mHEALTH-AD

Training program for enhancing the adoption of mobile health technologies by persons with mild-dementia

HANDBOOK MODULE 3: mHealth for training health condition

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1. INTRODUCTION

1.1 What is the purpose of training for health conditions?

People worldwide are living longer. Today most people can expect to live into their sixties and beyond. At the biological level, ageing results from the impact of the accumulation of a wide variety of molecular and cellular damage over time. This leads to a gradual decrease in physical and mental capacity. These changes are neither linear nor consistent, and they are only loosely associated with a person's age in years. Moreover, as people age, they are more likely to experience several conditions at the same time. Older age is also characterised by the emergence of several complex health states commonly called geriatric syndromes [1]. Therefore, there are some common problems that elderly people may experience and tracking the health condition, adapting the behaviour and visiting the professional on time is crucial to enable the wellbeing of an older adult.

The most common change in the cardiovascular system is stiffening of the blood vessels and arteries, causing your heart to work harder to pump blood through them. The heart muscles change to adjust to the increased workload. Changes increase the risk of high blood pressure (hypertension) and other cardiovascular problems. Therefore, to have an insight into what is happening, people can be encouraged to include some daily routines and adapt their behaviour.

Next, with age, bones tend to shrink in size and density, weakening them and making them more susceptible to fracture. You might even become a bit shorter. Muscles generally lose strength, endurance and flexibility — factors that can affect your coordination, stability and balance. A well-known sign of declining health in elderly people is mobility issues. They may sit around longer, don't get out as much, and stay in one spot more than another. Mobility is a key component of physical health that can affect social and emotional well-being. Maintaining mobility is important to prevent falls, which could result in hip fractures or prolonged hospitalisation [2]. Staying active—even with simple, low-impact movement like walking for 30 minutes a day five times a week—is an effective way to maintain mobility with age, according to the Centers for Disease Control and Prevention (CDC). Without activity, muscles can weaken, leading to a decrease in balance and coordination and a greater risk of falls. Besides including physical activity, getting enough of some minerals and vitamins can help.

Therefore, allowing the use of tools that help with self-monitoring conditions may empower elderly in daily challenges faced, but also with the prevention of health deterioration. In addition to everyday activities, the use of mobile apps has impacted the way the population has managed healthcare.

1.2 Health literacy and prevention

Persons living with dementia and their caregivers need access to health information to better understand their condition, take care of their health and better manage their daily life. They

may have difficulty making the right health decisions or knowing what health information is reliable. By developing health literacy competencies, they can be less dependent on health care providers and become their own experts. In fact, individuals with dementia are at a greater risk for certain health conditions as compared to those without dementia. Although health care providers are involved in the diagnosis and medication management, persons with dementia and their caregivers should be encouraged to actively seek information about their health and find resources on their own. They should know the characteristics of health and disease and understand their interdependence. The more individuals know about dementia and its comorbidities, the better they can manage their condition, make decisions in favour of their own's health and the health of others and health literacy is an essential aspect of this improvement. Equipped with this awareness and understanding, people can determine if they are at risk and then make daily health-related decisions to prevent and control these conditions for themselves, their family members and their community. Health literacy plays a key role in prevention and control of non-communicable diseases and to reduce the spread of misinformation.

Examples of common dementia comorbidities include high blood pressure, stroke, cardiovascular diseases and diabetes, their interdependence and relation to dementia is part of the health literacy.

1.3 How can it be applied to manage daily activities?

While scientists continue to actively research how to slow or prevent age-related declines in physical health, they've already discovered multiple ways to improve the chances of maintaining optimal health later in life. Taking care of physical health involves staying active, making healthy food choices, getting enough sleep, limiting alcohol intake, and proactively managing health care.

According to the data that can be available for self-management, like:

- Sleep duration
- Information on sleep depth
- Constancy of behaviour: when does the person go to bed and when does he/she awake
- Interruptions of sleep
- Steps taken during the day
- Heart beat rate
- blood pressure
- Glucose level
- Brain health maintaining through above mentioned and with engagement in cognitive activities

Small changes in each of these areas can go a long way to support healthy aging:

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Photo: Pixabay

Regular moderate physical activity can help maintain a healthy weight and lower heart disease risk. **Including physical activity in a daily routine.** The tools available can be used to track individual activity and set individualized goals per day (like steps that are taken, distance that is being walked...).

Photo: Pixabay

Eating a healthy diet. Tools can be chosen to navigate the preparation of food, choosing the food etc.

Photo: Pixabay

Managing stress. There are tools that can help to track the level of stress, to reduce stress, ...such as meditation, exercise.

Photo: Pixabay

Getting enough sleep. Quality sleep plays an important role in healing and repair. Tools are available that can encourage healthy behaviour (constancy, duration of sleep) but also to manage daily routine accordingly (exposure to light, activity, liquid and food intake, adapting the space where the person sleeps etc.).
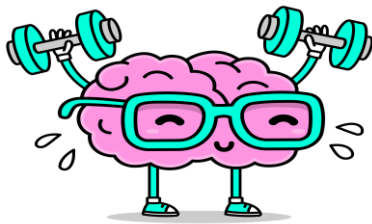
Photo: Pixabay

Staying mentally active. Staying mentally active may help sustain memory and thinking skills. A person can be encouraged to read, play word games, have a hobby, …

Photo: Pixabay

Being social. Social interaction helps ward off depression and stress, which can contribute to memory loss and also others. A person can be encouraged to spend time with family and friends, or attend social events.

Photo: Pixabay

Treating cardiovascular disease. A person can be directed for consultation and following recommendations to manage cardiovascular risk factors — high blood pressure, high cholesterol and diabetes — that may also increase the risk of cognitive decline.

2. CONCEPT

The relation between physical health and subjective wellbeing is bidirectional. Wellbeing might also have a protective role in health maintenance. Therefore, the awareness of the importance of having insights into a person's daily living habits and other insights is rising in the health-care sector. mHEALTH technologies can assist a lot in information gathering. Correlations among different parameters create potential opportunities to implement new effective pharmacological, therapeutic, care, and above all preventive interventions. Different daily life resources that can be tracked with the help of mHEALTH technologies can be therefore used to assess the wellbeing parameters that can contribute to the level of the intervention acceptance and from which the research on diseases and professionals that are in the care sector can benefit. The past years have seen a steep rise in the amount of data being generated from individuals and used also for health purposes. The outcome is to provide a more personalised level of care for each person and can assist the person herself to manage its own healthy habits.

