced as quite high. None of the coresearchers had a health care professional who provided suggestions on using the apps. Reimbursement from insurance companies and the acceptance of apps for diabetes control and self-management by the health care system were mentioned as important facilitating conditions.

**Discussion:** The research showed that mobile health apps provide support for diabetes control and self-management in patients with T2DM. Integrating app use in care as usual and guidelines for health care professionals are recommended. Future research is needed on how to increase the implementation of mobile health apps in current care pathways. In addition, health care professionals need to improve their digital skills, and lifelong learning is recommended.

## Participatory Design of Lifestyle Coaching for People with Low Health Literacy and Type 2 Diabetes

Eclaire Hietbrink, Marlin Meulman, Anouk Logtenberg, Lara Schemkes, Manou Hijink, Petra Welmers, Eline Droppers, Dorthé Brands, Arie Koster & Anouk Middelweerd

**Background:** Health literacy forms the basis of the healthy lifestyle that is required in the management of type 2 diabetes (T2D). Many people with T2D have low health literacy (LHL), which means that they have difficulty obtaining, understanding, and applying health-related information. Therefore, this group has more difficulty maintaining a healthy lifestyle. Many existing (digital) lifestyle interventions are not accessible to people with LHL because those are not tailored to their needs. This study aimed to develop a lifestyle coaching intervention to support a healthy lifestyle in people with LHL and T2D.

**Methods:** We followed a participatory design approach consisting of three phases. In the first phase, the needs for people with LHL were explored by identifying design principles for people with LHL from literature and conducting semi-structured interviews. Fourteen semi-structured interviews were conducted among nine people with LHL, four healthcare professionals and a language expert familiar with the target group. The identified design principles and needs were translated into a list of requirements. In the second phase, a first version of the intervention was developed based on the list of requirements. In the final phase, the intervention was evaluated in think-aloud sessions with a person with LHL and a language expert for people with LHL to assess the comprehensibility and applicability.

**Findings:** Various design principles and needs emerged from the first phase regarding the mode of delivery of the intervention, the comprehensibility of the information and the applicability of the information. People with LHL would like to have the choice between digital (e.g. app) or non-digital (e.g. paper materials) coaching, so that people can choose which form of support suits them. It is important to consider the choice of words, the structure, the use of numbers, and the use of images in the design. To make lifestyle advice applicable, the advice must encourage concrete action with an explicit step-by-step plan. The development phase resulted in two products: an app and a magazine with information, advice and coaching regarding diabetes and lifestyle. Both products incorporate principles that increase the comprehensibility and applicability of the information, such as short sentences with key words in bold, supporting illustrations/videos, a text reading function (only in the app) and concrete instructions that encourage action. The main positive points from the evaluation were the reading function, the large font size, the supporting illustrations and that each sentence was placed on a new line. Some important points for improvement were that the chat function in the app and some recipes were too complex. Some small improvements have already been implemented in both products.

**Discussion:** By involving people with LHL, healthcare professionals and experts in the development, many needs of people with LHL have already been translated into the products and concrete points for improvement have been formulated. Future work should focus on further development and evaluation with the target group and exploring ways in which the products can be implemented.

## Citizen Science to Enrich Existing VR for Dementia With Fear-Reducing Scenarios

Hilco Prins, Franka Bakker, Gabriëlle ten Velde, Anjo Geluk, Charles van der Spek, Jan Rietsema, Rika Roffelsen, Dinant Bekkenkamp, Rens Brankaert, Marike Hettinga & Simone de Bruin

**Background:** Many people are afraid of getting dementia. This fear influences how people with dementia are approached and cared for. Senior citizens who took care of people with dementia, felt it was important to show that it is possible to live well with dementia. To this end, they wanted to investigate which images of fear about living with dementia prevail among citizens and what counter-images people with experimental knowledge have. These portrayals will be used to enrich an existing virtual reality application to self-experience dementia with scenarios that reduce fear, improve attitude and increase care providing options.

**Methods:** In this 'VRbeelding' (VRrepresentation) research project we go through the four phases of the Double Diamond Model of Design Thinking. Citizens are actively involved in the design, implementation and analysis of each phase. In phase 1 'Discover', citizens are asked to submit images with explanatory text (photo-voice) on the basis of which (other) citizens interview each other (Structured Interview Matrix: SIM). This results in a longlist of images of fear and counter-images. In phase 2 'Define', experts by experience (people with dementia, informal carers, professional caregivers) reflect on the longlist in group sessions, resulting in a prioritized shortlist. In phase 3 'Develop', the experts by experience and researchers brainstorm about storylines for a VR-film script and related training that contribute to turning fear images into more nuanced portrayals. Then script, VR-film and adjacent training are developed iteratively. In phase 4 'Deliver', evaluation of the VR-film + training takes place among informal carers, healthcare professionals, trainers and nursing students via qualitative pre- and post-test photo-elicitation interviews.

**Findings:** The photo-voice action generated over 220 submissions from citizens. The participating citizens ranged in age from teens to eighty-year-olds and in their association with dementia. Some had dementia themselves, many had experience in caring for people with dementia, as a partner, family or (professional) caregiver.

The photo clusters and coding of explanatory texts led to 4 themes about which 48 citizens interviewed each other in three SIM meetings: 1) 'Loss versus enrichment'; 2) 'Human interaction versus own world'; 3) 'Still enjoying versus no longer enjoying'; 4) 'Continuing to be a full human being versus being written off'. Analyses of photo-voice and SIM-meetings and first translations to the VR application can be presented at the time of the conference.

**Discussion:** Citizens participate enthusiastically in this research project, in varying roles, implying a high motivation among citizens to contribute to projects that support health and wellbeing of people with dementia. Even though the ultimate outcome is a VR application, the first phase is already leading to requests among participants to convert the submitted images into discussion cards and a public exhibition about dementia portrayals. So, citizens also suggest end-user supported interventions. Participants in photo-voice and SIM-meetings were attracted with relatively little recruitment efforts and have diverse backgrounds. However, multicultural background and level of education are points for attention in the development process of the VR- and other (technological) applications in order to ensure validity of end results.

## Understanding the Use of Monitoring Technology on Dementia Wards: Opportunities for De-Implementation, Design and Implementation

Sarah Janus & Jodi Sturge

**Background:** Many specialized dementia care units rely on various technologies to monitor the movement and safety of residents. Alert systems and location trackers can be used to notify staff when residents wander beyond a designated area or track the location of residents when they leave the facility. The aim of this presentation is to describe how technology is used in dementia care to monitor the mobility of residents.

**Methods:** A scoping review framework was used to summarize international literature on measures to modulate the mobility of people with dementia in residential care environments. For this review, five databases were searched: PubMed, Embase, CINAHL, SCOPUS, and Web of Science. Following the review, two researchers conducted 18 hours of observations in dementia care units and interviews with staff and stakeholders related to the freedom of movement of residents. This project was funded by the Ministry of Science and Culture of Lower Saxony (MWK) as a part of the Niedersachsen 'Vorab' Program (Grant Agreement No. ZN3831)

**Findings:** The literature review revealed that alarms and access-controlled keypads are used to lock doors or control elevator use when residents attempt to leave the environment. Studies described residential care environments in which transmitters or trackers were worn (e.g., electronic bracelets) or sewn into residents' garments to trigger an alarm to prevent residents from wandering beyond the designated door. However, as demonstrated in the literature and throughout site observations, there were several examples of ineffective technology practices:

1. Staff often ignore repetitive alarm sounds related to patient movement. Staff reported that the alarm indicated that the resident was moving in their room and evaluated these movements as a not urgent situation.
2. Entrances were controlled by access-controlled keypads and doorbells, which required staff to respond to open the door.
3. GPS trackers were available at both sites but were not being used. Staff reported that they needed more training to determine how the trackers worked.

**Discussion and conclusion:** The use of technology in dementia care will increase in the future. As organizations implement technology to support the well-being of residents concurrently, there should also be a de-implement process of removing ineffective technology. Our findings suggest that some technology used to monitor the mobility of people with dementia in care homes is inefficient and unnecessary. Identifying such technology provides an opportunity to remove and reintroduce more suitable technology. New technology needs to be designed within the workflow context of a dementia care unit and support the needs of the residents and staff. Further, to ensure the successful implementation of new technology, residents, staff, and family must participate in the design process to facilitate an evidence-based design practice. Such a de-implementation and implementation process can improve staff productivity and dementia care.



## Information Requirements of Informal Caregivers of Older Adults With Cognitive Impairment: Towards a Sensor-Based Communication Platform

Nikita Sharma, Annemarie Braakman-Jansen & Lisette van Gemert-Pijnen

**Background:** As the population of older adults with cognitive impairments (OwCI) continues to grow, the need for sensor-based monitoring solutions that can track their physical, emotional, and physiological activities in real-time from a distance has become apparent. However, these solutions appears promising for prolonging the stay of OwCI living alone and receiving home care, a careful consideration to the information that needs to be communicated to informal caregivers after observing via sensor-based solutions is required to prevent the information overload among informal caregivers. In that direction, this study aims to identify the information communication (IC) needs and conditions for acceptance of sensor-dependent IC platform among informal caregivers of community-dwelling OwCI living alone and receiving home care towards a sensor-dependent IC platform.

**Methods:** A convergent mixed-method design was utilized. Quantitative data was obtained from a survey with informal caregivers of OwCI living alone (N = 464) whereas in-depth interviews with informal caregivers of OwCI living alone (N=10) were conducted for the quantitative insights. Descriptive analysis was used to evaluate the information needs (in emergency and non-emergency scenarios) and user acceptance (TAM scale) from the survey data. A mix of deductive (for main themes) and inductive (for sub themes) thematic analysis was used to analyze interview data.

**Findings:** The findings of the study indicate that the IC needs of informal caregivers differ with respect to the care scenarios, and within scenarios also they are continuously evolving. In addition to scenario-specific needs, the study identified needs for administrative, physical, and emotional care task support. The acceptance of the sensor-dependent IC platform was found to be dependent on the care needs or scenarios at hand. The study also identified concerns towards hardware implementation, lack of system understanding, trust and reliability, and the dilemma between security and privacy as important themes that affect the acceptance of the platform.

**Discussion:** The study's findings inform the design and implementation of the sensor-dependent IC platform. It suggests the need of personalization in IC platform to cater the specific needs of the caregivers and the care situations at hand. Moreover, prior to implementation, demonstration of the platform's use/functionalities and embedding the elements of trust and reliability in the IC platform can increase the chances of acceptance of the platform among informal caregivers. Lastly, due to informal caregiver's dilemma between safety and privacy, a responsibility on technology developers to ensure privacy of care recipients is also observed.

## Bridging the gap – Developing, Implementing and Evaluating Virtual Reality for People With Severe Mental Illness [symposium]

**Hanneke Kip, Samantha Murray, Marileen Kouijzer & Lisa Klein Haneveld**

Due to its immersive nature, virtual reality (VR) has much potential to improve treatment of hard-to-involve patients, such as those with severe mental illnesses. Amongst other things, VR can be used to practice with emotion-regulation skills in real-life settings, to improve deep breathing in an engaging way, or to identify individual triggers for addiction or aggression. However - as is the case for most eHealth technologies - uptake in practice lags behind on expectations. An explanation for this is a suboptimal fit between the technology, the treatment context, and needs or wishes of patients and therapists. Consequently, there is a need for more participatory development, thorough implementation, and feasible evaluation of VR. By using suitable approaches, we can create and use evidence-based VR interventions that are aligned with characteristics of patients, therapists and treatment contexts. This symposium is focused on development, implementation and evaluation approaches. In the first presentation, we will present the outcomes of multiple focus groups on the needs and wishes of therapists regarding the use of VR in treatment of addiction. The focus groups serve as a starting point for a larger, multi-method development and evaluation process. The second presentation is focused on implementation. We will present the main outcomes of a comprehensive scoping review on implementation of VR in healthcare in general, and will discuss how these results are applicable to mental healthcare by providing examples from practice. In the third presentation, we will discuss the outcomes of a mixed-methods single case experimental study, in which experience sampling, questionnaires, interviews and physiological data were combined. This innovative method is useful for the evaluation of new technologies in complex contexts. We will conclude this symposium with a short discussion on promising future directions of VR and accompanying development, implementation and evaluation processes.

