



# Supporting Health by Technology

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Abstract Book

The sequence of abstracts is based on the first letter of name of the first author. It runs from Laurence Alpay to Anna Żukowicka-Surma.

# Adoption of ehealth for outpatient geriatric rehabilitation

## Authors

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## Abstract

### Background

Geriatric rehabilitation (GR) aims at recovery of functioning and participation of frail elderly. About 95% of GR concerns inpatient treatment. The use of eHealth may provide solutions for better recovery at home. In another inpatient rehabilitation setting eHealth has been successfully implemented for stroke patients by means of a platform (ikoefenzelf.nl) containing applications for physical exercise and mental well-being. As part of the Medical Delta Living Lab Geriatric Rehabilitation@Home, a qualitative study was conducted in the context of GR. The aims were 1) to gain insights into the attitude in using eHealth in general from different stakeholders; 2) with a specific interest for the aforementioned ikoefenzelf.nl platform.

### Methods

Two focus groups (FG) were carried out, one with managerial stakeholders (n=6) and one with healthcare professionals from different disciplines (n=9). In addition, interviews (n=5) were held with patients rehabilitating at home. Focus groups and interviews were recorded, transcribed and coded. The SPO model (Structure, Process, Outcome) was used to guide the analysis of the first FG, the MIDI instrument for the analysis of the second FG. Thematic analysis was used for the analysis of the interviews.

### Findings

Management mentioned the following organizational aspects as important: new eHealth applications should be aligned with the vision of the healthcare organization and part of the organization's digital infrastructure. The healthcare professionals mentioned motivating and monitoring the patients, and supporting interprofessional collaboration as eHealth added values. Patients preferred a combination of physical contact with the healthcare professionals and the use of eHealth. The three groups of stakeholders saw the potential in using the platform ikoefenzelf.nl in the GR process.

### Conclusions

Health to support outpatient geriatric rehabilitation is promising for blended care interventions. Further work will be carried out to establish the requirements to embed the applications from the ikoefenzelf.nl platform into the home-based setting.

# Virtual reality and social training skills to adults with epilepsy and intellectual disabilities

## Authors

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## Abstract

### Background

People with epilepsy and mild intellectual disability have a limited adaptive capacity resulting in difficulties in communication and social skills. Virtual Reality (VR) has the potential to help this group of people to learn how to manage difficult situations. SEIN (Expertise Center for Epilepsy) provides training to the residents to improve their social and communication skills. The purpose of the exploratory study was to establish whether VR could be a suitable digital means to provide a more efficient blended training.

### Methods

Online interviews were conducted with healthcare professionals from SEIN: two coordinators, three psychologists and two coaches. The participants were asked about their ideas for improving the social skills of the residents and their view on using VR to do so. Interviews were recorded, transcribed and analyzed using thematic analysis approach. In addition, observations were conducted during a training session to get a realistic sense of its process and contents. Observations were noted in a logbook.

### Findings

The participants are positive to use VR in the training but point out that it is not suitable for all the residents. VR glasses were ruled out because it put the resident alone in a virtual setting. VR with a tablet is preferred to allow the residents and the healthcare professional to simultaneously view 3D simulated situations and allowing opportunities to talk about it. The development of VR contents and simulations using tablet will need to take into account relevant VR guidelines dedicated to people with epilepsy. Appropriate training for the healthcare professionals also needs to be provided.

### Conclusions

The use of Virtual Reality in training programs to improve communication and social skills of adults with intellectual disabilities and epilepsy is promising. We advocate to utilize user-centered design and co-creation approaches with all concerned parties for further development of tablet-based VR solutions.

# Digital smoking cessation intervention for cancer survivors: associations between participant characteristics, engagement and outcome

## Authors

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## Abstract

### Background

Recent studies have shown positive though small clinical effects of digital smoking cessation (SC) interventions for cancer survivors. However, research on associations between participant/clinical characteristics, intervention engagement, and outcome of such interventions is limited. The aim of this study was to explore possible associations between participant characteristics, engagement, and outcome of 'MyCourse Smoking' (in Dutch: 'MijnKoers Roken'), a digital self-help intervention for cancer survivors.

### Methods

A secondary analysis of data from a randomised controlled trial was performed. The trial took place between November 2016 and September 2019. The primary outcome measure of this study was the number of cigarettes smoked in the past 7 days at 6-month follow-up. We analysed interactions between participant characteristics (11 variables) intervention engagement (three variables), and outcome (one variable) using Robust Linear (Mixed) Modelling.

### Findings

In total, 165 participants were included in our study. Overall, female participants accessed the intervention less often than men ( $B = -14.92$ ,  $p < .001$ ). A higher Alcohol Use Disorders Identification Test (AUDIT) score at baseline was associated with a significantly higher number of logins ( $B = 1.12$ ,  $p < .001$ ) and diary registrations ( $B = 1.29$ ,  $p < .001$ ) in the intervention. Within the intervention group, a higher Fagerström Test for Nicotine Dependence (FTND) score at baseline was associated with a significantly larger reduction in the number of smoked cigarettes after 6 months ( $B = -9.86$ ,  $p = .002$ ). No other associations and no moderating effects were found.

### Conclusion

Overall, a limited number of associations was found between participant characteristics, engagement, and outcome, with a few exceptions: gender, the AUDIT, and the FTND. This study is a first step in exploring secondary associations with regard to digital SC interventions for cancer survivors, but does not provide a definite answer to the 'what works for whom' question.

# Development of a preliminary model for co-creation of antenatal digital self-monitoring services: a mixed-method examination from a sociomaterial perspective

## Authors

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## Abstract

### Background

Access to digital self-monitoring services is changing the face of antenatal care delivery and has the potential to influence pregnancy health and wellness outcomes. Little is known about what types of nuanced interactions pregnant users and digital components have during adaptive processes of new digital health service access and use.

### Aim

A mixed-methods study was conducted to inform the development of a preliminary model for co-creation during adaption when accessing and using a new digital self-monitoring service.

### Methods

Twenty pregnant women received access to a digital self-monitoring service. One-on-one semi-structured interviews were conducted investigating pregnant users' perceptions of participating in the adaptive process of accessing and using the wearable technology. Data was analysed in phases; first a deductive approach was conducted guided by the definition and attributes of Patient Engagement, then the group was statistically stratified into high and low using the Kernel Density Estimate test. Lastly, inductive, and abductive content analysis was performed according to user group.

### Findings

A preliminary model for Co-creation of an Antenatal Digital Self-Monitoring Service was developed. The model includes four categories; 1) Pregnant user activities within the process of adaptation; 2) Mediation activities of the digital components influencing the adaptation process; 3) Recommendations for improvement of personalization and accessibility; and 4) Recommendations for End-User Training. The high and low user groups perceived differing mediating activities from the digital components during the co-creation process.

### Conclusion

Mediation activities of the digital components and the different user activities according to the low and high engagement groups contributed to an understanding of the adaptation process of co-creation and informs a preliminary model for co-creation of antenatal digital self-monitoring services.

# Using a social robot to improve the quality of life

## Authors

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## Abstract

Nowadays, medical staff in elderly care has a hard time providing the required care with fewer people and they run the risk of becoming overburdened. At the same time, the number of older adults in society will definitely increase in the coming decades. To prevent a decrease in quality of life, the use of social robots is seen as a possible solution. Starting in May 2021, we conduct research in two care institutions for older adults to find out whether the use of a social robot (i.e., Maatje) can improve their quality of life. In particular, the effect of the robot on positive emotions, confidence about the structure of the day and the relationship with the (in)formal caregivers are examined.

As a second aim, the influence on the workload of the caregivers is examined. Maatje is a small humanoid robot, programmed to make reminders of an appointment, stimulate to undertake an activity, utter greetings, tell a joke, perform a dance, play music or have a short dialogue with the participant. The internet signal comes from a wi-fi connection or the 4G network. Each Maatje can be programmed and fine-tuned to the resident's wishes or needs by means of an online platform. For this study, the programming was done in three sections: Notifications, Dialogue and Mood. Beside these pre-programmed features, messages can be entered via the platform to be uttered in real time.

In this demonstration, Maatje will be presented in a live performance. It will introduce itself and show some of its socially assistive and entertaining features. Furthermore, the researcher will demonstrate the way the programming platform is used to adapt the robot to the wishes and needs of the user in the care institutions. Additionally, we will present cases from the research, accompanied by the reactions of the participants.

# Successfully implemented ehealth technologies to support informal care: a multiple case study

## Authors

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## Abstract

Providing long term unpaid care for a sick relative or loved one is a burdensome activity with many challenges. eHealth, can support informal caregivers with their duties by fostering practical and emotional support. Although numerous eHealth technologies are evidence-based and proven effective, their implementation often fails. Implementation is an articulated process with many unknowns. If not introduced properly, useful innovations are likely to be abandoned. To better understand how to deal with this problem, the present work aims at examining, describing, and comparing examples of successful implementation of eHealth technology in the context of informal care.

This multiple case study is made up of semi-structured interviews inquiring the touchpoints of the most frequently used frameworks for implementation and prior research. To select the included cases, informants from academia, industry and informal caregivers were asked to indicate examples of eHealth technologies they knew/ used. Ten cases were selected following in/exclusion criteria. Contact people involved in the implementation of the selected technologies will be interviewed. Furthermore, the Business Model Canvas will be filled together with the interviewees to provide a systematic comparison between cases. The present work aims at offering principles to build a framework for implementation of eHealth that is specific to the context of informal care.



# Point of care testing of insuline for early detection of type ii diabetes

## Authors

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## Abstract

In this presentation we present to you some preliminary results on the detection of insulin and various other targets for different PoC applications using integrated photonic chip and lab-on-a-chip technology. The ultrasensitive detection of insulin is the first step towards implementing this technology in care practice to contribute to the prevention, early diagnosis, and treatment of type II diabetes. For this project funding has been applied for.

The aim of this oral presentation is threefold. First, we want to provide the audience with basic information on the technology of Point of Care Testing. Secondly, we aim at providing insights on the promising possibilities on how this technology can be of use in care practice, specifically on type II diabetes. Thirdly, we want to inform and discuss with the audience the opportunities of practice based research projects concerning Point of Care Testing. This type of research increases the chance that such new and promising technology will be structurally embedded in the healthcare sector.

This oral presentation is part of a session initiated by the platform PIT (Platform Inzet van Technologie voor Gezondheid en Welzijn) during the Supporting Health by Technology 2022. In this session PIT aims at informing and inspiring participants on Point of Care Testing.

# Wacht@ctief: a minimally guided self-help ehealth program for individuals waiting for mental health care

## Authors

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## Abstract

### Background

The waiting times in mental health care (MHC) are long, especially for secondary MHC. Clients suffer while waiting for MHC. Untreated mental disorders can result in a lower quality of life, more complaints and ultimately heavier care. That is why Wacht@ctief has been developed within Lentis; an eHealth program for people with mental health problems, who are on the waiting list for an intake interview. Wacht@ctief aims to prevent or reduce the negative consequences of the waiting time for those waiting and to facilitate a better start of treatment. Wacht@ctief is currently being developed, implemented and evaluated amongst three pilot departments (both primary and secondary MHC) using action research, with the third phase currently being completed. The current substudy examined whether and how Wacht@ctief meets the needs of individuals on a waitlist for their mental health problems. Suggestions for improvement were formulated.

### Methods

Wacht@ctief consists of an informative basic module, elective modules on positive health, self-help modules and the possibility of contact with an experience expert. Evaluation concerns usage data (n=356) and qualitative interviews (n=10) with users, practitioners and referrers. Usage data are described. Interview data are transcribed and analyzed using thematic analysis.

### Findings

About half of the participants invited (202 out of 357; 57%) tried out Wacht@ctief, and 77 (22%) completed the basic module. Interviews suggest people feel taken more seriously and seen. Individuals also experienced increased self-management. Nonetheless, there were experienced functional limitations and several individuals would have preferred more personal contact.

### Conclusion

Patient experiences suggest that Wacht@ctief shows promise to reduce some of the negative consequences of the (sometimes) long waiting times for MHC. The experienced limitations are being targeted in the current and third development phase of the study, after which implementation will be expanded to other departments of Lentis.

# Online and offline behavior change techniques to promote a healthy lifestyle: a qualitative study

## Authors

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## Abstract

### Background

Combined lifestyle interventions (CLI) aim to help clients with weight-related health risks to change their physical activity levels and dietary behaviors. These long-term (2 year) interventions are mostly delivered through face-to-face sessions with limited use of eHealth technologies. To integrate eHealth into existing CLIs, it is important to determine how behavior change techniques (BCTs) are being used by health professionals in the online and offline treatment of overweight clients. Therefore, we conducted semi-structured interviews with providers and developers of online and offline CLIs.

### Methods

Due to the COVID-19 restrictions all semi-structured interviews were organized online. We recruited professionals who had experience with the (1) provision of the traditional 'offline' CLIs, (2) provision of online CLIs and (3) the development of (online) CLIs. The interview guide contained topics about the use and requirements of online and offline BCTs in practice. The data were analyzed through an inductive thematic approach.

### Findings

Thirty-eight lifestyle professionals were interviewed. Professionals who work online use diary apps, smartwatches or smartphone-based accelerometers to support clients in changing their dietary and physical activity behavior. These tools help professionals in the provision of specific BCTs, including monitoring, feedback and shaping knowledge. Monitoring is seen as a starting point for feedback. Professionals use online modules to enhance knowledge about health consequences of unhealthy behavior. Coaches who work predominantly offline use goal setting and action planning techniques. Although online contact can be a quick and easy way to interact, physical meetings are seen as the best way to enhance social support.