2.1 Training to use device that measure internal parameters

The use of modern information communication technology is a powerful tool for promotion of a healthy lifestyle. In the last few years, the use of technology has increased even among elderly people.

Mobile Health or mHealth offers the opportunity to provide timely and efficient healthcare. It contributes to greater patient empowerment, a shift towards preventive measures, early disease detection, and thus an improvement in patients' quality of life. mHealth technologies are appearing in a variety of devices and for a wide range of applications. These include wearables and mobile devices, as well as mobile applications intended for both patients and healthcare professionals.

Very often, older users of health services are often not digitally literate [4]. The use of mHealth solutions requires a certain level of digital literacy. Despite the enormous growth of mHealth solutions, challenges, such as access to technology and digital literacy, limit their adoption. It is necessary to consider how the elderly or individuals without advanced technical skills will interact with the devices [5, 6]. Physical incapacities (sight problems, problems with hands, cognitive impairment) are also most common causes for patients to not use the applications.

Wearable and mobile devices represent technologies with which the patient has a brief interaction, like blood pressure monitors, or wear them on the body and continuously collect data, like from smart watches. The devices collect data on the patients' physiological functions and then transmit them either physically or wirelessly download the links to a smartphone, tablet or personal computer [6].

The majority of these devices are fitness trackers (fitness trackers), they follow to a much lesser extent heart rate monitors and smart devices watches (smartwatches). The latter often offer similar functions as fitness trackers, but they also have some additional functions resulting from communication with the phone, e.g. receiving notifications from the phone, reading and writing short messages, web browsing, contactless payment etc. The rest of the frequently used devices are dedicated control of chronic diseases such as diabetes, hypertension, heart disease as well as stress management. Currently, there are more than half of wearable devices designed for use on the wrist, a good fifth to wear on and around the chest, a sixth for carrying on a purse, in a pocket or on a shoe [6].

Mobile apps on the other hand can empower patients to participate more actively in managing their own health and have a positive effect on their behaviour and health results [7-9]. They are roughly divided into two categories [6]:
1. Applications in the field of well-being, which address nutrition, exercise, fitness, lifestyle, stress etc. About two-thirds of all mobile applications in the field mHealth falls under this category.
2. Applications that focus on mastering specific diseases such as diabetes, hypertension and mental diseases.

The functionalities of these mobile applications differ to a great extent. Most applications show only one or two functionalities, and the more advanced ones are multi-functional. Most applications only inform patients through different formats (text, photo, video). Other applications can give instructions to patients, for instance how to measure blood glucose. A number of applications enable the capture of information entered by patients. These apps also typically display the patient's data graphically. More advanced applications can, based on the input data they receive, give instructions to patients, they give possible diagnosis or they recommend consultation with a healthcare professional.

- ***blood pressure, heart rate***

Blood pressure and heart rate are two important physiological parameters that are closely related to each other. Blood pressure refers to the force with which blood flows through the arteries, while heart rate refers to the number of times the heart beats per minute. The heart pumps blood through the arteries, and the pressure of the blood against the walls of the arteries is what causes blood pressure.

When the heart beats faster, it pumps more blood through the arteries, which causes an increase in blood pressure. Similarly, when the heart beats slower, it pumps less blood, which can cause a decrease in blood pressure.

However, it's important to note that blood pressure and heart rate can be influenced by a variety of factors, including physical activity, stress, medications, and underlying medical conditions. In some cases, changes in one parameter may not be accompanied by corresponding changes in the other parameter.

Therefore, it's important to monitor both blood pressure and heart rate regularly and consult a healthcare professional if there are any concerns or significant changes in either parameter.

Photo: Pixabay

"Smart" blood pressure monitor connected to an app

- *heart rate, sleep quality*

Smart watches available on the market can continuously monitor vital parameters for detection of heart health and so help to improve general fitness. Some models can record even an electrocardiogram and for instance detect an irregular heartbeat. They can also warn of low and/or high heart rates. Advanced smart watches have a built-in oximeter, which controls blood oxygen saturation. A combination of the above parameters also enables the detection of sleep apnea. Resting heart rate is also closely related to sleep quality. Generally, a lower resting heart rate is an indicator of better sleep quality and vice versa. When the body is well-rested and the nervous system is functioning optimally, the heart rate will naturally decrease during sleep.

Conversely, if a person's heart rate is elevated during sleep, it could indicate that they are not getting restful sleep. This could be due to a number of factors, such as stress, sleep apnea, or other sleep disorders. When the body is not getting enough restful sleep, it can lead to a variety of negative health effects, including increased risk for heart disease, stroke, and other chronic conditions.

It's important to note that individual variations in resting heart rate can exist and a higher resting heart rate does not always indicate poor sleep quality. However, consistently elevated resting heart rate during sleep can be a sign to investigate further to ensure proper sleep and health.

A 2019 study [13] investigated the relationship between sleep quality and resting heart rate in adults. The researchers found that poor sleep quality was associated with an increase in resting heart rate, while good sleep quality was associated with a decrease in resting heart rate. The study also showed that higher resting heart rate during sleep was an independent predictor of poor sleep quality.

- *heart rate, physical activity*

Resting heart rate can be an indicator of physical fitness, as it reflects the efficiency of the heart in delivering oxygen-rich blood to the body's tissues. However, blood pressure can vary based on factors such as age, sex, weight, and overall health status. It's important to consult with a healthcare professional to determine what blood pressure range is appropriate for your individual circumstances.

In general, people who are physically fit tend to have lower resting heart rates because their hearts are able to pump more blood with each beat, meaning the heart doesn't need to work as hard to meet the body's oxygen demands. On the other hand, people who are less physically fit may have higher resting heart rates because their hearts need to pump more frequently to meet the same oxygen demands.

However, it's important to note that resting heart rate can also be influenced by factors such as stress, medications, and medical conditions. Therefore, a single measurement of resting heart rate may not necessarily provide a comprehensive picture of a person's physical fitness.

In addition to resting heart rate, other indicators of physical fitness include aerobic capacity, muscular strength and endurance, flexibility, and body composition. A sudden increase in resting heart rate may be a sign or concern about ones heart health, it's therefore important to consult a healthcare professional for an evaluation and proper diagnosis.

Regular exercise is good for the heart. Exercise has numerous benefits for cardiovascular health, including strengthening the heart, lowering blood pressure, reducing inflammation, improving cholesterol levels, improving circulation and reducing stress.