## Using VR in Treatment of Substance Use Disorder: Participatory Development Approach

**Samantha Murray, Hanneke Kip, Saskia Kelders, Marijke Broekhuis & Joanneke van der Nagel**

**Background:** Patients with low cognitive and/or adaptive functioning are at a higher risk for developing substance use disorders (SUD) and have worse treatment outcomes than patients with normal cognitive functioning. Cognitive behavioural therapy (CBT) is one of the most commonly used treatment forms for treating SUD and has demonstrated its effectiveness in substance-related outcomes. However, vulnerable patients such as people with intellectual disabilities, low adaptive functioning or forensic issues do not benefit as much from the general CBT programs that are available for treating SUD. This is probably because CBT demands a large portion of self-reflection, verbalization of thoughts and feelings, and applying newly acquired skills in practise - things that are difficult for this patient group. Virtual reality (VR) offers the opportunity to practise real-world interactions in a safe and simulated environment and relies more on learning by experience, thereby providing a powerful tool for the treatment of difficult to treat patient groups. The goal of this presentation is to present the needs, wishes and requirements of patients, lived experience experts and therapists regarding the possible implementation and use of VR within a CBT-based substance use treatment program. Moreover, we will discuss the larger multi-method development and evaluation project of which this study is part.

**Methods:** A qualitative study design was used, and 6 focus groups of approximately 90 minutes were conducted at Tactus and Trajectum with in total 16 therapists, 3 lived experience experts and 14 patients. All audio recordings gathered from the focus groups and co-creation sessions were transcribed and analyzed by two researchers using inductive coding.

**Findings:** In this presentation, we will discuss the main outcomes of our qualitative study, which we will illustrate with quotes from participants. First, expected facilitators and barriers of VR within treatment according to both patients and therapists will be discussed, with a specific focus on the differences between the two groups. Moreover, we will discuss the wishes and needs of patients and therapists regarding the integration of VR within current treatment protocols, preferred VR requirements and the usability of VR. Lastly, we will provide a plan on how to conduct a needs assessment with stakeholders (patients and therapists) for the sustainable development of VR within CBT protocols for difficult patient groups.

**Discussion:** This study helped to identify knowledge gaps with regards to the wishes and needs of both patients and therapists on the implementation of VR within practice for patients with low cognitive and/or adaptive functioning. It is recommended to include both patients and therapists within the development of technology-based protocols, as our study showed large differences in terms of wishes and needs from therapists and patients. Furthermore, it is important for future research to further investigate the differences and similarities with regards to patient's and therapists needs and wishes when it comes to VR-treatment. At last, we will discuss how the results of our study will be used as a guideline for our multi-method development and evaluation project.

## Implementing VR in Complex Healthcare Settings: A Scoping Review and Experiences From Practice

Marileen Kouijzer, Hanneke Kip, Yvonne Bouman & Saskia Kelders

**Background:** Virtual reality has much potential for mental healthcare. In VR, users have the feeling that they are actually present in the virtual world due to a sense of presence'. Due to this immersive quality, VR can bridge the gap between the outside world and treatment room. However, its uptake in clinical practice is lagging behind on the expectations of patients, therapists, managers, and researchers. Consequently, there is a need for more scientific and practical knowledge on how to implement VR within mental healthcare settings. The goal of this presentation is twofold. First, we will describe the outcomes of a scoping review on the current state of affairs in the implementation of VR technology in healthcare settings in general. Second, we will supplement the findings of the scoping review with experiences with implementation processes of VR in Dutch mental healthcare organizations.

**Methods:** To give an overview of relevant literature, a scoping review of articles published up until February 2022 was conducted. Information about each study was extracted using a structured data extraction form. Experiences with implementation of VR in mental healthcare were based on semi-structured interviews with therapists who are experienced with the use of VR in mental healthcare. These experiences were connected to the implementation factors and strategies that were identified in the scoping review.

**Findings:** In this presentation, we will first discuss the main outcomes of the scoping review, in which 29 full papers were included. Most studies were focused on factors (i.e. barriers or facilitators) related to the

implementation of VR. Less attention was paid to concrete implementation objectives strategies that can be used to overcome barriers. Furthermore, very few studies used a systematic implementation approach, guided by theoretical frameworks. Based on the outcomes of this review and the semi-structured interviews, we will provide an overview of relevant implementation factors on multiple levels, using the CFIR framework as a foundation. To illustrate these factors and strategies, we will provide concrete examples from practice of barriers related to the therapist (e.g. lack of experience in working with VR), patient (e.g. skills), organization (e.g. lack of resources), wider context (e.g. unclarities about financial reimbursement) and the technology itself (e.g. poor usability). Furthermore, we will provide examples of implementation strategies that were identified in the interviews, such as intervision sessions with therapists, technical training, and information materials for patients.

**Discussion:** While the importance of implementation of technologies such as VR in healthcare is widely acknowledged, we identified major knowledge gaps in research and practice. The lack of knowledge was especially apparent for implementation strategies that can be used to address barriers. Based on the results of both studies, we recommend that the implementation of VR entails the entire process, from identifying barriers to developing and employing a coherent, multi-level implementation intervention with suitable strategies. Furthermore, it is important to generate more knowledge on how to apply implementation frameworks to clinical practice. It has become clear that before VR can reach its full potential, there is a lot of work to do in research and practice. Our review and interview studies have identified multiple important avenues for future research.

### Evaluating the Effect of VR Biofeedback Game DEEP in Forensic Inpatient Care: A Single-Case Experimental Design

Lisa Klein Haneveld, Hanneke Kip, Yvonne Bouman, Hanneke Scholten, Joanneke Weerdmeester, Andre Bester & Saskia Kelders

**Background:** Forensic psychiatric patients are treated mandatorily for their (imminent) delinquent behaviour that is partly caused by their psychiatric illness(es). This group often has low treatment motivation, complex psychosocial problems and suboptimal cognitive skills. Hence, existing treatment methods that rely heavily on reflection, reading or writing are not always the best fit. DEEP is a serious VR game that seem to fit the needs and skills of forensic patients, because of its experience-based and gamified design to teach its user diaphragmatic or ‘deep’ breathing. However, DEEP has not yet been studied with forensic patients. In this presentation, we will show the outcomes of our study to provide insight into whether DEEP contributes to decreasing physiological arousal, stress and anger and in preventing aggression in forensic psychiatric inpatients.

**Methods:** A mixed-methods introduction-withdrawal single-case experimental design (SCED) was conducted. By using a SCED, it was possible to use a relatively small participant sample and still receive much data, which is helpful when doing research with a hard-to-include participant group. During three weeks, six Dutch forensic inpatients with aggression-regulation problems participated in individual DEEP-sessions, with three days in between each session. Participants were monitored continuously throughout the study, using experience-sampling and physiological data collected by the Empatica E4. Additionally, validated questionnaires were used to measure aggression, anxiety and engagement. Finally, interviews

were conducted with participants and their caregivers to gain insight in their experiences, the short- and long-term effect of DEEP and its added value for forensic inpatient care.

**Findings:** In this presentation we will discuss the main outcomes of the SCED. First, four participants showed a small increase in their heartrate when they started playing DEEP. However, just after they stopped DEEP their heartrate and skin temperature declined. Second, using experience sampling, five participants showed a stabilisation or decline in self-reported tension, stress and anger the hour after they finished a DEEP-session. Additionally, four participants showed a (slight) decline in self-reported anger over the whole study period. Third, five participants scored lower on the depression- anxiety and stress scale (DASS) at the end of the study than at the start. Four participants scored lower on the Dutch Aggression Scale (AVL-VL) as well. During the interviews, five participants felt enthusiastic about DEEP and that it helped them relax and focus on their deep breathing. However, most participants were unsure about whether they actually learned new coping skills through DEEP.

**Discussion:** This study helped to gain insight into whether DEEP can support forensic inpatient in offering short-term relaxation and teach them deep breathing as a long-term coping skill to regulate their negative emotions. Based on all results, DEEP seems to be of most value as a short-term relief when patients are feeling unwell. DEEP was only used for three weeks in a research setting with no treatment methods involved, which might explain why the breathing techniques thought in DEEP were not as easily obtained and applied in the daily lives of patients. However, patients seem to prefer DEEP not as an treatment intervention, but as a technology that can be used ad hoc and on their initiative. Future research could further investigate whether DEEP can be combined with other technologies (e.g. apps or wearables) to increase its learning-effect and if same results are found in other populations.

## Dysfunctional Breathing in Children: Development Wearable Breathing Trainer and Opportunities for Integration in Care Process

Richard Evering, Beatrijs van Hoof, Leonie Bouwmeester, Hellen van Rees, Geke Ludden & Marjolein den Ouden

**Background:** Dysfunctional breathing occurs in approximately 6-10% of people in the general population. Although no exact numbers are available for children, children are often diagnosed and in treatment for dysfunctional breathing. The treatment consists of guided breathing exercises combined with exercises at home. However, children perceive these exercises as boring, and there is limited guidance and insight about breathing exercises performed. The concept of the Wearable Breathing Trainer (WBT) is an interactive vest for children (8 and 12 years) that guides breathing exercises at home, including a game element for increasing motivation. The WBT measures respiration, provides haptic stimulation during exercises and visual feedback after exercise. The aim of the present study was to develop a patient journey, to understand the design requirements for the WBT for implementation in the current care path.

**Methods:** The Patient Journey was iteratively developed in co-creation with pediatric physiotherapists (n=13) and pediatricians (n=3) in three focus groups. The first focus group focused on: In depth information about the training, role of physiotherapists, exercises at home, and role of the parents. In the second focus group, the first draft of the patient journey was presented. Participants checked the journey on completeness, opportunities and barriers. In the final focus group, the second draft of the patient journey was presented and focused on: completeness of the patient journey and opportunities and barriers of the WBT in the care path. The focus groups were audio recorded and transcripts were analyzed to develop the patient journey.

**Findings:** The patient journey describes a new concept with integration of the WBT in the current care path: 1) Diagnosis and referral by general practitioner or pediatrician, 2) Preparation of treatment plan by pediatric physiotherapist, 3) Treatment phases (awareness, lying, sitting, standing, effort) with various breathing exercises during consultations with the pediatric physiotherapist and at home, 4) Completion of treatment with the pediatric physiotherapist. Respondents stated that the WBT can be of added and motivating value in achieving awareness and learning correct breathing patterns during treatment. However, the added value also depends on the context of children (i.e. age, developmental level) and the home situation (i.e. social relation and proximity of a parent/ guardian). Pediatricians also stated that the WBT can be used for children who are readmitted to the hospital for dysfunctional breathing (i.e. refresher course). Finally, the data collected while using the WBT at home can be of added value for physiotherapists and pediatricians to monitor children's progress and improve diagnosis.

**Discussion:** The future patient journey outlines the various phases of the treatment of dysfunctional breathing in children, connecting it to the home context, while showing how the WBT can be used throughout the care path. The WBT may improve diagnostics, shorten the treatment period, and reduce the number of consultations. The added value of the WBT differs for pediatric physiotherapists and pediatricians. Hence, the preferred patient journeys also differs. Future research is needed into the technology development, acceptance and use of the WBT and an acceptable business model.

## Towards Continuous Mental State Detection in Everyday Settings: Investigating Between-Subjects Variations in a Longitudinal Study

Lea Berkemeier, Wim Kamphuis, Herman de Vries, Anne-Marie Brouwer, Jan Ubbo van Baardewijk, Maarten Schadd, Hilbrand Oldenhuis, Ruud Verdaasdonk & Lisette van Gemert-Pijnen

**Background:** Maintaining mental health can be quite challenging, especially when exposed to stressful situations. In many cases, mental health problems are recognized too late to effectively intervene and prevent adverse outcomes. Recent advances in the availability and reliability of wearable technologies offer opportunities for continuously monitoring mental states, which may be used to improve a person's mental health. Previous studies attempting to detect and predict mental states with different modalities have shown only small to moderate effect sizes. This limited success may be due to the large variability between individuals regarding e.g., ways of coping with stress or behavioral patterns associated with positive or negative feelings.