### Conclusion

These Findings suggest that it may be beneficial to use monitoring devices to provide just-in-time feedback based on the client's actual performance. Based on the Findings we are now developing an online platform with instructions for lifestyle coaches how to integrate online BCTs into practice.

# Developing an emental health monitoring module for older mourners using fuzzy cognitive maps

## Authors

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## Abstract

### BACKGROUND

For an eMental Health service for older mourners, we developed a monitoring module to guide the user to offline support if their situation deteriorates. The monitoring module consists of two questionnaires, measuring risk factors for developing complicated grief and the user's current symptoms. These measures are processed by an automatic decision algorithm whose outcome is signalling the user to keep using the service or to seek offline support. In this study, we configure the algorithm using expert knowledge.

### METHOD

Eight psychotherapists and grief coaches participated in fuzzy cognitive mapping sessions, a semi-quantitative interview method that yields a fuzzy cognitive map (FCM). FCMs are directed graphs, consisting of nodes and weighted interconnections that capture experts' knowledge in decision making. Participants rated the relationships between symptoms (e.g., Hopelessness) and outcome ((Not) seeking offline support) nodes regarding their relationship type (positive, negative, neutral) and regarding the strength of the relationship. Interview data was analysed with a focus on assessing participants' rationale.

### RESULTS

From the combined FCM weights, mutually strengthening relationships between symptoms Crisis Detection, Grief Symptoms, Hopelessness, and Social Isolation arose, accounting for most of the model's influence towards the outcome Seek offline support. Therapeutic Progress counterbalances these symptoms. Participants' rationale revealed that the duration of symptoms is crucial for decision making and that Time since loss is difficult to model linearly since its influence is conditional.

### CONCLUSION

Fuzzy cognitive mapping is a promising method for designing decision-making in eMental Health and for explicitly incorporating expert knowledge in the process.

# Developing a mobile application for assertiveness development through co-creation with student nurses

## Authors

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## Abstract

### Background

One challenge novice nurses face at the start of their career is coming to grips with the tumultuous working environment and its social dynamics. Assertive behavior and interprofessional communication play a key role in maintaining one's health throughout this process: skills which novice nurses feel they lacked in their education. Within their education, clinical placements provide a true-to-life working environment to train these skills. However, studies show that assertive behavior and interprofessional communication skills are not structurally addressed within this learning environment. To alleviate this theory-practice gap, our study focused on developing a digital tool together with nursing students that helps them structurally reflect upon and monitor these skills. Our main question was: How do students want to reflect upon their assertive behavior and interprofessional communication during their clinical placement using a digital tool?

### Methods

Following the principles of participatory design, four two-hour co-creation sessions were held at a nursing program in the Netherlands in the period of December 2021 until March 2022. On average, each session was attended by one nursing teacher and three to four student nurses. The first two sessions focused on understanding students' needs, with the latter two focusing on discussing concepts and prototypes of a tool that meets those needs.

### Findings

Students appreciated the possibility to reflect using their smartphone as it allows them to reflect whenever and wherever they would like, ideally in a short timeframe. This also fed into the students' needs: flexibility in what, when, and how they wish to reflect and favoring quick summaries of experiences.

### Conclusions/Discussion

Using co-creation, we have developed a prototype together with student nurses (and teachers) that aligns with their needs. Flexibility and timeliness are valued strongly and must be considered during upcoming development-cycles.

# Early cerebrovascular autoregulation in neonates with congenital heart disease

## Authors

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## Abstract

### Background

Delayed brain development in neonates with congenital heart disease (CHD) could lead to impaired cerebrovascular autoregulation (CAR). CAR ensures constant cerebral blood flow despite varying cerebral perfusion pressures. Disturbed CAR may contribute to ischemic brain injury. The aim of this study was to investigate which percentage of time neonates with CHD display disturbed CAR (%dCAR) in the first 72 hours after birth.

### Methods

In this retrospective cohort study at the UMCG neonatal intensive care unit, we assessed %dCAR, clinical factors that may influence CAR, and survival between March 2015 and September 2020. We calculated correlation coefficients (cc) between cerebral tissue oxygenation (rcSO<sub>2</sub>) and mean arterial blood pressure (MABP, mmHg) for two hours per day. Disturbed CAR was defined as a cc of > 0.3. We assessed the effect on %dCAR of clinical parameters (CHD type, inotropes, ventilatory support, and PCO<sub>2</sub>). Lastly, we assessed a correlation between %dCAR with signs of ischemia/hypoxia on transcranial ultrasound, and mortality.

### Findings

In 57 neonates, we found %dCAR during 9.3% of the time on day one and 4.6% on day three. More %dCAR was associated with administration of inotropes on day one (B=19.5, 95% CI=10.6-28.3) and three (B=11.5, 95% CI=7.1-16), and with lower MABP on day one (B=-0.6, 95% CI=-1.2-0.0) and two (B=-0.5, 95% CI=-1.0-0.0). Neonates with transposition of the great arteries (TGA) had higher mean %dCAR on day one (17.7%) than other CHD types (1.2-9.4%; p=0.021). We did not find an association with survival.

### Conclusion

Neonates with CHD display disturbed CAR during 9.3% of the time during day one after birth. Lower MABP, inotropes, and TGA were significantly related with more %dCAR. More research is needed to further evaluate this relation between inotropes and TGA and %dCAR, and long-term outcome, using sensitive tests in a larger population.

# Transferable therapy: virtual reality mirror therapy at home

## Authors

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## Abstract

### Background

Mirror therapy is used in a broad spectrum of rehabilitation therapy ranging from phantom limb pain, stroke, peripheral nerve injury to cerebral palsy. With the development of a virtual reality (VR) environment for mirror therapy, patients can now practice independently of time and place. However, the challenges and needs of patients using VR at home are still unclear. In this study we therefore tried to answer the question: “what are the (experienced) challenges when using virtual reality mirror therapy at home”.

### Methods

We designed an in-the-wild study in which 8 healthy participants received a cultural probe containing an empty floorplan, emotion cards, question cards, postcards, empty paper sheets and video instructions. Participants used a VR-headset (Oculus Quest 2) for two weeks and were asked to use the virtual reality mirror room at least 5 times within this period. Afterwards a reflective interview took place and the cultural probe was examined.

### Findings

When using the VR environment independently for the first time, participants felt insecure. However, after several sessions participants felt more comfortable. Furthermore, participants felt enthusiasm and curiosity to discover the possibilities of VR. When using the VR-headset participants felt it shut out the real world making it easier to be calm and focus on the virtual reality mirror. However, some bugs in both hand-tracking and the VR environment resulted in frustration. Finally, participants often forgot which exercises to do and only few participants succeeded in practicing five times within the two week period.

### Conclusion

After using VR the first time, participants were able to practice by themselves. Experienced challenges for participants were performing the exercises according to the instructions, dealing with some bugs in the VR environment, and compliance can be a challenge when practicing at home. Future research should therefore focus on coping with the therapist's absence.

# Inclusive approaches in the design, development and implementation of ehealth for people with intellectual disabilities

## Authors

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## Abstract

### Background

The use of eHealth by people with intellectual disabilities (ID) is more challenging compared to the general population. A translational gap exists between the developed technology and the needs and capabilities of the end-users while there are approaches to overcome this mismatch. For example, by involving end-users and stakeholders in the design, development and implementation of the technology. Therefore, the following research question was formulated: What are current inclusive approaches used for the design, development and implementation of eHealth for people with ID?

### Methods

By performing a scoping review we aimed to map the key concepts, summarize the evidence and identify gaps in existing literature concerning the research question. The eHealth technologies described and approaches used in the studies were analysed. Moreover, the involvement of stakeholders in the processes and in which phases and activities they were involved was analysed. The analysis of the design, development and implementation processes was guided by components identified from the NASSS Framework and CeHRes Roadmap.

### Findings

The study selection left 22 studies included for analysis. The Findings show different approaches used for the design, development and implementation of eHealth such as 'iterative co-design', 'agile development methodology' and 'human-centered design'. Stakeholders involved in the processes were people with ID, healthcare professionals and family. The analysis showed stakeholder involvement in various phases and activities such as setting up user and technical requirements for the design and usability tests. Examples of components identified from the frameworks were co-creation, prototyping and iterative testing.

### Conclusion

Researching eHealth design, development and implementation can change these processes and concentrate on barriers and how to overcome them. Including end-users and stakeholders in the design, development and implementation ensures that eHealth is adjusted to the living environment and needs for health and support, which increases the sustainability of eHealth use over time.



# Issues and needs towards an ehealth tool to support young adult caregivers: a usability study

## Authors

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## Abstract

### Background

Informal caregivers (ICGs) provide care to their family or friends in case of an illness, disability, or frailty. They often do so out of love, but it can also be burdensome. eHealth solutions to support ICGs are being developed and integrated into ICG's lives. However, different ICGs may have different needs and issues as a caregiver, which may result in different design requirements (e.g. content, aesthetics) for eHealth solutions. Therefore, we aim to explore the issues, needs and preferences towards the usability of eHealth tools to support student young adult caregivers (YACs) aged between 18 and 25.

### Method

We conducted an online usability testing with 13 student YACs in the Netherlands. The study targeted towards the content, navigation, and aesthetics, of eHealth tool. For this, we used an already existing eHealth tool, 'MantelzorgBalans'. MantelzorgBalans aims to support ICGs by offering information to balance their care activities. We analyzed the data using the thematic analysis method.

### Findings

Our Findings suggest that YACs preferred to have information regarding the type of professional mental health support available for them. They found the quotes and success stories of other ICGs helpful in understanding the information presented in the tool. Although, they preferred quotes from ICGs in their age group. In terms of aesthetics, YACs preferred more visuals and bright colors instead of just textual information.

### Discussion

Knowing the needs of specific groups of ICGs can help develop tailored solutions to improve the quality of life of the ICGs and their CR.

# Mydiamate: implementing self-guided web-based support for mental health in type 1 diabetes.

## Authors

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## Abstract

### Background

Mental health problems such as diabetes-related distress and fatigue are highly prevalent in people with diabetes type 1 and complicate diabetes self-management. MyDiaMate is a self-guided, web-based application for adults with type 1 diabetes (T1D), designed to assist in preserving/improving mental vitality. A pilot test confirmed its feasibility and usability. Since March 2021 the application is offered freely to Dutch speaking adults with T1D. Here we report on interim results regarding usage of MyDiaMate and user profiles.

### Methods

Users can opt for participating in the user-profile study, providing self-reported socio-demographics, diabetes-distress (PAID-11), emotional wellbeing (WHO-5) and fatigue (CIS). User profiles, number of downloads, and usage were analyzed using log-data.

### Findings

N=777 persons downloaded MyDiaMate (date November 2021), n=281 participated in the study. Mean age was 43 years (SD=14.8), 64.1% females, and 62.5% higher educated. The majority was not receiving psychological treatment (86.8%). Of the 281 participants, 162 (59%) persons reported low emotional wellbeing (WHO-5≤50), 194 (70%) elevated diabetes-distress (PAID-11≥18) and 138 (49.8%) were severely fatigued (CIS≥35). 698 persons (96.9%) opened the start module 'Diabetes in Balance', of whom 25.6% completed the module. In-depth modules 'My Mood' and 'My Energy' were opened by 16.8% and 18.9% participants respectively, of whom 21.5% and 6.1% completed these modules. Median usage of all modules together was 2 hours (3 sec – 882 hours).

### Conclusion

Preliminary results 9 months after launching the app show that participants in the user-profile study have relatively low well-being and high fatigue scores, indicating a need for psychosocial support. Log-data showed a wide variety of user behaviors, indicating a spectrum of individual support needs. Further data collection is ongoing.

# **The development of an ehealth intervention motivating patients with a low socioeconomic position during cardiac rehabilitation.**

## Authors

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## Abstract

### Background

Health disparities between socioeconomic classes are growing. People with a low socioeconomic position (SEP) have unhealthier lifestyles compared to their higher SEP counterparts, increasing the risk for cardiovascular diseases. Within cardiac rehabilitation, people with a low SEP experience more barriers and are less adherent towards their rehabilitation program. eHealth offers on the one hand the potential to make cardiac rehabilitation more accessible, while on the other hand it could cause an increase in health disparities as it requires knowledge, skills and a positive attitude. In this research we investigated how eHealth could be tailored towards the needs, skills and preferences of patients with a low SEP during cardiac rehabilitation.

### Methods

Our design thinking approach consists of four fases: (1) problem exploration; context mapping interviews with healthcare providers (N = 7) and patients (N = 7) to map problems and opportunities, (2) Ideation; develop ideas and conceptualise solutions, (3) Prototype; develop a functioning prototype of the concept and (4) Evaluate; test the effectiveness and acceptance of the prototype with users. The users (patients and providers) will be actively involved in each phase.

### Findings

We currently finished the problem exploration phase in which we identified three design opportunities: (1): Preparation and guidance before rehabilitation, (2) Support motivation during rehabilitation and (3) Maintain lifestyle after the rehabilitation. In discussion with various stakeholders at the participating rehabilitation center we chose the first opportunity for developing the intervention.

### Conclusion

In subsequent phases, an eHealth intervention will be developed that prepares and supports patients before the start of their rehabilitation. This intervention and its evaluation should provide new insights into how eHealth could be used to better support patients with a low SEP during cardiac rehabilitation.