It's important to note that the type, duration, and intensity of exercise can affect the cardiovascular benefits. Generally, at least 150 minutes of moderate-intensity aerobic exercise per week or 75 minutes of vigorous-intensity aerobic exercise per week is recommended for cardiovascular health. Before starting a new exercise program, it's important to consult with a healthcare professional to determine what type and intensity of exercise is appropriate for your individual needs and health status.

Photo: Pixabay

Wearable devices for measuring heart rate (smart watches, chest straps, fitness trackers, armbands)

There are many wearable devices that can measure heart rate. Some popular options include:

- Smartwatches: Many smartwatches have built-in heart rate monitors that can track your heart rate throughout the day.

- Fitness trackers: Fitness trackers, such as those made by Fitbit, also have built-in heart rate monitors that can track your heart rate and provide information on your activity levels and calorie burn.

- Chest strap monitors: Chest strap monitors are designed to be worn during exercise and provide accurate heart rate measurements by detecting electrical signals from the heart.

- Armband monitors: Armband monitors use optical sensors to measure heart rate and can be worn during exercise or throughout the day.

- Earbuds: Some earbuds have built-in heart rate monitors that can track your heart rate during exercise.

It's important to note that the accuracy of heart rate measurements can vary between different devices, and it's always a good idea to consult with a healthcare professional if you have any concerns about your heart rate or cardiovascular health.

- ***glucose, diabetes***

The number of patients that are suffering from diabetes has increased for over 300 million over the past 40 years. Diabetes can cause many serious complications. Lately, more and more mobile applications for diabetic patients have become available, and they could represent a potential solution to treating patients with diabetes. Patients see them as tools to promote better selfcare, they make it easier to keep the disease under control, help to achieve their goals and motivate them towards a healthier lifestyle. There have also been positive results with keeping the blood sugar levels more stable and patients suffering from less hypoglycaemic episodes. The biggest obstacles for using mobile applications are: not seeing the applications as a legitimate tool for healthcare, internet accessibility, internet literacy and manual data entering.

Patients with diabetes can use applications that allow logging blood glucose levels, meals, carbohydrates consumed and medicines. Based on the entered data, some can even evaluate glycated haemoglobin A1c (HbA1c) values. They also offer motivational challenges and feedback for easier coping with diabetes. Based on the data, they can create reports that patients can share with their healthcare workers [10].

An example of a wearable device aimed at a specific patient population, are socks for patients with disease that continuously monitor the temperature of the feet and detect early signs of neuropathy. Information communicates to a personal physician who can recognize the signs of early inflammation or injury [11]. For more Apps, please check the website of mHEALTH.

2.2 Sleep monitoring and daily activities

As people get older, their sleep may change due to the effects of ageing. Many of these changes occur due to alterations in the body's internal clock. The section of the brain which regulates our clock (*suprachiasmic nucleus*, SCN) controls the 24-hour daily cycles, called circadian rhythms. These circadian rhythms influence daily cycles, such as when we get

hungry, when the body releases certain hormones, and when we feel sleepy or alert. The SCN receives information from the eyes, and light is a cue for maintaining the circadian rhythms. Alzheimer's disease often changes a person's sleeping habits. A decrease in the cellular activity of the dedicated region in the brain is common, and cells may be damaged due to the disease as well. The result of this is that patients are often unable to follow a 24-hour sleep-wake cycle. In addition to this, dementia is associated with transformations of sleep structure. Some people with Alzheimer's disease sleep too much; others don't sleep enough. Some people wake up many times during the night; others wander or yell at night. Sleep problems and Alzheimer's disease often go hand in hand. There may also be other sleep problems related to dementia. For example, "Sundowning" is a phenomenon in which individuals with dementia experience increased agitation later in the day and in the evening. The symptoms of sundowning include confusion, anxiety, wandering, and yelling. Sundowning can contribute to insomnia and other sleep problems when these behaviours continue into the night. Possible causes of sundowning include the circadian rhythm changes that occur in dementia, as well as fatigue, depression, and pain. Moreover, obstructive sleep apnoea is also more common in people with Alzheimer's disease. This potentially serious sleep disorder causes breathing to repeatedly stop and start during sleep. People with sleep apnoea have short pauses in breathing while they are asleep. If not treated, sleep apnoea can lead to other problems, such as high blood pressure, stroke, or memory loss.

Specific sleep stages

When we sleep, our bodies cycle through a series of sleep stages, starting with light sleep (stages 1 and 2), followed by deep sleep (stage 3 or slow-wave sleep), and later by dream sleep (also called rapid eye movement or REM sleep). Having insight into the sleep habits, break-down of the depthness of the sleep, being aware of interruptions during sleep and other...may help to adapt behaviour and arrange daily activities.

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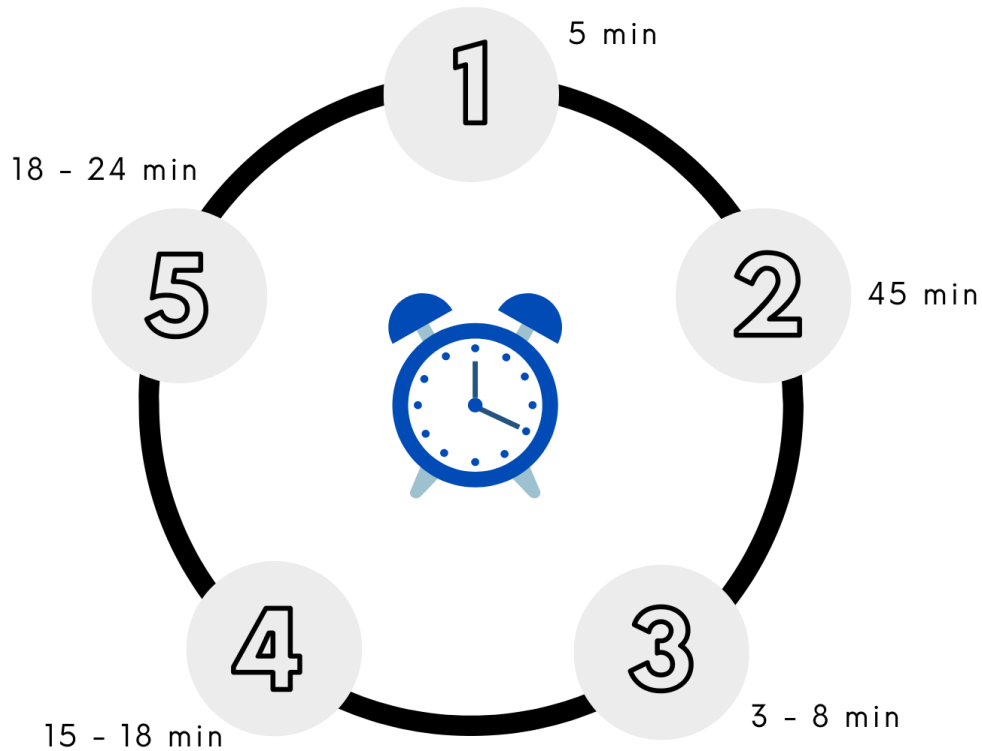
Stages of sleep

In the Figure, there is a representation of 5 stages of sleep. The sleep cycles occur regularly every ninety minutes on average, the average individual experiences around four to six sleep cycles in a full seven to nine-hour night of sleep.