**Methods:** A study was set up for the detection of mental states based on longitudinal wearable and contextual sensing, targeted at investigating between-subjects variations in terms of predictors of mental states and variations in how predictors relate to mental states. At the end of March 2022, 16 PhD candidates from the Netherlands started to participate in the study. Over nine months, we collected data in terms of their daily mental states (valence and arousal), continuous physiological data (Oura ring) and smartphone data (AWARE framework including GPS and smartphone usage). From the raw data, we aggregated daily values for each participant in terms of sleep, physical activity, mental states, phone usage and GPS movement.

**Findings:** First results (six months into the study at the time of writing) indicate that almost all participants show a large variability in ratings of daily mental states, which is a prerequisite for predictive modeling. Direction, strength and standard deviations of Spearman correlations between valence, arousal and the different variables suggest that several predictors of valence and arousal are more subject dependent than others.

**Discussion:** In future analyses, we will test and compare different versions of predictive modeling to highlight the potential of wearable technologies for mental state monitoring and the personalized prediction of the development of mental problems.

## Implementing Digital Care: Lessons Learned and Shared, but not Found And Applied

Jolanda van Til, Corine Böhmers & Marike Hettinga

**Background:** In March 2020, everything changed due to the pandemic. Lockdowns challenged care organizations to find alternatives for providing care. In this crisis, many lessons were learned about how to implement digital care. These lessons were shared on numerous websites, leading to an extensive body of knowledge. Innovation managers of care organizations could benefit from all these shared lessons if they indeed would search for them, find them and actually use them. In this study, we examined to what extent innovation managers of care organizations during the second half of the pandemic looked for, found and applied the lessons learned by their predecessors.

The project was commissioned by province of Overijssel and carried out by researchers from Windesheim University of Applied Sciences and Health Innovation Park (now Health Valley).

**Methods:** We used a variety of ways to collect data. A total of 14 innovation managers from 11 care organizations in different sectors were interviewed, 130 documents were included in the desk research, and 2 expert sessions were held with the interviewees. We used thematic analysis to analyze the data.

**Findings:** The innovation managers interviewed did only to a very limited extent perform online searches for information, lessons learned or implementation models. As far as they retrieved information about how to implement digital care, this was learned from colleagues within their own networks. The innovation managers experienced added value from these shared lessons and indicated that sharing best practices and brilliant failures with colleagues should be more common. Hence, they were also willing to share their own experiences. One important experience concerned the substantial role the specific organizational context played in the implementation process. The size and type of the organization counted, but of more weight was the innovation climate: the presence of innovation policy, innovation budget, basic infrastructure to build on, digital skills and open mindedness of colleagues, etc.

**Discussion:** This study revealed that an extensive body of knowledge on implementation of digital care was not used to its full extent, to say the least. Why did the innovation managers exploit it so little? They stressed themselves that they tended to search for information within their own network, hence limiting the search scope quite drastically. Knowledge stemming from colleagues and peers they know, is apparently valued most. Furthermore they stressed the importance of their specific context. Can it be that information generally available is assessed to not suit their specific contextual needs?

Besides these clarifying questions this study raises another, more important, issue. As researchers at a university of applied sciences we want our scientific research to be socially relevant and we want it to have added value for the professional field. Hence we publish our results not only in scientific journals, but also in more accessible forms for professionals. From this study we learn that this will not guarantee the uptake of the presented insights. We need to go to greater lengths to valorize our research results; simply adding them to the body of knowledge, even in an accessible form, is insufficient.



## Modelling Observations of Online Sensemaking Involving Digital Health Literacy

Szilvia Zörgő, Anna Jeney, Szilárd Kovács & Rik Crutzen

**Background:** Digital health literacy (DHL), the ability to find, understand, and evaluate health information in digital environments and apply it to health behavior, is a core competence for navigating online information and health service environments. Past studies have primarily employed self-reported questionnaires, but observations of users utilizing their DHL in an online environment may aid a deeper understanding of how individuals engage with health-related information, especially in organic search behavior and ill-structured problem-solving, such as sensemaking (iterative process of finding and synthesizing information). Our study focuses on sensemaking connected to the DHL dimensions of understanding and appraising information relevant to health; this presentation elaborates our methodological process in hopes that our innovations provide a useful basis for other projects.

**Methods:** We recruited experts and novices in information retrieval and assessment (n=20), aiming for homogeneity within and across subsamples with respect to geographical location, age, language, and ethnicity. We used an observational protocol for a 10-minute organic search task and a think-aloud protocol that standardized how self-reflection on behavior and sensemaking was elicited. This generated two sources of audio-video data; sociodemographic and task-specific data was collected with a self-developed questionnaire. Audio-video data was transcribed manually and with a combination of AI and manual transcription, then coded and segmented with the Reproducible Open Coding Kit (ROCK). Codes were developed inductively by multiple coders in an iterative process, then applied deductively to the entire dataset. Code co-occurrence frequencies were modelled with Epistemic Network Analysis (ENA) and state transitions among visited websites were visualized with Qualitative/Unified Exploration of State Transitions (QUEST).

**Findings:** Quantification through data coding and segmentation allowed us to more easily identify patterns within the sample and subsamples, as well as create quantitative models of our data. ENA visualizations enabled us to model the sensemaking journey of individuals and subsamples, lending insight into how participants solve an ill-structured task through organic searching. Comparing experts and novices we could identify specific website features used to appraise the trustworthiness of information sources, as well as interpret online content. State transition (Markovian) models via QUEST enabled us to visualize the probability of users in the expert versus novice group transitioning from one website type to another (e.g., academic to governmental sources).

**Discussion:** Although these quantitative models offered insights into patterns in large amounts of qualitative data, both techniques have limitations. ENA models display the relative frequency of co-occurrences between code pairs within designated segments of data; as of now it has no hypergraph capabilities. QUEST does not display transition probabilities between specific websites, as this would be unwieldy and uninformative on the subsample level. States, therefore, represent codes for website types, and transition probabilities can only be computed for two given states, not all states in a process (entire search task). Albeit, results obtained from these models may be informative in designing interventions to increase DHL by highlighting best practices and pitfalls in sensemaking and information appraisal.

## Interview Study: Nurses and Nursing Students Perspectives on Digital Health Literacy of Their Patients

Eline Dijkman, Jobke Wentzel, Carine Doggen & Constance Drossaert

**Background:** Nurses play an important role in providing information and supporting their patients during their treatment. The last decade, information technology has significantly changed this role. Whereas technology offers great opportunities, some patients have low (digital) Health Literacy (dHL), meaning that they experience difficulties in understanding information about their disease, or in using digital health technologies. Consequently, low (d)HL may lead to poor health outcomes and health inequalities. Nurses can play a crucial role in recognizing and supporting patients with low (d)HL. However, little is known about if and how nurses do so. Our first aim was to explore how -in a hospital context- the communication between nurses and their patients changed through information technology. A second aim was to uncover current (best) practices in recognizing and supporting patients with low d(HL).

**Methods:** Semi-structured interviews with nurses (n=14) from a tertiary hospital in the Netherlands, and with nursing students (n=6) of a bachelor and vocational nursing program (MBO/HBO) were conducted. The interview guide was developed based on the six function model<sup>1</sup> that distinguishes 6 functions of medical communication: (1) building a relationship, (2) gathering information, (3) providing information, (4) making decisions, (5) supporting self-management and (6) paying attention to emotions. To stimulate the discussion, infographic with some examples of digital tools were used. The critical incident method<sup>2</sup> was used to explore best / worse practices in recognizing and supporting patients with low dHL. Data were analyzed using Atlas.ti.

**Findings:** Results showed that technology has influenced all 6 functions of nurse-patient interaction. Both positive and negative changes were mentioned. Positive changes included being able to personalize communication and care, and the possibility of using videos and pictures for patients who cannot read. Negative changes included lack of non-verbal cues and digital tools not being accessible for all patients. Regarding recognizing limited dHL, seven categories were identified. Some were related to the patients (their [1] characteristics, [2] behavior or [3] dependence of social or care network), others to the nurses (their [4] intuition, [5] explicitly asking about dHL or [6]) observing when the patient demonstrates) or to the context [7] registered in the Electronic Medical Record (EMR). Regarding supporting patients with limited dHL, five categories were identified, namely: [1] creating trust, [2] using a patient's social and care network, [3] tailoring communication, [4] use more or different care and [5] discuss digital health literacy of patients.

**Discussion:** The identified changes in communication to recognize and support patients with low dHL were derived from nurses and students with already some experience in providing (information) technology. Therefore, this does not reflect the skills and experience of all nurses. Moreover, further research is needed to examine whether current practices are in fact effective and (ethically) desirable as they may result in patients being excluded from technology, based on the nurses' assessment of the patient's capability. The results will be used to develop training modules for the "Empowering Nurses to Empower their Patients (ENEP-) project.

## Patients' Digital Health Literacy – Let's Focus on Nurse Training & Education

Jobke Wentzel, Eline Dijkman, Ronald Uittenbroek, Marike Hettinga & Carine Doggen

**Background:** About 1 in every four Dutch adults have low or inadequate health literacy<sup>1</sup>, meaning that these persons have difficulties in obtaining, understanding, judging or applying health-related information. The current transition to more digital care (including patient portals, e-consultations and tele-monitoring) requires additional digital skills of patients, such as operating devices and applications or navigating the internet. Low (digital) Health Literacy (d)HL may impact patients' health negatively as it can hamper decision making and may lead to poor self-management. Nurses can play a pivotal role in supporting patients with low (d)HL. However, studies have shown that health care professionals (including nurses) often overestimate the (d)HL of their patients, and that they lack knowledge about how to adequately support patients with low (d)HL<sup>2,3</sup>. In current nursing curricula and post-graduate training there is only little attention for recognizing and supporting patients with low (d)HL. In our ENEP (Empowering Nurses to Empower their Patients) -project, we want to address this gap by developing effective training modules that enable nurses to recognize and support patients with low (d)HL. The aim of the current study was to get insight into the needs, wishes, and preconditions for developing and implementing such a training.

**Methods:** We conducted 27 semi-structured interviews with nurses (n=14), teachers (n=7) and nursing students (n=6) of bachelor/vocational education level. Interviews took place between November 2022 and January 2023. The interview guide focused on 1)how (d)HL is integrated in current education programs, 2)what needs/wishes exist regarding the content of (d)HL training modules, 3)what ideas respondents have regarding methods to implement (d)HL in training modules. The interviews were analyzed inductively by two independent coders.

**Findings:** Preliminary results show that currently there is little attention for (d)HL in the nursing curricula. More attention for recognizing and supporting patients with low (d)HL in the curriculum and post-graduate training is perceived as urgent among all respondent groups (nurses, students, teachers). A module should focus on creating awareness, increasing knowledge, but also on communication skills. Regarding the methods of education to address (d)HL, respondents indicate that including realistic (or even real) cases or persons with (d)HL in lessons and practical training are needed to have a high and sustainable impact. The diversity of skills and tasks in the curriculum are mentioned as a barrier; educational modules should be integrated into or match current education.

**Discussion:** In this study, we explored the educational needs of nurses, nursing students and teachers regarding patients' (d)HL. Respondents agree that more attention should be paid to this topic in the education curriculum and in post-graduate training. The nursing profession is broad, and encompasses diverse competencies in different care-related topics. This poses a challenge for the development of training modules, in fitting the already tight curriculum. Also, nurses experience a high workload in practice, withholding them from spending time on specific themes such as (d)HL. However, given the digitalization in healthcare and the ever stronger focus on self-management, it is pivotal to empower nurses to better support their patients with low (d)HL.

## Using Virtual Reality to Train Healthcare Professionals That Support Patients With Swallowing Problems (dysphagia)

Job van 't Veer & Chiem Tuil

**Background:** Dysphagia (i.e. swallowing problems) is a fairly common geriatric syndrome among residents in nursing homes. Not all healthcare professionals know how to deal with residents with dysphagia. To educate healthcare professionals in adequately handling possible risks and incidents, organizations often invest in elaborate, costly training-programs, as an addition to existing training programs. Technologies like Virtual Reality (VR) may offer benefits that can train healthcare professionals more effectively and efficiently.