# Integrated biofeedback in videoconferencing for therapy: investigating therapists' experiences and perceived value

## Authors

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## Abstract

### Background

Research has shown that an important barrier for mental healthcare professionals to use eMental Health, in particular videoconferencing, as a clinical tool is their concern about the limited availability of non-verbal cues in technology-mediated communication, leading to unsatisfying therapeutic interactions. Therefore, we have developed BioCall, a videoconference tool that presents therapists with real-time visual feedback on their clients' arousal level measured through a skin conductance sensor. This study aims to investigate therapists' experiences with such an application and whether they think adding physiological information would be of added value in clinical practice.

### Methods

Thirteen couples (7 therapist-experience expert and 6 therapist-therapist couples) engaged in a videocall session of 15-30 minutes, in which the participant in the role of client was asked to recall two recent events that evoked strong emotions, one negative and one positive, while wearing the skin conductance sensor. During this conversation, the therapist was presented with real-time feedback about the clients' arousal level. After the session, individual semi-structured interviews were held to probe the participants' experiences with the tool, which were analyzed through a reflexive thematic analysis.

### Findings

Therapists generally were positive about working with the tool. Most frequently suggested uses of the physiological information were to indicate which moments in the clients' story were particularly emotional, confirm other observed cues, and - if made explicit to clients - help clients become aware of their feelings and bodily sensations. Some participants felt the tool had no added value over their own observations or that the feedback distracted them from their focus on the client.

### Conclusion

Presenting physiological information might be a valuable addition to videoconferencing in therapy to compensate for the limited non-verbal cues, especially with clients that do not easily express their emotions. Additionally, it could be employed to improve clients' awareness of their emotions.

# Development process of an internet-based intervention for the prevention of postpartum depression

## Authors

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## Abstract

### Background

Chile has been reported as a country with a very high postpartum depression (PPD) prevalence. Despite national efforts on applying a protocol for universal PPD screening, early detection, and referral to mental healthcare services, there is still a significant treatment gap. Internet-based interventions (IBIs) bring an opportunity for overcoming some logistical and economic barriers for PPD care. IBIs for the prevention and treatment of depression have proven to be effective and provide the possibility to reach community members on a broader scale. Our research project aims to develop an IBI for the prevention of PPD. A human-based approach was included to make the intervention attractive and engaging to Chilean women.

### Methods

The intervention development process is based on the CeHRes Roadmap framework (van Gemert-Pijnen et al., 2011). The procedures carried out are the following: 1) a systematic review on IBIs for PPD prevention and treatment, 2) an online survey on perinatal mobile applications use and preferences, 3) six focus groups to explore the central values and features of the IBI, and 4) four focus groups to explore opinions on a low-fidelity prototype. Participants of the survey and focus groups were perinatal women and perinatal health care professionals.

### Results

To date, 541 participants have contributed to the IBI's development. We are about to conduct the second round of focus groups. This presentation will elaborate on the IBI development process, the lessons learned, and briefly exhibit the prototype.

### Conclusions

The development process in this project has been iterative, with many evaluations contributing to the IBI's design. We expect to achieve a good fit between technological, human, and contextual factors. By that, we hope the intervention will be engaging for postpartum women, improving the chances of reaching its goals.

# Cognitive bias modification against fatigue in different patient populations. user acceptance and preliminary effects

## Authors

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## Abstract

### Background

Fatigue is a highly invalidating symptom in chronic diseases and it is thought to be perpetuated by implicit cognitive biases. Recurring fatigue may result in an integration of fatigue into one's self-schema, a self-as-fatigued concept bias, as well as attentional bias towards fatigue signals. Cognitive Bias Modification (CBM) is thought to retrain self-fatigue towards self-vital associations. Different CBM trainings were developed and delivered; kidney patients received computer tasks with a combination of self-concept implicit association tasks and attentional visual probe tasks and breast-cancer patients received a self-concept IAT with incorporated approach-avoidance mechanisms. In this presentation, we demonstrate user evaluations and preliminary effects of the CBM training in the two patient populations.

### Methods

Mixed-methods, including interviews with thematic data-analyses, and single case experimental designs were applied among small samples of kidney patients, breast-cancer patients, and their healthcare professionals.

### Findings

Acceptance of CBM and bias measures in patients was found to be high, but the simplicity also made patients doubt the effectiveness and annoyed some patients. Each patient group brought about specific barriers (e.g., digital literacy in kidney patients) and possible solutions (e.g., app personalization for breast-cancer patients). On bias level, the training significantly affected kidney patients in the expected direction, and a similar trend was found in breast-cancer patients. In these short and small pilot studies, no spill-over effect on behavior or fatigue was found yet.

Discussion. The CBM application is promising both regarding acceptance and first effects. The evaluations are taken into account for further development and a larger study with longer follow-up is recommended to explore more conclusive effects.

# The mediating effects of digital skills on psychosocial health factors

## Authors

Charlotte Griffin (Cardiff University - United Kingdom), Georgina Powell (Cardiff University - United Kingdom)

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## Abstract

### Background

In an increasingly digital world, digital aptitude and technology use are becoming more important for social connection. Loneliness in older adults is a 'growing public health and policy concern' (WHO, 2021), and this group is more likely to be digitally isolated. Our objective for this study was to develop a model that captures the relationship between digital skills and age, isolation, loneliness and wellbeing. Based on previous research, we hypothesised that digital skills would mediate the relationship between age and isolation, and that isolation would predict loneliness and wellbeing.

### Methods

A cross-sectional, online survey measured psychosocial and technology-related variables. Structural equation modelling (SEM) was used to capture the relationships between digital skills and psychosocial outcomes. 3492 community-based adults in South Wales, from a health-research mailing list, completed an online survey. Measures included the Essential Digital Skills framework, the De Jong Gierveld Loneliness Scale, the Lubben Social Network Scale, and the Warwick Edinburgh Mental Wellbeing Scale.

### Results

A significant model (model chi-squared = 391; baseline chi-squared = 5802;  $p < 0.001$ ; CFI = 0.94; RMSEA = 0.06), accounted for 74% of the variance in loneliness by using age as a predictor and digital skills and isolation as mediators. Similarly, a further significant model (model vs saturated chi squared = 4750; baseline vs saturated chi squared = 37651;  $p < 0.001$ ; CFI = 0.88; RMSEA = 0.08) accounted for 78% of the variance in wellbeing using age as a predictor, and digital skills, isolation and loneliness as mediators.

### Conclusions

One interpretation of our model is that digital skills improvement may be a mechanism to reduce isolation, and this, in turn, could reduce loneliness and improve wellbeing. Future research should build upon this by investigating the psychosocial outcomes of positive technology interventions, digital upskilling and inclusion.

# Secondary findings of a scoping review into the evaluation of serious games for healthcare professionals

## Authors

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## Abstract

### Background

Serious games are increasingly used in education and training of healthcare professionals. However, it remains unclear how evaluation of intended results in terms of gained knowledge, skills or behavior can be taken into account during development. To gain insights we conducted a scoping review. After screening of articles based on title and abstract, we analyzed relevance of selected databases, use of selected exclusion criteria, and inter-rater reliability.

### Methods

During the scoping review we searched databases on healthcare (PubMed, CINAHL, Cochrane), education (ERIC, Education) and technology (ACM, IEEE). After an initial calibration session with 10 articles and first screening of 100 random articles, three researchers screened remaining articles (with 100 overlapping) based on title and abstract.

### Results

Our search resulted in a total of 4050 articles divided over PubMed (1426), CINAHL (579), Cochrane (17), ERIC (151), Education (85), ACM (1371) and IEEE Xplore (421). After removing duplicates 3721 articles remained. After screening a total of 573 articles were preliminary included divided over ACM (43), IEEE Xplore (56), PubMed (367), CINAHL (100), Cochrane Reviews (2), ERIC (2) and Education (3). From the exclusion criteria “no (serious) game” and “not for healthcare (professionals)” were most common, 680 and 1050 respectively. Reliability agreement (Fleiss Kappa) increased from 0.29 (first 100 random articles) to 0.58 (second 100 random articles).

### Discussion

Within our scoping review we selected databases covering specific research area and expected to find relevant articles in each of them. However, although ACM and PubMed make up more than half of all articles, we found little to no overlap between these two. Moreover, only 3% from ACM articles were included compared to 26% from PubMed. At the time of writing, we are further analyzing exclusion criteria, inter-rater reliability, and relevance of databases. We expect to present more findings at Supporting Health by Technology.



# Extended reality for enhancing preoperative patient-reported experiences: a systematic review

## Authors

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## Abstract

### Background

Extended Reality (XR) covering technologies like Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR) is a promising technology with the potential to optimize preoperative experiences by allowing immersive, lifelike three-dimensional visualization of the surgical stages and anticipated outcome. Objective: This systematic review aimed to assess whether preoperative use of XR improves preoperative patient experiences.

### Methods

A systematic literature search was conducted in EMBASE, MEDLINE (Ovid), Web-of-Science, Cochrane and Google Scholar databases on January 3rd 2022. All articles studying the effect of preoperative XR (VR, AR or MR) on patient education, preparedness, expectation management, shared decision-making, and preoperative anxiety were included.

### Results

10 articles were identified; 9 studied preoperative VR and one studied preoperative MR. All studies had patient populations with different surgical procedures. No articles on AR were found. The primary outcomes were patient education, preparedness, and preoperative anxiety, all of which showed improvement after use of VR and MR.

### Conclusion

VR is the most common modality of XR used in a preoperative setting. VR and MR improve preoperative patient-reported experiences with regard to better patient education, better preparedness and reduced preoperative anxiety. More studies are needed to understand the mechanisms through which XR impacts preoperative patient-reported experiences, such as impacting expectation management and shared decision-making. This reviews shows that XR has the potential to personalize healthcare and allow for better preoperative patient experiences.

# Take control: can a self-control training app improve the effectiveness of psysical activity interventions in people with severe mental illness?

## Authors

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## Abstract

### Background

Improving physical activity (PA) through eHealth can promote the wellbeing of people with severe mental illness (SMI). Most existing eHealth-interventions are unsuitable for them, since they rely on high-level cognitive skills, such as goal-setting. Complementary interventions focusing on automatic processes, like self-control training (SCT), can potentially bolster effectiveness of PA interventions in this population. In co-creation with SMI patients, the Self Control Intervention aPP (SCIPP) was developed, based on self-control training - an existing, evidence-based intervention. This study aims to assess the effectiveness of SCIPP as an add-on to a PA intervention (Google Fit), to increase its effectiveness.

### Methods

Two single-case experimental designs (SCEDs) will be conducted from March to June 2022. SCED I is a concurrent multiple baseline of 52 days, SCED II is an introduction-withdrawal of approximately 42 days (optimal intervention length determined in SCED I). Participants are adults with SMI (n=12) from two Dutch mental healthcare organizations. Intervention: a) SCIPP. Users receive daily challenges to perform everyday tasks (e.g. drinking) using their non-dominant hand for two weeks, to practice with overriding dominant responses. b) Google Fit: an app to increase PA via goal-setting and self-monitoring. Primary outcome is daily PA (ActiGraph GTX+ accelerometer). Secondary, we evaluate self-control (experience sampling, Brief Self-Control Scale, Go/No-Go Task).

### Results

Preliminary results of SCED I will be presented on the poster.

### Discussion

Being physically active can be challenging for people with SMI. With this study, we gain more insight into the role of (training) self-control to improve PA in people with SMI, which could, in turn, impact their disadvantaged health and well-being. This poster will provide insights into whether SCT works for patients with SMI. We will also reflect on the research design and how SCED can be used in research with complex target groups like patients with SMI.

# Implementation of the diameter app in primary diabetes care: perspectives of patients and healthcare professionals

## Authors

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## Abstract

### Background

In primary care, lifestyle changes are the cornerstone of treatment for people with Type 2 Diabetes (T2D), as a healthy lifestyle can contribute to the reversion or remission of T2D. eHealth applications that support lifestyle changes can be of added value in supporting healthcare. The Diameter app offers lifestyle support through monitoring and coaching of physical activity, nutrition and blood glucose. This study explored the perspectives of people with T2D and healthcare professionals regarding the implementation of the Diameter in primary care.

### Methods

A qualitative design was used to explore motivations, facilitators and barriers to implement the Diameter in primary care from the perspective of people with T2D and healthcare professionals. From April 21 to June 8 2021, 18 semi-structured interviews were conducted based on the Consolidated Framework for Implementation Research (CFIR). All interviews were audio-recorded, transcribed verbatim, and coded applying inductive thematic analysis.

### Results

Eight main themes with accompanying sub codes emerged. Motives for using the Diameter were found in the provision of insight for the patient and healthcare professional, the diversity of the patient population, and the implementation setting. The main motivation for implementing the Diameter was the insight that it can provide into the relationship between lifestyle and glucose levels for people with newly diagnosed or poorly controlled diabetes. Facilitators for implementing the Diameter were related to the adoption of the Diameter in the region and the potential to improve efficient working. Important barriers converged around the characteristics of the patient population, interoperability with IT systems, and reimbursement from the health insurer.

### Discussion

People with T2D and a diverse group of healthcare professionals both see the potential added value of the Diameter in primary diabetes care, provided that the main conditions and barriers for use and implementation are taken into account.