The breakdown of the phases according to the Figure: **[1]: Light stage sleep**: eyes are heavy, the body hasn't fully relaxed, though the body and brain activities start to slow. We feel drowsy and relaxed. Light sleep is also when it's easiest to wake up. **[2]: Light sleep -Relaxation:** body enters a more subdued state including a drop in temperature, relaxed muscles, and slowed breathing and heart rate. During this stage, the brain produces sudden spikes in brain waves known as sleep spindles for their spindly appearance on EEG charts. These spikes in brain activity are thought to play a role in long term memory consolidation and sensory processing, making this an important stage as we age. **[3 and 4]: Slow-wave sleep:** The muscles of the body become fully relaxed, and breathing rate, blood pressure, and body temperature all decrease significantly. The body produces growth hormones, regulates immune system function, and develops and repairs muscle tissue during these stages, making them critical for physical health and recovery. At this stage, it is much more difficult to wake up. **[5]: REM phase (Rapid eye movement phase):** During this phase, we experience dreams, but also a host of neurological and physiological responses which are similar to being awake. During REM sleep, eyes move rapidly behind closed eyes, heart rate speeds up, and breathing becomes irregular. In contrast to other stages of sleep, in which brain waves slow down, the brain is highly active during REM sleep, and brain waves become more variable.

As we age, however, the timing and duration of our sleep cycles change. Older individuals tend to experience a much longer sleep cycle with less time in REM, as opposed to infants who experience shorter cycles with more REM sleep.

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Practical example of views of personal sleep data (from Withings App - bed sensor):
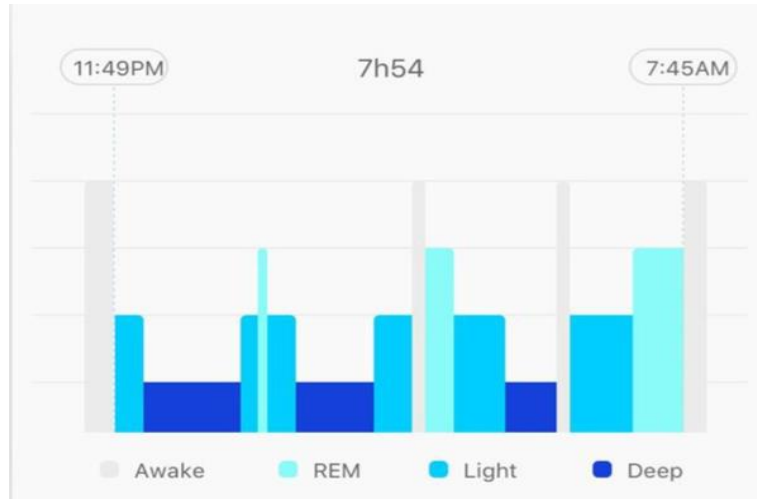
Sleep score: 75

You've had a restful night. Here is a breakdown:

Duration: 7h 54 minutes

Recovery: Good

Interruptions: 2 times

Regularitiy: Poor

Time to sleep: 8 min

Time to get up: 5 min

Some devices also allow monitoring of snoring detection. Moreover, some devices can monitor sleep disturbances.

To give you a complete and accurate overview of your snoring episodes, our exclusive snoring algorithm has been trained against a dataset of low to heavy snorers. A wide variety of unwanted noises has been included in this dataset: subway noises,partner snoring, washing machine noises, cell phone vibration, and TV shows. Sleep Analyzer can also distinguish your snoring patterns from environmental noises and your partner's snoring patterns. Example from Withings App connected to bed sensor:
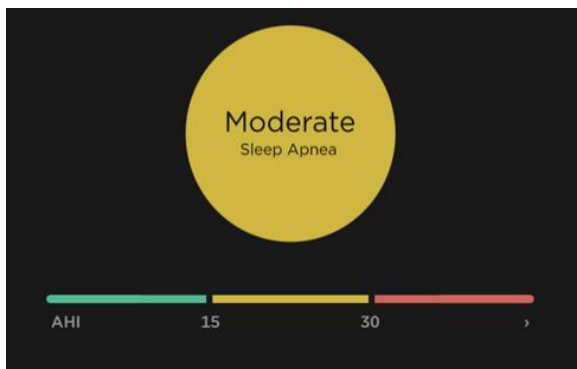
Snoring detection:
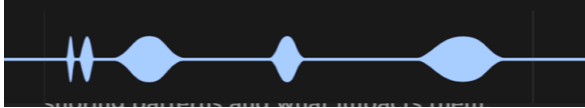
Know how severe your sleep apnea is

Sleep Analyzers exclusive algorithm analyses your thoracic and cardiac activity to identify breathing episode cessations that are characteristic of this disorder.

To promote better sleep, it is important to keep the following in mind:

- Maintain a regular schedule: Create a bedtime routine that involves quiet, soothing activities before bed. Television and electronic devices can be stimulating and emit blue light that interferes with sleep, so try avoiding these activities before bed;
- Limit naps to no longer than 30 minutes;
- Add light exposure: Light is a key regulator of circadian rhythm, so if possible, getting natural light during the day can help with sleep at night. If access to natural light is limited due to weather or other factors, indoor bright light therapy may help;
- Avoid stimulants like caffeine, alcohol, and nicotine if possible and treat pain and sleep disorders;
- Set a peaceful mood in the evening. Help the person relax by reading out loud or playing soothing music. A comfortable bedroom temperature can help the person with dementia sleep well. Create a calming bedroom environment: A dark, quiet, comfortable bedroom promotes sleep. Some people with dementia benefit from having well-loved objects near their bed. If total darkness is not calming, add dimmed night lights to create a sense of security.