**Objective:** This study we examined the learning effects of a VR-simulation training for nurses to deal with dysphagia among residents in nursing homes. We also studied how users experienced typical features of VR to be of added value to their learning experience.

**Methods:** We used a VR-module (3D-footage) that confronts participants in various scenarios to solve problems regarded residents with dysphagia. With a 11-item self-evaluation questionnaire (pre- and post-training) immediate learning results were measured. One group of participants (n=95) participated in the pre-training measurement. Another group (n=88) completed post-training measurements (avoiding biases caused by testing effects). During trainings (30-40 minutes), we also observed interactions between trainer and trainee (8 observations). In structured interviews (2-4 weeks after training) we asked a subpopulation (n=21) about their user-experiences. These interviews focused on themes like relevancy to daily practice, experimentation, debriefing and immersiveness.

**Findings:** After analysing the pre- and post-measurement questionnaires, a significant overall improvement was seen between pre- and post-measurements in (self-assessed) knowledge about and skills in dealing with dysphagia. However, learning effects varied in some specific subthemes. The interviews showed the VR-simulation brought intense immersive experiences and the scenes were seen as highly relevant in daily practice. Participants had the tendency to avoid mistakes, despite the opportunity to safely experiment in a simulated environment. Furthermore, participants wished a more in-depth debriefing, to relate lessons learned to their own daily practice. Concurrently, observations of trainer behaviour showed little attention was given to stimulation of experimental learning and debriefings were short and lacked structure.

**Discussion:** Healthcare professionals value VR-simulations as an innovative educational tool. This study demonstrated that VR can be a powerful tool to train large groups in a brief period. Although only short-term, we found a significant increase in self-evaluation, compared to pre-training. However, certain benefits VR-simulations have to offer as an educational tool are not yet fully utilized. First, it is important to encourage participants to experiment with their choices, since VR offers a safe learning environment. Second, it is of relevance to develop a protocol to guarantee in-depth debriefing. A strong aspect of this study is that a large group of participants was included in this study. Using 2 different populations in pre- and post-measurements, we avoided testing-effects. However, the effect on the long term was not examined. Future studies could add follow-up measurement to their research-design.

## Primary Care Physiotherapists' and Older Clients' Experiences and Needs for Home Rehabilitation Supported by eHealth

Laurence Alpay, Petra Siemonsma, Ybranda Koster, Freek Lötters, Arlette Hesselink, Erzy Kassens & Pieter Flaton

**Background:** Primary care physiotherapists face an increasing number of older patients who are in need of home rehabilitation. Challenges in patient care include not only the patient's behavioral changes in exercising but also the way healthcare professionals from different disciplines collaborate. eHealth offers opportunities to support patients as well as primary healthcare professionals to reach effective home rehabilitation. More research into the current practices is needed. This exploratory study reports on the experiences, wishes and needs from these stakeholders with regards to using eHealth to support patient's behavioral changes in exercising and professional collaboration.

**Methods:** Qualitative methods were used: ten semi-structured interviews (six with physiotherapists and four with patients), two focus groups with two physiotherapists per session were carried out. The results of these interviews and focus groups were used to set out an online questionnaire to the regional professional network. Ten participants filled out the questionnaire.

**Findings:** The importance of eHealth for interprofessional collaboration (IPC) and exercise behavior of clients is clearly recognized by the participants. The physiotherapists use different eHealth applications depending on the task at hand such as supporting client's home exercises, updating patient dossier or information sharing. The barriers that arise to collaborate have mainly to do with the connection between existing applications, data exchange and the lack of a central digital platform. eHealth applications mentioned in relation to client's exercise behavior varies e.g. setting goals, self-monitoring or remote consultation. In addition, lack of motivation, limited social support and impaired cognition are reported as barriers to the client's exercise behavior. Opinions of the older clients regarding the use of eHealth varied. The main use making medical appointments using computers. Face to face contact remains important for exercising. Better access to their own patient file was deemed desirable. With regards to IPC, the clients mentioned having to deal with more than one primary care professional, and experienced limited communication between professionals. No eHealth application was used to support this process. In addition, three clustered themes for IPC emerged. 1) Communication (e.g. knowledge sharing and short lines); 2) Relationships (e.g. interdependence, roles and responsibilities and shared accountability); and 3) Client-centered (e.g. patient care and positive health). Cluster Communication is both obstructive and facilitating, while cluster Relationships is the most obstructive and cluster Client-centered the most facilitating.

**Discussion:** Rehabilitation at home of the older client is a complex process and can benefit from an approach supporting different perspectives, namely facilitating exercise behavior, interprofessional collaboration between primary care professionals and the use eHealth to support these processes. This study has elicited the experiences, wishes and needs of primary care physiotherapists and clients with regard to eHealth for exercise behavior and interprofessional collaboration.

Use of eHealth applications supporting IPC en exercise behavior appears to be limited and fragmented, making it difficult to effectively connect various eHealth applications. A central digital platform is therefore desirable. In addition, more attention should be given to the relational cluster of IPC and to the factors supporting the client's exercise behavior (e.g. motivation, capabilities and opportunity).

## Facilitators and Barriers for the Implementation Of eHealth Technologies From a Healthcare Professional's Perspective

Elza Muller, M.A. Huysmans, H.J. van Rijssen & J.R. Anema

**Background:** EHealth is increasingly used to provide and improve healthcare. Long-term and sustainable implementation of eHealth intervention in healthcare practice does, however, often fail.

We sought to create an overview of facilitators and barriers for the implementation of eHealth interventions in healthcare as a guideline for a future implementation strategy for the field of insurance medicine. We aimed to provide an overview of facilitators and barriers for the implementation of eHealth interventions as seen from a healthcare professional's (HCP's) perspective by means of a systematic review of reviews. We discuss the preliminary results of our systematic review of reviews.

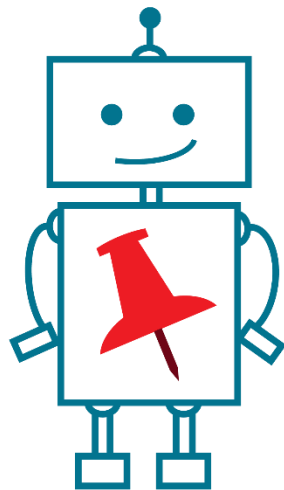
**Methods:** A search was conducted in PubMed. Inclusion criteria were qualitative systematic reviews in peer-reviewed journals, published between 01-01-2014 and 01-11-2021, reporting on facilitators and barriers for the implementation of eHealth technologies. We collected data about the facilitators and barriers reported from a healthcare professional perspective only and categorized them at 4 levels ( the individual, organizational, technical and policy level) based on the MIDI (a validated instrument for determinants of innovations).

**Findings:** We identified sixteen reviews that met the inclusion criteria. Specific facilitators and barriers for the different types of eHealth in all 4 levels were found. Additionally, group transcending general factors existed. Facilitators often resembled the opposite of barriers. General barriers on the individual level consisted of increased workload and lack of computer literacy. Lack of training and funding were barriers on the organizational level. Security issues and poor network connectivity on the technical level. And lack of guidelines and legislation on the policy level.

**Discussion:** This systematic review of reviews resulted in an overview of facilitators and barriers for the implementation of eHealth, from a HCP perspective.

2023

Poster presentations



**“Living with Cancer”; Implementation and Sustainability of a Peer Self-Management Support Program**  
M.A. Schreijer, K.L. Luu, R.M. Verdaasdonk, J.E.W.C. van Gemert – Pijnen, I.J. Korfage, F.E. Witkamp, & J.A.C. Rietjens

**Background:** Persons with advanced cancer and their relatives are increasingly expected to self-manage their health and care. We developed the online “Living with Cancer” program. This peer-led peer support program by video conferencing group meetings is based on an existing face-to-face program and aims at supporting self-management behaviors, self-efficacy and health-related quality of life of persons with advanced cancer and their relatives. Sustainable implementation of such programs can be challenging. To optimize the sustainability of the “Living with Cancer” program we identify and potentially reduce complexity, using the NASSS framework in seven domains 1) illness, 2) technology, 3) value proposition, 4) intended adopters, 5) organization(s), 6) external context and 7) future perspective).

**Methods:** The dataset included the research protocol, interviews with patients who participated to the pilot program, published articles about the pilot program about experiences with self-management and peer support of patients with advanced cancer, relatives and healthcare professionals and (focus group)interviews with relevant stakeholders, such as the director of an insurance company and members of patient cancer organizations. We used a pre-defined data extraction form containing questions of the NASSS interview guide to analyze the data.

**Findings:** Five main complexities were found. 1) the “Living with Cancer” program is targeted at people with all kinds of cancer, while patient organizations often aim at one kind of cancer. This may result in less awareness about the program among the target population. 2) there are socio-cultural factors which are expected to influence participants’ engagement and the inclusivity of the program, such as the need of being proactive, the willingness and readiness to talk about being incurably ill, the need to have a certain level of health literacy and to be fluent in Dutch. 3) the online format is on the one hand for some more inclusive, since people who do not feel well enough to travel can also participate. However, it is by some experienced as more rigid and less personal. 4) financial requirements for the future are not yet in place and important stakeholders, such as hospitals or patient organizations, are not fully committed to host the program or support it by referring their patients or members to it. 5) participants need to log in for every meeting (for which privacy regulations should be met), make action-plans, act on these plans, keep a diary during the length of the program and participate to six online meetings of 1.5 hours each.

**Discussion:** There are multiple complexities which might hinder the implementation and sustainability of the “Living with Cancer” program. Having identified them will help the researchers to further improve the program and the chances at a successful implementation. The main recommendations for the study team are: 1) offer the program in multiple languages to make it more inclusive. 2) develop and evaluate more individualized formats of the program, including (partly) face-to-face peer support groups. 3) capacity building among all stakeholders (e.g. patient organizations, clinicians and insurance companies) relating to acceptance, embedding and long-term financing and hosting of the program.

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## Self-Help Insights Based on Real-World Data From eMentalHealth Providers Therapieland and Gezondeboel

Maaïke Meurs

**Background:** Therapieland and Gezondeboel are eMental health platforms that offer over 200 online modules that aim to improve mental health. In the past year, over 162.000 people have followed one or more online modules. Most of the modules can be used with or without guidance.

According to the literature, unguided self-help is generally less effective than guided self-help, due to lower levels of engagement and adherence. However, unguided self-help is more scalable and can be a solution for the long waiting lists and the high work pressure in mental healthcare. Unguided self-help is easily accessible, and it may prevent worsening of symptoms in an early stage, thereby reducing mental healthcare usage and costs. Also, for those who recovered from mental health problems, self-help can prevent relapse. Thus, although unguided self-help is associated with lower uptake, it has great potential. When online modules are personalized and tailored to individual needs, it will be suitable and engaging for more people, creating a larger impact.

Currently, Therapieland and Gezondeboel are working on improving unguided self-help by making it more accessible and engaging. In the present study the usage, characteristics of the users, engagement and effectiveness of guided and unguided self-help are evaluated and compared.

### **Methods:**

**Measurements:** Usage is measured using log-data of total number of logins, total duration of logins, and total number actions (clicks, assignments etc.). Engagement is measured using the validated questionnaire “TWente Engagement with Ehealth Technologies Scale (TWEETS)”.

Effectiveness is addressed using the following outcome measures: feeling helped by the module, perceived decrease of symptoms, satisfaction, and extent to which set goals are achieved.

The following user characteristics will be evaluated: type and level of symptoms, stage (waiting list, early/late-stage treatment, or post-treatment), module, and preference for guided or unguided self-help. These characteristics are assessed by a questionnaire that is incorporated in all our modules.

**Analyses:** AN(C)OVA and Pearson Chi-square tests are performed to compare the variables for different groups.

**Findings:** The sample consists of N=33.097 users of Therapieland and Gezondeboel; 7% reports to follow the online module completely independently (“unguided-”), 58% reports to be invited by a professional, but follows the module without any guidance (“unguided+”), and 35% reports to follow the module guided by a professional (“guided”). Results show small significant differences in the outcome measures in favor of the “guided” group. Though to a lesser extent, the unguided groups also feel helped, experience a decrease of symptoms, reach their goals, and are satisfied with the modules. When preference with regards to guided or unguided self-help matches the actual situation, unguided self-help is associated with similar outcomes as guided self-help.