# Design your life: a toolkit that helps young autistic adults create their own supportive technologies

## Authors

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## Abstract

In recent years, an increasing number of assistive technologies have been proposed to support young autistic adults (YAA) in daily life. However, the effectiveness and use of these technologies are limited. First, many assistive technologies are designed for and by non-autistic individuals, so autistic users may have difficulties using these technologies in terms of functionality and overall usability. For example, a simple assistive technology such as an alarm clock may cause sensory overload. Second, assistive technologies created specifically for an autistic person are often part of formal therapy and training. Often these technologies align with or are intentionally based on contested treatments for autism, including Applied Behaviour Analysis.

In the Design Your Life research project, we are working with young autistic adults to develop a co-design toolkit that helps them create their own supportive technologies. Central to Design Your Life is a personalized and experiential design process, with attention to the user's unique preferences. To develop this toolkit, ten design case studies were conducted over a nineteen-month period. Each case study was conducted with a young autistic adult and a caregiver, with whom different toolkits were tested. Upon completion of all case studies, the resulting data was analysed and synthesized using a grounded theory approach. This led to the development of a single, integrative toolkit. In subsequent research phases, the integrative toolkit will be validated through another fifteen case studies. We want to determine whether the toolkit supports practical self-efficacy, but we will also investigate whether the toolkit evokes a sense of empowerment in its users.

# The acceptance of a social robot in rehabilitation care

## Authors

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## Abstract

### Background

When people think about the future of healthcare, they often mention robots. Nowadays, robots are being used within healthcare organisations, solely to entertain patients. Within the SCOTTY-project, we aim to implement a social robot in a rehabilitation centre with functionalities beyond entertainment. We studied the acceptance of such a robot among patients and nurses of a rehabilitation centre.

### Methods

We are assessing the acceptance among patients and nurses at two stages in the development. First, we studied the acceptance within a lab setting. Participants performed several tasks with the robot and completed the Technology Acceptance Model (TAM) questionnaire. Currently, we are studying the acceptance within the rehabilitation centre. Participants rate their acceptance at first sight, perform several tasks with the robot, rate their acceptance after each task, and complete the Almere Model questionnaire. This questionnaire is based on the TAM, but provides more detailed information regarding social robots.

### Findings

Within the lab setting, we measured the acceptance of 5 patients and 3 nurses. On average, the patients scored Scotty's perceived usefulness with 4.4 (SD=2.0), its perceived ease of use with 4.5 (SD=1.5), and their intention to use Scotty with 4.5 (SD=1.9). Regarding the nurses, the average scores of the TAM domains are 4.5 (SD=0.9) for perceived usefulness, 3.9 (SD=1.4) for perceived ease of use, and 4.6 (SD=1.3) for intention to use. Within the rehabilitation centre setting, we aim to include 10 patients and 10 nurses. These results will be available end of March 2022.

### Conclusions

This study will provide insight into the attitudes of patients and nurses of a rehabilitation centre towards social robots. With this knowledge, we can improve the implementation of the current roles for the robot (nurse aid, physical therapist assistant, companion and host) and increase the value of social robotics for rehabilitation care.

# The societal impact of social robotics in rehabilitation care assessed by means of the sroi-method

## Authors

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## Abstract

### Background

New technology, such as eHealth, serious gaming, virtual reality and robots have boosted the number of innovations in rehabilitation care. A innovative method to address the societal impact of these innovation is the Social Return on Investment (SROI) method. The aim of this presentation is to present the SROI method and to provide an example of a (forecast) SROI by means of the SCOTTY-project. This project focusses on the implementation of a social robot in rehabilitation care.

### Methods

The general aim of the SROI method is to demonstrate the sustainability and the social value added by innovative interventions. Within the SCOTTY-project a (forecast) SROI analysis will be carried out. This analysis is based on the principles of a cost-benefit analysis, and attributes monetary value to the social return of a social robot (Pepper) in rehabilitation care.

### Findings

At this moment, the main stakeholders are defined (Patient, Healthcare organisation, Technology provider and Healthcare insurance company). Also the impact map is available, which provides a schematic overview of the activities of every stakeholder. Next steps are to monetarize all inputs and outcomes per stakeholder, to establish impact and to calculate the SROI ratio. The needed information are gathered by means of desk research and small scale evaluations of the Pepper robot within the rehabilitation centre.

### Conclusions

First of all, this SROI analysis will give us insight if social robotics in rehabilitation care can provide a social return on investment. Next to this, it will help to discuss the added value with stakeholders and will bring us a step closer to full stakeholder commitment and the implementation of the Pepper robot in rehabilitation care. Finally, as the use of the SROI method is new, we will learn whether this method is applicable for social robotics and rehabilitation care in general.

# Using engagement to personalize digital health interventions: a pilot experiment

## Authors

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## Abstract

### Background

Digital Health Interventions (DHIs) can be effective, but struggle with high rates of drop-out and large individual differences in outcomes. Personalization can be a solution to these issues, but it is difficult to select which DHI will work best for whom. Engagement with a DHI, a multidimensional construct including behavioural, cognitive and affective aspects, may be a way to match individuals to interventions. Engagement has been shown to be an early predictor of outcomes, differs between individuals, and is influenced by intervention aspects.

### Methods

This study pilot tests a personalization approach based on engagement, using two online surveys. During the first survey (N= 62), the TWEETS (TWente Engagement with Ehealth Technologies) was used to assess participants' expected engagement regarding different mental health app features, namely content (CBT, Meaning-based and Positive Psychology), feedback (text, text with avatar, pre-recorded video) and design (non-gamified, competitively gamified, storyline gamified). In the second survey (N= 58), participants were asked to rate their engagement with four different combinations of app features based on their engagement scores on the first survey (optimized, 2nd best, medium, least fit).

### Results

Participants' engagement scores for the optimized app (M= 7.31; SD= 1.37) were significantly higher than for the other options (2nd best M= 6.41, SD= 1.42; medium M= 5.71, SD= 1.54; least-fit M= 4.69, SD= 1.69; all  $p < .01$ ).

### Discussion

This study shows the potential of using engagement for personalization. However, more research needs to be conducted to show whether the personalization approach leads to more effective DHIs.

# Sightwalk: a mobile route planner app for people with visual impairment

## Authors

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## Abstract

### Background

There are an estimated 350.000 people in the Netherlands who are visually impaired. The largest group of these, about 75%, has low vision and the other 25% are blind. For both groups, their visual impairment has a profound impact on performing everyday activities and has therefore significant implications on actively participating in society. Even though social participation is important for both physical, mental, as well as social health, only 35% of people with a visually impairment are employed compared to 67% of the general Dutch working population. The use of mobility aids is therefore crucial for this group to be able to participate, within their ability, in society.

### Description of the application

Together with the start-up 'Blindsight Mobility' we demonstrate a prototype of a mobile route planner application for people with a visually impairment. The application consists of two components:

#### Component 1

A backend for planning user-friendly routes for people with a visually impairment , giving detailed instructions about this route (e.g., on which side of the road to walk, how to cross a road). The backend uses geographical data from OpenStreetMap (e.g., type of road, number of crossings) and usage data about the walkability of these roads (e.g., road quality, previous walking speed, number of route recalculations).

#### Component 2

SightWalk: a mobile route planner app developed with Web Content Accessibility Guidelines (WCAG) in mind. The SightWalk app features high contrast maps, dynamic text size and can be used with screen reader software. In addition, the app offers functionality to plan and follow routes and save and share frequently used locations. Practical description: The application runs on recent iPhone devices.



# From theory to app: participatory development of self-control training for vulnerable target groups

## Authors

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## Abstract

### Background

Self-control predicts a broad range of behaviours, ranging from physical activity to aggression. Self-control training (SCT) - in which participants use their non-dominant hand for daily tasks such as opening doors - is an effective, evidence-based way to improve self-control. Current studies use a pen-and-paper approach, while a persuasive app with reminders and rewards might be more effective. In this presentation, we provide an overview of the development process of an SCT app, specifically tailored to people with severe mental illness (SMI), for whom involvement in interventions is often more difficult.

### Methods

In this iterative development process, we first conducted a literature scan on theories on self-control and SCT. Based on this, a functioning prototype of a SCT app was developed. To investigate whether this app was more effective than a paper-based version of SCT in an easy-to-include population, a 2x2 full factorial design with 204 students was conducted, with an app, e-mail or control condition. Based on the findings of this study, an improved version of the app was developed in three design workshops with 6 people with SMI. Finally, usability tests with 3 psychiatric patients were conducted.

### Findings

The factorial design showed self-control improved over time in participants who used the app, as opposed to those in the e-mail and control conditions. The workshops resulted in multiple design requirements, related to supporting behaviour change, rewards, reduced text, and setting personal goals. Usability tests pointed out minor points of improvement, but overall, the app was well received by people with SMI.

### Conclusions

The SCT app provides a persuasive way to target self-control in a novel way. Currently, the app is evaluated in the context of bolstering physical activity in people with SMI, but research in other target groups and in relation to other self-control-driven behaviours is warranted.

# **Lessons learnt from daily use by end-users and contact tracing employees on the coronamelder. a mixed method study using email analysis, an online panel and remote interviews.**

## Authors

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## Abstract

### Background

The Dutch CoronaMelder app is the official Contact Tracing App (CTA) in The Netherlands. After its initial rollout, we were asked by the Dutch Ministry of Health (VWS) to evaluate usage by end users and contact tracing employees. Objectives: The goal of this mixed-method study was to establish understanding of the use of such CTAs in a global pandemic and its integration in processes of public health services that are involved in the containment of the pandemic through contact tracing. Moreover, the study aimed to investigate both the motivations and user experience related factors for observed behaviour regarding adherence to quarantine and isolation measures, which in turn would affect the use of CTAs.

### Methods

A topic-analysis of 56 emails, a survey among 1937 adults, and 48 in-depth interviews with users of the app and 14 employees of Municipal Health Services (MHS) involved in the Contact Tracing process.

### Results

Obtained data identified issues in the daily use of the CM app of both procedural and technical nature. Procedural issues included lack of training of Municipal Health Services (MHS) employees when using CTAs. Technical issues were connectivity and notification related mainly. Combined, these issues undermined confidence in and satisfaction with the technology. The interviews offered a deeper understanding of the various factors at play and their effects on stakeholders, including mixed experiences of users, user's own fears and uncertainties concerning the Coronavirus, problematic infrastructure at the time of the app's implementation at MHS' side, and the wider societal context. All findings were evaluated with the app's creators, VWS, and have since contributed to improvements.

### Conclusions

The study offers lessons learned for future e-health interventions in pandemics. Moreover, the study offers unique insights into interaction between very-large-scale adoption of ehealth by the general public, the processes of implementation and (lack of) adoption.

# Requirements for machine learning and ai in healthcare: preliminary results

## Authors

Iris ten Klooster (University of Twente - Netherlands), Saskia Kelders (University of Twente - Netherlands), Lisette van Gemert-Pijnen (University of Twente - Netherlands)

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## Abstract

### Background

The application of AI and machine learning seems to have multiple applications for improving healthcare. An example is predicting complications for patients with a chronic diseases. Currently, a machine learning model is being developed within Power4FitFoot project to predict foot ulcers and amputations. To explore the added value of this predictive model, interviews will be conducted with patients and healthcare professionals to identify (1) the barriers of using patient data for a predictive model and (2) the benefits of using of a machine learning model according to patients and healthcare workers. These insights will be translated into system requirements for an Early Warning System for diabetic foot ulcers and amputations.

### Methods

We aim to carry out interviews with diabetes patients and their healthcare givers at ZGT and Podotherapie Segerink to elicit their ideas and opinions regarding the use of predictive models in healthcare. Moreover, we aim to elicit requirements specifically for the machine learning model for predicting diabetic foot ulcers and amputations.

### Findings

Our interview study will contribute to gaining insight in the added value of AI and machine learning healthcare. Moreover, a list of requirements and a first prototype can be developed using these insights.

### Conclusion

During the poster presentation, we aim to present our protocol, share our preliminary results, and discuss ways in which AI and artificial intelligence can be of added value with the participants.

# Predictors of contact tracing app adoption: integrating the utaut, hbm and contextual factors

## Authors

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## Abstract

### Background

Contact tracing apps (CTAs) have been introduced to limit the spread of COVID-19. Since the adoption-rate determines the effectiveness of CTAs, we examined three types of factors, i.e., technology-related factors (Unified Theory of Acceptance and Use of Technology (UTAUT)), health-related factors (Health Belief Model (HBM)), and context-specific factors in relation to adoption. The aims were to 1) assess whether extension of the UTAUT with the HBM and context-related factors leads to a better-predictive model, and 2) identify predictors of app adoption.

### Methods

As part of the evaluation of the Dutch CoronaMelder app by the Ministry of Health, Welfare and Sports, a survey was administered among a representative sample (N=1865) 1.5 week after the launch of the CoronaMelder. Hierarchical logistic regression analysis was performed to compare four models. Each model tested an additional group of variables: 1) baseline only; 2) UTAUT; 3) HBM; and 4) context-related variables.

### Findings

Model 4 performed significantly better than model 1, model 2 and model 3, which was assessed by the likelihood ratio test ( $p < .001$ ). All UTAUT variables significantly predicted adoption in the expected directions, with social influence as the strongest predictor (ORs ranging from 1.57 to 2.01). All HBM variables significantly predicted adoption, except for perceived susceptibility (ORs ranging from 0.77 to 1.28). A stronger belief that the CTA monitors location and personal details, and the degree of fear towards the CTA and its notifications led to lower adoption. The belief that installing the CTA contributes to being a good citizen led to higher adoption.

### Conclusions

Extending the UTAUT with preventive health-behaviour factors and contextual factors contributed to better understanding of adoption. A tension between perceived privacy and expected societal benefits was found. Such beliefs should be considered simultaneously to nuance our understanding of CTA adoption and could be targeted in campaigns.