Moreover:

- Make sure the floor is clear of objects.
- Lock up any medicines.
- Attach grab bars in the bathroom.
- Place a gate across the stairs.

A very important part of the day, which influences sleep is of course **the active-day part.** We can manage sleep quality (and consequently some potential problems during wakefulness as well) by supporting the appropriate daily activities. **It is vital to understand that the day- and night- life of a person are interconnected.**

Photo: Pixabay

Health tracking Apps – standalone

Mobile health (mHealth) applications are smart-phone applications which can provide health information and functions to improve patient health. Compared with other technologies, mobile applications are less costly and fairly effective. Support provided via mobile devices is an obvious option as mobile devices, including smartphones and tablet computers, have been widely adopted and are commonplace in most households around the world. Today, mobile device users are not only young adults, but also include older adults as frequent users

Controlling and recording certain factors is crucial for the smooth running of a person's daily life and it would be very helpful to be able to control them through applications. As mentioned above in a previous topic, the most significant factors which would affect a person's daily routine are the quality and duration of sleep, the heart rate, the glucose level, the cholesterol level, are some of them that could improve someone's quality of life.

The App that will help in recording sleep data is **Sleep Cycle - Sleep Tracker**

https://apps.apple.com/us/app/sleep-cycle-sleep-tracker/id320606217

that analyses your sleep patterns and detects snoring, sleep talking, coughing and other sounds. Plus, a detailed analysis is given as a sleep tracker monitors your bedtime patterns from the moment your head hits the pillow, and access to premium features including relaxing sleep sounds and story library.

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Photo: Google Play

2.2.1 Activity monitoring and daily activities

Regular exercise can help older adults stay independent and prevent many health problems that come with age. Almost anyone, at any age, can do some type of physical activity. You can still exercise even if you have a health condition like heart disease, arthritis, chronic pain, high blood pressure, or diabetes. In fact, physical activity may help. Researchers are assessing the benefit of exercise to delay mild cognitive impairment (MCI) in older adults and to improve brain function in older adults who may be at risk for developing Alzheimer's disease. Older adults with MCI may be able to safely do more vigorous forms of exercise, similar to older adults without MCI, provided there are no other underlying health concerns.

Being active and getting exercise may help people with Alzheimer's or other dementia feel better and can help them maintain a healthy weight and have regular toilet and sleep habits. If you are a caregiver, you can exercise together to make it more fun [1].

Sedentary behaviour can be harmful to our health. Prolonged sitting has been linked to many health issues, including obesity, type 2 diabetes, and cardiovascular disease. According to the WHO [12], sedentary behaviour is defined as "any behaviour characterised by an energy expenditure ≤1.5 metabolic equivalents (METs) while in a sitting, reclining or lying posture."

Therefore, activities can be tracked in various ways. There are many devices that can help you estimate how active you are. Some devices measure your heart rate or the number of steps you take during physical activity. Others estimate the calories you've used.

Smart wristbands and smartwatches can help us to prevent sedentary behaviour and thus minimise the negative effects of sedentary living. With sedentary reminders these devices can help us to move more and be more active throughout the day.

A sedentary reminder is a feature found in some devices or apps that reminds the user to stand up and move around after a period of prolonged sitting. The remainder is typically set to trigger after a certain number of minutes of inactivity and may include suggestions for exercises or stretches that can be done while standing. The goal of a sedentary reminder is to promote a more active lifestyle and reduce the negative health effects associated with prolonged sitting.

For example: the steps can be used as a measurement for the overall activity that day. They don't tell how much effort a person puts in to achieve those steps, but a high step count will always tell that a person has been active one way or another. A good goal for healthy and normal weight seniors is 7,000 to 10,000 steps but it's always wise to start slowly and build up as you go so your body has time to adapt.

Pros of activity monitoring and step counting: (1) Can keep you motivated, since you can visually see the progress; (2) It allows you to set goals for yourself. For devices and Apps, please check the website of mHEALTH.

2.2.2   Important individual aspects

- Individual aspects concerning sleep quality monitoring

As mentioned, the timing and duration of our sleep cycles change as we age. Older individuals tend to experience a much longer sleep cycle with less time in REM, and this needs to be taken into consideration when interpreting the results. When a person wants to use the sleep tracking device to help himself/herself with a daily routine and insights, he/she shall follow:

Do: Use your sleep tracker for total sleep time and sleep habit goals (constancy, daily routine…).

Do: Use sleep analysis as an added value - sleep quality assessment - **not** as a diagnostic measure of sleep disorders.

Don't: Lose sleep over your sleep data - don't overly anxious about meeting your sleeping goals.

- Individual aspects concerning activity monitoring and step counting

When measuring activity, the device can be set to different programs depending on the type of activity (like: running, hiking). The most common activity measurements are: step detection, calorie consumption, heart rate, blood oxidation, elevation. It is important to know about step counting because there are differences between devices, some are more sensitive than others. Smart devices can also think that activities that involve shaking your hands are steps because they cause the sensors to register movements.

Remember that a consistent routine of regular exercise is more important than random vigorous exercise or fixating on numbers.

2.3 Brain health

According to WHO, brain health is the state of brain functioning across cognitive, sensory, social-emotional, behavioural and motor domains, allowing a person to realise their full potential over the life course, irrespective of the presence or absence of disorders. Different determinants related to physical health, healthy environments, safety and security, life-long learning and social connection as well as access to quality services influence the way our brains develop, adapt and respond to stress and adversity. These give way to strategies for promotion and prevention across the life course. Optimising brain health by addressing these determinants not only improves mental and physical health but also creates positive social and economic impacts that contribute to greater well-being and help advance society.

As introduced before, exercise improves blood flow and memory; it stimulates chemical changes in the brain that enhance learning, mood and thinking. Next, you are what you eat. As you grow older, your brain is exposed to more harmful stress due to lifestyle and environmental factors, resulting in a process called oxidation, which damages brain cells. Food rich in antioxidants can help fend off the harmful effects of oxidation in your brain. Moreover, sleep energises you, improves your mood and your immune system, and may reduce the abnormal protein called beta-amyloid plaque. Practising meditation and managing stress may help. And finally, mental exercise is just as critical as physical exercise in keeping your brain fit and healthy. Mental exercises may improve your brain's functioning and promote new brain cell growth.