**Discussion:** The results suggest that matching individuals to their preferred type of self-help can increase its effectiveness.

## Getting Flow Experience Through Crafting on Physical Activities: A Daily Diary Study

Wei Liu, Valentijn Visch, Timothy Houtman, Sara Hondmann & Erika Bloom

**Background:** It is well understood that individuals can initiate physical activities by being motivated by extrinsic rewards (e.g., money), but it is understudied how individuals can experience intrinsic rewards (e.g., flow) and develop intrinsic motivation for doing physical activity. This study aims to explore the effective strategies, especially from a crafting perspective, that users can use to improve their positive experiences when doing physical activities.

**Methods:** Using experience sampling method, we collected 59 (N at a between-level) participants through the collaboration with a Tech company which aimed to increase fun during health-related activity. After sending out a baseline questionnaire, on a consecutive of 12 days, we sent the participants daily questionnaire one time per day. We assessed their daily behavioral strategies, experiences, and motivation on a daily basis. In total, we collected 453 (N at a within-level) daily points.

**Findings:** Results showed that individuals experienced more flow on the days when they used several crafting strategies, such as playful design, change barriers and facilitators, and proactive vitality management. Flow experience was positively related to intrinsic motivation, but not related to extrinsic motivation. In addition, we found that one proactive strategy playful design was positively related to the intrinsic motivation for the next time. Moreover, social support played a moderating role on the effect of crafting strategy on flow.

**Discussion:** This study provides theoretical and practical implications. We add to the literature by linking crafting strategy with extrinsic and intrinsic motivation, and propose a theoretical model about how individuals can create more intrinsic motivation by themselves. We offer concrete behavioral strategies that individuals can rely on to acquire more rewarding experience from physical activity. The rewarding experience will be beneficial for them to generate intrinsic motivation, which is essential for long-term health behavioral maintenance.

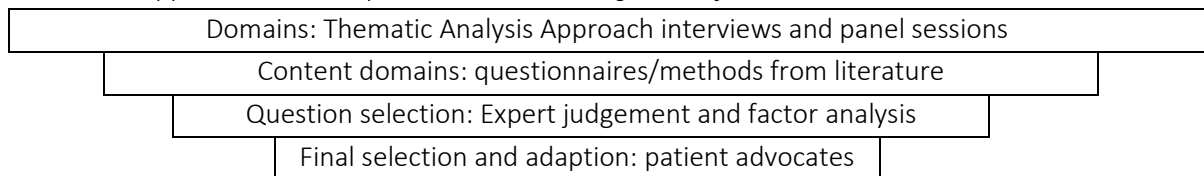
## Monitoring of Cancer-Related Fatigue After Breast Cancer in Daily-Life: From Development Towards Implementation

Kim A.E. Wijlens, Lian Beenhakker, Annemieke Witteveen, Sabine Siesling, Miriam M.R. Vollenbroek-Hutten & Christina Bode

**Background:** Due to rising incidence and survival, there is a growing group of women who experience long-term effects of breast cancer and its treatment. Cancer-related fatigue (CRF) is one of the most experienced long-term effects but is still underreported by patients resulting in unmet care needs and suboptimal daily functioning. A solution is empowering patients with a more holistic view on CRF, helping them to better understand the impact on their daily functioning. A holistic patient profile makes personalizing care possible, finally aiming for higher satisfaction, adherence and treatment effects, and subsequently also increased quality of life. Therefore, the aims of our studies were 1) to determine relevant domains of the holistic patient profile, 2) to develop a holistic monitoring toolkit that enables personal treatment advice for CRF, 3) to assess usability of the toolkit, and 4) to test its feasibility in daily-life.

**Methods:** First, semi-structured online interviews with fourteen healthcare professionals from different disciplines working with cancer patients and four group interviews with 27 breast cancer patients were held from four clinical institutions (Helen Dowling Institute [HDI], Roessingh Rehabilitation Centre, University Medical Center Groningen [UMCG], and “Ziekenhuisgroep Twente” [ZGT]). The toolkit was developed with a funnel approach using different sources and informants (see Table 1).

Table 1. Funnel approach to develop a holistic monitoring toolkit for CRF.



Usability was assessed with a thinking-aloud method with ten breast cancer patients from the ZGT (using Twente Intervention and Interaction Machine [TIIM], on a smartphone). Regarding the feasibility, nineteen breast cancer patients from four institutes filled in the toolkit bi-weekly for a month using TIIM and 58% participated in a focus group about user experience.

**Findings:** Based on the (group) interviews with patients and professionals, the relevant identified domains were CRF dimensions (physical, cognitive, and emotional), social participation (social, relational, and work), day pattern (including activity and sleep), and coping style. As results of the funnel approach, the toolkit consists of a selection of questions. The toolkit starts with onboarding questions and is linked to deepening questions for relevant domains. The usability study indicated the toolkit was easy to use by 90% of the patients. During the feasibility study, it appeared challenging for patients to use TIIM bi-weekly for a month as the mean duration was 45 days, and 16% dropped out.

**Discussion:** A toolkit should contain information about CRF, social participation, day pattern and coping style. The proposed toolkit is usable but its feasible needs improvement. Suggested improvements were an introduction page, reminders for new questionnaires, and remembering of login details. The toolkit information will serve as input for decision rules to generate a personalized CRF treatment advise. Moreover, we aim to implement the toolkit into a personal health environment to enable patients to share this information with their healthcare professional.

## PREFERENCES OF BREAST CANCER PATIENTS RELATED TO ATTRIBUTES OF EHEALTH INTERVENTIONS FOR CANCER-RELATED FATIGUE

Lian Beenhakker, Merel D.M. Brughuis, Kim A.E. Wijlens, Christina Bode, Sabine Siesling, Miriam M.R. Vollenbroek-Hutten, Annemieke Witteveen & Janine A. van Til

**Background:** Cancer-related fatigue (CRF) is one of the long-term effects after diagnosis and treatment of breast cancer. There are many (proven effective) interventions to help patients with CRF. Adherence to or effectiveness of these interventions might increase if interventions are advised based on personal characteristics and preferences of patients. Interventions differ from each other on various attributes like duration, intensity and contact with healthcare professional and these are aspects that patients might have preferences for. A first step in personalization of treatment advice is to identify breast cancer patients' preferences and therefore the aims of this study were to 1) test a survey on preferences and 2) get a first idea of similarities and differences in preferences.

**Methods:** Eight attributes of existing eHealth interventions were included in the first setup of the survey. Per attribute, a varying number of levels (potential outcomes within an attribute) were determined. The attributes and their number of levels were duration (6 to 26 weeks, 5 levels), intensity (daily to monthly, 5 levels), costs (2 levels), contact during intervention (3 levels), anonymity (2 levels), proven effectiveness (2 levels), language (4 levels) and type of intervention (2 levels). The analytic hierarchy process (AHP) and a simple ranking technique were used to estimate the importance of the attributes and the preferences for the level within each attribute. In AHP, all attributes were pairwise compared (eight attributes, 28 comparisons) and for each pair, participants were asked which of the two attributes was most important to them. The comparison scale had 9 levels ranging from attribute "A" being most important to attribute "B" being most important, with the possibility finding both equally important. The simple ranking technique was used to list preferences for the levels per attribute. The survey was pilot tested in six breast cancer patients. For each participant, consistency indices (CI) were calculated to determine if participants were consistent in their choices for the AHP questions ( $CI < 0.1$ ). Between participants, choices were compared on similarities and differences.

**Findings:** The consistency analyses showed that most participants were inconsistent ( $CI > 0.25$ ). Analysis of the relative importance of attributes indicated large variation between individuals. For instance, one patient attached most importance to the effectiveness of the intervention, whereas another attached most importance to its costs. In terms of preferences for levels, all wanted to have a Dutch intervention, in line with their mother tongue, and almost all (5/6, 83%) preferred to have no costs.

**Discussion:** With our pilot study, we showed that, already in this small group, preferences varied between individuals. This supports the need to personalize intervention advice to patient preferences. However, the consistency analyses showed that patients were inconsistent in their answers. Therefore, as a subsequent step, the questionnaire needs to be improved before distributed to a larger participant group. Due to the inconsistency with AHP, a simpler method is necessary, ideally one that also shortens the survey. Additionally, less attributes and/or less levels per attribute are needed to make it simpler for participants and thus easier to fill in.

## Virtual Reality at Home for Chronic Pain treatment: A Single Case Experimental Design Study

Syl Slatman, Lieke Heesink & Monique Tabak

**Background:** Chronic musculoskeletal pain (CMP) is a major health problem and prevalent in approximately 20% of adults. Recently, Virtual Reality (VR) has been introduced as possible (adjunct) treatment modality for patients with CMP. However, a lot is still unknown about working mechanisms of such VR treatments for patients with CMP, and how it can contribute to treatment outcomes. In this study, VR has been applied at home for patients that are on a waiting list for pain treatment. This pre-treatment might alter attitudes and beliefs about CMP (e.g. pain acceptance and self-efficacy), which possibly influences both pain interference and intensity in time. This study aimed to gain insight in the relationships between pain-related variables using a single-case experimental design (SCED) study.

**Methods:** This study applied a SCED to a four-week, at-home, VR treatment for patients with CMP (n=16) that were on a waiting list for pain treatment. This four-week period was preceded and succeeded by one week without treatment, for baseline and post-treatment measurements. The used VR application, Reducept, offers pain education and pain management techniques. Outcome measures for this study included daily questions about pain-related variables (i.e. pain intensity, pain interference, physical and emotional functioning), weekly questionnaires about pain-related variables (pain self-efficacy, pain coping and pain acceptance) and objectively measured biometric data (i.e. physical activity, sleep quality and stress). Outcome variables will be analyzed visually and statistically on an individual level to gain insight in the relationships between pain-related variables.

**Findings:** Ethical approval was obtained from the University of Twente (RP 2022-174) and local ethics committees of the participating healthcare organizations. This study is currently in progress and results are expected well before June 2023 to be presented.

**Discussion:** This study uses a novel study design, integrates both objective and subjective outcome measures and applies VR in the home environment. This way, the results of this study are expected to provide insights in the relationships between pain-related variables during VR treatment at home, before patients with CMP start with their treatment.

## Serious Gaming to Educate Healthcare Professionals: Facilitators & Barriers for Prevention, Positive Health, & Collaboration

Nils Keesmekers, Dennis de Ruijter, Ien van de Goor, Pim Assendelft & Stef Kremers

**Background:** Existing post-initial education for primary care professionals (PCP) in the Netherlands traditionally focuses on prevention, Positive Health, or interdisciplinary collaboration as separate topics. Given that prevention and interdisciplinary collaboration are integral components of Positive Health, a similarly integral approach to education is proposed to further the currently limited implementation of these topics. This study aims to identify barriers and facilitators for the implementation of prevention, Positive Health, and interdisciplinary collaboration as experienced by PCP in the Netherlands, to be used in the development of a serious game as activating, integral and interdisciplinary education for Dutch PCP.

**Methods:** 23 semi-structured interviews were performed with various PCP in an online setting. Snowball sampling resulted in a varied sample of professionals working in the South of the Netherlands including, among others, general practitioners, social workers, dieticians, physiotherapists, lifestyle coaches and a speech therapist. The following themes were discussed: familiarity with Positive Health, implementation of Positive Health and health promotion, collaboration with other healthcare professionals, and participation in and preferences for post-initial education programmes. Interviews will be transcribed and coded to allow for thematic analysis, which will provide an overview of barriers and facilitators for each of the themes that was discussed.

**(Preliminary) findings:** For prevention, participants reported low perceived investment (of time and finances) in association to increased motivation for its implementation. The perceived status of prevention, however, which has been described as less “cool” or interesting compared to other (surgical) interventions among professionals in the medical field, posed a barrier.