# Ethical review procedures in international internet-based intervention studies

## Authors

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## Abstract

### Background

International internet-based studies could be accessible by participants from various countries worldwide. However, the jurisdiction of research ethics committees (RECs) or institutional review boards (IRBs) is bound to geographical state or country borders. How can researchers deal with the geographical boundaries in the jurisdiction of RECs/IRBs versus the worldwide, open character of international internet-based research? Should ethical approval be sought in each country where participants will be recruited?

### Methods

We encountered the question on the geographical jurisdiction of RECs/IRBs in international internet-based research when we were setting up an international randomized controlled trial (RCT) testing the effectiveness of a self-management mobile application (the Untire app) in reducing fatigue and improving quality of life in patients with cancer and survivors. We aimed to assess the effectiveness of this app in patients from several countries (Australia, Canada, Germany, Spain, UK, USA, and The Netherlands), to be recruited via social media. We had to explore ethical regulations in each country since no international ethic committee yet exists. We share our “lessons learned” from this international internet-based m-health intervention study.

### Results

Differences in ethical procedures were encountered. In some countries, ethical procedures were waived since no institutions were involved in recruiting patients. In other countries, it was sufficient to receive approval of the country in which the data are analysed, while others requested a full review from their own ethical institute. Ethic committees also varied in the requested content, statistics, and privacy regulations.

### Conclusion

We experienced that there is no clear consensus in ethical regulations regarding internet-based intervention trials worldwide. Therefore, ethical guidelines on which, and how, RECs or IRBs need to be approached in international internet-based research are very welcome.

# The development of mantelzorgbalans – a digital tool to support caregivers of a palliative loved-one

## Authors

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## Abstract

### Background

Most caregivers care for their loved-ones with unconditional love, although over time they experience growing struggles in providing care and their other activities such as their social life, work or hobbies. To support caregivers of patients in the palliative phase pro-actively, guidance in balancing caregivers' own goals with caregiving demands could be helpful. Therefore, we have developed a digital tool to support informal caregivers, following the CeHRes (Centre for eHealth & Wellbeing Research) roadmap of the University Twente. We did so in collaboration with end-users, professionals, technical persons and other stakeholders.

### Description of the technology

The MantelzorgBalans tool was developed following interviews with informal caregivers and with professionals working with caregivers with a loved-one in the palliative phase, focus groups with caregivers, drafting and testing paper mock ups, digital mockups and testing the several versions of the website. Based on these steps, the adaptable website MantelzorgBalans (<https://balans.mantelzorg.nl>) was developed for use on a desktop/laptop, tablet and smart phone.

### The tool consists of three main components

1) four exercises to help informal caregivers to gain insight in their balance, their goals, their boundaries, and their environment; 2) information on topics related to caregiving and the final stages of life, with links to in-depth information, and 3) a memory page where caregivers can describe their memories and upload pictures in a secure environment; these memories can be shared with other people.

### Practical description of the demo

We will show the developmental steps taken before launching the first version of MantelzorgBalans. Thereafter, in a live demonstration, we will show the public the main features of MantelzorgBalans as described above.

# Developing and validating a new scale to evaluate technology on compassion

## Authors

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## Abstract

### Background

Compassion has beneficial effects in mental healthcare treatment when applied by therapists. In short, compassion refers to a sensitivity to suffering and a motivation to alleviate this suffering. Now that more and more digital mental health interventions are becoming available, the question arises whether technology for mental healthcare can also contribute to compassion in treatment. Currently, no measurement tool exists to evaluate whether technology for mental health care is perceived as compassionate. Therefore, the current study aimed to conceptualize, develop, and validate a new scale to assess the perceived level of compassion in technology.

### Methods

Based on the five elements of a comprehensive definition of compassion, a set of items was developed. Then, data was collected through a vignette based study (N=69) with three scenarios of different technologies.

### Findings

Exploratory factor analysis showed that there were indeed five underlying factors present, which could be linked to their conceptualized construct. Four items were removed due to having no factor loadings  $> 0.6$  on any factor. Reliability was excellent with Cronbach's  $\alpha = 0.93$ .

### Conclusion

This first version of the Compassionate Technology Scale has 25 items across five dimensions of compassion. The results indicate a successful and promising development of a scale for perceived compassion in technology that could have useful applications, such as in the design and implementation of healthcare technology.

# Creating trust in machine learning tools: a case study in diagnosing endocrine disorders using urine steroid analysis

## Authors

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## Abstract

Urine Steroid Profiling (USP) is used for diagnosis and monitoring of disorders of steroid biosynthesis and adrenocortical diseases. However, the analysis of a USP is complex, and the interpretations of USP vary greatly between clinicians and laboratories, a Machine Learning (ML) approach seemed useful. However, often clinicians and other users refuse to adopt it in the clinical routines because of lack of trust in the ML system.

In the current study we therefore worked with the end users to create a ML tool for USP. We first interviewed and investigated current use of USP in the laboratory to understand the workflow and the clinical evaluations of the USP. We then used different ML applications to diagnose the USP. The final ML workflow consisted of two-step model where first a neural network determined whether the profile was normal or abnormal (accuracy: 0.87, 95% CI=0.82-0.91), and then a random forest model determined the diagnosis-specific categories of abnormal USPs (accuracy: 0.83, 95% CI=0.71-0.91). This high accuracy is remarkable, considering that some diagnosis categories were rarely present in the dataset and the dataset was limited. We used additional ML Methods (SHAP analysis) to explain how the ML models classified the USPs.

The insights from these explanatory models were discussed with the end users and turned out to be in line with current knowledge on some pathological characteristics of the disorders. Although the ML models were not yet able to perform as a stand-alone clinical diagnosing support system, the lab is considering including the methods in their workflow. We believe the adoption of the ML Methods was greatly promoted by including the end user in the ML study from the start, using explanatory ML techniques, and having reasonably diagnosing accuracy, which all promoted trust of the laboratory analysts and clinicians in the ML models.



# Effectiveness of telemonitoring for respiratory and systemic symptoms of asthma and copd: adding an educational component might improve results

## Authors

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## Abstract

### Introduction

Asthma and chronic obstructive pulmonary diseases (COPD) are highly prevalent chronic lung diseases that require ongoing self-management, which is often suboptimal. Therefore, telemonitoring has been used to help patients measure their symptoms, share data with healthcare providers and receive education and feedback to improve disease management.

### Method

We conducted a narrative review of recent evidence comparing the effectiveness of telemonitoring for symptoms (respiratory and systemic) to care as usual, for both asthma and COPD. The disease-related outcomes of interest were exacerbations, hospitalizations, health-related quality of life and disease-related limitations in daily life. The literature regarding implementation and feasibility was also assessed.

### Results

Of the thirteen identified papers, eleven focused on COPD and two focused on asthma. The asthma papers showed improvement in adherence, quality of life and asthma control. Eight COPD papers showed a positive outcome on at least one outcome measure. All papers with a positive outcome included an educational component, while only one of the six interventions without positive outcomes included an educational component. No paper described adverse events.

### Conclusion

Telemonitoring is effective, feasible and safe compared to care as usual for patients with COPD. There was an insufficient number of studies to draw conclusions regarding asthma telemonitoring. Telemonitoring interventions seem more effective if they included an educational component regarding different aspects of self-management. There is a lack of research on the behavioral and process factors related to telemonitoring.

# Process evaluation of the dutch covid-19 qr code app: an example of citizen science

## Authors

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## Abstract

### Background

The Dutch Ministry of Health developed and implemented the CoronaCheck app. With the app, citizens can show proof of "non-infectivity" when traveling within the EU and to gain access to e.g. restaurants or events. The study was carried out among citizens, companies and civil society organisations. The results of were used by the Ministry for optimization.

### Method

42 interviews and 353 questionnaires were conducted in the general population, visitors to events, managers of test lanes and employees of society organisations. Field observations were performed at 3 events. The interviews were transcribed verbatim and thematically coded. Descriptive analyses were used for the questionnaires.

### Findings

49% of the citizens see the added value and necessity of CoronaCheck yet 47% fear that CoronaCheck will lead to a divide in society. As the vaccination rate increases, doubts increase among respondents about the necessity of the app. The travelling distance to a testing location and the digital accessibility were bottlenecks. Companies had difficulties to find the right information. It turned out to be difficult to avoid fraud with QR codes. The interviews with civil society organisations showed that there is too little attention for low digital literate people.

### Conclusion

Citizens, companies and civil society organisations all find the concept CoronaCheck relevant. However, there are some points of interest: testing should be easily accessible, information about the control procedure and a telephone helpline should be available for organisers and the procedure should also be easily available in analogue form.

# IJ-lab: less assumptions, more research

## Authors

Maaïke Meurs (Therapieland/Visma - Netherlands)

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## Abstract

### Background

IJ-lab is the research hub of Therapieland and Gezondeboel, e-mental health platforms which offer a broad range of preventive and curative e-mental health modules, which are used in blended treatments or as self-help. At IJ-lab a diverse group of internal and external researchers, team members and students share knowledge and jointly conduct research into the effectiveness and applicability of e-health. Use, engagement, and effectiveness are our most important pillars. We start projects in different research areas, including effectiveness, tracking & monitoring, virtual reality, UX design, and implementation.

### Methods

We perform qualitative, quantitative and data science research. IJ-lab actively searches for more collaborations with universities, colleges and knowledge institutions, to conduct research and put the generated knowledge directly into practice. These collaborations can take different forms: IJ-lab facilitates research by providing insight into our data and access to our platform; IJ-lab can be a partner of a research consortium when submitting a research application, for which we can make an in-kind contribution; IJ-lab can be a partner for the development of an e-health application in the context of research; IJ-lab gives students the opportunity to conduct graduation research.

### Findings

Our research shows that engagement plays an important role in the effectiveness of online modules. We investigated factors that influence engagement of our users. Based on these findings we're currently implementing improvements in our platforms in order to increase engagement, with the ultimate goal of helping more people. In line with this we are working on a data-driven prediction model, to match individuals to the content that fits their situation best. Also we strive to gain consensus on a more standardized definition of the value of eMental health. We're currently defining outcome indicators, based on systematic literature reviews and Delphi research, in which micro, meso and macro perspectives will be represented.

# **A human-centered design approach for an unobtrusive breastfeeding parameter assessment device for young infants**

## Authors

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## Abstract

An adequate eating pattern is of great importance for a babies' health, especially in the first six months after birth. Breastfeeding provides health benefits to the baby such as protection against infections and a reduced chance of allergies. Not all infants can self-regulate the amount of breastfeeding needed. An assessment device can support this process by assessing breastfeeding parameters (such as the volume of the milk drank, the frequency feeding and the drinking speed). However, current assessment methods of breastfeeding are cumbersome. Existing solutions are obtrusive, inconvenient and often require a lab setting to utilize the device.

This research explores concepts that measure one or more of the breastfeeding parameters while meeting unobtrusiveness, mobility and simplicity requirements. A human-centered design approach was used to identify user requirements and technical requirements, that facilitated the creation of concepts (prototypes).

This work demonstrates the potential of several concepts in their ability to function as a breastfeeding assessment device. Proof of concepts were built to evaluate on the aforementioned requirements. Several concepts show promising results. Research prototypes will now be created and applied in a pilot study setting with the target group.

# Individual-specific changes in circadian rest-activity rhythm and sleep in symptom-free patients tapering their antidepressant medication

## Authors

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## Abstract

### Background

Group-level studies showed cross-sectional and prospective between-person associations between circadian rest-activity rhythms (RAR), physical activity (PA), sleep, and depressive symptoms. However, whether these associations replicate at the within-person level remains unclear. Therefore, it is clinically relevant to investigate these associations within persons and study whether changes in depressive symptoms are related to changes in circadian rhythm and sleep variables. In the current study, we aim to identify changes in circadian rhythm elements in proximity to a transition in depressive symptoms, whether changes are less frequent in individuals without compared to those with transitions, and whether there are individual differences in the direction of change of circadian rhythm variables.

### Methods

Data of remitted individuals tapering antidepressants were used: 12 with and 14 without a transition in depressive symptoms. RAR, PA, and sleep variables were calculated as predictors from four months of actigraphy data. Transitions in depressive symptoms were based on weekly SCL-90 scores and evaluation interviews. Kernel Change Point analyses were used to detect change points (CPs) and CP timing in circadian rhythm variables for each individual separately.

### Findings

In 67% of individuals with depressive symptoms transitions, CPs were identified in proximity to symptom transitions. CPs were detected less frequently in the no-transition group with 7 CPs in 14 individuals, compared to transition groups with 10 CPs in 12 individuals. For several RAR and sleep variables, consistent changes were detected in expected directions.

### Conclusion

Circadian rhythm variables provide potentially clinically relevant information, although their patterns around transitions are highly person-specific. Future research is needed to disentangle which variables are predictive for which patients.

# Needs assessment, development and trial design of an internet-based mindfulness-based couple intervention targeting cancer-related fatigue

## Authors

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## Abstract

### Background

Chronic Cancer-Related Fatigue (CCRF) is a common symptom among cancer survivors. The currently available internet-based mindfulness-based cognitive intervention (eMBCT) targets the patient alone, while evidence suggests that targeting the dyad might be more beneficial.

### Methods

(Focus group) interviews with survivors, partners and psychotherapists were conducted to assess needs and preferences regarding a dyadic approach for CCRF care. Subsequently, needs and preferences of patients and partners were quantified with an online survey. Qualitative and quantitative results were used to co-design a couple version of the existing eMBCT, which will be tested in a pilot trial.