2.3.1   Water intake and brain health

There is a close relationship between water intake and brain health [18-19]. Even a mild dehydration can have negative effects on cognitive function and mood. Research suggests that dehydration can lead to decreased cognitive performance, impaired concentration, and reduced alertness. Dehydration can also lead to headaches, fatigue, and feelings of anxiety and depression.
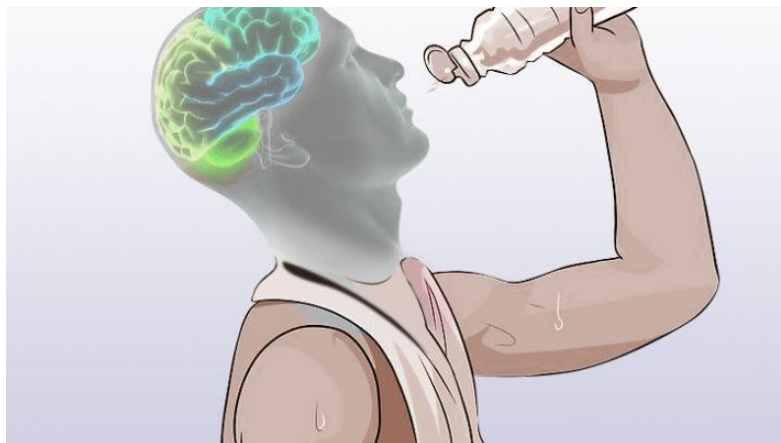

Photo: Pixabay

Good hydration is important for brain health

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In contrast, staying well-hydrated has been associated with improved cognitive performance, better mood, and increased alertness. Drinking enough water can also help prevent headaches and improve overall brain function.

Therefore, it's important to ensure that you're drinking enough water throughout the day to support optimal brain health. The exact amount of water you need depends on several factors, including your body weight, activity level, and the climate you live in, but a general guideline is to aim for at least 8-10 glasses of water per day.

2.3.2 Tobacco and alcohol use

Tobacco and alcohol use can have significant negative effects on brain health.

Smoking tobacco can lead to decreased cognitive function, memory impairment, and an increased risk of dementia [14-17]. Nicotine, the addictive substance in tobacco, can also cause changes in the brain that lead to addiction and withdrawal symptoms. Long-term smoking can also increase the risk of stroke and brain damage.

Alcohol use can also have negative effects on the brain, particularly if consumed in excess. Drinking heavily and regularly can lead to memory loss, impaired cognitive function, and even brain damage. Long-term heavy drinking can also increase the risk of developing dementia.

It's important to note that even moderate alcohol consumption can have negative effects on brain health, and the risks increase with higher levels of consumption. In addition, combining alcohol with tobacco use can increase the negative effects on the brain.

Therefore, it's important to avoid or limit tobacco and alcohol use to support optimal brain health. If you are struggling with addiction, seeking help from a healthcare professional or addiction specialist can be an important step in improving your overall health and well-being.

Photo: Pixabay

Smoking and drinking have negative impacts on brain health

2.3.3 SERIOUS GAME for mHEALTH and cognitive training– an example from mHEALTH project

Recent years, game-based learning has gained a lot of attention. It's considered one of the most efficient and prominent informal educational methods. In mHEALTH-AD project, the online digital serious game meets the needs of the target group by transferring the knowledge through an enjoyable and playful way. It aims to better understand the concepts related to mobile health, their benefits, increase their motivation and also increase their knowledge about good health habits.

The innovation of Digital Serious Game is its specific design and development fully aligned with the global training approach, as there is no other Digital Serious Game which addresses the application of mobile health concepts in the dementia collective. The impact on PWD is that it will increase their digital skills, needed for the adoption of the mHealth technologies.

The development of the Digital Serious Game provides training in a "friendly" environment, reducing fears, concerns and reservations to the mHealth technologies before they used it in the real world. It is a powerful motivation for the engagement with mobile health technologies.

2.3.4 Mood

Mental health and mood are critical aspects of overall health and well-being. They can affect every area of life, from work performance to relationships and physical health. Monitoring mental health and mood through devices can provide valuable insights into patterns, triggers, and potential problems.

It is important to try every day to improve your mental health and mood but it's also okay some days to feel down and not happy. We have to accept those days in our lives or we won't appreciate the others. There are many ways to try to improve your mood:

- Practice mindfulness: Mindfulness involves being present in the moment and paying attention to thoughts, feelings, and sensations without judgment. It can help reduce stress and improve mood.
- Exercise regularly: Exercise has been shown to improve mental health and mood by reducing stress and anxiety, boosting self-esteem, and increasing the production of endorphins, which are natural mood-boosters.
- Get enough sleep: Getting enough sleep is essential for mental health and mood. Aim for 7-9 hours of sleep per night, and establish a regular sleep routine.
- Eat a healthy diet: A healthy diet can help improve mental health and mood. Focus on eating a variety of nutrient-rich foods, including fruits, vegetables, whole grains, lean protein, and healthy fats.
- Connect with others: Social connections are important for mental health and mood. Spend time with friends and family, join a club or organization, or volunteer in your community.
- Seek professional help: If you're struggling with mental health or mood issues, seek professional help. A mental health professional can help you develop coping strategies, manage symptoms, and improve overall well-being.
- Practice relaxation techniques: Relaxation techniques like deep breathing, meditation, or yoga can help reduce stress and improve mental health and mood

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Mood tracking with mobile health technologies is a way to monitor one's emotions, moods, and behaviours over time. There are several ways to track mood using mobile health technologies. There are various mood tracking apps available on mobile devices that allow users to record their moods throughout the day. Users can select from a range of emotions or use a slider to indicate their mood, and some apps also allow users to add notes or contextual information about their mood. Mood tracking apps can help users identify patterns in their moods and provide insights into how their behaviours and experiences affect their emotions.

Additionally, some wearable sensors, such as smartwatches or fitness trackers, can detect changes in physiological indicators that are related to mood, such as heart rate variability, skin conductance, or movement patterns. These sensors can provide real-time feedback to users about their mood and stress levels. Mobile health technologies can also be used to prompt users to report on their mood at regular intervals throughout the day. This can be done through a mobile app or via SMS messaging. Users can indicate their mood using a range of emotions, and the data can be aggregated over time to identify patterns and trends.

Mood tracking with mobile health technologies can be a useful tool for individuals who are looking to better understand their emotions and behaviours. However, it is important to note that mood tracking should not be used as a substitute for professional mental health treatment. Users should always consult with a mental health professional if they are experiencing significant mood changes or distress.