The implementation of Positive Health was reportedly facilitated by repeated exposure to and subsequent familiarity with its components, such as “the alternative dialogue”. On the other hand, healthcare recipients’ perceptions that PCP are responsible for solving their health problems were mentioned to pose a barrier to the implementation of Positive Health.

For interdisciplinary collaboration, participants reported that knowledge and understanding about each other’s field of work was linked to fruitful collaboration between PCP. A lack of face-to-face contact and cultural differences between professions and organisations were reported to be barriers for its implementation.

**Discussion:** Distinct barriers and facilitating factors were identified for the implementation of prevention, Positive Health and interdisciplinary collaboration in Dutch healthcare. Within these implementation topics, however, similar experiences are reported by a varied sample of PCP. These findings suggest that universal education targeting this common ground could indeed connect multiple disciplines within primary care. The currently identified barriers and facilitators can be translated into behavioural determinants which allow the selection of persuasive technologies and practical applications for behaviour change. These technologies and applications in turn can be integrated into education that is both theory- and evidence-based. Furthermore, the use of serious gaming as an informal type of education provides a possibility to develop an activating and less time-intensive form of interdisciplinary education to support PCP in implementing prevention, Positive Health, and interdisciplinary collaboration.

## Engaging with eCHANGE - Users' Experiences with an App-based Weight Loss Maintenance Intervention: A Pilot-Trial

Asbjørnsen, R.A., Børøsd, E., Hjelmesæth, J., Smedsrød, M.L., Ollivier, M., Wentzel, J., van Gemert-Pijnen, J.E. & Solberg Nes, L.

**Background:** To adopt sustainable behavior changes to maintain weight after weight loss is challenging. Persuasive system design principles and behavior change techniques can be translated into design features of digital interventions to motivate, engage and support behavior change maintenance. This study evaluates how the design features are experienced by the users in daily life, to understand engagement and optimize effectiveness of the intervention.

**Methods:** A 3-month multi-site pilot-trial (i.e., ClinicalTrials.gov: NCT04537988) was conducted with 60 participants (i.e., adults with obesity, BMI  $\geq 30$  kg/m<sup>2</sup>) after weight loss (i.e.,  $\geq 8\%$ ). User experiences with the design features was assessed by semi-structured interviews (n=15) and intervention engagement by a 9-item questionnaire (i.e., the TWente Engagement with Ehealth Technologies Scale (TWEETS)).

**Findings:** Preliminary analyses identify user experiences and preferences related to incorporated design features. Features facilitating self-regulation of behavior, habit formation, knowledge and skills, and tailored feedback (e.g., reminders, suggestions, praise) were highlighted as useful to support behavior change maintenance to prevent weight regain. Technology engagement measures indicate that the users experienced the eCHANGE-app as easy to use, joyful and helpful to get insight into behaviors to maintain weight.

**Discussion:** This pilot-study shows the importance of performing real-life studies as part of the development process to improve and optimize digital behavior change interventions. The findings can contribute to development and evaluation of digital interventions aiming to support sustained behavior change to maintain weight loss long-term.

## Detection of Lifestyle Changes in Physical Activity, Stress, And Sleep With a Wearable Sensor

Carlijn I.R. Braem, Utku S. Yavuz, Hermie J. Hermens & Peter H. Veltink

**Background:** A healthy lifestyle that encompasses physical activity, sleep, and stress improves the quality of life and prevents the onset of chronic diseases. Improving lifestyle behaviour can be challenging and should be assisted by monitoring important lifestyle metrics and eHealth coaching based on these metrics. In this study, we estimate changes in physical activity, stress, and sleep during a combined lifestyle intervention (CLI) using wearable sensor signals. A data analysis pipeline is necessary to extract lifestyle metrics from the raw wearable sensor signals.

**Methods:** In an observational longitudinal study lifestyle data is acquired in subjects approved for 'Coaching on Lifestyle' (Cool) CLI in the Netherlands. The subjects are measured at intake, two weeks after the first meeting of CLI, and at the end of the main program of CLI at 8 months. These measurements are 1 to 2 weeks of continuous monitoring with a Imed Chill+ wristband, ecological momentary assessments (EMA) and validated questionnaires at the end of the measurement period assessing food intake (DHD-FFQ), sleep quality (PSQI), stress(PSS), physical activity (IPAQ) and quality of life (SF-36). The Imed Chill+ wristband includes an inertial sensor (IMU), photoplethysmography (PPG) and electro dermal activity(EDA)sensor. A processing pipeline to process raw signals to obtain lifestyle features is developed in a preliminary study with 3 healthy subjects, which included continuous monitoring for 2 weeks with the Empatica E4 and EMA. The raw data streams are filtered, whereafter it is windowed to obtain quality indicators. Windows with good quality data can be used to extract physical activity, stress, and sleep features.

**Findings:** According to the preliminary findings, subjects participated in the pilot study with sufficient adherence. The EMA were filled in 78.6% of time, of which in 10.1% of the cases they self-reported to be very to extremely stressed in the past hour. Quality of the data varied between the sensors. We found that the PPG had the lowest quality, where only 37.8% of the data was suitable for feature extraction. Skin conductance was valid 99.1% of the time. Quality indicators for the IMU signal need to be implemented. Currently, we are acquiring data from larger population who participate in the CLI program. We will further investigate the effect of CLI on lifestyle metrics using this data. Inclusion started in February 2023.

**Discussion:** The findings show that EMA and wearable sensor measurements during the CLI are feasible. A processing pipeline is being developed using data of healthy subjects. The pre-processing of the EDA sensor seems sufficient but needs to be improved for the PPG signal to obtain more good quality data for feature extraction. Next to that and a quality indicator for IMU signal is needed. Eventually, the analysis of more study subjects should show whether changes in lifestyle are measurable with a wearable sensor.



## Identifying Affective States in Daily Life in Adults With Personality Disorders Using Hidden Markov Modelling

Jory Schoondermark, Muriel Hagedaars, Emmeke Aarts, Alireza Khanshan, Pieter van Gorp & Barbara Montagne

**Background:** Emotion regulation is a central problem in personality disorders. Insight in its dynamics is therefore crucial for treatment. Traditional assessment methods are prone to biases in capturing affective states. In this study, modern technology (wearables) was used to collect ESM data in order to identify and visualize affective states and typical state-transitions in patients with personality disorders.

**Design:** A longitudinal study with high-frequency Experience Sampling measurements was conducted.

**Methods:** Participants were 30 patients with (severe) personality disorders. Longitudinal data were collected on a smartwatch over a three-week period including self-report scores for valence, arousal and crisis. Also, heart rate was measured. Data were analyzed using a multilevel hidden Markov model. Bayesian estimation was used to explore the clustering of observations into latent or hidden affective states over time, and the dynamics between these affective states over time within patients.

**Findings:** Three affective states can be distinguished: “good” as characterized by high valence, low arousal and low crisis; ‘intermediate’ as characterized by a moderate arousal and valence score and some crisis; ‘bad’ as characterized by a low valence, high arousal and more crisis. Heart rate did not contribute in distinguishing these states. Individual differences were observed in the probability of switching between states and the duration of an affective state.

**Discussion:** By high frequency measurement in patients with personality disorders, three affective states were distinguished by self-report measurements while physiological measurements added nothing. In addition to patterns at the group level, it is worth paying attention to individual patterns due to the variation in the course of affective states during the day. Getting to know the personal ‘road map’ of patterns in affective states in individual patients with a personality disorder, can contribute to the recognition of (impending) crisis and recovery.

## Design Thinking: Inspiring Professionals to Reflect And Discuss Implementation of Technology in Daily Work Practice

Loes Bulle-Smid, Fenne Verhoeven, Gido Hakvoort & Marike Hettinga

**Background:** Design Thinking (DT) is a problem-solving approach that centers around users' needs and can be used for developing healthcare technology. Less known is that it is an excellent method to foster technology implementation. In this study, we illustrate the latter by two projects in which health care professionals were supported in both development and implementation of healthcare technology in their daily practice by applying practical DT-tools.

**Methods:** During two research projects in 2020, health care professionals (N=4) and patients (N=4) participated in a DT-process. Whereas the first project focused on developing practical tools for health care professionals for implementing telemonitoring in daily hospital care, the second project concerned supporting implementation of Virtual Reality (VR) in a rehabilitation setting.

The first research project was conducted together with nurses and included three steps: (1) Eight co-creation sessions where we used walking interviews, a customer journey map (CJM), diary keeping, context mapping, and affinity diagram. (2) Collected data was analyzed and in an iterative process discussed with the nurses. Concurrently, four patients were interviewed to develop patient case reports. Based on this data, we developed templates, cases, and patient experiences. (3) Results were presented, tested, adapted, and eventually approved by the nurses.

In the second research project, a CJM was developed together with an occupational therapist, a treatment team, and a physician in eight consecutive interviews and co-creation sessions. The CJM was used to visualize the potential use of VR for mirror therapy and served as a conversation tool for the treatment team to optimize the use of VR and create support within the organization.

**Findings:** Using DT resulted in a website ([www.verpleegkundigehartzorgopafstand.nl](http://www.verpleegkundigehartzorgopafstand.nl)) for the telemonitoring project, describing both DT-tools and best practices for using them. More importantly, DT made health care professionals change their perspective on their daily practice. In addition, they were enthusiastic throughout every session and were inspired to use these sessions as input for discussion within their teams for reflection and intervention. For the VR in rehabilitation project, a CJM was delivered, containing both the current and desired situation. Creating a CJM led to engagement, involvement and participation of the entire treatment team. Team members collaborated in the development of the CJM and discussed the possibilities for their desired practice. Therefore, developing a CJM appeared not only to be a tool to gain insights into the care process and conditions, but also an excellent way to involve health care professionals and increase support for implementation. Furthermore in this project, the tools and results inspired the professionals to initiate conversations about the care process and choices made independently by the health care professionals.

**Discussion:** The described projects emphasize the benefits of involving both professionals and patients using a DT-approach. In addition, DT-tools inspire professionals to reflect and discuss their daily practice and possibilities for implementation. Although patients were included in the first case, an interesting next step would be to further develop methods combining the professional and patient perspective and study their impact/added value.

## Adolescents' Perceptions on Barriers and Facilitators of Physical Activity Maintenance: Diversity and Dynamics

Timothy Houtman, Amy van Grieken, Froukje Sleeswijk Visser & Valentijn Visch

**Background:** Improving physical activity (PA) among adolescents poses significant obstacles to behavioral interventions. Although (digital) interventions have demonstrated success in promoting PA, the results are often not maintained over time. Adolescents in particular seem harder to influence due to peer influences and dynamic priorities and goals associated with this developmental period. To address this issue, personalization has been proposed as a strategy for enhancing the effectiveness and longevity of PA interventions. The aim of this study is to understand the diversity and dynamic experiences of adolescents in relation to the barriers and facilitators of maintained PA. This study is a step in moving beyond one-size-fits-all interventions towards more tailored approaches.

**Methods:** Thirty high school students, aged 13 – 18, were recruited for interviews in Rotterdam, The Netherlands. Based on Q methodology, participants were asked to sort and rank two decks of cards according to personal relevance for a physical activity that they had maintained for a longer period of time. Each deck represented barriers or facilitators of adolescent PA behavior, based on previous interviews and systematic reviews. After ranking the items, participants were interviewed about how their experience of barriers and facilitators influencing their PA behavior changed over time. Next to thematic analysis of the interviews, the ranked items were analyzed using inverted factor analysis to explore clusters of barriers and facilitators.

**Findings:** Our results show that adolescents have common and divergent barriers and facilitators to maintain their PA behavior. For example, 'having fun', 'being able to be yourself' are recurring facilitators, while life factors such as 'other responsibilities', 'having too many things on my mind' were recurring barriers in the sample. Using inverted factor analysis, we also explore the variety of barriers and facilitators of PA and found 6 facilitator clusters and 4 barrier clusters. The clusters were distinct and focus on different domains such as achievement, social environment, personal development, and health reasons. Furthermore, the majority of the participants indicated that barriers and facilitators had changed over time. Where PA used to be more about more about having fun and the social environment, the regulation of physical and psychological well-being became more significant facilitators in the present. For barriers, not feeling like doing PA due to not feeling well or laziness used to be more important whereas in the present, barriers were more related to having less time and more responsibilities.