### Findings

Patients, partners and psychotherapists acknowledged the potential benefit of involving the partner in CCRF care. The majority preferred a flexible approach to partner involvement. Half of the patients were concerned to burden the partner whilst psychotherapists stressed the importance of not losing the focus on patient treatment goals. These needs and preferences were translated into requirements, which were prioritized according to the MoSCoW (must; should; could; would not) method. A flexible approach to partner involvement was a must. As the original eMBCT, couple eMBCT will be guided by a psychotherapist. The partner will be involved from the first contact. The couple will receive dyadic psycho-education and can decide which exercises they want to perform together. A newly developed session is dedicated to the couple's relationship and communication about CCRF. A one-arm pilot trial with 34 couples will test the acceptability of the couple eMBCT, potential effectiveness on patient fatigue, feasibility of trial procedures and working mechanisms. The trial will incorporate a diary method and final focus groups.

### Conclusion

A needs- and preference-based couple eMBCT was developed. The subsequent pilot trial is expected to support the acceptability of the intervention in terms of adherence and satisfaction with the dyadic approach and the intervention overall.

# A gamified ehealth intervention to improve lifestyle in nafld-patients: results of a needs assessment study

## Authors

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## Abstract

### Background

Non-Alcoholic Fatty Liver Disease (NAFLD) is due to its fast-growing prevalence a major concern in health care nowadays. Advanced stages of NAFLD can be prevented or reversed by lifestyle changes. However, NAFLD patients experience difficulties in changing their lifestyle. eHealth can support patients in this process. This study explored the needs and wishes of NAFLD-patients regarding information about the disease, their lifestyle changes and their preferences regarding a variety of potential features of a gamified eHealth intervention.

### Methods

An online survey was distributed via Dutch patient organizations. The questionnaire included questions about the received information on NAFLD-related topics (e.g. underlying causes, treatment options), information needs, advised and implemented lifestyle changes and preferences regarding a number of eHealth features (derived from Persuasive System Design principles) and Behaviour Change Techniques (derived from Theoretical Domains Framework). The data was analyzed using descriptive statistics.

### Findings

In total, 469 NAFLD patients (19% males, mean age 55 years) completed the questionnaire. On average, only 13% of the participants indicated that they had received sufficient information about NAFLD-related topics from their health care professional, and 78% would like more information on almost all NAFLD-related topics including disease specifics and therapies. The minority of participants indicated to have succeeded in permanently changing their diet (38%), exercise pattern (37%) or losing weight (17%). Nearly all patients used smartphones (95%), computers (82%) or tablets (62%), but wearables (24%) were used less often. Regarding a future eHealth intervention, respondents mentioned that they were highly interested in information about NAFLD (63%) and practical examples (58%), but less in competition with other app-users (9%) or contact with other NAFLD-patients (17%).

### Conclusion

Our study revealed a considerable need for information and lifestyle support in patients with NAFLD. Based upon the results of this study, a prototype intervention is developed that will be presented.

# Modern times in point of care diagnostics

## Authors

Wolter Paans (Hanze University of Applied Sciences - Netherlands)

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## Abstract

The aim of this presentation is to clarify the implications for professionals and citizens of the developments within point of care technology POCT in general and concerning diagnostic Methods in particular. The lecture contains the discussion of four movements: family care, health literacy, the e-patient movement, and self-management. Based on technological developments, the impact of POCT on the healthy aging paradigm is illustrated by means of examples and possible future developments. Aspects of the process of validation, valorization, feasibility and adoption will be discussed by using practical cases. An example (using infrared technology to diagnose superficial infections) will be briefly explained in the format of: 'Background, Methods, Findings and conclusion'. In addition, desirable developments in higher education and science are examined. Ethical considerations are also included in this consideration. It is a broad view, which is intended to be introductory. The lecture is part of a collaboration in higher education and research under the name PIT. (A SIA-RAAK Platform in health related technology).



# Detecting clinical deterioration in covid-19 patients using continuous monitoring

## Authors

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## Abstract

### Introduction

Continuously monitoring vital signs may enable clinicians to detect patient deterioration sooner than with intermittent measurements by nurses. Furthermore, monitoring patients remotely may result in restricting nurses' exposure to infectious patients by reducing patient contact. The utility of the monitoring may depend on the monitored vital signs. The present study aims to determine to what degree intensive care physicians are capable of assessing the health status of COVID-19 patients based on continuous measurements of heartrate and respiratory rate, and supportive intermittent measurements, compared with 4-hourly monitoring by nursing staff.

### Methods

Patients admitted to the COVID-19 ward received a biosensor which continuously measured heartrate and respiratory rate, in addition to usual care. Biosensor data were not used for clinical decision making. Two intensive care physicians retrospectively assessed the continuous measurements, supported with intermittent oxygen saturation, temperature, and blood pressure measurements, independently, and indicated when clinical intervention might be needed. A third intensive care physician independently extracted clinical events from the electronic medical record (EMR) that occurred during the period that the patient was admitted for COVID-19 and was equipped with a biosensor. Primary outcomes were sensitivity and number of false positives.

### Results

The first two physicians assessed data of 21 patients and, together, they indicated 62 instances where clinical intervention might be needed. The third physician extracted 72 events from the EMR where a clinical intervention took place. Out of these 72 events 14 were detected based on biosensor data (sensitivity 19.4%). In 48 out of 62 instances, no events were found in the EMR.

### Conclusion

It seems that continuous measurements of heartrate and respiratory rate in addition to intermittent SpO<sub>2</sub>, temperature and blood pressure, are insufficient for clinicians to determine whether clinical intervention is needed in COVID-19 patients. Other clinical parameters are likely to play a more important role.

# Improvement of the upper limb function after a home-based assistive-device training for chronic stroke patients

## Authors

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## Abstract

### Background

The upper limb function is often affected by stroke. A limited upper limb function has severe implications for the quality of life of a patient. Assistive training devices have shown to be effective in improving the upper limb function due to intensive training. Patients in the chronic phase of stroke could benefit from the possibility to train at home. hoMEcare aRm rehabiLiTation (MERLIN) is an assistive device combined with a telerehabilitation platform which facilitates intensive training at home. The aim was to investigate if MERLIN was effective to improve the upper limb function and feasible to be used at home.

### Methods

Twelve patients in the chronic phase after stroke (>6 months- <3 years) were asked to train 3 hours per week over the course of 6 weeks. The assistive device moved over the tabletop and trained shoulder, elbow, wrist and finger movements using serious games. Via the telerehabilitation system, the researcher could contact the participant, monitor the training and adjust the training program. Arm function tests (Wolf Motor Function Test (WMFT), Action Research Arm Test (ARAT) and Fugl-Meyer Assessment-Upper Extremity (FMA-UE)) and quality of life (EuroQoL-5D (EQ-5D)) were measured six weeks pre-intervention (T0), at the start (T1), end (T2), six weeks (T3) and six months (T4) post-intervention. At T2, user experience was assessed.

### Findings

One patient dropped out due to illness (unrelated to intervention) and device discomfort. Significant improvements in upper limb impairment were measured directly after training in WMFT and FMA-UE. FMA-UE was significantly higher (5.5 points) 6 months after cessation of the training compared to baseline. ARAT and EQ-5D did not show significant differences. Usability questionnaires revealed that comfort and robustness can be improved.

### Conclusion

Training at home using MERLIN resulted in significant improvements in upper limb function, which were partly retained at six months follow up.

# Alerts for medication (relatively) contra-indicated in patients with diabetes mellitus: implementation in primary care information-systems

## Authors

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## Abstract

### Background

Drug-disease interactions (DDIs) may have negative consequences on a patient's health status. It can be necessary to avoid specific medication, monitor therapy or to adjust dosage. To better support healthcare professionals (HCPs) in their prescribing and dispensing activities, these DDIs should be implemented in software information systems.

### Methods

We developed a best practice method for signalling DDIs in software information systems. This best practice facilitates HCPs to register comorbidities, such as diabetes mellitus, as a contraindication. All prescribed drugs were checked for a DDI. When a clinically relevant interaction occurred, an alert with specific recommendations for diabetes mellitus was shown. We analysed the current DDIs with respect to number of alerts, pharmacological mechanism and most common practice recommendation.

### Findings

Clinically relevant DDI alerts with diabetes mellitus were developed for 166 drugs. Effects on glucose homeostasis, insulin sensitivity and/or insulin secretion were identified as underlying pharmacological mechanisms. The alerts for DDIs with diabetes mellitus provide HCPs with decision support for specific drugs: when to avoid a drug; when to monitor blood glucose concentrations during therapy and when to inform the patient about potential risks of hyper- or hypoglycaemia. The contraindication diabetes mellitus was implemented in the two national clinical decision support databases. Hence, alerts can easily be generated in all software information systems and used in all primary care and hospital settings in the Netherlands.

### Conclusion

Alerts for medication (relatively) contra-indicated for diabetes mellitus support both pharmacists and physicians in primary care and hospitals, by signalling clinically relevant DDIs at the point of care. Clinical decision support assists HCPs to identify and deal with DDIs, thereby improving medication safety. Effort will be made to further individualize alerts, by taking into account additional clinical characteristics, resulting in more personalized recommendations on medication safety.

# The open digital health: making digital behaviour change interventions open, scalable and accessible for all

## Authors

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## Abstract

### Background

Digital health tools defined as the use of technology solutions (e.g., computers, phones, wearables, virtual reality) to deliver health interventions are increasingly used to promote health and wellbeing across different populations and settings. They can improve disease prevention and healthcare delivery and have a potential to deliver effective health promotion interventions and to support health behaviour change. In this presentation, we will outline recommendations from the perspective of health psychology and behavioural science, addressing three research gaps: what methods in the health psychology research toolkit can be best used for developing and evaluating digital health tools? What are the most feasible strategies to reuse digital health tools across populations and settings? What are the main advantages and challenges of sharing (openly publishing) data, code, intervention content and design features of digital health tools?

### Methods

We used consensus building methods to make actionable suggestions for researchers joining the growing Open Digital Health movement, poised to revolutionise health psychology research and practice in the coming years.

### Findings

Conventional randomised controlled trials (RCTs) are seen as the gold-standard and are helpful for assessing the efficacy and effectiveness but not always fit-for-purpose in the context of dynamically changing digital health tools. Other innovative frameworks, research designs and accompanying statistical methods are more closely aligned with the iterative nature of digital health tools. The not-for-profit Open Digital Health initiative was established with the overarching aim to give digital health tools 'a second life' by promoting the reuse of existing evidence-based tools (or components of these) and their replication and application across different populations and settings.

### Conclusions

This presentation is positioned in the current context of the COVID-19 pandemic, exploring how digital health tools have rapidly gained popularity in 2020–2022, when world-wide health promotion and treatment efforts rapidly shifted from face-to-face to remote delivery.

# Stimulating healthy behavior: the development of a modular e-health platform

## Authors

Josje Schoufour (Amsterdam University of Applied Sciences - Netherlands), Sumit Mehra (Amsterdam University of Applied Sciences - Netherlands), Daniël Bossen (Amsterdam University of Applied Sciences - Netherlands), Marije Verwijs (Amsterdam University of Applied Sciences - Netherlands), Annette Brons (Amsterdam University of Applied Sciences - Netherlands), Joey van der Bie (Amsterdam University of Applied Sciences - Netherlands), Michel Oey (Amsterdam University of Applied Sciences - Netherlands), Peter Weijs (Amsterdam University of Applied Sciences - Netherlands), Somaya Ben Allouch (Amsterdam University of Applied Sciences - Netherlands)

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## Abstract

### Background

Encouraging healthy eating behavior and increasing physical activity can improve health, vitality, and quality of life. Individuals and health professionals have specific needs and wishes. Creative technology allows personalization of blended lifestyle programs that support behavior change by presenting persuasive elements and self-regulation. However, the development of such personalized digital tools are time consuming and expensive. New research projects with regard to physical activity and/or nutrition that apply creative technology often start from scratch, while many of the core components are generic. Therefore, we aim to develop a modular platform that serves as a foundation to build several lifestyle applications for various populations, while taking into account the specific needs of the end users. To demonstrate how we can use the platform for a blended lifestyle program regarding physical activity and nutrition, the SONUTS application was developed. SONUTS helps older adults to maintain or lose weight while preserving muscle mass and function.

### Description of the application

Our Modular E-health platform supports three end users: clients, health professionals, and researchers. It enables the use of various behavior change techniques such as goalsetting and action planning. The SO-NUTS application, that has been built on the platform, offers clients to track their dietary intake and physical activity, goal setting, evaluation, communication with health professional and in the future with members of the community. The health professional can track progress and can adjust goals when necessary. Data from both clients and health professionals can be retrieved by researchers, clients and professionals to determine effectiveness of the intervention.

### Practical description of demo

We will present a clickable demo version of the SO-NUTS application that was built on the modular platform. Moreover, we will show various options of the modular platform to demonstrate its use in the development of new applications for future research projects.

# Best-practices for participatory design involving people with severe mental illness for eMental health interventions

## Authors

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## Abstract

### Background

A mismatch between the design and content of eMental Health (eMH) technologies and the skills, context and preferences of people with severe mental illness (SMI) might explain the lack of adoption by this target group. Participatory design (PD) can optimize this fit, but vulnerable populations are often excluded or misrepresented. The active role of SMI patients in PD is relatively new and not clearly defined, so in-depth knowledge on this is lacking. The goal of this study is to gain insight into the best-practices for doing PD with people with SMI.