Mood tracking devices are also very useful for patients as they allow individuals to track their emotional state and monitor changes in their mood over time. These devices can help patients manage their mental health and improve their overall well-being.

There are many apps available for tracking mood, and some popular and user friendly options include:

1. **daylio** https://daylio.net/
   This app allows you to track your mood and activities throughout the day, and provides you with statistics and visualizations to help you identify patterns. You can create a daily entry in two taps – pick mood and activities. We crunch data and display them in stats, charts, and correlations.

2. **Moodfit** https://www.getmoodfit.com/

   Moodfit offers a variety of features, including mood tracking, goal setting, and personalised insights to help you improve your mental health.

Benefits it offers:

- Reduce stress & build resilience
- Learn what brings you up & down
- Beat rumination & procrastination
- Learn to respond versus react
- Get your motivation back
- Identify & dispute distorted thinking

3. **MoodCast** https://apps.apple.com/us/app/moodcast-easy-mood-tracker/id1511879827

 This app uses machine learning algorithms to provide personalised insights and recommendations based on your mood data.MoodCast is a simple but powerful mood tracking and journaling app. It has all of the tools you need to track the things that are important to you. There are opportunities for reflection and logging that make it a great way to care for yourself. With proper care you can help reduce many of the stresses that you may face everyday such as anxiety and low moods.

4. **Youper** https://www.youper.ai/
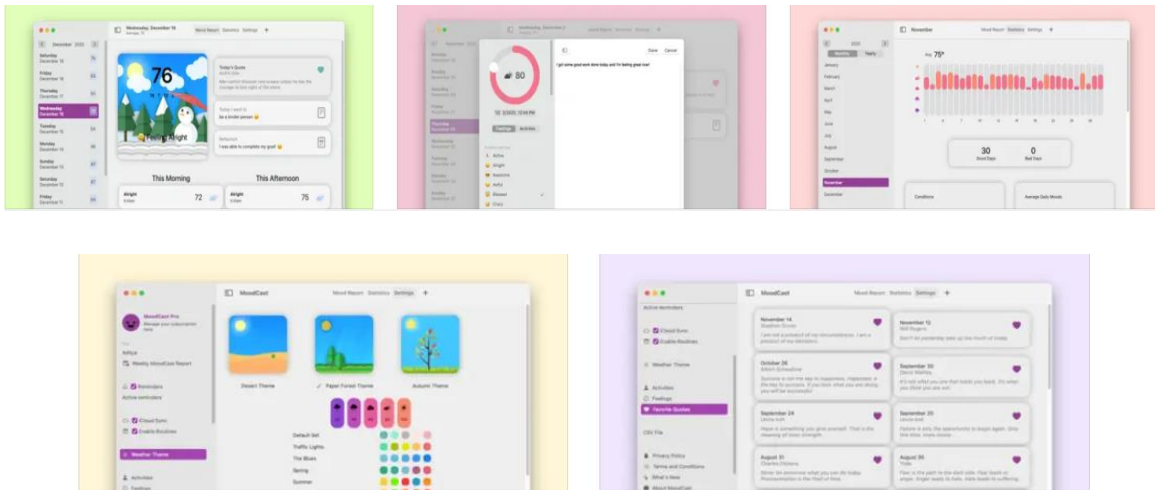
Youper uses artificial intelligence to help you manage your emotions and improve your mental health. It offers a variety of features, including mood tracking, guided meditations, and personalized recommendations.
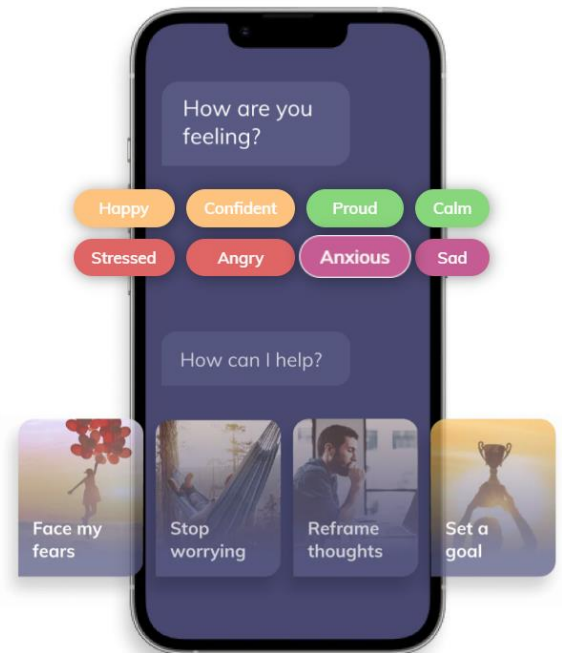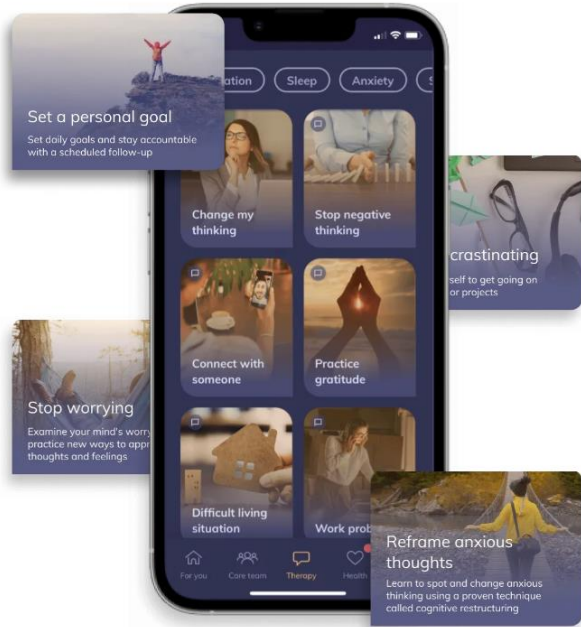
Youper's digital therapeutics are based on clinically proven behavioral therapies, including Cognitive Behavioral Therapy (CBT), Acceptance and Commitment Therapy (ACT), Dialectical Behavioral Therapy (DBT), Problem Solving Therapy (PST), and Mindfulness-based Cognitive Behavioral Therapy.Leveraging artificial intelligence (AI) makes Youper uniquely able to combine clinical effectiveness and patient engagement. At the core of Youper's AI-powered digital mental health solutions are (1) a conversational agent that listens to and interacts with users; (2) just-in-time interventions that help users manage emotional challenges whenever and wherever they need; and (3) personalization to recommend techniques that fit users' specific needs.