**Discussion:** The findings show that some barriers and facilitators for maintaining PA are more universal between adolescents, but others are only relevant to specific groups. Understanding differences and dynamics of underlying barriers and facilitators of PA maintenance, can be used to design personalized PA interventions. For example, the distinct clusters of barriers and facilitators can inform personalized behavior change strategies which are more personally relevant to the user. Moreover, it is important to consider that barriers and facilitators change over time. Personalization of PA interventions should be a continual process in which the user's perspective is used to maintain a high level of personal relevancy.

## Medical Device Regulation and Applied Science in Health Technology: Why It Concerns Us All

Sander Holterman, Gido Hakvoort & Marike Hettinga

**Background:** The Medical Device Regulation (MDR) came into effect in May 2021. Compared to its predecessor (the Medical Device Directive), the scope and definition of software has been expanded, and medical software often falls into a higher risk classification. For developers of health technology, healthcare organisations, research institutes, and education this has a major, often underestimated, impact. The MDR sets high standards for safety and efficiency of medical devices.

We investigated the impact of the MDR on an ongoing project, in which Virtual Reality (VR) applications are developed for rehabilitation care. In this abstract we share our lessons learned that also apply to health technology research and development.

**Methods:** To assess the impact of the MDR for our project, we did desk research, consulted experts, and joined a national taskforce of MDR experts. For the desk research we examined the European Regulation including the guidance documents, reports, eBooks, and online available tools. The experts consulted were developers of medical devices, researchers, lawyers, and policy officers of knowledge institutions and healthcare organisations.

**Findings:** Within our project, the VR-applications are intended to be used for treatment of individual patients, and therefore fall within the scope of the MDR. As a result, these applications should be seen as medical device software, and most likely fall within risk classification 2a. The used VR-headset itself is commercially available technology and not considered a medical device. Overall, we underestimated the impact of the MDR on our project and therefore several improvement actions were required.

There is abundant documentation available, such as legal texts, guidelines, reports, templates, and tools that require at least a basic understanding of legislation, clinical research, and international standards. Moreover, the MDR is adjacent with other European legislation such as the General Data Protection Regulation, Cybersecurity Act and in some cases the (proposed) Artificial Intelligence Act. Going through the full process to adhere to the MDR to become CE-certified is a timely and costly manner and for new parties difficult to handle.

**Discussion:** Based on our discussions with various stakeholders and MDR experts we conclude that educational and research institutions, companies, and healthcare organisations still have a lot to learn about the MDR and how to apply it accordingly. The risk of not working MDR-compliant might lead to delays and additional expenditures because of necessary product redesign or repeating test procedures, not receiving the CE-mark from notified bodies, or measures from the Health Inspection after being audited.

Regardless of extensive documentation, there is ambiguity when it concerns new technologies such as VR or Artificial Intelligence. There still is a limited number of CE-certified medical software applications, and certifying agencies lack experience in assessing new technologies. There is not always an unequivocal answer to the question whether and how parts of the MDR apply.

In a future project, we will work on raising awareness and improving knowledge of the MDR among SME's, knowledge institutions and healthcare organisations so that they can make better use of existing tools and guidelines and keep innovating health technology.

## XR-Technology: from Commercial Release to Research Topic in Acquired Brain Injury Rehabilitation

Wouter Keuning, Loes Bulle-Smid, Renée van den Heuvel, Gido Hakvoort, Mariëlle Zwaga, Coen Kriknie & Marike Hettinga

**Background:** Acquired brain injury (ABI) is one of the major causes of disability within adults worldwide. It covers any type of brain damage occurring after birth resulting in physical and/or cognitive difficulties. In most cases some type of rehabilitation is prescribed depending on symptoms and severity of the acquired brain damage. To support patients and therapists during rehabilitation the application of technologies such as robotics, wearables, but also extended reality (XR) have been studied as part of interventions. Since both patients and therapists see the added value of XR for ABI rehabilitation the question arises to what extent XR can be utilized for patients with ABI. To gain insight into this question we conducted a scoping review (published elsewhere) on the use of XR in rehabilitation for patients with ABI. In this abstract we focus on some secondary results of this scoping review: the uptake of XR-technology in ABI rehabilitation research. How long does it take for new XR-technologies to be used in acquired brain injury (ABI) rehabilitation research?

**Methods:** For the scoping review we followed Arksey and O'Malley's methodological framework, searched databases on healthcare (PubMed, CINAHL, Cochrane, Embase) and technology (IEEE Xplore), and limited our results to articles published after 2009. Publications were selected by three researchers in three phases: 1) screening of titles, 2) screening of abstracts, and 3) screening of full-text. At the start of each phase reviewers screened 100, 50 and 5 random articles respectively and discussed differences to reach consensus on exclusion criteria and used definitions. All remaining items were divided among the researchers and were screened individually.

**Findings:** The initial search resulted in 6243 articles from PubMed (1391), CINAHL (1820), Cochrane (38), Embase (2498) and IEEE Xplore (496). After removing duplicates 4180 articles were screened leaving a total of 75 articles on XR in ABI rehabilitation research. Virtual reality was studied most (70), followed by augmented reality (5), and non on mixed reality. We identified 20 different XR-devices, of which the HTC Vive (21) was most used, followed by the Oculus Rift (18). The number of years between XR-technologies appearing in articles and their commercial release date had a median of 3 (SD=2). Most common user interfaces are controllers (16), followed by Leap Motion (8), and Kinect (2).

**Discussion:** Uptake of new XR-technologies within ABI rehabilitation research takes place rapidly and as early as within a year. A steep increase in publications from 2016 suggests that considerable experience has been gained in developing XR applications supporting this rapid uptake. Since ABI rehabilitation often involves movement exercises, being able to track movement is a critical component. Although controllers are widely used, contactless interactions appear to be another important factor. As new XR-devices support tracking of limb movement we expect a decline in the use of additional user interfaces. Finally, the use of AR-technologies seems to be lagging behind. However, with experiences gained from VR-interventions, which lessons learned apply to AR-interventions might be an interesting focus for future research to speed-up uptake of XR-technologies for ABI.

## Towards Responsible Use of Decision-Support Systems in Dementia Care: A Qualitative Study on Caregivers' Perspectives

Dirk, R.M. Lukkien, Sima Ipakchian Askari, Nathalie, E. Stolwijk, Bob, M. Hofstede & Henk Herman Nap

**Background:** In the long-term care for older people, clinical decision-making is increasingly being augmented by digital technologies that are driven by artificial intelligence (AI). For instance, decision support systems (DSSs) can support caregivers by acquiring relevant data about care needs or processes, and translating relevant data into actionable information such as alerts, risk calculations or recommendations about care strategies. Importantly, the development and deployment of increasingly advanced DSSs in LTC not only comes with promises such as better and more efficient decision-making, but also with risks related to e.g., undermining people's privacy, autonomy and self-determination, and discrimination and stigmatization of old age. In this line, recent years have seen a growing prevalence of high-level guidelines and principles for responsible design and use of AI. However, far less attention has been paid to the translation and application to the development and deployment of DSSs for dementia care. Therefore, this study explores the views of caregivers on responsible innovation in DSSs in dementia care.

**Methods:** Twenty-four semi-structured interviews were conducted with a variety of caregivers of people with dementia, including homecare and quality nurses, case managers dementia, specialists elderly care, data analysts, and care centralists. The interviews were conducted within the HAAL project, which is part of the European Active and Assisted Living (AAL) programme. In HAAL, a DSS is being developed that is intended to provide actionable information to formal caregivers of people with dementia. In the interviews, two scenarios about the HAAL-DSS were used to inspire respondents about the possibilities of DSSs, before discussing their needs and requirements. Also, six AI ethics principles from the World Health Organization were used as a starting point for exploring respondents' views on potential implications of DSSs in dementia care, and strategies to address them. A thematic analysis was performed on all interview data to uncover conditions the responsible design, implementation and use of AI-based DSSs in the context of dementia care.

**Findings:** Various interrelated and overarching themes will be discussed, representing conditions for the responsible design, implementation and use of DSSs in dementia care. The conditions relate to a broad group of stakeholders, including developers, users (i.e., caregivers) and educators.

**Discussion:** Responsible innovation in AI-based DSSs is a balancing act. Using AI can be framed as a way to support RI, as it can help translating datasets into actionable insights thereby e.g., preventing information overload, and because it can unfold human blind spots and contribute to early prevention. At the same time, there are limitations to the role of AI in DSSs due to e.g., the complexity of dementia care and potential opacity of AI-outcomes. The responsible use of DSSs requires a major change management approach within care practice in order to empower caregivers to use AI as a support, while remaining in charge as a human. Given that this research merely addresses the wishes and needs of caregivers, future research could aim at providing insight into the practical feasibility and application of the identified conditions for RI in DSSs.

## Cyclic Evaluation and Optimization of Digital Health Interventions

Gido Metz, Rosa Thielmann, Hanneke Roosjen, Sarah Stutterheim & Rik Crutzen

**Background:** In 2020-2022, we evaluated and optimized the Chlamydia page of the sexual health intervention Sense.info. A newly developed cyclic evaluation process was used, triangulating a theoretical analysis of intended use, an analysis of actual use, and a further investigation of user perspectives with a think-aloud study. This was followed by an optimization phase, in which we developed and posted role model stories on the Chlamydia page to raise self-efficacy and skills regarding Chlamydia preventive behaviors. We then re-evaluated the Chlamydia page to assess the impact of the newly added stories. This presentation reflects on the results of this final evaluation and on the use of the cyclic evaluation process.

**Methods:** Evaluation of systematically developed role model stories with web-analytics and a think-aloud study. Participants were recruited via a banner on Sense.info and purposively selected based on demographic characteristics (N=20, Mage=19.7, SD= 2.65). Template analysis was used to interpret the data.

**Findings:** Participants expressed that the stories contributed to normalization, enhanced self-efficacy and skills, and led to an intention to engage in preventive behaviors. Regarding the conditions for effectiveness of the behavior change principle Modeling, identification with the role model differed per participant and story. Some participants indicated that the stories were too positive. Web-analytics revealed that all role model stories were noticed and clicked on by visitors. On average, the time spent on each story page was around 1 minute. Bounce and exit rates were relatively low.

**Discussion:** The personal stories seemed to effectively engage end-users and motivate them to adopt chlamydia prevention strategies. However, a balance needs to be struck between adhering to theoretical conditions and needs from the end-users. In terms of methodology, we concluded that the cyclic evaluation process offered useful insights in the potential impact of digital health interventions and might be beneficial across domains and media. In a following project, we will use the cyclic evaluation process to develop, evaluate, and optimize a TikTok social media campaign on sexual health.

## Self-Rated Health Linked to More Exercise, but not Sitting Time; Objective Monitoring in Public Health

Willemieke Ligtenberg, Simone Theresa Boerema & Caroline Dekkers

**Background:** This study aimed to investigate the relationship between subjective and objective measures of physical activity and sedentary behaviour, and perceived health in adults. Additionally it explores the added value of wearables in Public Health Monitoring by Public Health Services (GGDs) in the Netherlands.

**Methods:** A pilot study was conducted by GGD Twente and GGD Haaglanden in the spring of 2021. Adults were invited to take part in the Gezondheidsmonitor Volwassenen & Ouderen 2020 and the Twente GGD Panel, respectively, and were asked to complete a short online screening questionnaire. This included questions about background characteristics, perceived health and subjective physical activity and sedentary behaviour. At the end, participants were asked if they would be willing to wear an activity monitor for one week. 441 participants were then selected based on gender, age and physical activity level, and those who agreed to wear the activity monitor were provided with an ActivPal device. The device was worn on the thigh and recorded physical activity and sedentary behaviour.

**Findings:** 6,859 and 5,514 people were invited to participate in study in Haaglanden and Twente respectively. Of these, 441 were sent a physical activity monitor, and 91% (402) of them wore the device for more than 4 days. 107 participants who wore the device for less than 4 days were excluded from further analysis.