### Methods

A qualitative, multi-method approach was used. First, a scoping review was used to gain insight into the lessons learned of 21 PD studies targeting eMH development with people with SMI. Second, an online survey with open-ended questions rendered insight into the best-practices of 25 researchers with experience in conducting PD with vulnerable groups. Third, semi-structured interviews with six PD participants with SMI shed light on their opinions and preferences for PD involvement. All data were coded with the same coding scheme to ensure synthesis of the findings

### Findings

The results were 23 recommendations divided into four distinct categories: 1) activities to carry out prior to the start of data collection; 2) recommendations to ensure longevity in the fruitful collaboration of the participatory team; 3) recommendations targeting the bespoke approach within PD to accommodate the skills and abilities of SMI participants; and 4) the mitigation of ethical challenges surrounding power balance.

### Conclusion

PD with people with SMI does not come with a one-size fits all approach. It calls for a flexible and bespoke process that fits the participants' skills, preferences and context. In addition, more attention should be paid to the personal benefits of participation for people with SMI, rather than solely focusing on the benefits for research.

# Improving implementation of e-health applications: applying the nasss framework to an advance care planning tool

## Authors

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## Abstract

### Background

Implementation of e-health applications often fails, mostly because technologies are either not adopted or soon abandoned, or fail to scale up (abbreviated as NASSS). The NASSS framework was developed to identify and reduce complexity of e-health applications in seven domains: illness, technology, value proposition, intended adopters, organization(s), external context and future perspective. In this study we applied the NASSS framework to the online Advance Care Planning tool, embedded in “thuisarts.nl” (Dutch for “homedoctor.nl”). The tool helps users to think about, discuss and record their wishes for care and treatment. Users can start using the tool when they are still healthy, but also when they get older or become ill.

### Methods

Existing data about development and implementation of the tool was collected (including scientific publications, a SROI analysis, user data and developer notes). Additional interviews were conducted. The total dataset was analyzed using case study methodology to identify any complexities which might hinder a successful spread and sustainability of the tool.

### Findings

We identified complexity in two domains. The domain ‘intended adopters’ was classified as complex, because the tool requires the users to read multiple information pages and fill in answers, thus requiring an active participation. The domain ‘organization(s)’ was classified as complex, because the readiness of healthcare professionals to engage in advance care planning conversations with their patients may differ, hampering uptake of the tool.

### Conclusion

The use of the NASSS framework identified complexities which may influence a successful spread and sustainability of the advance care planning tool. However, in most domains no complexity was found, which indicates that the tool has a good chance at a successful spread and sustainability over time. A national policy on ACP may further improve the sustainability of the program.

# Beating cancer-related fatigue with the untire mobile app: results from a waiting-list randomized controlled trial

## Authors

Simon Spahrkäs (UMCG / RUG / Tired of Cancer - Netherlands), Anne Looijmans (UMCG / RUG - Netherlands), Robbert Sanderman (UMCG / RUG - Netherlands), Mariët Hagedoorn (UMCG / RUG - Netherlands)

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## Abstract

### Background

This waiting-list RCT examined the effectiveness of a self-management mHealth app in improving fatigue and quality of life (QoL) in cancer patients and survivors. Further, we examined whether specifically targeted factors mediated the potential intervention effects of the Untire app on fatigue outcomes.

### Methods

Persons with cancer-related fatigue (CRF) were recruited across four English-speaking countries and randomized into intervention (n=519) and control (n=280) groups. Whereas the intervention group received immediate access to the Untire app, the control group received access only after 12-weeks. Primary outcomes, fatigue-severity, interference, and secondary outcome QoL and mediators were assessed at baseline, 4, 8, and 12-weeks. We ran GLMM for all outcomes to determine the effects of app access (yes/no) over 12-weeks, following the intention-to-treat principle. Participants who completed the 12-week-assessment were included in the mediation-analyses (intervention=159; control=176). We performed longitudinal mediation analysis using PROCESS-macro to examine whether the potential mediators explained the overall intervention-effects.

### Findings

Compared with the control-group, the intervention-group showed significantly larger improvements in fatigue-severity ( $d=0.40$ ), fatigue-interference ( $d=0.35$ ), and overall-QoL-on-average ( $d=0.32$ ) ( $P$ 's  $< .01$ ), but not for overall-QoL-in-the-past-week ( $P = .07$ ). Sensitivity-analyses indicated that participants with medium or high app use benefited most when compared with nonusers and control participants ( $P$ 's  $\leq .02$ ). RCI-analyses indicated that significantly more people showed full recovery for fatigue in the intervention vs. the control group ( $P$ 's = .02). Improvements in fatigue catastrophizing, depression, and mindfulness, significantly mediated the intervention effect on fatigue severity, whereas sleep-quality, sleep-disturbance, and physical-activity did not. Similar associations were found for fatigue-interference.

### Conclusions

Untire app access reduces fatigue-severity and interference mainly by decreasing fatigue, catastrophizing depression, and increasing mindfulness. Supporting these psychological mechanisms is crucial for lowering fatigue among cancer patients and survivors. The Untire app can be an effective mHealth solution for cancer patients and survivors with moderate to severe CRF.



# Beating cancer fatigue with the untire app - demo

## Authors

Simon Spahrkäs (Tired of Cancer - Netherlands)

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## Abstract

Cancer-related fatigue (CRF) is a frequent and invalidating problem in (former) cancer patients. If there are no medical causes, relief of fatigue can be attained by means of non-pharmacological interventions. Guidelines prescribe a multimodal approach focusing on mental processes, physical activity, and sleep. Online interventions have shown to be effective in reducing CRF. These results inspired the creation of an all-embracing app on the various behavioral and physical activity modification themes recommended in oncological guidelines. This basis for the 'Untire' app is the Daily Program, consisting of 4 components. In 2018, the 'Untire' app has been launched in several languages around the globe. Its effectiveness has been studied by means of a randomized controlled trial, and further RCTs are on the way. In this demo we will showcase the intervention and discuss content and delivery mode interactively together. Also areas for future development and research will be discussed.

# Patients' perspectives regarding home-based telerehabilitation using an assistive device for the upper limb after stroke

## Authors

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## Abstract

### Background

In the chronic phase after stroke the possibilities to intensively train the upper limb are limited. To provide intensive training at home, assistive training devices can be used. This qualitative study explored stroke survivors' perspectives regarding a training program at home, using the hoMEcare aRm rehabilitation (MERLIN) system, an assistive training device and telerehabilitation platform. The aim was to investigate patients' perspectives on the facilitators and barriers of the MERLIN system and on the International Classification of Functioning, Disability and Health (ICF) domains.

### Methods

Semi-structured interviews were conducted with the stroke survivors who completed the MERLIN trial. The framework method was used to analyze the interviews.

### Findings

Eleven patients participated, 8 of them were male and the mean age was 66 years (SD 8.4y). The general opinion about the device and training was positive. Participants experienced some improvement on ICF level body functions, such as hand oedema, joint range of motion and self-confidence. Also, some positive effects were noticed on activity level, but not on participation level. Not having to travel and the flexibility in training time and duration were the most named advantages of training at home. Problems were encountered in ergonomics, hard- and software and the amount of assistance that was needed from a therapist or relative. These experienced facilitators and barriers were translated into recommendations, for instance intensive guidance at the start, a compact and sustainable device which can be ergonomically adjusted to different postures and the training should remain challenging upon progression.

### Conclusion

It has been shown that for training the upper limb function, a home-based training program using an assistive training device is well received. To prevent similar barriers in future new assistive training devices at home, device developers should take the patients' feedback into account in the early stages of development.

# Classification of paediatric movement disorders using freehand single camera video recordings of gait

## Authors

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## Abstract

Children with Early Onset Ataxia (EOA) and Developmental Coordination Disorder (DCD) have significant phenotypic similarities that can be difficult to distinguish in clinical practice. Gait in ataxia can be assessed semi-quantitatively using the Scale for Assessment and Rating of Ataxia (SARA). Such clinical assessment requires prior knowledge about physiological age-related motor development and behavior, with resultant scores depending on the observer's interpretation. Therefore, wearable inertial sensors could provide an objective and feasible alternative. Before usage, this approach requires special preparation, however. The widespread use of video cameras in outpatient clinics and recent advances in computer vision prompted us to develop a 2D skeleton-based technique for the classification of the disorders from video footage.

Thirty children (10 EOA, 10 DCD, and 10 controls) walked in a straight path in front of a single 2D camera. First, Alphapose pretrained on the MSCOCO dataset was used to extract 17 skeleton keypoints. The skeleton was then matched to the same subject in a recording using the PoseFlow framework. We employed a normalization method to derive distance-based features after obtaining the skeleton sequence. Traditional machine learning models were used to examine the effectiveness of skeleton features for classification of the disorders.

After data cleaning, the mean likelihood for keypoints from the pose estimation model was 0.86 (std = 0.04), suggesting strong keypoint reliability. The xgboost classifier obtained the highest group-level classification accuracy for our dataset, with 71.4% for EOA, 60.0% for DCD, and 62.5% for healthy control. Changes in the average distance for both the ankle and elbow keypoints were the most relevant discriminative features. Our method demonstrated a promising application of 2D pose estimation for the classification of movement disorders in a convenient and objective manner. We will derive more relevant features in a larger dataset and develop better algorithms to improve classification accuracy.

# Usability of smart visual assistant (alexa) to monitor adherence in chronic patients: preliminary results

## Authors

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## Abstract

### Background

Low medication adherence is identified as one of the main issues for increased morbidity and mortality in chronic patients. Smart Virtual Assistants, such as Amazon Alexa, are becoming increasingly common in households, enabling the possibility of using vocal commands to interact with active solutions to non-adherence. The aim of this study is to evaluate the usability of Amazon Alexa devices to monitor medication adherence in chronic patients.

### Methods

A Skill was developed for the Alexa environment, together with a cloud database and a connected online dashboard. Each enrolled participant answered the eHealth Literacy Scale (eHEALS) and 8-items Morisky Medication Adherence Scale (MMAS-8) questionnaires, then inserted prescribed medications into the online dashboard, linked to the Alexa device, thus automatically setting reminders at the proper time and 25 minutes later. Patients had a 30-minute range around the set time to communicate to the Skill the medicine intake. After seven days, participants participated in a semi-structured interview including the System Usability Scale (SUS) questionnaire.

### Results

Six people (three males and three females, median age 46.5 (IQR = 13.8) years old), participated in the study. eHEALS scores ranged from 20 to 40 (N=3 in the range 39-40; N=3 in the range 20-22). Apriori, MMAS-8 identified general low adherence to therapy, with median score 4.5 (IQR = 2.2). In the 7 days Alexa utilization, median adherence was 85.7% (IQR = 7.1%). Post-experiment SUS questionnaire resulted in a median score of 86.2 (IQR = 14.4).

### Conclusions

Participants were very satisfied with the usability of the developed Skill. The high SUS score shows Amazon Alexa as an effective, interactive and easy-to-use tool to monitor medication adherence. Additional studies will be required to further improve the developed Skill and quantify its ability to effectively increase adherence in chronic patients.

# Critical decision making in surgical necrotizing enterocolitis analyzed: surgery or comfort care

## Authors

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## Abstract

### Background

One-third of neonates with necrotizing enterocolitis (NEC) require emergency laparotomy, with high perioperative mortality (~50%) and morbidity (~75%). Each case poses the urgent dilemma whether surgery is still in the best interest of the child, or if comfort care and accepting death is a preferable option. The decision is highly complex and therefore hard to capture in rigid decision rules. Understanding relevant decision-factors and their implicit weight is crucial for future decision support and focused research. We applied a novel artificial intelligence technique to identify the most important decision-factors and differences between specialties and centers.

### Methods

Thirty-five hypothetical surgical NEC scenarios with different factor-levels were evaluated by neonatal care experts of all Dutch neonatal care centers in an online environment, where a recommendation for surgery or comfort care was requested. We conducted choice analysis by constructing a binary logistic regression model according to behavioral artificial intelligence technique (BAIT).

### Results

In total 62/109 (57%) neonatal care experts responded, with 44 neonatologists and 14 pediatric surgeons who reported their specialism. Cerebral ultrasound (Relative importance=20%, OR=4.06, 95%CI=3.39-4.86) was the most important decision-factor, both nationwide and for all specialties and centers. For neonatologists, birth weight and gestational age were the next most important decision-factors, for pediatric surgeons hemodynamics and congenital comorbidity. Pediatric surgeons more often recommended surgery compared to neonatologists (62% versus 57%,  $P=0.03$ ). For all centers, cerebral ultrasound, congenital comorbidity, hemodynamics and parental preferences were significant decision-factors ( $P<0.05$ ). Sex ( $P=0.14$ ), growth since birth ( $P=0.25$ ), and estimated parental capacities ( $P=0.06$ ) had no significance in nationwide nor subgroup analyses.

### Conclusion

Findings on cerebral ultrasound are the prime decision-factor in the recommendation for surgery or comfort care in surgical NEC among Dutch neonatal care experts. Between centers, decision-factors' significances are generally harmonious. In the future, after validation, our choice model/BAIT might function as decision support.