2.4 Complementary videos

- Sleep analyzer Withings: https://www.withings.com/si/en/sleep-analyzer
- Change the activity goal - smartwatch:

  https://www.youtube.com/watch?v=Qw0NxOsp4rc
- How to set the Health App: https://www.youtube.com/watch?v=tH61kmcAVLc
- A Tour of the mySugr App: https://www.youtube.com/watch?v=2J651YaRI6A&t=108s
- Fitbit Charge 5 smart watch: https://www.youtube.com/watch?v=QprVwk9YAk
- Understanding blood pressure and cholesterol:

  https://www.youtube.com/watch?v=4YNdp3pRjig

3. CONCLUSION

In order to help people with the achievement of a level of knowledge, personal skills and confidence to take action to improve personal and community health by changing personal lifestyles and living conditions, the training on how to use the mHEALTH technologies is presented. By empowering and thus allowing people the use of tools that help with self-monitoring conditions may empower elderly in daily challenges faced, but also with the prevention of health deterioration. In addition to everyday activities, the use of mobile apps has impacted the way the population has managed healthcare. Taking care of our health is part of everyday life, not just when we visit a doctor, clinic, or hospital. We can help ourselves to prevent health problems, protect our health, and better manage health problems when they arise. Therefore, there are some common problems that elderly people may experience and tracking the health condition, adapting the behaviour and visiting the professional on time is crucial to enable the wellbeing of an older adult. Herein, the tools and basic information is provided on how to engage in taking care of physical health. This involves staying active, making healthy food choices, getting enough sleep, taking care of cognitive fitness and proactively managing health care. Small changes in each of these areas can go a long way to support healthy ageing. The main focus is on the areas: health literacy, tracking health parameters, taking care of brain health, tracking quality of sleep and physical activity. Finally, the project result 4 is introduced that will incorporate the game that can be used to empower people with mild dementia on mHEALTH.

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5. ANNEXES

5.1 What types of devices, systems are available?

In the following table are some examples, but you can find more in Annex I.

Pedometers: Pedometers are generally about the size of a pager and can be clipped onto the belt or onto the waistband of the pants. All pedometers keep track of how many steps a person takes during the day, while some even track the distance a person walks, or the number of calories he/she burns.	 https://img.aws.livestrongcdn.com/ls-1200x630/ds-photo/getty/article/69/124/183182952.jpg
Wearables. For example: a ring, a bracelet or a watch with functionality to track activity, but also sleep can be worn on the wrist. These types of devices typically collect data about the movement of a person and his/her heart rate. Some also track the breathing patterns. **Fitness bands:** This device can measure the amount of activity a person does. There are many different varieties of fitness bands, but most are worn on the wrist, like a watch or bracelet. **Heart Rate Monitor:** Heart rate monitors track heart rate and let a person know how	 https://ouraring.com/?cppid=3058&cpclid=467f0282277440d0b32bb8fb0c15c1bb https://www.techradar.com/best/best-fitness-trackers

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hard he/she is working when being physically active.

https://www.fitbit.com/global/us/products/smartwatches/versa3
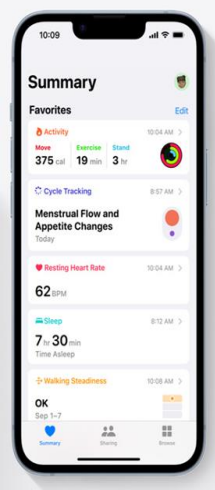

https://www.garmin.com/en-US/p/682155?zebratwo=CJ&cjevent=2c0bb5d1ea6311ed81b400a50a18b8fc&utm_source=CJ&utm_medium=Text&cjdata=MXxZfDB8WXww

https://us.amazfit.com/products/amazfit-powerbuds

● **Cell Phone apps:** Many cell phones have apps that can be downloaded, either for free or for a fee, that track physical activity.	https://www.apple.com/ios/health/
Bedside devices. For example: these types of devices are placed next to the bed. They primarily collect data about body movement and breathing. They may also store information about the room environment, including temperature, humidity, ambient noise and light.	https://us.sleepace.com/pages/reston
Bed Sensors. For example: these types of devices are placed under the sheets or mattress. They collect information about the movement and heart rate. Some devices also track information about the room environment, like temperature and humidity. https://www.withings.com/us/en/sleep	https://www.withings.com/si/en/sleep-analyzer

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AVAILABLE mHEALTH TECHNOLOGIES (ALL)

5.2 TABLE FROM DETA 3 + additional devices and Apps, serious games

mHealth Apps and devices for training health conditions and planning activities				
App or device name	**Brief description**	**Available languages**	**Android available**	**IOS available**
Withings sleep analyzer https://www.withings.com/si/en/sleep-analyzer	Sleep analyzer records and computes different parameters to understand sleep: time going to sleep, sleep duration, depth of sleep, interruptions, heart rate, snoring, time to wake up	EN	Y	Y
smartwatch, Xiaomi band	HBR, steps count	EN	Y	Y
Digital diary				
Food quality information: Fooducate; How much you eat: Edo: Know what you eat	recognizes food and informs you about its nutritional composition and the intake	EN, SI	Y	Y

Basic First Aid	The basic first aid application consists of 4 main titles. It consists of first aid, additional information, training process, testing parts. https://play.google.com/store/apps/details?id=com.cube.arc.fa&gl=US	EN	Y	Y
blood glucose tracker	https://play.google.com/store/apps/details?id=mobi.littlebytes.android.bloodglucosetracker&gl=US	EN	Y	
Blood Pressure Monitor	https://apps.apple.com/us/app/blood-pressure-monitor/id430133691	English, French, German, Japanese, Korean, Simplified Chinese, Spanish	Y	Y
Blood Sugar Tracker - Diabetes	https://play.google.com/store/apps/details?id=bloodsugartracker.bloodsugartracking.diabetesapp&hl=en&gl=US		Y	
Glucose Buddy Diabetes Tracker	https://apps.apple.com/us/app/glucose-buddy-diabetes-tracker/id294754639	Almost all Eu languages	Y	Y
Heartify: Heart Health Monitor	https://apps.apple.com/us/app/heartify-heart-health-monitor/id1546156891	English, French, German, Hindi, Italian, Japanese,	Y	Y

		Russian, Spanish, Vietnamese		