The percentage of participants who took  $\geq 10,000$  steps/day was significantly higher among participants with good perceived health (54%) than among participants with poor perceived health (30%). Also, participants with good perceived health were more likely to meet the exercise guideline than those with poor perceived health (60% vs. 39%). This suggests that participants with good perceived health are more physically active than those with poor perceived health; for both the objectively measured and self-reported physical activity. However, the percentage of participants who sat for long periods (objectively  $\geq 8$  hours/day) did not differ significantly between those with good (81%) and poor (83%) perceived health. The same was true for the percentage of participants who subjectively reported sitting  $\geq 8$  hours/day (good perceived health: 47%, poor perceived health: 50%). These results suggest that sitting behavior is independent of perceived health. Moreover, there was no significant relationship between objective and subjective sitting behavior (adjusted for age and gender). This suggests that the agreement between subjective and objective sitting behavior is limited: participants often misjudged their own sitting behavior.

**Discussion:** The results showed that people with good perceived health moved more than those with poor perceived health, while spending the same amount of time sitting. It also showed that sitting behavior is largely underestimated. This suggests that in studies on the relationship between sedentary behavior and health measures, the actual relationship is probably underestimated. The Health Monitors of GGDs would be a good opportunity to gain more insight into these relationships in the Netherlands, given the comprehensiveness of the health questionnaire and the size of the population. In addition, more joint research by GGDs and universities on these datasets could provide more in-depth insights.



## Access to Health Care is a Human Right: A Focus Group Study in COPD Patients Regarding eHealth Accessibility

Esther Metting

**Background:** Digital health becomes increasingly important and can improve health outcomes. Over the past decades new technologies have been developed and embraced that are of interest for patients and healthcare professionals. Examples are Bluetooth measuring devices, wearables, VR glasses and more. Moreover, large electronic patient records are an excellent basis for the development of prediction models that can be used in future healthcare applications. Electronic health applications are also called eHealth. E-health is important because it can help to address healthcare challenges such as shortness of staff, high workload increasing number of chronic patients. Unfortunately, 4 million Dutch citizens are not digital literate and therefore have difficulties in using eHealth.

**Aim:** It is unknown, why people are not digital literate. In this study, we will explore barriers and facilitators of COPD patients regarding e-health, so that this information can be used by future developers and policymakers to let a larger group of patients profit from the benefits of e-health.

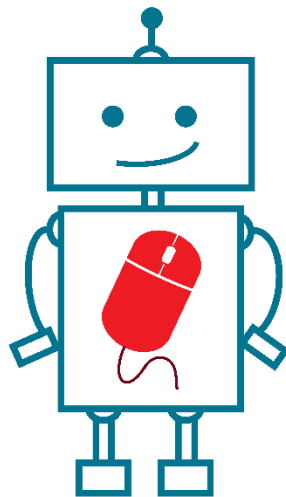
**Methodology:** In 2 focus groups, we spoke with COPD patients (n=13) about their experiences, with technology, possible, barriers, preferred health, applications, and facilitating factors.

**Results:** Some patients used an eHealth self management application, or accessed their electronic patient record. the focus groups showed that there are different barriers that patient can face such as fear of losing face-to-face contact, lack of basic technology, knowledge, (e.g. not knowing that a WebCam is needed to have an online consultation), medical information is too complex, difficulties remembering instructions about how to use technology. The social environment, plays an essential role in facilitating access to technology. All patients who use some type of technology needed help from a spouse, family or friends.

**Conclusion:** Although all patients in the focus groups has access to Internet at home, most of them faced severe difficulties in using technology. The barriers of patients discovered in the study can be used by policymakers to improve access to digital care. In this way, healthcare remains accessible for all patients, including those with poor digital skills. At the conference I will present several anecdotes and stories from patients that emerged during the focus groups and will be of interest of healthcare professionals.

2023

Demonstrations



## A Personalized and Adaptive Music Player for People with Dementia

Rik Wesselink, Marike Hettinga, Geke Ludden & Berry Eggen

**Background:** An increasing number of studies show that music can have a positive impact on the quality of life of people with dementia (PWD). Unfortunately, PwD often lack access to music due to difficulties in product use and the loss of initiative that often results from cognitive decline. Within the project “Access to Music for People with Dementia” we explore how the design of smart technology can improve access to music for people with mild-moderate dementia living at home. As part of this project, we have developed high-fidelity prototypes.

In this project, we first explored the role of music in the daily lives of people with dementia who live at home. Secondly, we analysed related work that discusses design recommendations and principles in the context of dementia. In a third study, we proposed a new design principle that addresses loss of initiative, and we evaluated the ‘inviting music player’ we designed based on this new design principle and the insights from our previous work.

Currently, we are in the process of evaluating and updating a new – more adaptive – inviting behaviour of the music player in the homes of people with dementia.

**Description of the application/technology/concept:** The product we will demonstrate is a high-fidelity prototype of a music player for people with mild-moderate dementia. It plays online radio and Spotify playlists, which we personalize for each participant in our studies. In the design of the music player we aimed for a rich set of controls while keeping the product easy to use and understand for PwD.

The key feature of the music player is the adaptive inviting behaviour: the music player can invite PwD to play music using visual and auditory prompts that vary from subtle to apparent. The invitations are based on various nudging techniques. The parameters of invitations, such as the timing and the type of music, adapt to the participants over time based on previous interactions.

**Practical description of demo:** Conference visitors can try out the high-fidelity prototype of the music player. We will display previous models, explain our design iterations, and discuss how our design decisions link to related literature on design for dementia.

## Thubble – Interactive Customer Journey of On Demand Mental Healthcare Service

Fennie Wiepkema, Guido Williams & Nadine Köhle

**Background:** Recent research has shown disturbing figures about mental health in the Netherlands. Almost half of all people in the Netherlands will be confronted with emotional or mental health problems (e.g., anxiety, depression, stress) at some point in their lives. In 2022, at least a quarter of 18 to 75-year-olds suffered from a mental disorder. Effective treatments are available. Yet, the threshold to seek or access help is still high, for example due to long waiting lists in mental healthcare or because of stigma. At Thubble we try to reverse this trend so that mental health is just as self-evident as physical health in the long run.

**Description of the application/technology/concept:** Thubble was launched in 2019 with its roots in the Dimence Groep. In a start-up environment, a new treatment model for primary and secondary mental healthcare has been developed. We work remotely which enables us to be there for our clients when it matters the most to them. Our clients and therapists have intensive contact through various forms of communication during a defined period. Think of chat, video calls, motivating messages or via the online treatment platform which is available 24/7. We call this on-demand mental healthcare. Initial results of this newly developed approach are promising and preliminary results will also be presented at this conference.

**Practical description of demo:** Participants of this conference have the unique opportunity to get a glimpse of the interactive Thubble experience. A customer journey will guide them through all steps of Thubble's on demand treatment.

## Supporting Sensible Self-Testing for STIs and HIV by Self-Assessment Technologies

Koenraad Vermey, Erwin Fisser & Filippo Zimbile

**Background:** Self-testing for sexually transmitted infections (STIs) including HIV can improve the health and well-being of individuals and contribute to the public good. Benefits of self-testing and self-care include timelier diagnosis, better treatment outcomes, lower healthcare costs and a lower burden of care on general practitioners and municipal sexual health clinics. The market for self-care and self-diagnostics has grown, but the quality of care that is provided does not always suffice. Ill-informed self-testing can lead to both underdiagnosis as well as overdiagnosis and insufficient partner management. A selection procedure was implemented to select and refer to private self-care providers which offer good quality of care and work together with general practitioners and public sexual health clinics. In order to ensure individuals access the healthcare provider that is most suited in their situation, public health institutions in the Netherlands worked together to develop and launch the advice tool Soatestwijzer.nl. The aim of this advice tool is to ensure individuals make informed decisions when seeking STI/HIV testing and access sensible self-care of good quality to reduce the burden on public healthcare.

**Description of the application/technology/concept:** The tool generates tailored advices based on clinical guidelines. The questionnaire takes into account personal characteristics, sexual behavior, sexual risks and symptoms. A built-in chatbot answers free text questions from users. The advice explains which specific STIs need to be tested for following the clinical guidelines. The tool also refers to selected self-care providers which sell diagnostic and treatment services that are not covered by the Dutch healthcare insurance and reimbursement system. Providers are only eligible for referral if they meet quality criteria for information provision, professionals standards and care including treatment.

**Practical description of demo:** The demonstration shows each step of the software development process, how guidelines for Dutch general practitioners were transformed into a digital advice tool, following the principles and methods of privacy by design and decision modelling. It is shown how legislation to protect privacy and patient safety was taken into account in the development and lifecycle of the software. The demonstration highlights the architecture of the advice tool, which operates on open source and community edition software solutions, including Wordpress, Camunda and Mysql. The demonstration concludes with the preliminary results of a comparison between the advice tool Soatestwijzer.nl and ChatGPT. The audience is invited to join a discussion on the future of advice tools such as Soatestwijzer.nl in the context of current and future artificial intelligence and natural language solutions.

## The Design for Autonomy Toolbox

**Bard Wartena & Job van t Veer**

**Background:** NATALIE (Need Articulation Through Autonomy Loss In Elderly) is the name of a project under the ZonMW grant program CreateHealth (2018-2022). The project's main goal was the communication around needs through autonomy loss in people with early-stage dementia and their (in)formal caregivers. Through a Research-through-Design (RtD) approach, the project focused on understanding autonomy as the balance between the perception of patient autonomy (by (in)formal caregivers)) and the experience of personal autonomy (by the person with dementia) in person-centered care. The main knowledge-building block was a framework bridging these two perspectives through artifacts (man-made things, either material or digital objects). This led to a framework focused on designing for autonomy, specifically how to create a design rationale based on respecting autonomy in artifacts. To put the framework to a practical use for both the creative industry and healthcare professionals, a tangible toolbox was created.

**Description of the application/technology/concept:** The Design for Autonomy Toolbox consists of a card set of design principles, theoretical lenses, and pre-structured thinking steps that can be used to analyze an existing artifact. The toolbox consists of three canvas-formed methods; the Formal Analysis (a quick scan of an existing artifact on the underlying design choices in terms of supporting the autonomy of the PwD), the Design Critique (a more detailed analysis of the artifact in which the participants look at it through a scenario written from the perspectives of those involved in the client system to more specifically address imperfections in the design choices that affect the autonomy of the PwD) and the Wicked Circle (an ideation/prototyping method to - based on the earlier analyses - come to the improvement of design choices for the artifact in question).

**Practical description of demo:** The demo will allow people to play around with the different canvasses based on either their own artifacts or example cases (Timesteps & MyLableCare) from the project in which the toolbox was developed. The embodied interaction from the tangible "Autonomy Alignment Wheel", will enable participants to take the perspectives of both the Person with Dementia (PwD) and/or (in)formal caregivers in the autonomy experience in/from the artefacts. Discussion about the inner workings of the canvases and ramifications for the design rationale and choices of the artifacts, as well as other applications are encouraged.

## Challenges and Opportunities in Mobile Coaching

Elvis Vrolijk, Lucia Rabago Mayer, Jan-Willem van 't Klooster

**Background:** Mobile ehealth technologies provide tailored assessment, intervention and coaching capabilities for a range of usage scenarios. Thanks to their spread and adoption, smartphones are an important carrier for such applications.

**Problem:** However, the process of design, realisation, evaluation and implementation of e-health solutions is a wicked and challenging process, requiring multiple stakeholders and expertise.

**Method:** Over the last five years, we have developed and improved a tailorable intervention and interaction e-health solution, that allows rapid development and evaluation of e-health interventions on large scale. This app-based platform allows researchers and clinicians to develop ecological momentary assessment (EMA), just-in-time adaptive interventions (JITAI), ecological momentary intervention (EMI), cohort studies, e-coaching and personalised intervention piloting and implementation. More recently, vital sign monitoring is introduced.

**Results:** The Twente Intervention and Interaction Instrument (TIIM) has been used by over 1000 researchers in over 3000 studies. We present the ecosystem and synthesise main scientific output from clinical and research studies in different fields, focusing on the recent '3.0' redesign and vital sign monitoring additions.

We present and reveal the ecosystem and synthesise main scientific output from clinical and research studies in different studies, and detail the recent '3.0' redesign and vital sign monitoring additions.