# The influence of the covid-19 pandemic on the attitudes towards and use of health technology in the northern part of the netherlands: a longitudinal study

## Authors

Job van 't Veer (NHL Stenden Hogeschool - Netherlands), Dirk Postma (Fries Sociaal Plan Bureau - Netherlands)

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## Abstract

### Background

To face the challenges in healthcare, much is expected from (digital)-health technologies. However certain populations struggle to keep up with this digitalization of healthcare, causing 'digital division' that generally disadvantages older, less wealthy and less educated people. It is established that the COVID-19 pandemic caused many aspects of daily life to become more digital and there is debate whether the pandemic has either 'deepened' or 'levelled' this digital divide. However, this is not yet thoroughly examined. In this longitudinal study we assess the attitudes and actual use of digital health applications in the general public and investigate how the omni-present COVID-19 pandemic has influenced these variables.

### Method

A digital questionnaire was sent to approximately 6000 inhabitants in Fryslân (province in The Netherlands). First in October 2019 (pre-pandemic; n=2845) and in November 2020 (during pandemic, n=2258). Besides demographic characteristics, we asked participants' use of 12 common examples of health technologies, e.g. Internet health information, apps, e-consulting (yes/no). We assessed peoples' attitudes towards technological health applications using 7 statements (5-point scale; agree/disagree).

### Results

In general, respondents show moderately positive attitudes towards health technology, yet no significant improvement between pre- and during-covid measuring points. However, the actual use of health technologies improved. The level of uptake does differ among the 12 applications. Logistic regression analysis shows that education level, socio-economic status and ehealth attitudes are positively associated with higher levels of ehealth use. People's level of ehealth use in 2019 is positively related to increased use in 2020, suggesting a worsened digital divide during the pandemic.

### Conclusion

The covid-19 pandemic has a positive effect on the uptake of digital health application in the general public. Use of ehealth-applications accelerated more among populations that already were more familiar using these technologies. Attitudes towards ehealth-applications seem less susceptible to change during this period.

# Training healthcare professionals in movement-oriented restorative care using virtualreality simulations: effects and user-experiences

## Authors

Job van 't Veer (NHL Stenden Hogeschool - Netherlands), Danjel Sijtsma (Kwadrant zorggroep - Netherlands), Chiem Tuil (NHL Stenden Hogeschool - Netherlands)

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## Abstract

### Background

In many nursing homes it is policy to stimulate physical activity among residents, since it positively influences functional independence and overall health. To educate healthcare-professionals in Movement-oriented Restorative Care (MRC), organizations invest in elaborate, costly training-programs. Technologies like Virtual Reality (VR) may offer benefits that can train healthcare professionals more effectively and efficiently. Objective: This study examines the lessons learned from a VR simulation training to put the principles of Movement-oriented Restorative Care (MRC) to use in nursing home environments.

### Methods

This study involved a VR- training in which most MRC-principles were addressed in 15 simulated scenes. A total of 62 participants participated in this study. With a 10-item self-evaluation questionnaire (pre- and post-training) we measured immediate learning results. In structured interviews (3-5 weeks after training) we asked a subpopulation (n=6) about their user-experiences.

### Results

Pre- and post-measurements showed a significant overall improvement in (self-assessed) MRC-knowledge and skills. However, learning effects varied among specific MRC-principles. Interviews showed that the VR-simulation yielded intense immersive experiences and most scenes were recognized as highly relevant in daily practice. Participants expressed the need for a more in-depth debriefing to facilitate the transfer of knowledge to their daily contexts. Despite the fact it was a simulated i.e. safe learning-environment, participants were very eager to avoid mistakes and receive high in-game scores.

### Conclusions

Health professionals clearly appreciate VR-simulations as an innovative educational tool. This pilot proved VR can be a powerful tool to train large groups in a short period of time. First results on learning effects seem promising, but certain benefits VR-simulations has to offer are not yet exploited to its fullest. First, it is important to develop a protocol to guarantee in-depth debriefing. Second, being situated in a realistic yet safe learning environment, participants should be persuaded to use more experimental learning-strategies.

# Designing for appropriate trust in artificial intelligence: making machine learning usable for radiologists

## Authors

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## Abstract

### Background

Artificial intelligence-based computer-aided detection (AI-CAD) systems are supposed to help radiologists with the detection of pulmonary nodules in medical images. However, inappropriate trust in these systems often leads to an incorrect use, manifested in both under- and over-reliance. Literature suggests that a lack of transparency in the system and insufficient knowledge of the underlying algorithm from the user are the main causes for this concern. The current study tested proposed solutions for the design of CAD systems to counter these causes.

### Methods

Eleven radiologists took part in an online experiment, detecting pulmonary nodules in thoracic computed tomography slices using an AI-CAD system. The participants were randomly assigned to one of six conditions, varying in the degree of transparency of the system and whether the algorithm was used as first or second reader. Transparency was reflected in the display of the system's performance, confidence ratings for each mark, and extensiveness of the explanation of the system. The outcomes measured were the subjective evaluations of the radiologists as well as the specificity, sensitivity, and additional false positives marked.

### Findings

Due to the small sample size, only data exploration was performed. The results showed lower specificity in the least transparent conditions, without affecting sensitivity. Specificity was also lower with CAD as second reader. The evaluation showed that participants did not think the explanation of the system affected their trust. They did indicate that display of the system's performance and confidence ratings helped them in their scanning, pattern recognition, and decision making processes, which led to more confidence and higher satisfaction.

### Conclusion

In conclusion, displaying the performance levels and the confidence ratings could lead to an increased appropriate trust in CAD as does using CAD as first reader.



# E-health developments during the covid-19 pandemic, Findings from the literature and empirical research

## Authors

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## Abstract

### Background

The COVID-19 pandemic created an environment in which visits from patients to healthcare professionals had to be minimized. This resulted in an upsurge of e-health use which may result in a structural change in the delivery of healthcare. The aim of the study was to explore the developments of e-Health during the COVID-19 pandemic and how insights from this period can be utilized for the optimalization of the usage of e-health in the future.

### Methods

The international scientific literature and grey literature from the Netherlands were searched for publications on developments regarding the use, attitude towards, experience and implementation of e-health during the COVID-19 pandemic. Embase was searched in May and November 2021. Grey literature was searched using literature alerts and snowballing. In addition, empirical data from the E-healthmonitor was used, collected from panels and focus groups. Dutch health claims data was obtained via Vektis.

### Findings

The use of e-health increased during the pandemic, both nationally and internationally. E-health was mainly used during the peaks of the COVID-19 infection rates. E-health was also used for monitoring and treatment of COVID-19 patients. In general, users had a positive attitude towards the use of e-health, driven by positive experiences during the pandemic. Users felt that the main advantages of e-health during the pandemic were continuity of care and involving significant others. However, many would prefer blended care (a mix of face-to-face and digital contact).

### Conclusions

The COVID-19 pandemic resulted in an increase in the use of e-health. It remains to be seen to what extent this increase will be sustained in the future. The pandemic created an environment in which many individuals gained experience with e-health. Continued experience and experimentation is crucial to gain further insight into the added value of e-health and preferences for e-health use after the pandemic.

# Using vr to train paramedics to perform triage in complex situations

## Authors

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## Abstract

### Background

Training of paramedics to carry out a triage in complex situations is either a costly procedure when carried out with real people, or a more theoretical practice when done in simulation. In co-creation, we developed a virtual reality (VR)-based training that allows paramedics to train triage in an environment with various levels of complexity (number of patients) and environmental features (e.g., bystanders and sound). In this study, we carried out a field evaluation to assess how the prospective users experience the training.

### Methods

We recruited 32 paramedics (12 females) from 5 different regional ambulance companies in the Netherlands to test our VR training (briefing, VR experience, debriefing). Five participants were also a trainer in their regional service organization. In total, 4 discontinued their training due to motion sickness felt. The remaining 28 participants were asked to fill in a questionnaire composed of the RIMM and the UEQ (both on a 5-point scale), and a few other questions. The RIMM contains questions asking about motivation and the UEQ about the user-experience (Cronbach alpha's > 0.72 for all categories).

### Results

Participants were highly motivated: Mean scores were around 4 on Attention (M=4.04; SD= 0.94), Confidence (M=3.83; SD=0.93), Relevance (M=4.10; SD=0.65) and Satisfaction (M=4.34; SD=0.85). Participants scored the user experience comparably high: Attractiveness (M=4.24; SD=0.79), Efficiency (M=3.84; SD=0.64), Novelty (M=4.39; SD=0.57), Perspicuity (M=3.71; SD=0.65) and Stimulation (M=4.30; SD=0.68).

### Discussion/Conclusion

While the current evaluation does not quantify the effectiveness of the VR training, the results clearly indicate a high potential that the current VR prototype has for training triage in complex situations. While further improvements are necessary (e.g., regarding motion sickness in VR), our study not only provide a set of trainings, but also a roadmap for how to design multidisciplinary VR training environments for paramedics and possibly other health personnel.

# Trends in daily heart rate variability fluctuations are associated with longitudinal changes in stress and somatisation in police officers

## Authors

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## Abstract

### Background

The emergence of wearable sensors that allow for unobtrusive monitoring of physiological and behavioural patterns introduces new opportunities to study the impact of stress in a real-world context. This study explores to what extent within-subject trends in daily Heart Rate Variability (HRV) and daily HRV fluctuations are associated with longitudinal changes in stress, depression, anxiety, and somatisation.

### Methods

Nine Dutch police officers collected daily nocturnal HRV data using an Oura ring during 15–55 weeks. Participants filled in the Four-Dimensional Symptoms Questionnaire every 5 weeks. A sample of 47 five-week observations was collected and analysed using multiple regression.

### Findings

After controlling for trends in total sleep time, moderate-to-vigorous physical activity and alcohol use, an increasing trend in the seven-day rolling standard deviation of the HRV (HRVsd) was associated with increases in stress and somatisation over 5 weeks. Furthermore, an increasing HRV trend buffered against the association between HRVsd trend and somatisation change, undoing this association when it was combined with increasing HRV. Depression and anxiety could not be related to trends in HRV or HRVsd, which was related to observed floor effects.

### Conclusion

These results show that monitoring trends in daily HRV via wearables holds promise for automated stress monitoring and providing personalised feedback.

# Clusters of medical specialties around patients with multimorbidity – employing fuzzy clustering to explore multidisciplinary collaboration

## Authors

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## Abstract

### BACKGROUND

The increasing prevalence of multimorbidity, defined as having two or more chronic diseases, challenges hospital care organization. Hospital care is currently structured around medical specialties, focusing on separate treatment of individual organ systems. Organizational structures for multidisciplinary collaboration and coordination between medical specialists in case of multimorbidity are limited. With machine learning we aimed to unravel groups of medical specialties who were simultaneously involved in the hospital care for patients with multimorbidity.

### METHOD

We used retrospectively collected electronic health record data from 2017 in a Dutch hospital of 22,133 patients with multimorbidity. We used a fuzzy c-means clustering algorithm and explored the patients' membership degree factors to each cluster to distinguish subgroups of patients with a specific pattern of involved medical specialties.

### RESULTS

The mean age was 67.9 years (interquartile rang (IQR):20.9), and 56.0% was female. We identified six clusters and 22 subgroups. Most patients had a full or dominant membership to one cluster only (11 subgroups) and the remaining subgroups were combinations of two clusters. The prevalence of specific diagnosis groups, patient characteristics and healthcare utilization seemed to differ between subgroups. For instance, patients of the subgroup with high involvement of internal medicine, cardiology and geriatrics; was characterized by cardiometabolic diseases. These patients had the highest average age (median:73 years, IQR:16.2), number of diagnoses (median:5, IQR:3), and number of outpatient visits (median:7, IQR:6). The subgroups and their characteristics can provide clues about potential target populations that might benefit most from (more) multidisciplinary collaboration, such as a formalization of a cardiometabolic outpatient clinic.

### CONCLUSION

This study identified clinical relevant clusters and subgroups of medical specialties simultaneously involved in hospital care for patients with multimorbidity. The method enables hospitals to study and evaluate subgroups of medical specialties to identify potential target populations that might benefit from new models of care.

# Toward a conceptual framework of data-driven healthcare ecosystem: a systematic literature review

## Authors

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## Abstract

### Background

Digitalization is claimed to lead to disruptive changes in the healthcare industry including the formation of new business models, lower the barriers to entry the market, and enable the breakup of sectorial silos. Digitalization, or more specifically use of data-driven technologies is critical in healthcare, because effective healthcare depends on connecting systems, data, and people. Today the effects and benefits of digitalization for the whole healthcare ecosystem have not been substantially addressed. Moreover, the health sector has been notoriously slow to adopt innovative technologies therefore in the previous studies has been identified severe need to construct the implementation framework for data-driven technologies in the healthcare ecosystem. This paper aims to answer the RQ: “How are the use of data driven technologies displayed at the different levels of the healthcare ecosystems?” in order to explore the development of health technology from the organizational innovation ecosystems perspective by conducting a comprehensive review and analysis and to explore future research directions of the influence of data-driven technologies in the context of healthcare ecosystems.

### Methods

A systematic literature review (SLR) methodology was applied in order to answer the research question. To maintain reliability and credibility, the data collected from the articles was analyzed with NVivo 10.

### Results

The systematic literature review revealed a nuanced multidimensional picture of the data-driven healthcare ecosystem. The analysis of the research findings reveals the complementary classification of the data-driven technologies outcomes for the healthcare ecosystem at the macro-, mezzo-, and micro-levels.

### Conclusions

The paper discusses development and evaluation applications for health technology in organizational innovation ecosystems by investigation and description the current state of the research and tendencies. The paper's contribution to the theory and practice is the presentation of the future research directions in the performance management of new data-driven technologies in the context of digitalization.

